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AN INSTITUTE OF THE BAVARIAN ACADEMY OF SCIENCES AND HUMANITIES

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ANALYSES AND STUDIES

The bidt-Digitalbarometer. international

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As an institute of the Bavarian Academy of Sciences and Humanities (BAdW), the Bavarian Research Institute for Digital Transformation (bidt) contributes to a better understanding of the developments and challenges of the digital transformation. It thus provides the basis for shaping the digital future of society in a responsible and public interest-oriented manner.

The bidt Think Tank provides an independent, fact-based picture of the state of digital transformation. It also provides suggestions and recommendations for evidence-based decisions to successfully shape the digital transformation. To this end, the Think Tank team observes, documents, and analyses current developments using empirical methods.

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Abstract

The bidt-Digitalbarometer.international is a joint project of the Bavarian Research Institute for Digital Transformation (bidt) and the SZ-Institut (a unit of the publishing house Süddeutsche Zeitung). It builds on the bidt-SZ-Digitalbarometer published in 2022 and expands the data from the representative population survey on digital transformation in Germany to include six additional countries. For this purpose, between 1,157 and 1,734 people per country were surveyed from 14 November 2022 to 5 January 2023 in Austria, Finland, France, Italy, Spain and the United Kingdom. This study presents key findings from the data on the topics usage behaviour and e-government, digital competence, digital transformation of the working environment and artificial intelligence. The results thus allow an international comparison of the current status of digital transformation in Germany.

Contents

Executive Summary

The digital transformation can be seen in all areas of life, including workplaces, private life, or contact with the public administration. This development poses major challenges for the economy, society and the state, as it forces everyone to adapt to the changing circumstances. In this process, digital competence is crucial, as it is the key to participating in digital life.

The bidt-SZ-Digitalbarometer 2022 showed where Germany stands in terms of digital transformation. In order to enable an international classification of these results, the Bavarian Research Institute for Digital Transformation (bidt) has now conducted representative surveys in the European countries of Austria, Spain, Finland, France, the United Kingdom, and Italy. In cooperation with the SZ Institute of the Süddeutsche Zeitung publishing house, the institute surveyed residents of each country on the topics of usage behaviour, e-government, digital competence, digital transformation of the working environment, and artificial intelligence (AI) between November 2022 and January 2023. The data collected allows comparing the results from Germany internationally. Specifically, the study aims to identify differences and similarities in the selected countries and to better understand the developments and challenges of the digital transformation. The corresponding findings also expand the empirical foundation for initiating debates and helping to shape the digital future of society in a responsible and public interest-oriented manner.

Core Results

- Digital competence in Germany is more dependent on socio-structural factors than in other countries. This means that the digital divide in terms of digital competence is particularly pronounced in Germany. While there are hardly any differences between the countries regarding social groups with high digital competence, in Germany particularly older people, people with lower incomes and women fall considerably behind in an international comparison.
- In Germany, proportionally more employees see digitalisation as an opportunity for their company, compared to the other countries. At the same time, more German employees than in the other countries state that too little attention is paid to digitalisation in their own company. However, relatively few Germans are afraid of their jobs becoming redundant as a result of digital transformation.
- Germany ranks lowest among all countries in the proportion of people who have already carried out a complete administrative process online. This is mainly due to the lack of digital administrative services offered in Germany. Accordingly, more people in Germany than in the comparison countries state that too little attention is paid to the topic of digitalisation in their country.
- When compared to other countries, the opportunity/risk assessment of AI is relatively balanced in Germany. Particularly when it comes to recognising diseases and autonomous driving, the proportion of people who predominantly see opportunities in the use of AI is comparatively large in Germany.

The bidt-Digitalbarometer.international

The results of the bidt-Digitalbarometer.international show that there are considerable differences between countries in the use of digital devices and technologies. In terms of the proportion of the population that uses the Internet, Germany is in the middle range compared to the other countries. With regard to the different ways of using the Internet, usage in Germany is far lower particularly regarding online medical or therapeutic services and online job applications. The completion of a full administrative process online is also rather rare in Germany. In contrast, landline telephony is still more widespread than in any other country in the survey. These differences can often be explained by the availability of such options in the individual countries or the existing infrastructure. At the same time, the German population is generally relatively open to new technical developments.

Digital Competence

Digital competence differs considerably between countries, with Finland scoring highest and Germany, Spain, and Italy bringing up the rear. The countries also differ in terms of the variation of their levels of digital competence by age, formal education, or gender. For example, the digital competence gap between different levels of education is greatest in Spain and lowest in Finland. Germany also shows relatively large differences based on the level of education. In addition, the differences in competence between different age groups and genders are particularly strong in Germany. In this context, one problematic aspect is that relatively few of the people aged 65 years and above as well as the formally less educated respondents in Germany have recently improved their skills in using the Internet or digital devices. As a result, in Germany, there is a particularly high risk that large sections of the population will increasingly fall behind digitally.

Digital Transformation of the Working Environment

Most employees in Germany predominantly see the opportunities of digitalisation for their own company. In addition, a lower proportion of employees in Germany than in other countries are afraid that their jobs will become redundant as a result of digitalisation. When countries are compared by the digital competence of employees, Finland takes the top position, followed by Austria. German employees perform considerably worse in terms of their digital competence. This is aggravated by the fact that the opportunities for training on the topic of digitalisation in one's own company are rated as rather poor in Germany. Relatively low digital competence, a perceived lack of opportunities to improve them as well as imminent upheavals on the labour market in the course of digital transformation paint a bleak picture for Germany as a business location.

Given the increasingly pronounced shortage of skilled workers, coupled with a work environment where digital competence plays a key role, the lack of digital competence in Germany can cause serious long-term damage to the country's technological competitiveness. However, awareness of the need for change is relatively strong in Germany. More than a third of

German employees state that too little attention is paid to digitalisation in their own company. This is considerably more than in the other countries surveyed. Specifically, a quite profound change can be observed when it comes to the topic of working from home. In this area, due to the COVID-19 pandemic, Germany has moved up from one of the bottom ranks to the top group.

Artificial Intelligence

When it comes to questions about the use of AI, the population in Germany is rather open-minded in an international comparison. Here, Germany and Finland show similar patterns in many respects. There is at least a basic knowledge of AI among relatively broad sections of the population in Germany. Further, there exists a link between digital competences, the opportunity/risk assessment of AI, and self-assessed knowledge about AI. People who state that they have at least a basic knowledge about AI are more likely to emphasise the opportunities of AI more strongly. However, in Germany, there is also a relatively large gap between different age groups when it comes to knowledge about AI. When considering the respondents' assessments of the opportunities and risks of AI in specific areas of application, a differentiated picture emerges. For example, people in Germany are considerably more open to the application of AI for autonomous driving than people in other countries.

Fields of Action

Digital transformation needs to be understood increasingly as a pluralistic process for society as a whole, in which people can actively participate. This includes, among other things, accelerating the provision of digital public administration services, with a targeted focus on the user perspective.

In the area of digital competence, the importance of low-threshold learning opportunities, accessible to all individuals to counteract social inequality and the digital divide, is evident. Specifically, against the backdrop of an ageing society in Germany, a main focus needs to lie on strengthening the digital competence of the elderly in order to allow for their social participation even in old age. Furthermore, against the background of the shortage of skilled labour, there is a need for a focus on lifelong learning and increased activities in the areas of further education and training. In particular, greater participation by low-skilled, low-income earners and/or women can realise additional potential for the economy. Higher digital competence can also ensure greater prosperity and gender equality.

Considering the study results, the risk-based supranational regulatory efforts in the area of AI under the European AI Act are to be welcomed in principle. However, a suitably flexible regulatory framework will be crucial to stay abreast of the rapid pace of AI development.

Foreword

Welcome to the bidt-Digitalbarometer.international! The Bavarian Research Institute for Digital Transformation (bidt), in collaboration with the SZ Institute, offers you up-to-date data on the digital competence of the population in various European countries. Our representative study illuminates a fundamental prerequisite for the successful transformation of modern societies towards greater sustainability, climate protection, efficiency, productivity and, last but not least, fairly distributed opportunities for participation: citizens, employees in companies and public authorities, as well as stakeholders of the civil society need to be confident, agile, and effective in dealing with digital innovations. Only then can the potential for positive transformation inherent in AI, the platform economy, and network media be fully realised. The bidt-Digitalbarometer.international assesses the current state of digital competence in Austria, Spain, Finland, France, the United Kingdom, and Italy and compares it with the existing findings on the situation in Germany. Thus, this study concretises the discourse surrounding digitalisation, a subject often discussed but seldom quantified and therefore often "invisible" in everyday life.

You are warmly invited to explore the findings of the latest bidt-Digitalbarometer.international. Equip yourself with methodologically rigorous insights and discover the data basis for your endeavours on the digital transformation. Whether you are at the forefront of innovation, an academic or media expert, or making strategic decisions, our research replaces conjecture with evidence and plausible assumptions with empirical truth.

On behalf of the bidt Board of Directors, the bidt-Digitalbarometer team, and the SZ Institute, we hope you enjoy reading this report. And we invite you to engage in dialogue. Do you have any questions or suggestions or would you like to discuss the digital transformation with us? We would love to hear from you! You can find out how to get in contact with us in this study or at https://en.bidt.digital/.

If you would like to test your own competence and compare it with the results, you can take a digital self-assessment at www.sz.de/digitalbarometer.

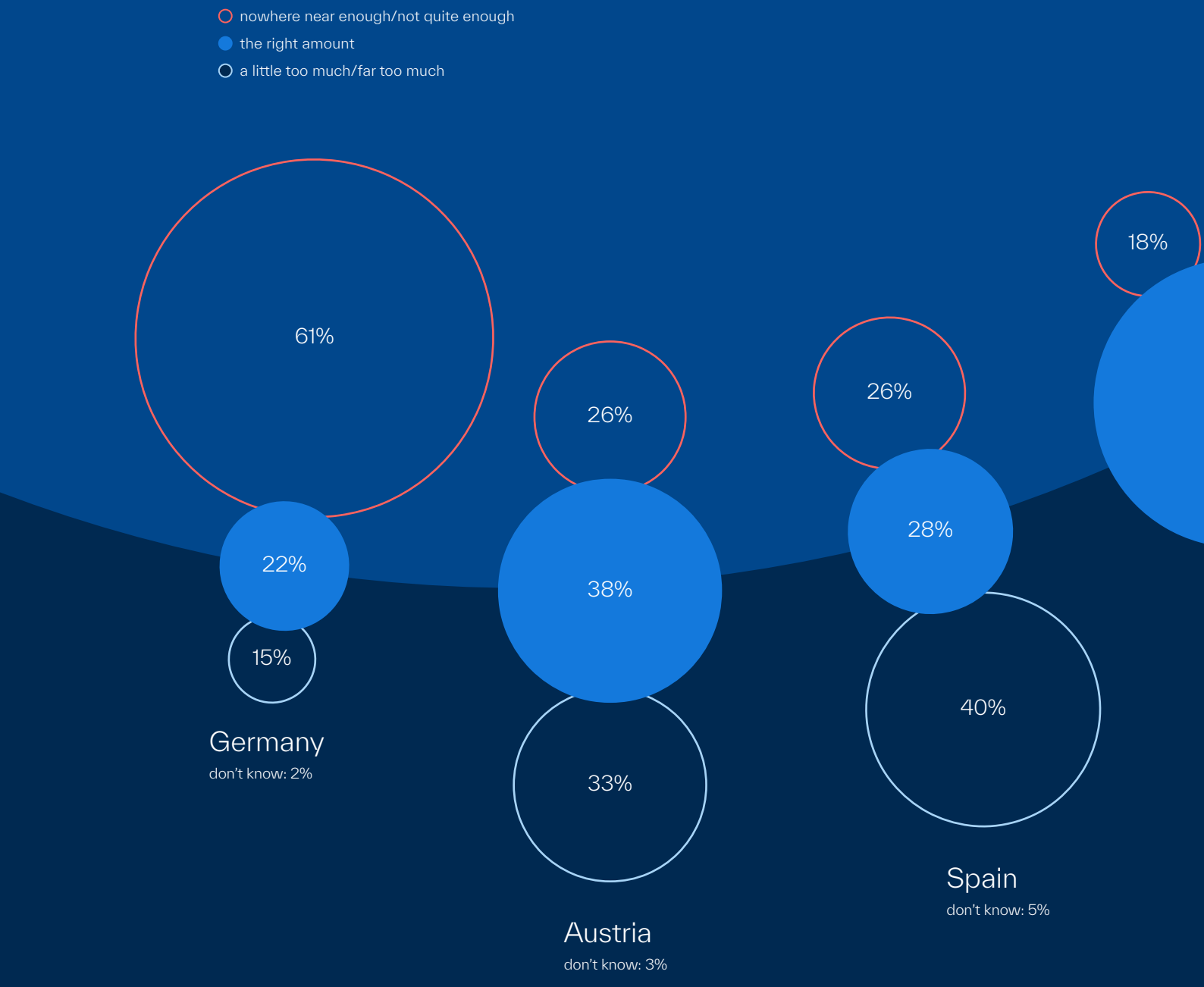
Prof. Dr. Hannah Schmid-Petri & Dirk von Gehlen

Prof. Dr. Hannah Schmid-Petri holds the Chair of Science Communication at the University of Passau and is Director of the bidt.

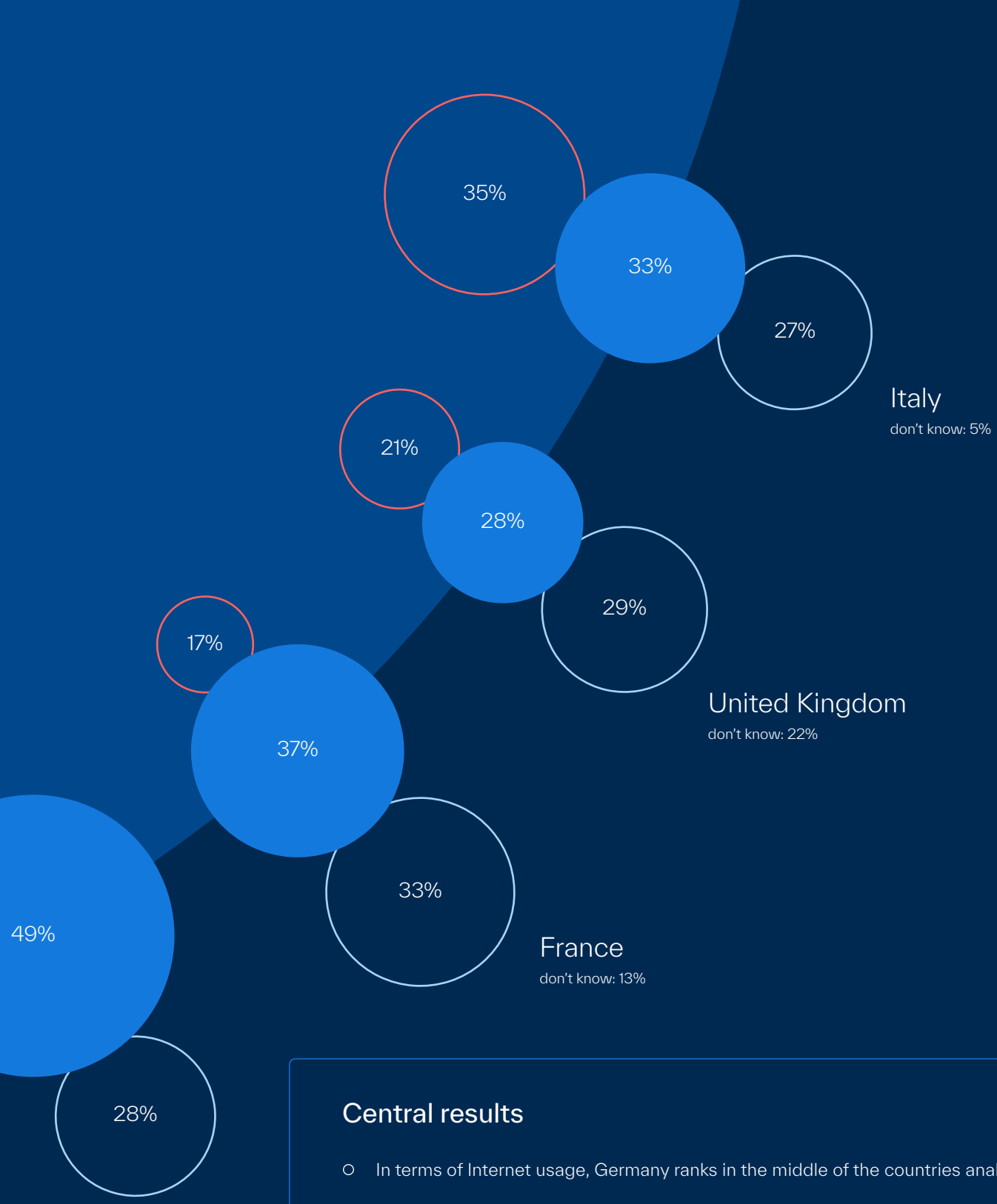
Dirk von Gehlen is Director of the SZ Institute Think Tank of "Süddeutsche Zeitung".

1 The bidt-Digitalbarometer. international

In your opinion, how much attention is paid to the topic of digitalisation in your country overall?



Basis: GER: n = 9,024; AUT: n = 1,154; ESP: n = 1,680; FIN: n = 1,198; FRA: n = 1,705; GBR: n = 1,677; ITA: n = 1,730.



Central results

- In terms of Internet usage, Germany ranks in the middle of the countries analysed.
- Among the countries analysed, Germany is the leader in using landline telephony, but brings up the rear in terms of smartphone use.
- Germany is last when it comes to online job applications and the use of online medical and therapeutic services.
- In none of the analysed countries have so few people completed an entire administrative process online as in Germany.
- A relatively high proportion of Germans quickly take a liking to new technical developments.

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Introduction

The digital transformation is changing all areas of life at a rapid pace. It is influencing how and in what way people communicate and obtain information, how they work and socialise, how they shop, and how they interact with government agencies. The ever-advancing digitalisation poses major challenges for society, the economy, as well as the state. Germany runs the risk of being left behind internationally. For example, digitalisation in the public administration is still only progressing at slow pace. Furthermore, Germany has missed the goals of the Online Access Act, which aimed to make all administrative services available digitally by the end of 2022 (Wollscheid 2022, BMI 2023). In the EU benchmark for e-government services, Germany ranks 21st out of 35 European countries analysed (European Commission 2022b) and runs the risk of falling even further behind in the future (Fischer 2023). But the criticism is not restricted to the lack of bureaucracy reduction, inefficient processes, and a missing comprehensive digitalisation concept at the government level (Becker/Girschick 2022); the digitalisation process of the education system (The Standing Conference of the Ministers of Education and Cultural Affairs 2022) and of the lack of digital competence in parts of the German population (EFI 2023) must also be seen critical.

Appropriate skills and knowledge are very important in order to be able to deal with new technologies in an informed and thoughtful manner in private and professional life. A digitally competent society can also actively drive digital transformation forward, while a lack of digital competence can have a negative impact, not only on participation in social life but also on demand for digital services (EFI 2023). In the long term, a lack of digital competence among the population also jeopardises Germany's technological ability to compete as a business location.

In 2022 the bidt-SZ-Digitalbarometer created a comprehensive database, in order to analyse the status of the digital transformation in Germany and the associated challenges in more detail. The now released supplementary bidt-Digitalbarometer.international answers the question of how the digital competence of the population in Germany (GER) compares to six other European countries – Austria (AUT), Spain (ESP), Finland (FIN), France (FRA), the United Kingdom (UK, GBR in graphs and tables), and Italy (ITA). Further, the study examines aspects of the usage of digital devices and technologies, the digital transformation of the working environment, as well as attitudes towards and assessments of AI in an international comparison. The analysis of the survey data reveals similarities and differences, as well as relative strengths and weaknesses of Germany in relation to the comparison countries. In addition, the data allows determining areas where there is a particular need for action. Therefore, the study contributes to a better understanding of the developments and challenges of the digital transformation. It also expands the basis for initiating debates and helping to shape the digital future of society responsibly, and in a way that is oriented towards the common good.

Data Collection in Brief

The bidt-Digitalbarometer.international follows on from the bidt-SZ-Digitalbarometer 2022 in Germany and enables comparisons between countries on various aspects of digital transformation through parallel data collection in Austria, Finland, France, Italy, Spain, and the UK. The bidt developed the original questionnaire for the bidt-SZ-Digitalbarometer 2022 together with partners at the SZ Institute and the Max Planck Institute for Innovation and Competition. The instrument was finalised in close collaboration with forsa Politik- und Sozialforschung GmbH.

The questionnaire covers the following key areas:
- usage behaviour and e-government
- digital competence (based on the EU's DigComp reference framework for digital competence)
- digital transformation of the working environment
- attitudes towards AI

The data collection in Germany took place from 9 August to 13 September 2021. Forsa conducted the study partly online and partly as a computer-assisted telephone survey. In Germany, a total of 9,044 people were surveyed: 7,644 online, 1,400 infrequent and non-users of the Internet by telephone. The results for Germany presented below stem from this survey.

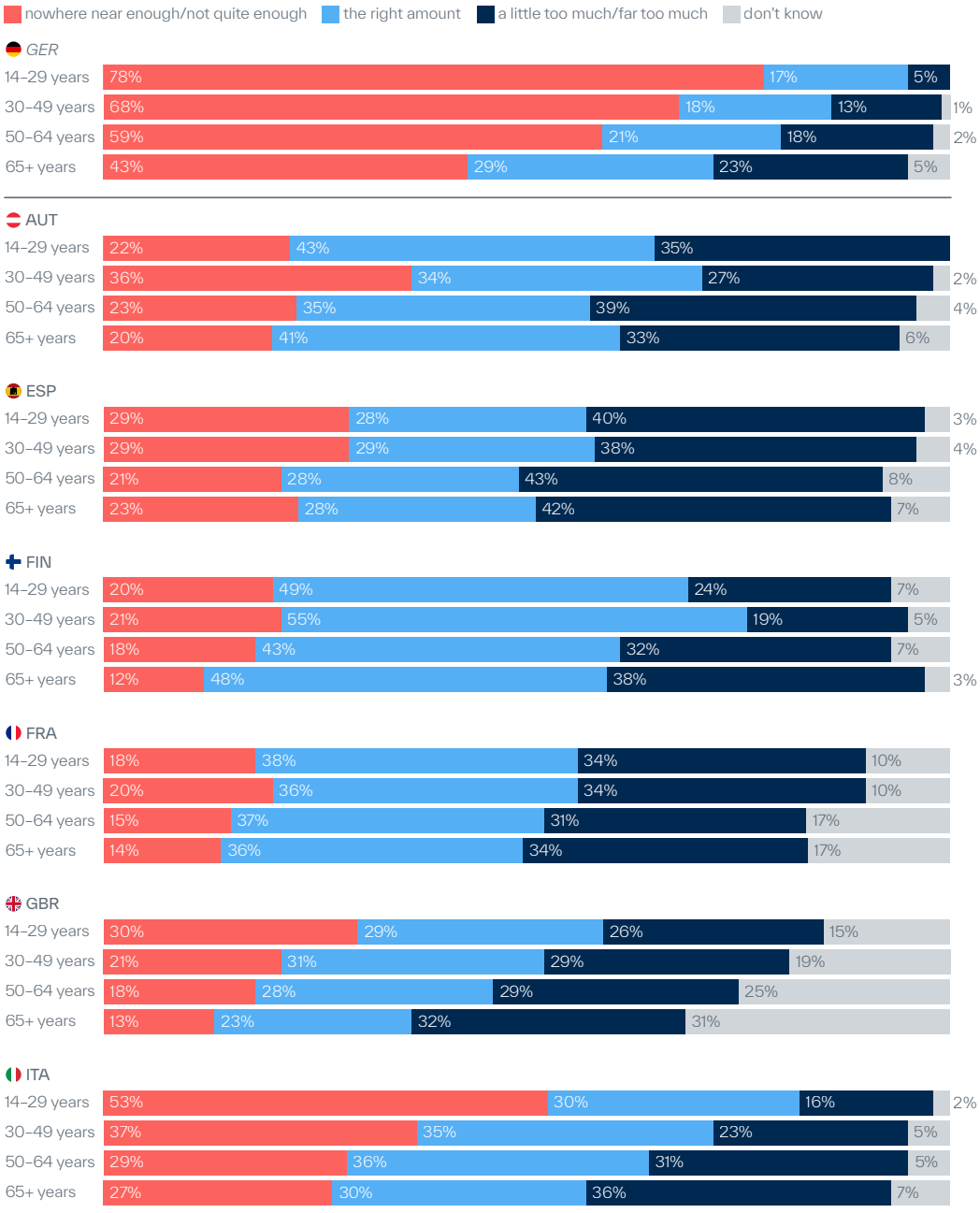
For the comparative surveys, the bidt, in close coordination with DCORE GmbH, adapted some details of the questionnaire to current developments and existing country specifics as part of the translation into the respective national language.

The data surveys in the six comparison countries – Austria, Finland, France, Italy, Spain, and the UK – were conducted by DCORE between 14 November 2022 and 5 January 2023. As with the data collection in Germany, the basic population was the respective resident population aged 14 and over with sufficient knowledge of the respective national language. In the six comparison countries, the surveys were also conducted partly as online surveys and partly as telephone surveys in order to be able to draw a representative picture of the overall population. The number of cases per country ranged from 1,032 to 1,565 people in the online surveys and 125 to 200 infrequent and non-users of the Internet, who were interviewed by telephone.

The sampling design and the subsequent weighting with structural specifications from official statistics allow population-representative analyses for each country. All results presented are weighted accordingly. Possible deviations from the sum of 100% in individual charts are due to rounding. More detailed information on the surveys and calculations carried out can be found in the methodological description in the appendix.

Figure 1: Assessment of Attention to the Topic of Digitalisation by Age

In your opinion, how much attention is paid to the topic of digitalisation in your country overall?



Basis: GER: n = 9,024; AUT: n = 1,154; ESP: n = 1,680; FIN: n = 1,198; FRA: n = 1,705; GBR: n = 1,677; ITA: n = 1,730.

The results from the bidt-Digitalbarometer.international show the need to actively shape the digital transformation in Germany. In no other country surveyed do so many people believe that too little attention is paid to the topic of digitalisation. At 61%, the proportion of people who hold this view is around twice as high in Germany as in Italy. The proportion is even lower in the other countries analysed (Figure p. 12 f.). Additionally, in Germany, differences in answers to this question by age group are much stronger than in the comparison countries. The vast majority of younger people in Germany believes that digitalisation receives nowhere near or not quite enough attention. This proportion is only 43% among older people. In the other countries, the age differences are considerably less pronounced or – as in France, for example – hardly exist (cf. Figure 1).

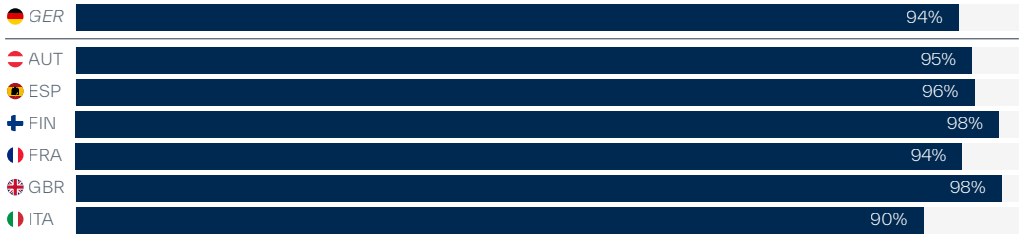
Usage Behaviour

Internet Usage in Germany in the Midfield at 94%

Access to the Internet and the use of digital devices and technologies are two essential prerequisites for participation in digital life. Even though Internet usage is high in all selected countries according to Eurostat data, Italy in particular lags behind the other countries with an Internet usage proportion of only 90% of the total population. One reason for this finding could be the relatively old population in Italy. Almost a quarter are aged 65 years or above, the median age is 48.0 years; in Germany it is 45.8 years (Eurostat 2023b) and in the UK 40.7 years (ONS 2021). The UK and Finland have the highest Internet usage rates, with 98% of the population each, although there is also a high proportion of people aged 65 and above in Finland (Eurostat 2023b). With 94% of the population using the Internet, Germany is on the same level as France.

Figure 2: Internet Usage

Percentage of Internet users



Source: Eurostat 2022 (GER, AUT, ESP, FIN, FRA, ITA), 2020 (GBR);
Online data code: TIN00093, retrieved on 10/05/2023.

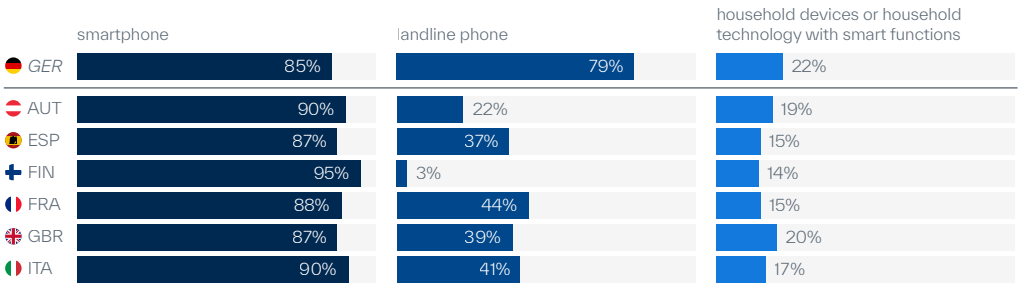
Only in Germany is Landline Telephony still of Major Importance

The smartphone is the most frequently used technical device in all the countries surveyed. With 95% smartphone users, the Finnish population is the frontrunner, while Germany brings up the rear with a proportion of 85%. However, the difference between the survey periods should be taken into account here, as smartphone use is still on the rise. The situation is different when it comes to the use of landline telephony, which is most prevalent in Germany and practically non-existent in Finland. One of the main reasons for this major difference is the availability of and demand for corresponding communication services. Finland's largest telecommunications provider discontinued its traditional landline services back in 2019 (Telia Finland 2019). The reasons for this were the outdated technology used for landline telephony compared to modern mobile technology, coupled with offers for mobile Internet usage that are particularly inexpensive in a global comparison. In Germany, on the other hand, the costs for mobile Internet usage are the highest among the countries analysed (Rewheel Research 2023).

In contrast, Germany leads the field with regard to the use of modern household appliances with a smart function, with 22% of the population using them, closely followed by the UK with a proportion of 20%. Finland has the fewest users of smart household appliances with a proportion of just 14%. More information on the use of other technical devices can be found in the country profiles at the end of the study.

Figure 3: Use of Technical Devices

Which of the following devices or objects do you use in your personal time?



Basis: GER: n = 9,044; AUT: n = 1,157; ESP: n = 1,690; FIN: n = 1,207; FRA: n = 1,715; GBR: n = 1,698; ITA: n = 1,734.

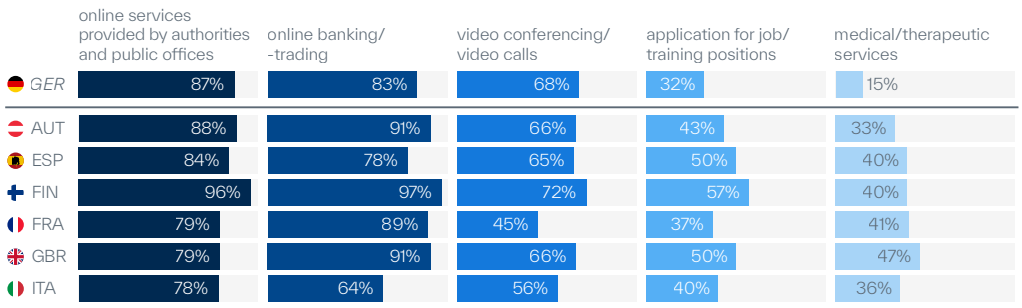
Germany is Lagging Behind Regarding the Use of Online Medical Applications

There are some considerable differences in the online activities of users. While almost all Internet users in Finland (97%) use online banking, only 64% do so in Italy. Germany is in fifth place of the seven countries analysed with a proportion of 83%. However, when it comes to the use of video conferencing and video telephony, German Internet users are in a leading position after Finland with a proportion of 68%. One possible reason for this finding is the persistently high share of people working from home in Germany since the start of the COVID-19 pandemic (Stürz et al. 2022b). France brings up the rear in terms of using video conferencing and video telephony with a proportion of 45% of Internet users. With regard to online job applications and the use of therapeutic and medical services online, German Internet users are ranked last among the countries analysed. In the UK, for example, around three times as many Internet users as in Germany make use of therapeutic and medical services on the Internet.

When looking at online services offered by authorities and public offices, a different situation emerges. Around nine out of ten Internet users in Germany have already used such services – a similar number as in Austria and more than in Spain, France, the UK or Italy.

Figure 4: Online Activities of Internet Users

Do you use the following options on the Internet?



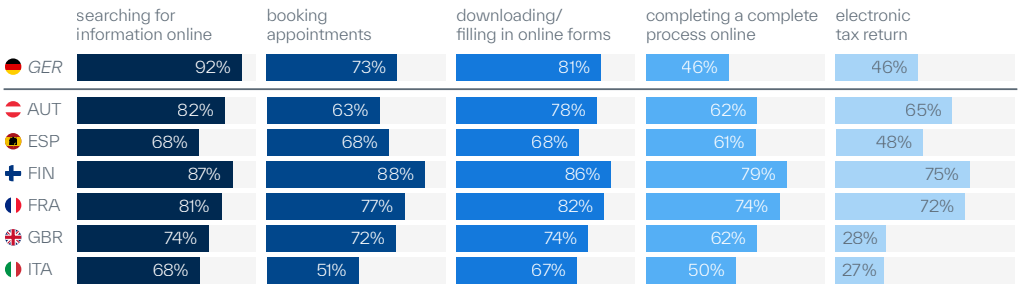
Basis: Internet users only; GER: n = min. 7,730; AUT: n = min. 1,080; ESP: n = min. 1,614; FIN: n = min. 1,148; FRA: n = min. 1,594; GBR: n = min. 1,618; ITA: n = min. 1,598; without "don't know".

In Germany, the Complete Execution of E-Government Processes Fails Due to a Lack of Availability

However, a closer look at the services used shows that the usage of public administration services on the Internet in Germany relates primarily to searching for information, making appointments or using individual forms. However, when it comes to completing a full administrative process online – with the exception of submitting a tax return – Germany ranks lowest among the countries analysed. This finding is also due to the limited availability of such services. In contrast, around eight out of ten Finnish Internet users have already completed a full administrative process online, whereas in Germany the figure is not even one in two. Approximately one in two German Internet users has already submitted an electronic tax return. For this specific administrative service, Germany lies in the middle of the countries analysed. Overall, however, the results show that Germany lags considerably behind when it comes to the consistent digitalisation of administrative services.

Figure 5: Use of E-Government Services by Internet Users

Which of the following options for contacting authorities and offices online have you used?



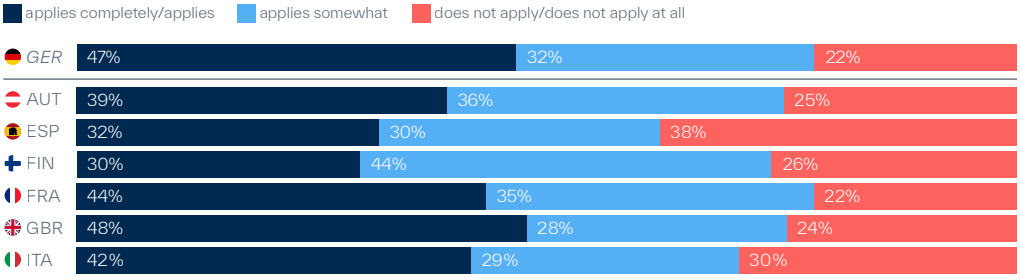
Basis: Internet users only; GER: n = min. 7,955; AUT: n = min. 1,091; ESP: n = min. 1,530; FIN: n = min. 1,153; FRA: n = min. 1,607; GBR: n = min. 1,474; ITA: n = min. 1,563; without "don't know".

High Level of Openness to New Technological Developments in Germany

The low usage figures in Germany seen above are not due to a lack of interest in new technical developments (cf. Neyer et al. 2016). For example, only in the UK and Germany do almost half of the population state that they quickly find pleasure in new technological developments. In Finland, in contrast, less than a third claims this. At the same time, Finland also has the highest proportion of people (44%) who say they somewhat quickly find pleasure in new technological developments.

Figure 6: Technology Acceptance

I quickly find pleasure in new technological developments.



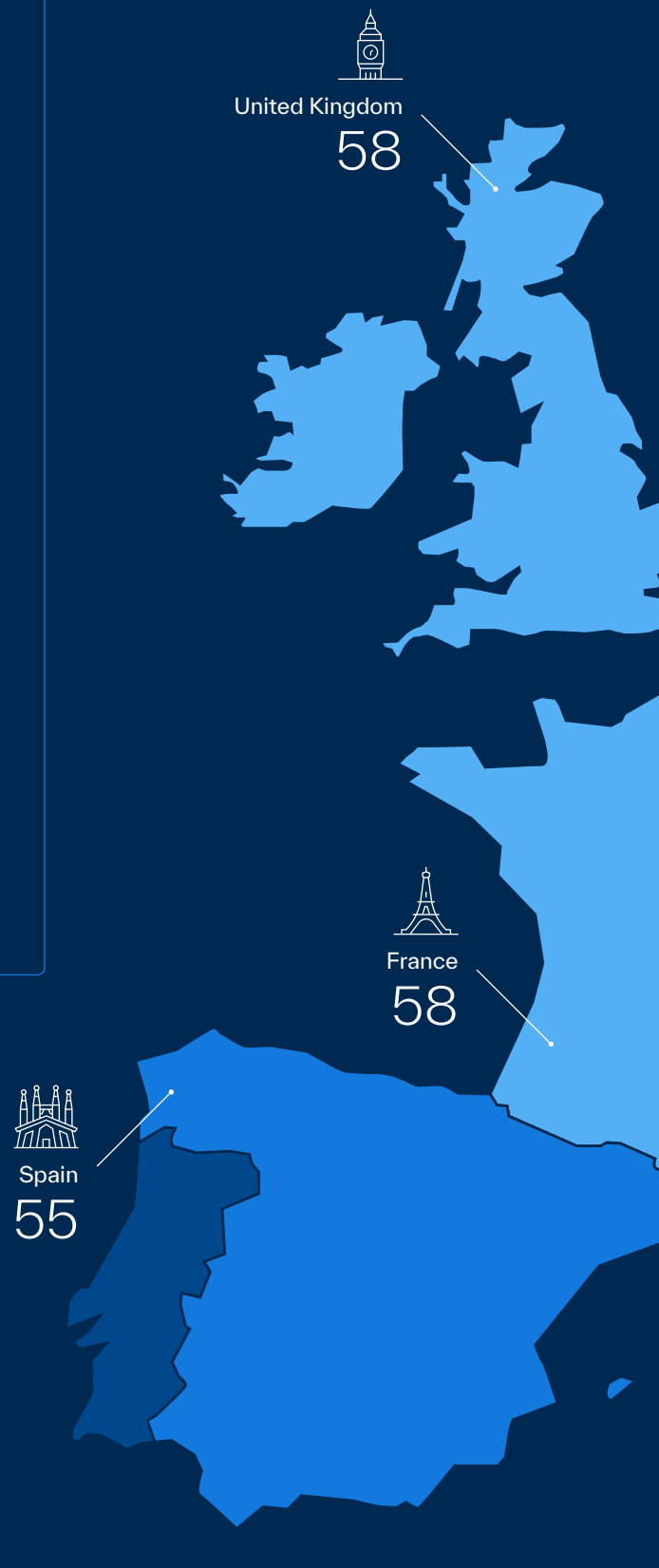
Basis: GER: n = 9,018; AUT: n = 1,148; ESP: n = 1,675; FIN: n = 1,179; FRA: n = 1,673; GBR: n = 1,675; ITA: n = 1,722, without "don't know".

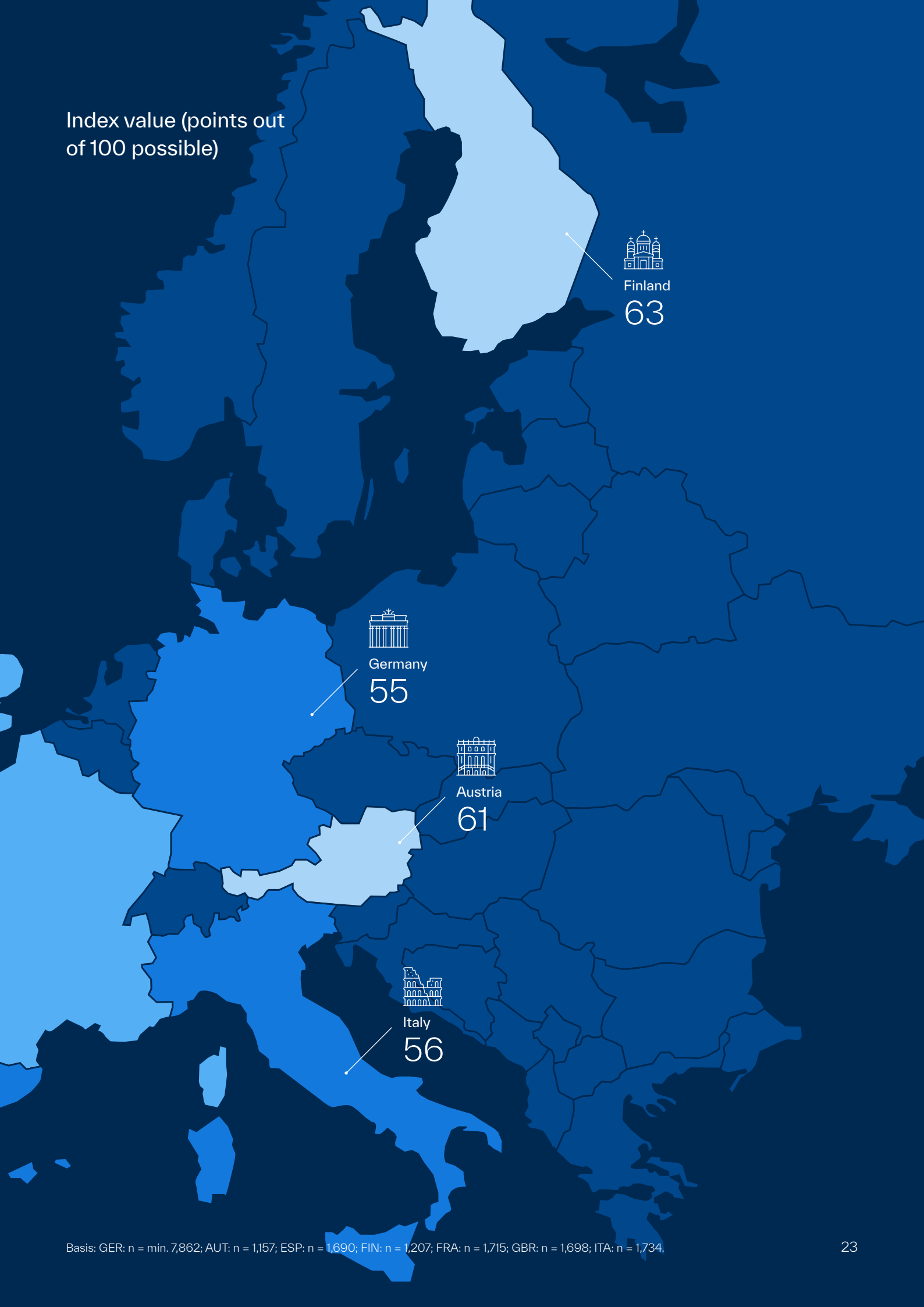
The results of the bidt-Digitalbarometer.international show that there are considerable differences in usage behaviour between countries. These differences can often be explained by the range of options available, such as the availability and cost of landline connections compared to mobile phone connections. In Germany, the lack of options for completing an entire administrative process online also contributes to the low use of such services. On the other hand, available services, such as booking appointments online, are relatively popular. This observation is in line with a high level of openness towards new technical developments within the German population. The Finnish population shows the most differentiated opinion when it comes to finding pleasure in new technical developments – perhaps also because Finns have the highest competence with regard to dealing with digital technologies, as is shown in the following chapter.

2 Digital Competence

Central Results

- The digital competence level in Germany is comparatively low. Together with Spain and Italy, Germany is in the bottom group, with Finland at the top.
- The digital competence gap by formal education, age, and gender is relatively large in Germany. These differences are rather small in Finland, especially by level of education.
- Differences in digital competence between countries is particularly evident among the less educated and older people, and less pronounced among the more educated and younger people.
- In Germany, only a relatively small proportion of the population state that they have improved their digital skills in the last year. On this topic, there are also considerable differences by education and age. Therefore, Germany has a higher risk of a further widening of the competence gap leading to more and more sections of the population falling behind in terms of digitalisation, compared to the other countries investigated.





Basis: GER: n = min. 7,862; AUT: n = 1,157; ESP: n = 1,690; FIN: n = 1,207; FRA: n = 1,715; GBR: n = 1,698; ITA: n = 1,734.

2 Digital Competence

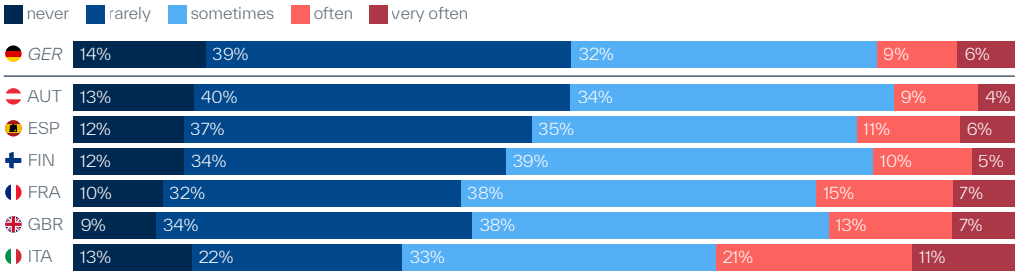
Digital competence is becoming increasingly important to be able to continue to fully participate in professional and social life. Not only are application skills crucial, but an understanding of the workings and mechanisms of action of new technologies is also becoming increasingly important. On the one hand, this knowledge is essential for evaluating not only the possibilities and opportunities but also the dangers and risks associated with new technologies. On the other hand, digital competence is the only way to judge when and where new technologies are useful (Vuorikari et al. 2016).

The Older the Person, the More Frequently They are Overwhelmed by Digital Technologies

Data from the bidt-Digitalbarometer.international show that not everyone always has an easy time using digital devices or the Internet. For example, 15% of people in Germany state that they are very often or often overwhelmed. The proportion is similar in Austria and Finland, and considerably higher in France, the UK and Italy. Further, Austria and Germany are the countries with the largest proportion of people who rarely or never feel overwhelmed when using digital devices or the Internet.

Figure 7: Excessive Demands When Using Digital Devices or the Internet

How often do you feel overwhelmed when dealing with digital devices or the Internet in general?



Basis: GER: n = 8,913; AUT: n = 1,143; ESP: n = 1,648; FIN: n = 1,194; FRA: n = 1,692; GBR: n = 1,675; ITA: n = 1,683; without "don't know".

There are sometimes considerable differences between the countries within different groups of people, as presented in the differentiated analysis in the country profiles. In Germany, for example, differences by gender and age are relatively pronounced compared to the other countries. While only 44% of women in Germany state that they are rarely or never overwhelmed when using digital devices or the Internet, 62% of German men report this. While this difference by gender is 18 percentage points in Germany, it is smallest in the UK at five percentage points. The differences by age are even more remarkable.

In Germany, 73% of people aged 14 to 29 rarely or never feel overwhelmed when using digital devices or the Internet, while only 31% of those aged 65 and above say the same. In Finland, however, the opposite can be observed. Here, young people state less frequently than older people that they rarely or never feel overwhelmed when using digital devices or the Internet. In Spain, there are relatively large differences by formal education in terms of feeling overwhelmed when using digital devices or the Internet. In Finland, there are hardly any differences between groups with different levels of education or income when looking at excessive demands. In summary, appropriate skills are required to be able to deal with digital technologies without feeling overwhelmed.

Digital competence includes skills and know-how that enable people to participate in life in a digital society. This competence is not limited to purely functional skills in dealing with information and communication technologies (Jisc 2014). In addition to skills, digital competence encompasses the knowledge and attitudes required in various aspects of digital life, such as using information and communication technologies to complete tasks, solving problems, organising information, collaborating with others, and creating and sharing digital content. In addition, digital competence describes an appropriate, effective, efficient, critical, autonomous, flexible, and ethically reflective development of knowledge for action in all areas of life (Ferrari 2012).

This survey used the DigCompSAT self-assessment test developed by the Joint Research Centre of the European Commission (Clifford et al. 2020). This test is based on the European Digital Competence Framework (DigComp). The reference framework is divided into the five competence areas: “information and data literacy”, “communication and collaboration”, “digital content creation”, “safety”, and “problem solving”. These competence areas comprise 21 individual competences (Vuorikari et al. 2022). The DigCompSAT includes 82 individual statements covering the competence types of knowledge, skills, and attitude. The measurement of competences is based on a self-assessment in which the respondents can answer the individual statements on a four-point scale, with scale labels being adapted depending on the type of competence. The instrument covers the most important digital competences that are considered necessary for participation in society and the world of work for most EU citizens (Clifford et al. 2020). The bidt-SZ-Digitalbarometer 2022 and the bidt.Digitalbarometer.international are the first comparative representative surveys applying the DigCompSAT in various European countries.

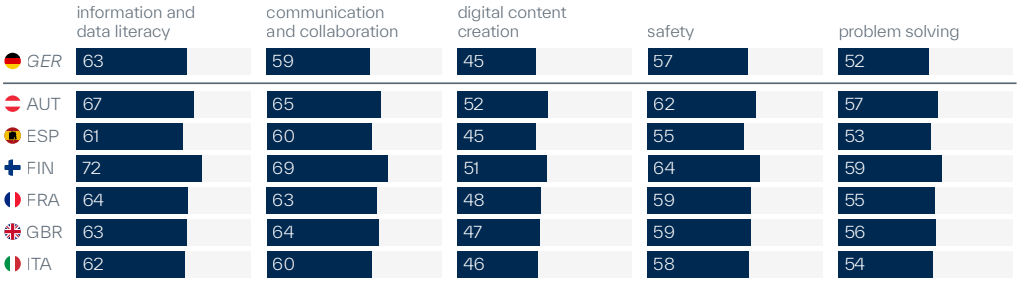
For the following analyses, the individual statement responses were computed into an index from zero to 100 points for each competence area or competence type as well as across all competence areas. Here, zero points represent no competence at all, 100 points represent the maximum achievable competence in the DigCompSAT. Further details on the DigCompSAT self-assessment test and index computation can be found in the methodological description in the appendix.

Finland Leads in Digital Competence, Germany in the Bottom Group

Finland leads the field in terms of digital competence. The Finnish population achieved the highest index values in all areas, except for "digital content creation", followed by Austria, France, and the UK. Spain, Italy, and Germany bring up the rear. In addition, the results show that people in the countries analysed generally have the highest index values in the areas of "information and data literacy" and "communication and collaboration", and the lowest in the area of "digital content creation". Therefore, the data suggest that digital competences related to the basic requirement of access to information and data available online are more pronounced than the competences associated with providing such information and data online oneself.

Figure 8: Digital Competences by Competence Area

Index value (points out of 100 possible)

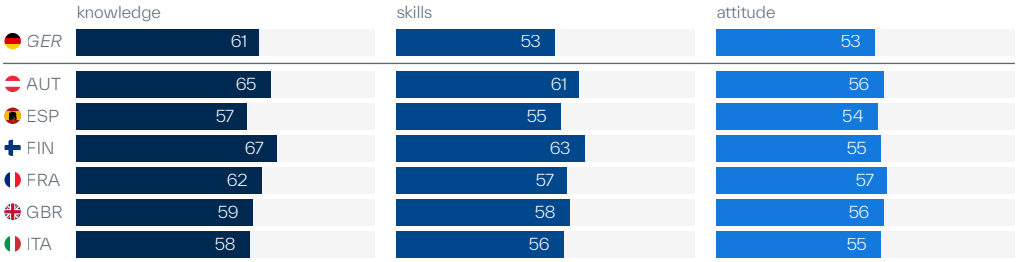


Basis: GER: n = min. 7,862; AUT: n = min. 1,154; ESP: n = min. 1,675; FIN: n = min. 1,206; FRA: n = min. 1,696; GBR: n = min. 1,688; ITA: n = min. 1,720.

The comparison between the digital competence types (knowledge, skills, and attitude) shows that the differences are less attributable to attitudes than to knowledge and skills. France, for example, achieved the highest average score of 57 points for the individual statements of the attitude type, while Germany scored the lowest at 53 points. Thus, the maximum difference here is four points. The Finnish population achieved the highest scores for the knowledge and skills types; the difference with the countries with the lowest scores is ten points for each of these two types. At the same time, it should be noted that the DigComp-SAT contains considerably more individual statements of the knowledge and skills competence types than individual statements of the attitude type.

Figure 9: Digital Competences by Type

Index value (points out of 100 possible)



Basis: GER: n = min. 7,639; AUT: n = min. 1,155; ESP: n = min. 1,683; FIN: n = min. 1,207; FRA: n = min. 1,708; GBR: n = min. 1,696; ITA: n = min. 1,731.

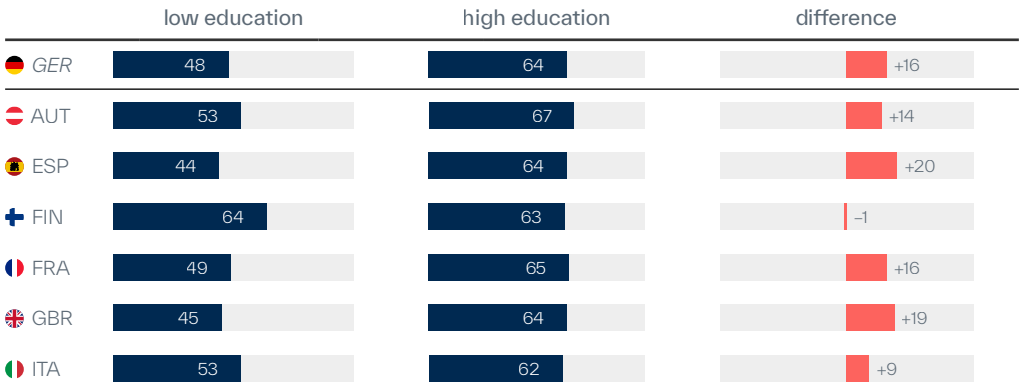
While individuals with strong digital competence are expected to face few problems in participating in digital life, those with low digital competence are particularly of interest due to their increased risk of being left behind. The more detailed analyses show that the differences in competence between the various population groups vary greatly among the countries analysed. For example, the digital divide is relatively pronounced in Germany compared to the other countries, particularly in terms of age and gender.

Digital Competence Gap Between Educational Levels: Particularly Large in Spain, Non-existent in Finland

The level of education often has a direct impact on a person's knowledge and skills and therefore also often has a major influence on career opportunities and income. Spain and the UK show the greatest differences between people with low and high formal education in terms of digital competence, followed by Germany and France. For example, Germans with a low level of formal education (at most a lower secondary school leaving certificate) score 48 points on the digital competence index on average. The index value of German people with a high level of formal education, namely at least a bachelor's degree, is 16 points higher at 64 points. In Spain, this difference is as much as 20 points. In contrast, there are practically no differences in digital competence according to educational level in Finland. There, the index value of digital competence for those with a higher level of formal education is virtually identical to the index value for those with a lower level of formal education. Moreover, differences between the countries are primarily evident for those with a low level of formal education. Concretely, while the range of index values for the low education level individuals is between 44 points in Spain and 64 points in Finland, the differences are considerably smaller for those with a higher level of formal education. The range here is only between 62 points in Italy and 67 points in Austria.

Figure 10: Differences in Digital Competence by Education

Index value (points out of 100 possible)



Formal education according to ISCED 2011: low (level 1-2), high (level 5-8).

Basis: GER: n = min. 6,606; AUT: n = 548; ESP: n = 1,265; FIN: n = 697; FRA: n = 1,011; GBR: n = 1,093; ITA: n = 1,002.

These results indicate considerable differences, particularly in the early stages of school education. Although there are many possible reasons for this gap as well as large regional

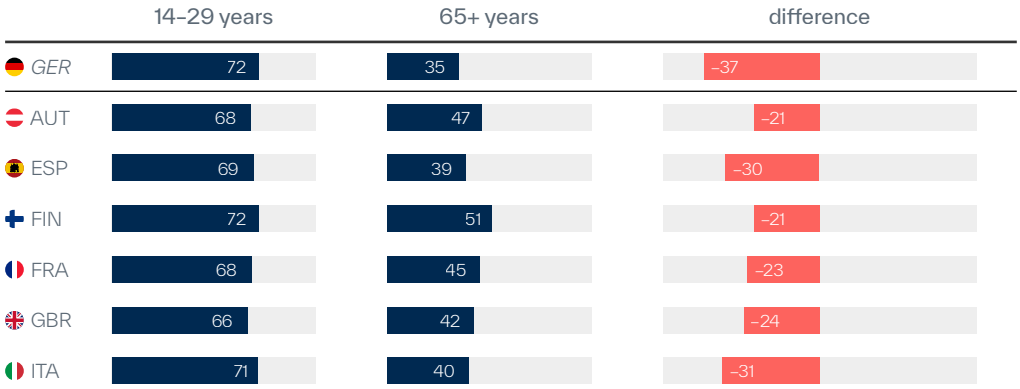
differences within the individual countries, the data from the bidt-Digitalbarometer.international show that the Finnish education system has been somewhat successful. This result is also confirmed by the findings of the PISA studies. Finland's scores are considerably above the OECD average, while the results in Germany were only slightly above average and in Spain recently even below average (OECD 2022a, 2020, 2018a, 2018b). Compared to other countries, pupils in Spain have to repeat a grade much more frequently (OECD 2019). In 2021, 28% of 25 to 34-year-olds in Spain also had no secondary school qualifications – almost twice the OECD average (OECD 2022b). At 5.9% of gross domestic product, Finland also spends considerably more on its education system in relative terms than Germany (4.7%) or Spain (4.6%) (Destatis 2023a). Additionally, Finland emphasises investment in early formal education, where the returns on education are greatest, and this focus is reflected in digital competence. At the same time, many education policy measures in Finland support greater educational equity, while in Spain and Germany, among others, the social background of pupils is still strongly associated with educational achievements. Another difference is that Finland manages education policy centrally across all levels in a single ministry. In contrast, in Germany there are major differences in education policies between the federal states. In summary, the German setup results in difficulties regarding comparability within the country, and standardised control of political measures is only possible to a limited extent (OECD 2022a, 2020, 2018b). In this context, it is also critical, from a German perspective, that almost all European countries have now introduced computer science as a compulsory subject at school, while this discipline remains a niche elective subject in many federal states in Germany (Suessenbach et al. 2023).

Digital Competence Gap by Age Widest in Germany

Focusing on age groups, there are also high differences in digital competence. Younger people aged 14 to 29 years have considerably higher competence scores in all countries than individuals aged 65 years and above. The digital divide among different age groups is most pronounced in Germany. Here, the difference in competence scores between people aged 14 to 29 years and those aged 65 years and above is 37 points. In Austria and Finland, on the other hand, this difference is considerably smaller at just 21 points. The picture is considerably more balanced among young people than for older groups, where digital competence varies more widely between countries.

Figure 11: Differences in Digital Competence by Age

Index value (points out of 100 possible)



Basis: GER: n = min. 3,444; AUT: n = 519; ESP: n = 719; FIN: n = 610; FRA: n = 847; GBR: n = 793; ITA: n = 790.

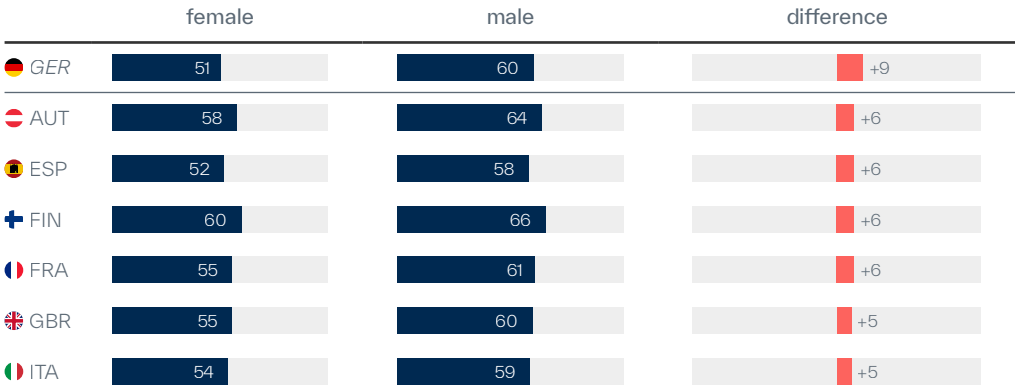
Here as well, the Finnish education system has been successful by consistently emphasising the lifelong learning approach, focusing on early formal education, as well as promoting adult education for all levels of initial education (Ministry of Education and Culture 2016). Accordingly, Finland performs particularly well in lifelong learning in an EU comparison. Austria also lies above the EU average in this area, followed by Spain and France, while this is not the case for Italy and Germany (Eurostat 2023a). Demographic ageing requires a strengthening and continuous development of digital competence, especially among older people, so that they can remain socially integrated longer and successfully deal with the increasing digitalisation of health and care services (EFI 2023). The way in which digital transformation and a lack of digital competence can affect older people in particular was recently demonstrated in Spain in the protest campaign entitled "I'm old, but not an idiot". The protest took aim at the closure of more and more bank branches and the reduction in staff combined with shorter opening hours due to the increase in online banking. As a result of these developments, particularly older people face increased difficulties with being served in a branch (dpa 2022).

Digital Competence Gap by Gender Widest in Germany

There are also differences between men and women in terms of digital competence, but these discrepancies are considerably smaller than those based on age or education. Overall, women have lower self-assessed competence than men in all of the countries surveyed. Once again, the digital divide in the countries analysed – this time by gender – is most pronounced in Germany. Specifically, German women score 51 points on the digital competence index on average, while the mean score for men is 60 points. The difference is smallest in the UK and Italy at five points.

Figure 12: Differences in Digital Competence by Gender

Index value (points out of 100 possible)



Basis: GER: n = min. 7,852; AUT: n = 1,156; ESP: n = 1,687; FIN: n = 1,199; FRA: n = 1,713; GBR: n = 1,690; ITA: n = 1,731.

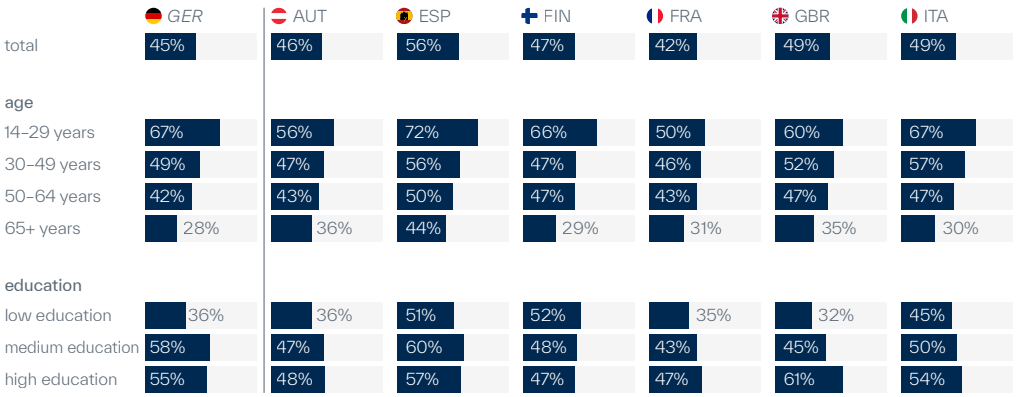
The reasons for these gender differences are likely complex. However, more detailed analyses of the data suggest that the discrepancies can only partially be explained by differences in the self-assessment of men and women, with men tending to overestimate their skills while women tend to underestimate them. For example, gender differences are not evenly distributed by age. Further, in many countries, the greatest differences in skills by gender are found in the age groups of people aged 30 to 49 years and people aged 50 to 64 years, which also indicates an occupational correlation. For Germany, Lott (2023) provides evidence based on data from the National Educational Panel Study. The author finds that, first, a gender-specific digital divide exists in the use of computer software or networked digital technologies in the workplaces and, second, that women working part-time have disadvantages. In addition, women, on average, receive less frequent and shorter training programmes than men. The fact that many digital competences for the working life are learnt, exercised, practised, and further developed at work and that women and men, on average, have different employment biographies provides another explanation for the observed differences. Accordingly, further analyses also show that in most countries, a high proportion of the observed differences vanish if only women and men in full-time employment are compared in terms of their digital competence.

Further Widening of the Digital Divide, Especially in Germany

Lifelong learning plays an increasingly important role in reducing the digital competence gap. It is therefore crucial that as many people as possible – regardless of age, gender, or level of education – improve their digital competence. More than two-fifths of people in all countries surveyed state that they improved their skills in using digital technologies in the last year. In France, this value is the lowest at 42%, while in Spain it is the highest at 56%. Germany is in second-last place among the countries analysed, with 45% of the population having improved their skills in using digital technologies in the last year. A more detailed analysis of the data reveals some substantial differences. The improvement of digital technology skills varies greatly by age and formal education, with the differences in Germany being relatively large compared to other countries. Once again, these findings show that in Finland there exist hardly any differences in the improvement of digital skills by level of education. Also, Finland is the only country in which more people with a lower level of formal education state that they have improved their digital skills in the last twelve months than those with a higher level of formal education. From a German perspective, a particularly critical aspect is that in Spain and Italy – countries with similarly low average competence scores – larger shares of people have improved their digital skills in the twelve months prior to the survey than in Germany. Secondly, the large age and gender differences in Germany in improving digital skills indicate a further increase in the digital divide. This increase exists in most other countries as well, though on a smaller scale.

Figure 13: Improvement in Digital Skills in the Last Year

In the last 12 months, have you improved your skills when dealing with software programs, apps, digital devices, or the Internet? – Percentage of "yes"



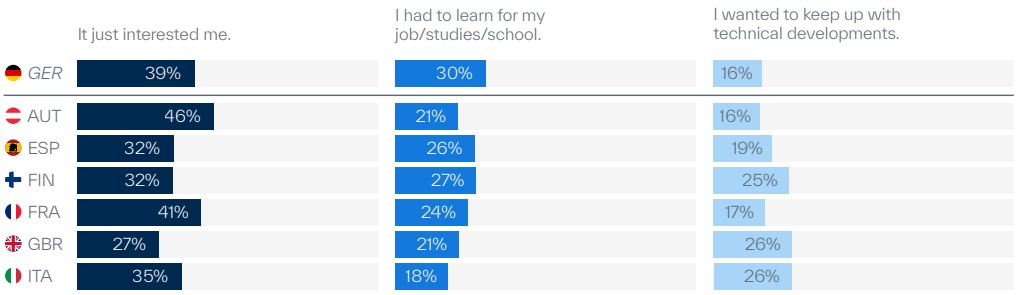
Formal education according to ISCED 2011: low (level 1-2), medium (level 3-4), high (level 5-8).

Basis: GER: n = 8,933; AUT: n = 1,139; ESP: n = 1,670; FIN: n = 1,188; FRA: n = 1,694; GBR: n = 1,676; ITA: n = 1,706.

In all countries, the most frequent reason for improving digital skills was personal interest, followed by the need for further training at work, school, or university. Personal interest is particularly pronounced in Austria (46%), France (41%), and Germany (39%). People in Finland (25%), the UK (26%), and Italy (26%) are particularly keen to keep pace with technological developments. 30% of Germans who have improved their digital skills in the last twelve months state that the reason for the improvement was the need for further training for work, school, or university – a higher share than in any other country surveyed.

Figure 14: Triggers for the Improvement of Digital Skills

What was the main trigger or incentive for improving your skills in the last 12 months?



Basis: only respondents who have improved their skills; GER: n = 3,670; AUT: n = 488; ESP: n = 844; FIN: n = 512; FRA: n = 684; GBR: n = 777; ITA: n = 838; without "don't know".

To summarise, in terms of digital competence, a comparison of countries reveals various weaknesses in Germany. Not only does the population generally have low digital competence scores, but the differences by various characteristics, such as age and gender in particular, are also comparatively high. Furthermore, as the digital divide is widening more than in many other countries, there is a risk that increasingly larger sections of the population will be left behind digitally. This circumstance also plays a role in the shortage of skilled labour as well as in Germany's technological competitiveness, as digital competence is particularly important in the working environment. Therefore, the following chapter takes a more detailed look at the labour force.

3 Digital Transformation of the Working Environment

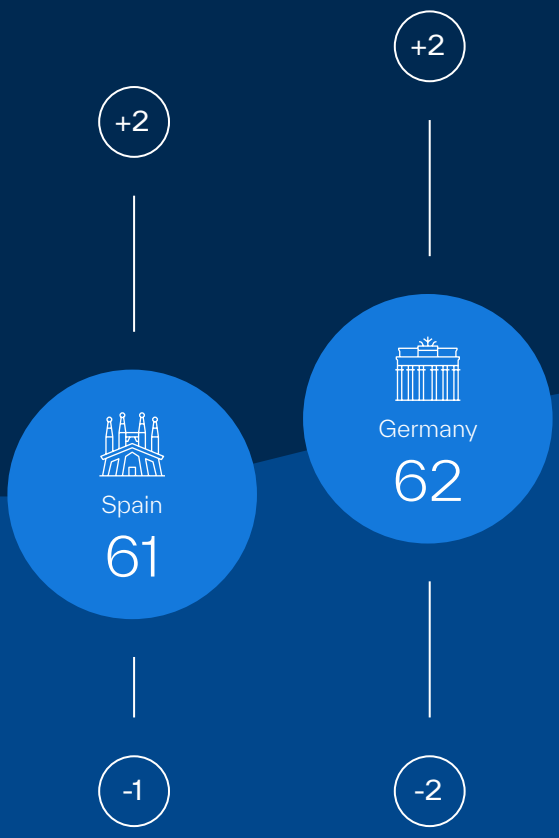
Digital Competence of Employees and by Company Size

Index value (points out of 100 possible)

- companies with 250 and more employees
- all employed persons
- companies with 1–49 employees

companies with 250 and more employees

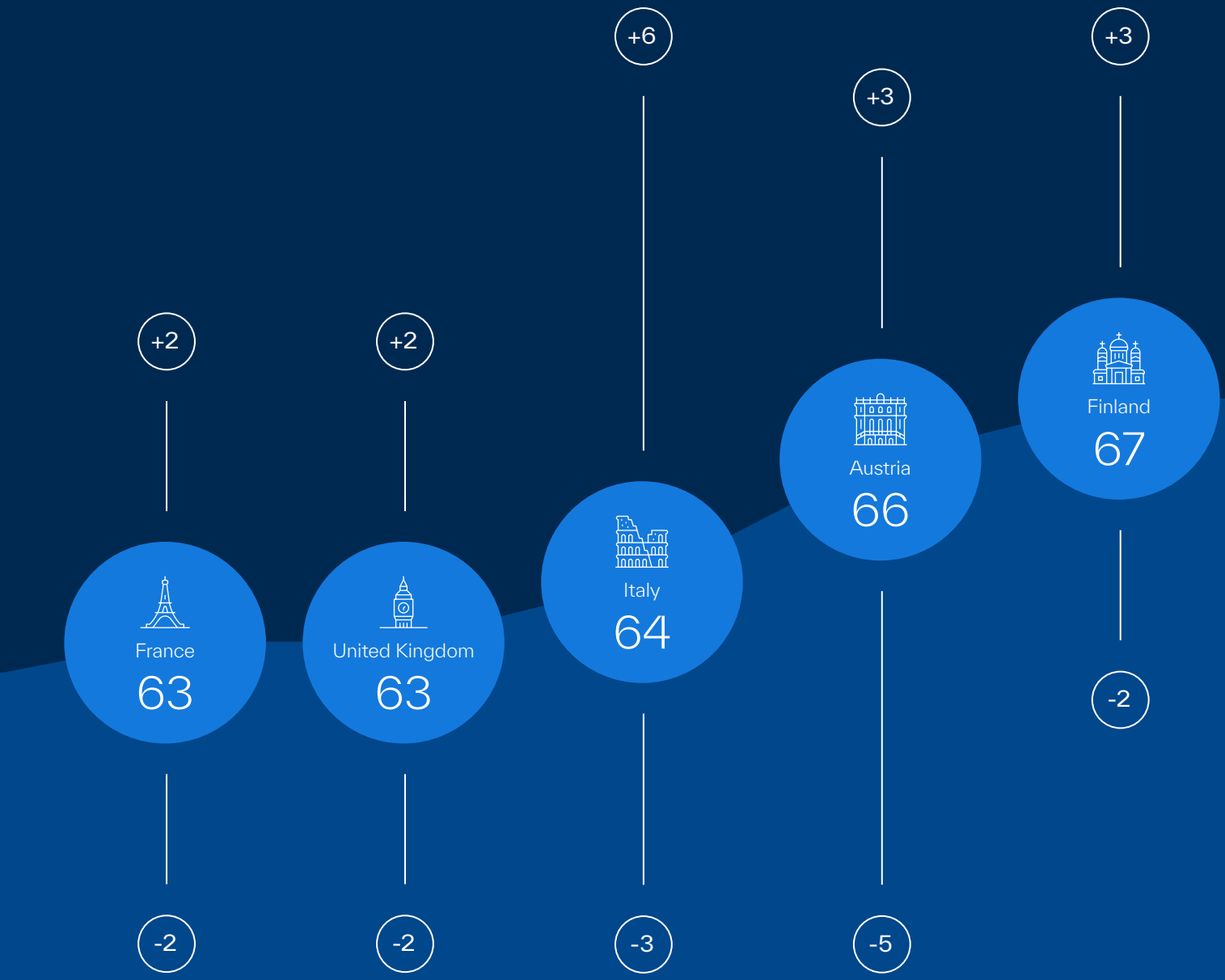
companies with 1–49 employees



Central Results

- In all of the countries analysed, more than nine out of ten people use the Internet in a professional context. Germany is in fifth place of the seven countries analysed with 94%.
- In the international comparison, employees in Germany perform relatively poorly in terms of digital competence. Generally, employees in small companies have lower digital competence than employees in large companies.

Basis: employed persons only; ESP: n = 740; GER: n = min. 3,968; FRA: n = 828; GBR: n = 884; ITA: n = 656; AUT: n = 593; FIN: n = 505.



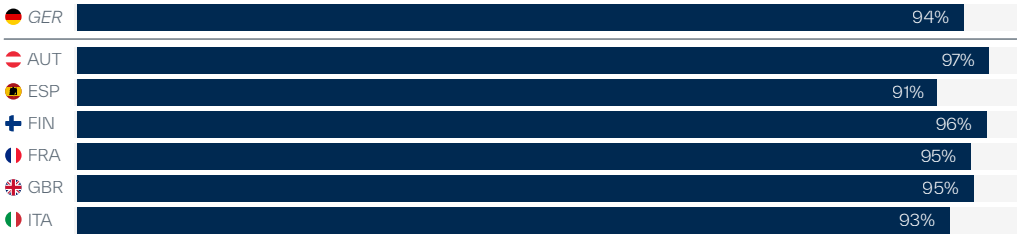
- Comparatively many employees in Germany tend to see digitalisation as an opportunity for their own company. Relatively few fear that at least some of their activities will become redundant due to digitalisation in the future.
- German respondents particularly often hold the view that too little attention is paid to digitalisation in their company. The range of training and further education opportunities on the topic of digitalisation is rated comparatively poorly.
- Regarding working from home, Germany has moved up considerably from one of the bottom ranks to the top group during the COVID-19 pandemic.

3 Digital Transformation of the Working Environment

The digital transformation also fundamentally affects working environments. On the one hand, existing business models change, or entirely new ones emerge. On the other hand, professional activities change as well due to the use of digital technologies. The digitalisation of work environments also leads to fundamental changes in the demands placed on employees. Internet use at work has become indispensable in almost all areas of the economy. Specifically, in all the countries surveyed, more than nine out of ten people use the Internet professionally. At 91%, the observed professional Internet usage is lowest among Spanish employees and is highest in Austria at 97%. Germany is in fifth place of the seven observed countries with 94%.

Figure 15: Professional Internet Usage

Do you use the Internet professionally?



Basis: employed persons only; GER: n = 4,146; AUT: n = 593; ESP: n = 739; FIN: n = 505; FRA: n = 823; GBR: n = 880; ITA: n = 653; without "don't know".

The fact that a large majority of working people are also professionally involved with the Internet and digital technologies corresponds to their digital competence. In all countries investigated, the associated index values for employees are higher than the respective values for the general population.

Regarding Digital Competence of the Workforce, Finland and Austria are Frontrunners

Finland also takes the top position among the countries surveyed in terms of the digital competence of employees, with 67 points, closely followed by Austria with 66 points. Germany ranks at the bottom with 62 points, roughly on par with Spain, France, and the UK (Figure p. 34 f.).

A detailed analysis by company size reveals that, in all countries, employees of large companies with 250 employees or more have a higher digital competence than individuals working in smaller companies. In Germany, there have previously been repeated indications that particularly small and medium-sized companies are lagging behind large companies when it comes to digitalisation (KfW Research 2023). However, with regard to the digital competence of employees there appears only an average gap in Germany by company size. The competence gaps between employees in small and medium-sized companies compared to larger companies are more pronounced in Italy and Austria than in Germany, but are similar in the other countries (Figure p. 34 f.).

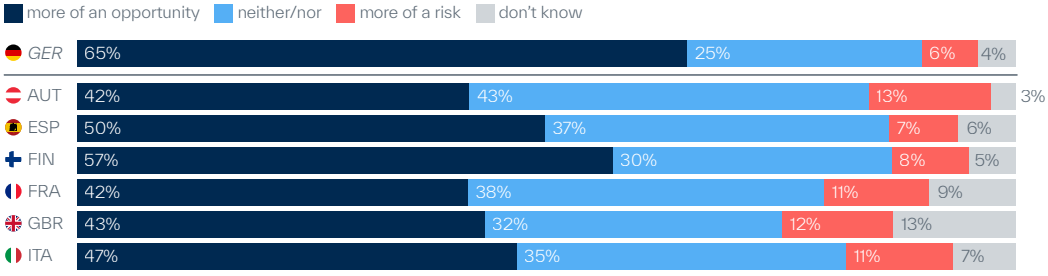
The Majority of Employees in Germany View Digitalisation as an Opportunity

When asked whether digitalisation is more of an opportunity or a risk for their own company, the majority of employees in Germany (65%), Finland (57%), and Spain (50%) say that they view digitalisation more as an opportunity. This only applies to 42% of employees in Austria and France – the lowest percentage in the countries surveyed. At the same time, a relatively large number of employees in Austria (13%) and the UK (12%) see digitalisation more as a risk. At just 6%, the corresponding figure in Germany is lowest overall.

More detailed analyses show that employees who work in large companies are more likely to see digitalisation as an opportunity for their own company, compared to employees in small companies.

Figure 16: Digitalisation as an Opportunity or Risk for Own Company

Thinking about your company/institution overall: Is digitalisation more of an opportunity or more of a risk?



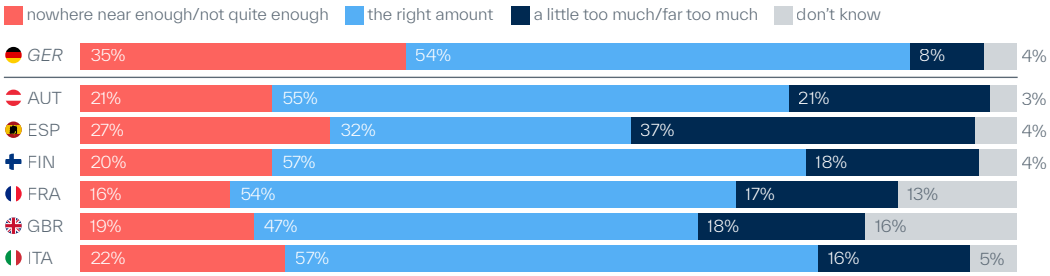
Basis: employed persons only; GER: n = 4,114; AUT: n = 586; ESP: n = 732; FIN: n = 504; FRA: n = 803; GBR: n = 867; ITA: n = 643.

In Germany, More Employees Think That Too Little Attention is Paid to Digitalisation Compared to Other Countries

The assessment of how much attention is paid to digitalisation in one's own company also varies greatly among countries. Of all countries analysed, Germany had the highest share of employees (35%) who consider the attention paid to digitalisation in their own company as nowhere near or not quite enough. In France, only 16% of employees express this opinion. In Spain, 37% of employees believe that digitalisation is given far too much or a little too much attention in their own company, while only 8% in Germany hold this view.

Figure 17: Assessment of Attention to the Topic of Digitalisation in Own Company

How much attention does your company/institution pay to the topic of digitalisation in general?



Basis: employed persons only; GER: n = 4,100; AUT: n = 586; ESP: n = 730; FIN: n = 503; FRA: n = 792; GBR: n = 862; ITA: n = 636.

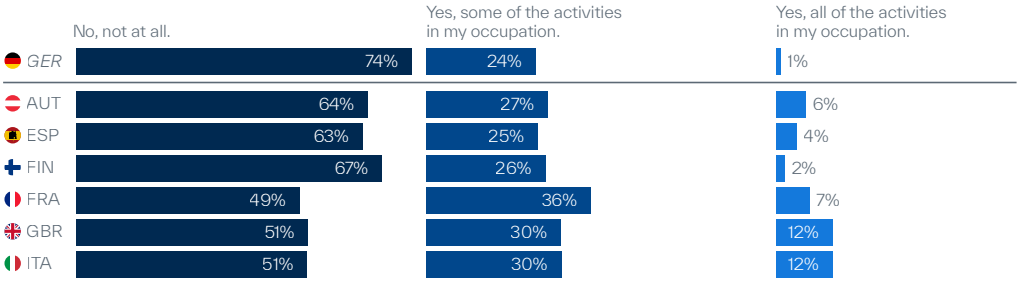
German Employees are Least Afraid of Losing Their Job Due to Digital Transformation

The digital transformation also causes significant structural changes in the labour market. Forecasts of the demand for labour in Germany assume that the transformation will cause the loss of around 3.39 million jobs by 2035. Simultaneously, this change will create approximately 3.21 million new workplaces. Many of these developments are due to structural change, partly driven by digitalisation (Schneemann et al. 2023). With around 45.7 million people employed in Germany, these changes affect about 7% of all jobs (Destatis 2023b). However, in the bidt-SZ-Digitalbarometer, only 1% of German employees assume that their jobs will become entirely obsolete as a result of digitalisation within the next ten years.

Around a quarter anticipate that parts of their jobs will become redundant. The situation is very different in the UK and Italy, where 42% of employees assume that, due to digitalisation, their jobs will at least partly become obsolete. In a cross-country comparison, the share of employees who fear losing their jobs due to digitalisation is lowest in Germany and Finland.

Figure 18: Expected Change in Own Professional Activities Due to Digitalisation

Do you believe that the activities you perform in your current occupation will become redundant either in whole or in part within the next 10 years as a result of digitalisation?



Difference to 100%: "don't know".

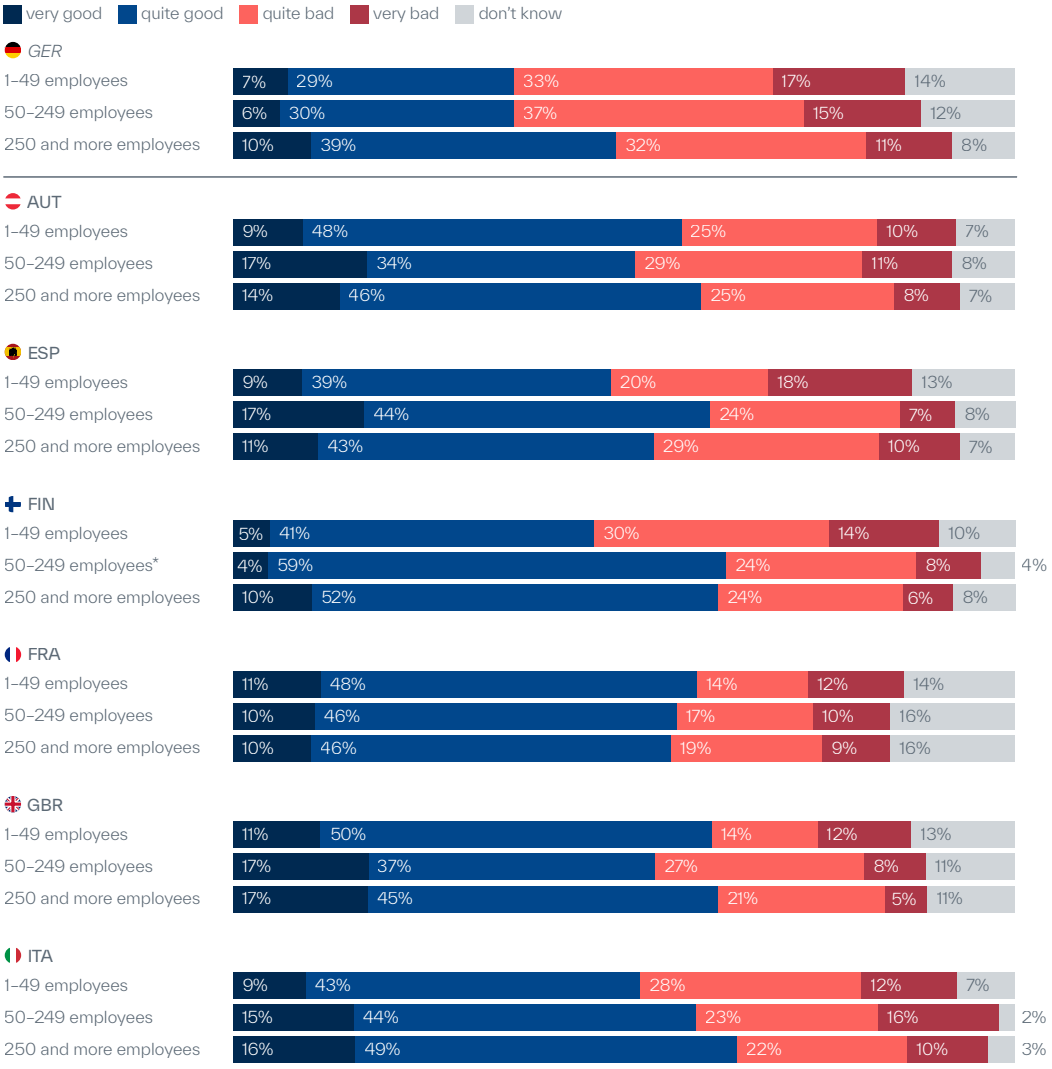
Basis: employed persons only; GER: n = 4,165; AUT: n = 589; ESP: n = 737; FIN: n = 503; FRA: n = 821; GBR: n = 880; ITA: n = 651.

German Employees Give Particularly Low Ratings to Training Opportunities on the Topic of Digitalisation

While structural changes in the labour market make some jobs obsolete, they also create new job opportunities with different and generally higher competence requirements. In this light, lifelong learning and further training become increasingly important. When asked about the opportunities for training on digitalisation topics in their own company, a majority of employees in all countries – with the exception of Germany – rate these opportunities as very or quite good. Distinguishing between company sizes reveals some specific cross-country differences: in Germany, Italy, and Finland, employees in large companies with 250 or more employees rate training opportunities on the topic of digitalisation in their own organisation considerably better than those in smaller companies. In Germany, employees in companies with up to 49 employees rate the training opportunities worse than in any other country.

Figure 19: Training Opportunities by Company Size

How would you rate the range of training and education opportunities on the topic of digitalisation provided by your company/employer?



*Sample size below 100.

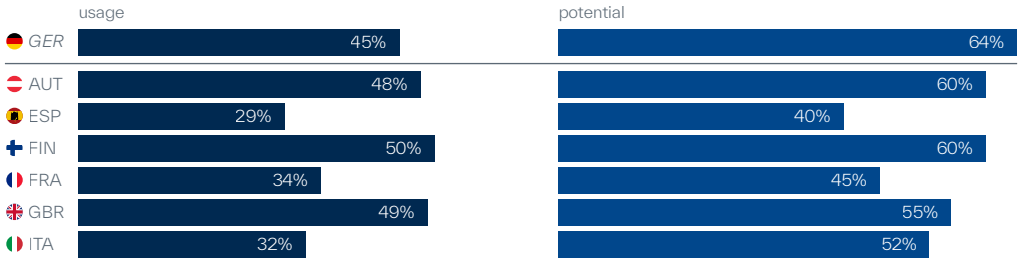
Basis: employed persons only; GER: n = 3,851; AUT: n = 551; ESP: n = 643; FIN: n = 447; FRA: n = 706; GBR: n = 780; ITA: n = 573.

Germany Among Countries With Most Employees Working From Home

During the COVID-19 pandemic, working from home had a more profound impact on the digital transformation of the working environment than almost any other topic. In 2019, Germany was still characterised by a pronounced culture of office presence in companies, with the rate of people working from home considerably below the EU average (Eurostat 2021). However, due to the COVID-19 pandemic, the number of employees working remotely substantially increased. Thus, Germany was able to considerably reduce the gap with countries such as Finland and the UK. As the surveys were conducted at different times, and therefore in different phases of the pandemic, the data from the bidt-SZ-Digitalbarometer survey in Germany and the international survey data from the bidt-Digitalbarometer.international are only somewhat comparable. However, there is no indication that the share of people working from home in Germany has decreased between the survey periods. The bidt's ongoing research on the prevalence and practice of working from home suggests that remote work in Germany has actually increased further since the survey in summer 2021 (Stürz et al. 2022b). Germany now has one of the highest shares of people working from home; around half of all employees work from home at least occasionally (Stürz et al. 2022b). However, employees in Germany have not yet exhausted their full potential for working from home: 64% of employees in Germany state that their jobs would allow them to work from home at least occasionally. Interestingly this self-assessed potential for working from home is higher in Germany than in any other country surveyed.

Figure 20: Working-From-Home Usage and Potential

Share of employed persons



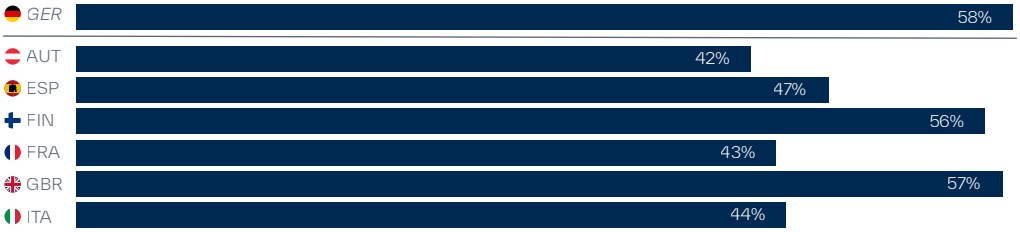
Potential: persons who could work from home at least part of the time (self-assessment based on current professional activities).

Basis: employed persons only; usage: GER: n = 3,910; AUT: n = 535; ESP: n = 650; FIN: n = 488; FRA: n = 723; GBR: n = 779; ITA: n = 532; potential: GER: n = 3,893; AUT: n = 524; ESP: n = 640; FIN: n = 486; FRA: n = 710; GBR: n = 779; ITA: n = 555.

In addition to the high share of German employees working remotely, this group also spends a relatively high proportion of their working time in home office. On average, employees working from home in Germany, Finland, and the UK do so predominantly. This finding does not apply to Austria, Spain, France, and Italy. However, these differences could be due to the survey having been conducted at a different time in Germany than in the other countries.

Figure 21: Average Proportion of Working Hours While Working From Home

Employed persons who are working from home



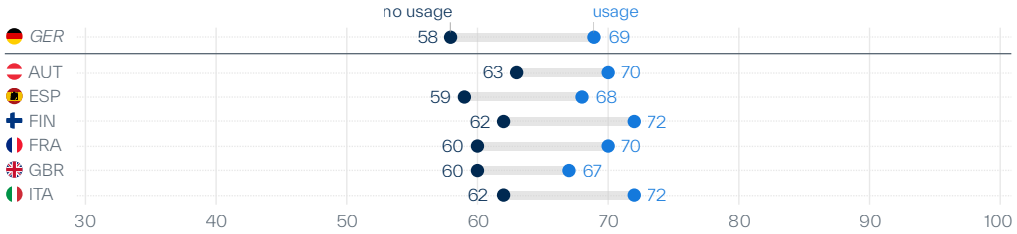
Basis: only employed persons who work from home; GER: n = 1,713; AUT: n = 241; ESP: n = 189; FIN: n = 242; FRA: n = 246; GBR: n = 391; ITA: n = 178.

Digital Competence Gap Between Employees With and Without Working-From-Home Usage Widest in Germany

The results also point to a digital divide in terms of competence between employees who work from home at least occasionally and those who do not. In all countries surveyed, the former group shows considerably higher competence scores than the latter. This difference is particularly pronounced in Germany – amounting to eleven points.

Figure 22: Digital Competence by Working-From-Home Usage

Index value (points out of 100 possible)



Basis: employed persons only; no usage: GER: n = min. 2,056; AUT: n = 294; ESP: n = 461; FIN: n = 246; FRA: n = 477; GBR: n = 388; ITA: n = 354;
usage: GER: n = min. 1,679; AUT: n = 241; ESP: n = 189; FIN: n = 242; FRA: n = 246; GBR: n = 391; ITA: n = 178.

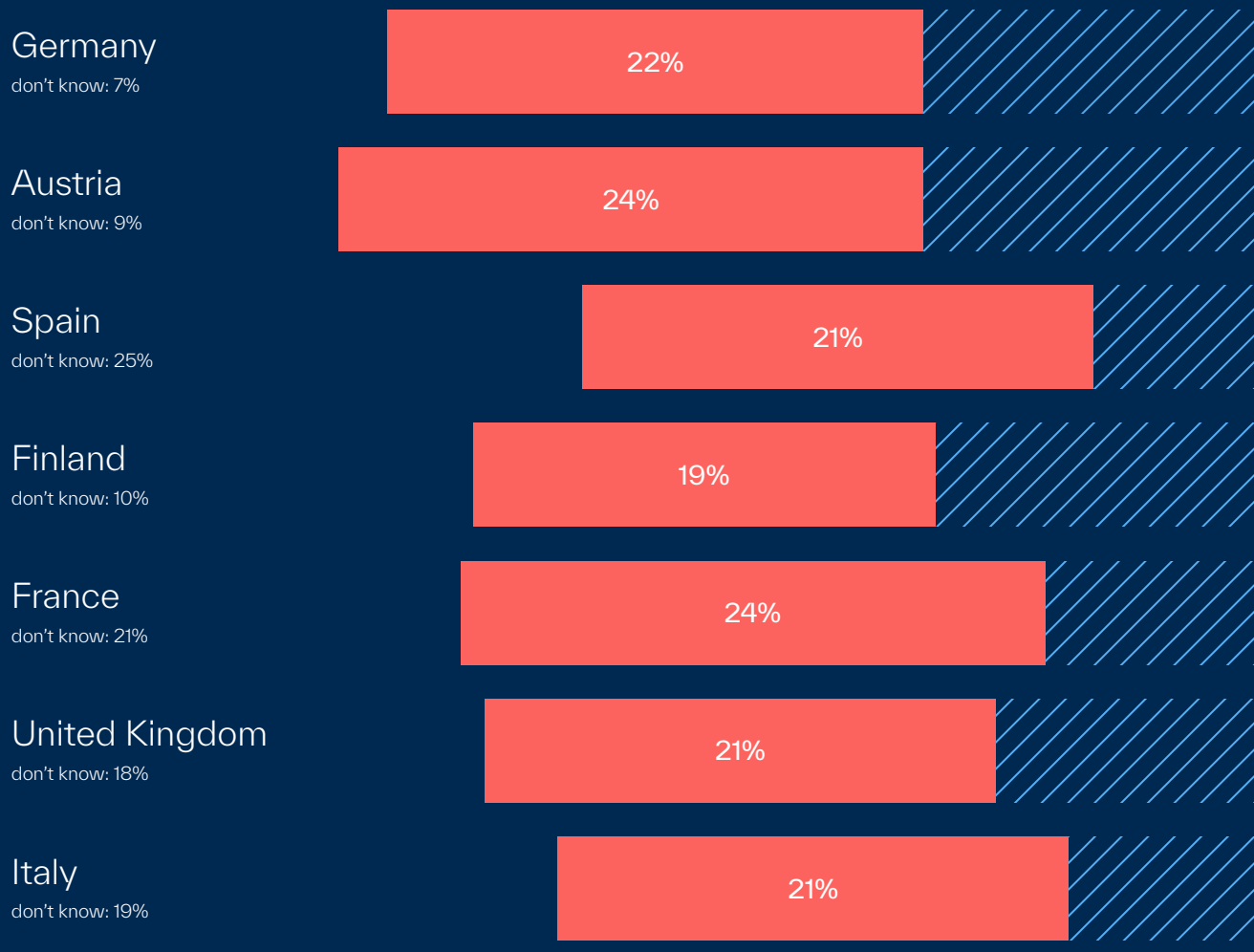
Compared to other countries, the average digital competence of German employees is rather poor. Also, the differences in digital competence among employees in Germany are comparatively large when differentiating by various other characteristics. This underscores the unfavourable result. In this light, it is concerning that German employees perceive opportunities for training on the topic of digitalisation within companies as relatively poor – especially when considering the anticipated upcoming structural upheavals in the labour market. To secure the employability of as many individuals in the population as possible and thus the competitiveness of the German economy in the long term, policymakers, companies, and citizens in Germany need to counteract the ever-widening digital divide. German employees show relatively high awareness of this need for change. The results of this study show that one substantial ongoing change concerns working from home. In this area, Germany has already moved up considerably from one of the bottom ranks to the top group, as a consequence of the COVID-19 pandemic.

4 Artificial Intelligence

Opportunities and Risks of Artificial Intelligence

Which of the following, in your opinion, best describes the opportunities and risks posed by AI?

Risks outweigh opportunities.



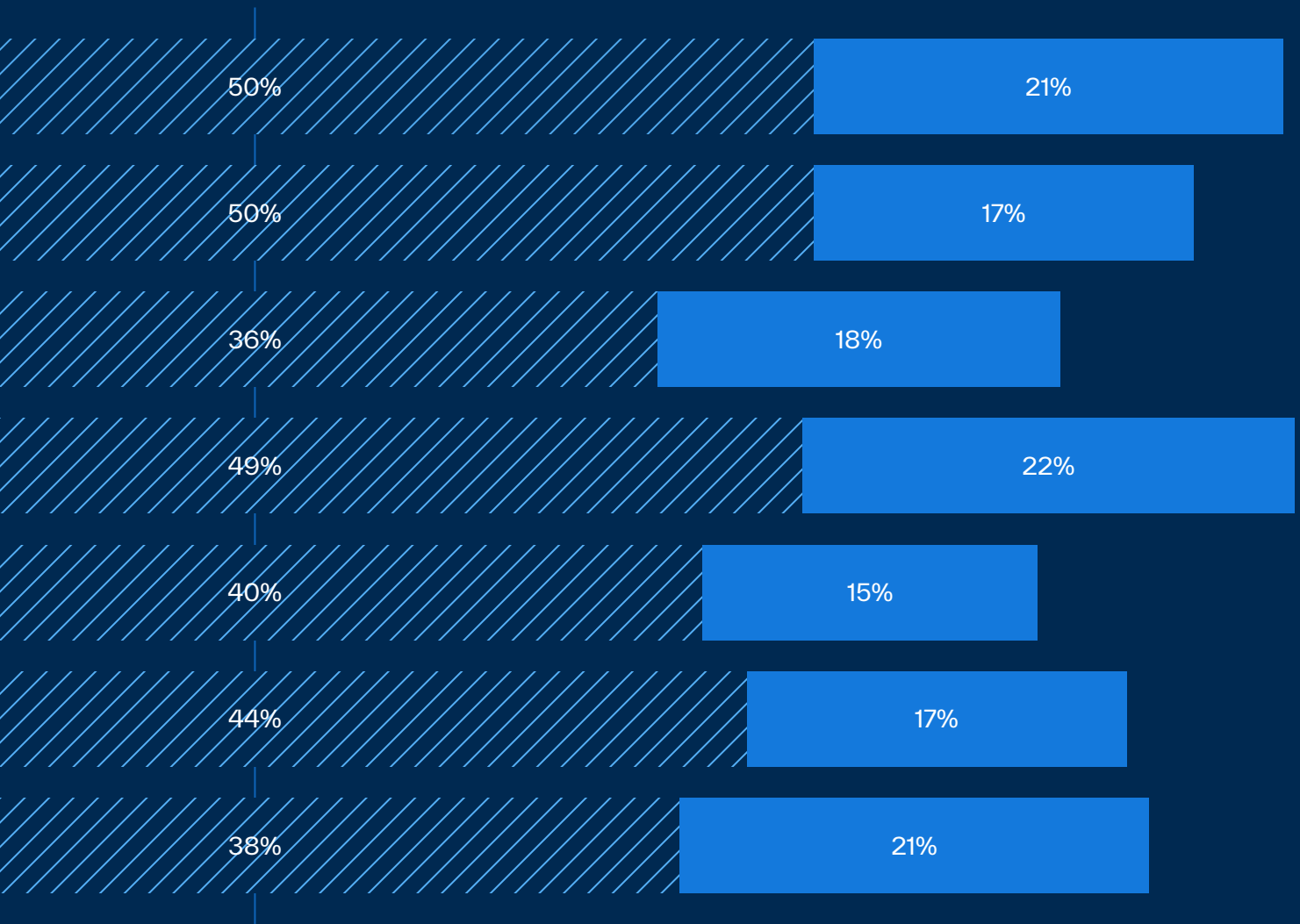
Basis: GER: n = 8,883; AUT: n = 1,140; ESP: n = 1,655; FIN: n = 1,197; FRA: n = 1,690; GBR: n = 1,675; ITA: n = 1.696.

Central Results

- The self-assessed level of knowledge about AI is highest in Germany and Finland.
- In all countries it can be shown that the more knowledge a person has about AI, the more likely they are to emphasise opportunities offered by AI.
- In many countries, the use of AI is seen primarily as an opportunity for identifying diseases. In contrast, in all countries, the risks are deemed to outweigh the benefits for applications of AI especially with regard to legal rulings.
- In Germany, people are much more open to autonomous driving compared to other countries analysed.

Opportunities and risks are balanced.

Opportunities outweigh risks.



4 Artificial Intelligence

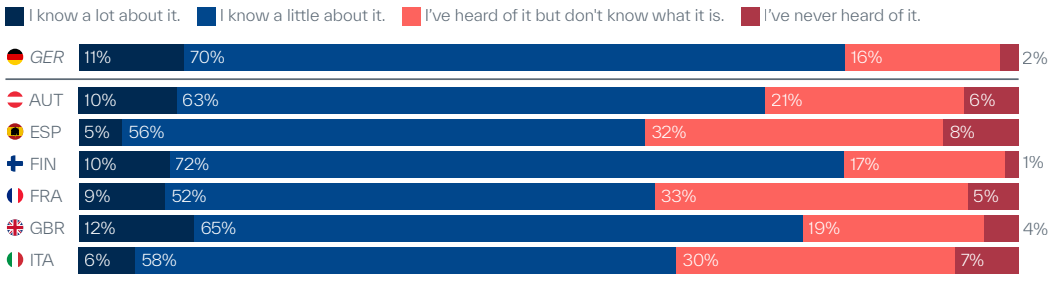
At the end of 2022, the company OpenAI caused a stir with the release of ChatGPT. For the first time, this generative AI in the form of a chatbot gave a wide user base access to a dialogue system that can process questions and instructions to an extent that was previously not possible. In addition, ChatGPT delivers text output of a quality and complexity that, in some cases, makes it almost impossible to distinguish the content from texts written by human authors. Since the publication of ChatGPT, discussions about the pros and cons of using AI have gained considerable momentum. The topics include legal and ethical issues surrounding the use of generative AI in various areas, the role of privacy policy and data security, and the impact on the arrangement and availability of workplaces in the future. Even though the questionnaire design and a large part of the data collection of the bidt-Digitalbarometer. international took place before the publication of ChatGPT, the figures on AI provide important insights into the mood in society – for example, on the assessment of the opportunities and risks of AI in the selected countries.

Little Knowledge About AI in Spain, France, and Italy

Remarkably, the self-assessed level of knowledge about AI is rated relatively high in Finland and Germany. In both countries, around 80% of people say they know at least a little about AI. At the same time, only around one in ten people in Germany and Finland claim to know a lot about this technology. In Spain, France and Italy, on the other hand, between 37% and 40% of people say they do not know anything about AI.

Figure 23: Knowledge About Artificial Intelligence

How much do you know about artificial intelligence?



Basis: GER: n = 8,816; AUT: n = 1,119; ESP: n = 1,597; FIN: n = 1,175; FRA: n = 1,628; GBR: n = 1,667; ITA: n = 1,654; without "don't know".

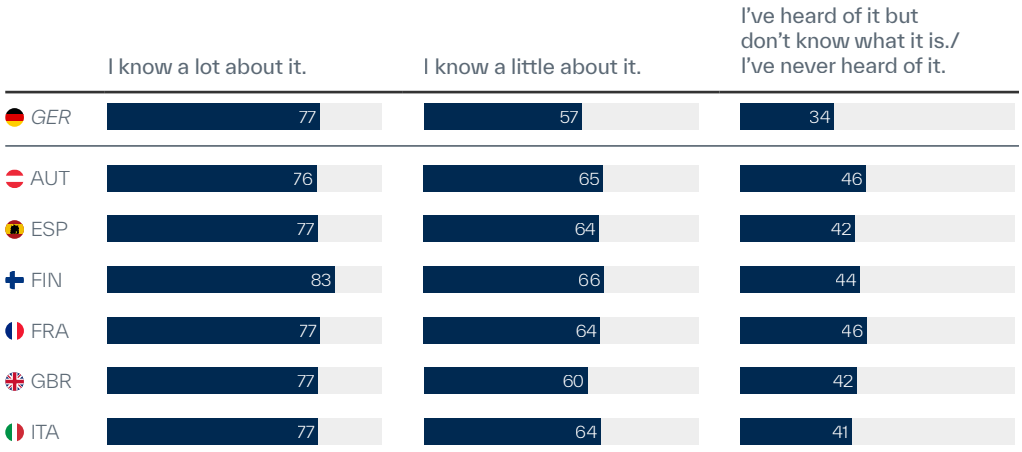
One reason for the high value in Finland could be the Finnish AI strategy, which aims, among other things, to convey an understanding of and knowledge about AI to broad sections of the population. The Finnish online course "Elements of AI" was published as early as 2018. In six chapters, the course teaches what AI means, what possibilities the technology brings, what limits it imposes, and what effects it has. The course was heavily advertised and Finnish employers motivated their employees to take part. After just four months, 1% of the population had completed the comprehensive course. "Elements of AI" is now freely available in all European languages (University of Helsinki/MinnaLearn 2023).

Digital Competence and Knowledge About AI Go Hand in Hand

An analysis of digital competence scores and self-assessed knowledge about AI returns a considerably positive correlation. In other words, the more people know about AI, the higher their digital competence. Specifically, people who believe they know a lot about AI achieve mean competence scores of around 77 points in all countries except Finland. In Finland, this part of the population even achieves an average of 83 points for digital competence. On the other side, people with no knowledge of AI achieve considerably lower competence scores on average. In the comparison countries, the values for this part of the population range from 41 to 46 points. In Germany, the index value for this group of people is only 34 points.

Figure 24: Digital Competence by Knowledge About Artificial Intelligence

Index value (points out of 100 possible)



Basis: GER: n = min. 7,677; AUT: n = 1,119; ESP: n = 1,597; FIN: n = 1,175; FRA: n = 1,628; GBR: n = 1,667; ITA: n = 1,654.

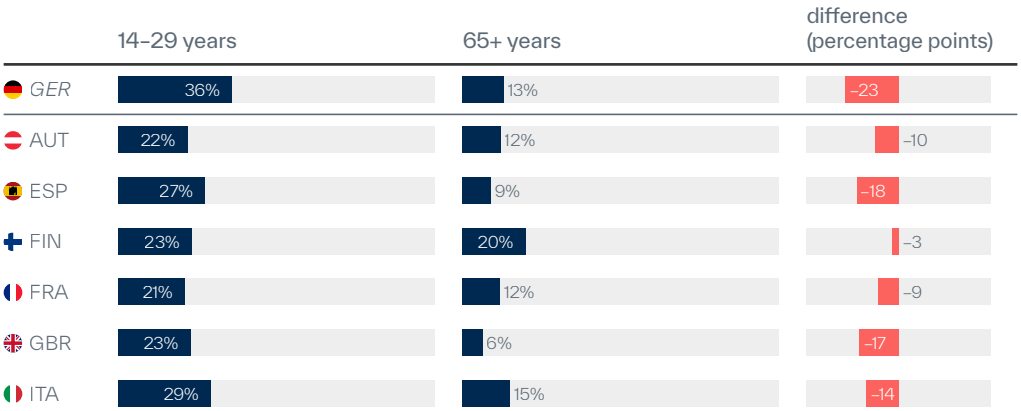
Balanced Assessment of Opportunities and Risks of AI in Germany, but Considerable Age Differences

Knowledge about AI is particularly important because AI is already being used as a cross-sectional technology in a large number of different areas. Technological development will also lead to a further increase in the number of application areas for AI in the future. When asked about the opportunities and risks of AI in general, slightly more people in Finland (22%) mainly see the opportunities of AI, while 19% predominantly see risks. A similarly balanced picture emerges for Italy and Germany. However, in Austria and France in particular, a larger proportion of the population primarily perceives the risks of AI usage (cf. Figure p. 44 f.).

Self-assessed knowledge about AI and the assessment of its opportunities or risks depend to a considerable extent on socio-structural characteristics. Generally speaking, younger people tend to see more opportunities in AI than older people. In Germany, the age difference is particularly strong. Specifically, more people in the 14 to 29 age group in Germany (over a third) than in any other country surveyed say that they predominantly see opportunities in the application of AI. Among people aged 65 and above, on the other hand, the proportion is similar to Austria and France at 13%. At 23 percentage points, the difference by age is greatest in Germany. The discrepancy is smallest in Finland, at just three percentage points.

Figure 25: Differences in the Assessment of the Opportunities of Artificial Intelligence by Age

Which of the following, in your opinion, best describes the opportunities and risks posed by AI? – percentage of answer category "opportunities outweigh risks"



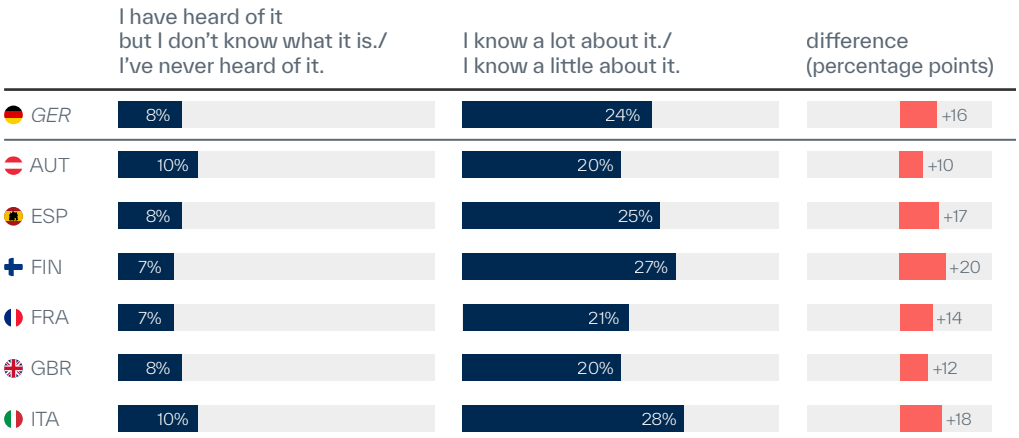
Basis: GER: n = 4,299; AUT: n = 510; ESP: n = 707; FIN: n = 603; FRA: n = 834; GBR: n = 784; ITA: n = 775.

Knowledge about AI is Associated with Greater Emphasis on the Opportunities of AI in all Countries

Another positive correlation exists between the opinion that the opportunities outweigh the risks when using AI and the person's knowledge about AI. A considerably higher proportion of people with at least limited knowledge of AI mainly see opportunities of the use of the technology, compared to the group who claims to know nothing about AI. This difference is greatest in Finland at 20 percentage points, and smallest in Austria at ten percentage points. In Germany, 8% of people with no knowledge of AI predominantly see opportunities in the use of this technology, compared to 24% of people with at least a little knowledge of AI.

Figure 26: Differences in the Assessment of the Opportunities of Artificial Intelligence by Knowledge About Artificial Intelligence

Which of the following, in your opinion, best describes the opportunities and risks posed by AI? – percentage of answer category "opportunities outweigh risks"



Basis: GER: n = 8,765; AUT: n = 1,111; ESP: n = 1,583; FIN: n = 1,167; FRA: n = 1,613; GBR: n = 1,651; ITA: n = 1,626.

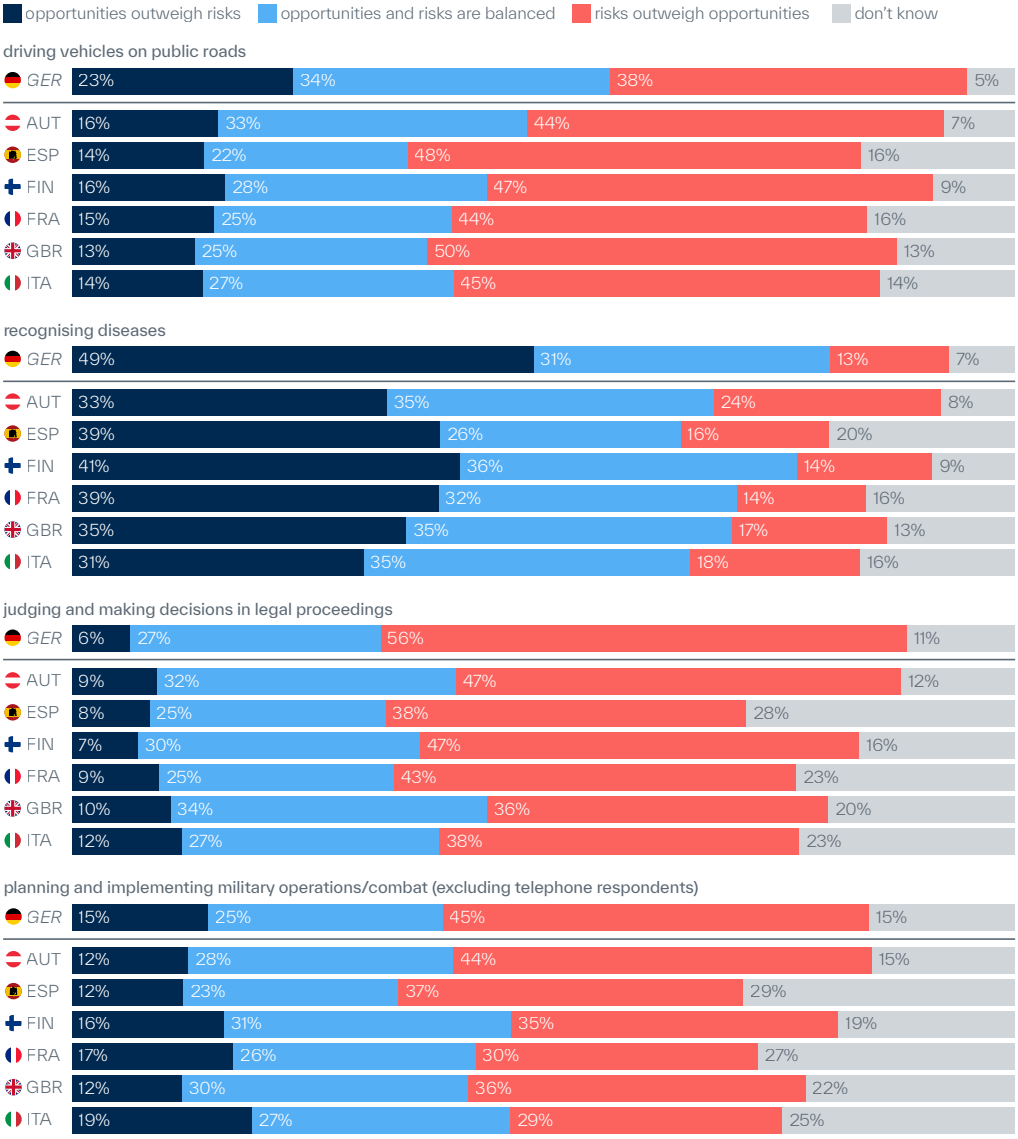
Differentiated Assessment of Opportunities and Risks by Application Areas

A detailed analysis of the fields of application of AI reveals a very differentiated picture. Across all countries, the opportunities of AI usage are most often seen in the detection of diseases and are least often seen for judgements and decisions in court proceedings. The surveyed application areas of autonomous driving and planning and conducting military operations rank in between. A country comparison shows that the German and Finnish populations in particular predominantly see opportunities in the detection of diseases through AI. The opposite is true for the use of AI in judgements and decisions in court proceedings, with people in Germany, Austria, and Finland being the most sceptical among the surveyed countries.

On the issue of autonomous driving, on the other hand, proportionally fewer people in Germany predominantly see risks and more people predominantly see opportunities through the use of AI, in comparison to all other countries. Overall, perceived risks seem to dominate when presumably sensitive areas are affected, in which moral aspects play a greater role. At the same time, the analysis shows that a quite high proportion of the population are not able to judge confidently. The proportion of undecided individuals is generally highest in countries where, at the same time, a relatively large proportion of the population state that they have no knowledge of AI.

Figure 27: Opportunities and Risks of Artificial Intelligence by Area of Application

Could you please tell us whether you believe the opportunities outweigh the risks in the following areas?



Basis: GER: n = min. 3,668; AUT: n = min. 504; ESP: n = min. 745; FIN: n = min. 529; FRA: n = min. 753; GBR: n = min. 754; ITA: n = min. 730.

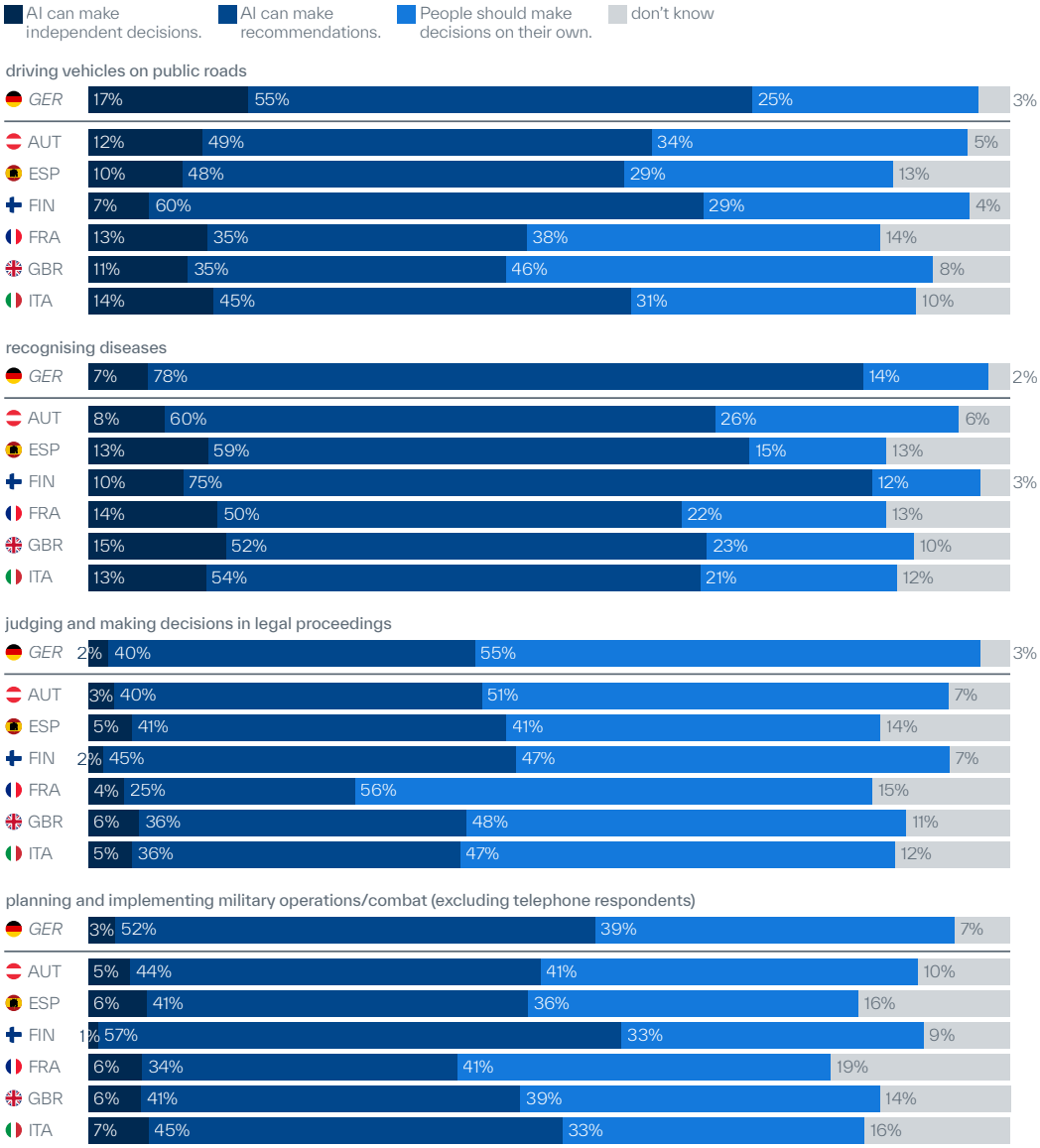
The assessment of opportunities and risks in certain fields of application is also reflected in the answers to the question regarding in which application scenarios AI should make decisions alone, where AI should provide suggestions for the decision ultimately made by humans, and where humans should generally make decisions without the support of AI.

For the field of recognising diseases, at least half of the population in the respective countries agree to AI making recommendations for the decisions then made by humans. In the application scenarios of autonomous driving and planning and conducting military operations, the largest proportion of the population in almost all countries states that AI should make suggestions for human decisions. For the application scenario of judgements and decisions in court proceedings, the largest proportion of the population in each country does not want AI to intervene at all.

A country comparison shows that in Germany and Finland, a relatively large number of people are amenable to AI making suggestions in all scenarios and, with the exception of autonomous driving, relatively few people want AI to decide alone. For autonomous driving, on the other hand, more people (17%) in Germany than in any of the other countries investigated would agree to AI making the decision alone. Regarding the decision-making authority of AI, the proportions of those who are not confident in their judgement, i.e., those who answered “don’t know”, are also relatively high in some cases. Here, Germany and Finland generally have the lowest proportions and Spain and France the highest. Thus, this finding also indicates a relationship with self-assessed knowledge about AI.

Figure 28: Attitude Towards the Decision-Making Authority of Artificial Intelligence by Area of Application

Can you please tell us when AI should make independent decisions, when AI should make recommendations for human decisions, and when people should make their own decisions?



Basis: GER: n = min. 3,687; AUT: n = min. 496; ESP: n = min. 741; FIN: n = min. 538; FRA: n = min. 748; GBR: n = min. 759; ITA: n = min. 723.

Generally, for the questions on the use of AI asked as part of the bidt-Digitalbarometer.international, Germany reveals a considerably more positive picture than for digital competence or the digital transformation of the working environment. Germany and Finland show similar patterns in many respects. A relatively broad section of the German population possesses at least a basic knowledge of AI and there is a relatively balanced assessment of AI's opportunities and risks. However, Germany shows once again a relatively large gap in knowledge about AI by age, compared to other countries. In terms of specific fields of application, the German population is considerably more open to autonomous driving than people in the other countries analysed.

5 Conclusion and Fields of Action

In a country comparison, the data reveals a relatively large digital divide within the population in Germany. Germans with a lower affinity for digital technology show particularly low levels of digital competence and therefore run the risk of being left behind.

Even though the need for digital transformation is widely discussed and emphasised in Germany, government agencies, the education system, and parts of the economy exhibit only slow progress. Regarding digitalisation, a common impression is that Germany is lagging behind internationally.

On the one hand, the results of the bidt-Digitalbarometer.international show that in Germany there is a comparatively high level of openness to technical innovations. Moreover, a majority of German employees consider digitalisation in a professional context as an opportunity and generally recognise and criticise the lack of attention paid to the topic of digitalisation. On the other hand, Germany ranks lower than Austria, Spain, Finland, France, the UK, and Italy in some areas of digital transformation. For example, only a relatively low share has already carried out complete administrative processes online – mainly due to the lack of services. In an international comparison, German employees also rate the opportunities for training on digitalisation-related topics in their own company relatively poorly. Additionally, in terms of digital competence, Germany performs worse than other countries. When differentiating by socio-structural characteristics, digital divides turn out to be especially large in Germany, which is particularly problematic. For example, specifically people aged 65 and above and people with lower income exhibit low levels of digital competence. Therefore, there is a particularly high risk in Germany that groups with lower digital competence might increasingly struggle to keep up with the digital transformation. This fact could exacerbate associated problems regarding social participation and employability.

In order for Germany to keep pace with digitalisation internationally and not fall behind in economic and social terms, there is need to close the gaps in the identified problem areas as quickly as possible and to reduce existing divides regarding digital competence in the population. Germany can achieve this goal by intensifying efforts in the following fields of action.

Fields of Action

1. Engaging Society in Digitalisation

Helping to shape the digital transformation is relevant for all citizens, because everyone is affected. However, if people feel that digital transformation only influences them passively or even negatively, and that they cannot actively participate in the transition, important social impulses for digital innovation will fade away. To counteract this, we have to understand digital transformation as a pluralistic process for society as a whole.

Other countries can serve as role models for a successful transition. The UK, for example, created the innovation agency Nesta, to which the population can contribute ideas for social innovations and digitalisation projects (Nesta 2023). This institution enables everyone to participate and thus also promotes general awareness of digitalisation. In addition, the foundation realises innovation potential in the population and provides information via various channels about the solutions to everyday problems developed within its framework. Similar programmes could also be introduced in Germany, to raise potential for innovation, to enable everyone to shape digital transformation, and to promote the development of applications and products that make everyday life easier.

2. Expanding Digital Services in Public Administration

The lack of comprehensive digital services in public administration is one of the main reasons that Germany, among all countries analysed, ranks lowest in the use of such services. Thus, there is need to accelerate the digitalisation of services provided by public offices and authorities and to also place greater focus on the user perspective. Furthermore, the lack of networking among different databases, due to Germany's federal structure, necessitates the modernisation of registers. This change would enable the automatic input of necessary data in administrative processes by means of register queries. It would further enhance usability, as this improvement omits repeatedly entering data in such processes. Although the Register Modernisation Act and the pilot project "Gesamtsteuerung Registermodernisierung" are important first steps (Hensiek 2023), the pace of development still leaves room for improvement. A look at neighbouring Austria shows what successful e-government can look like. The country digitised central data registers early and provides a highly developed, easy-to-understand online portal as an electronic access system as well as a comprehensive administrative platform that is also available as a mobile app (Röhl/Graf 2021). According to the bidt-Digitalbarometer.international, more than three quarters of Austrians are satisfied with the e-government offerings in their country – a share that is only slightly exceeded in France and considerably exceeded in Finland.

3. Strengthen Digital Participation, Reduce the Digital Divide

Enabling all societal groups to participate in the digital world is essential to counteract social inequality. This requires access to devices and infrastructure, but also the digital competence to operate devices and to use the Internet with confidence. However, different groups in society may possess different levels of expertise. In particular, people with a low level of formal education, people with low incomes, as well as older people often have lower levels of digital competence. These results indicate the need for low-threshold learning opportunities that are accessible to all individuals. Additionally, the finding signifies the importance of addressing particularly vulnerable groups. Against the backdrop of an ageing society in Germany, the main focus needs to be on strengthening the digital competence of older people to enable them to participate in society even in old age. This applies all the more in light of the ongoing digitalisation of the health and care sector. Furthermore, digital innovations can only counteract the cost explosion in the health and care sector if all groups involved have sufficient digital competence to use such innovations (EFI 2023). The Federal Ministry for Family Affairs, Senior Citizens, Women and Youth has already launched various initiatives to promote digital competence (BMFSFJ 2023). For instance, the "DigitalPakt Alter" programme aims to teach digital competence to older people. There are similar initiatives in Bavaria as well, for example offering free courses created by companies to all citizens (Bavarian State Ministry for Digital Affairs 2023). These initiatives should serve as a starting point for further measures, which should also be evaluated on an ongoing basis to evaluate their success and adapt them as necessary.

Educational policy measures can also help to counteract the competence gap by gender or educational level at an early stage of personal development. In Finland, for example, the acquisition and further development of digital competence are part of the curriculum starting at the primary school level. The Italian government also plans to promote digital competence at all school levels in the future (European Commission 2022a). In Germany's federal education system, there is need for a better coordination among the federal states to take a decisive step in promoting digital competence with standardised offerings, like the nationwide introduction of computer science as a subject. Moreover, it is advisable to extend educational programmes beyond the school for the rest of the population in Germany. Because keeping up with the ever-changing developments of the digital transformation requires lifelong learning.

4. Training for All – Counteracting the Shortage of Skilled Labour

Well-educated skilled workers are the prerequisite for an economy's growth, prosperity, innovation, and competitiveness. However, Germany is facing a shortage of such labour, and not just due to demographic change. In this context, the particular importance of digital competence is two-fold. On the one hand, this know-how becomes increasingly important as a new key competence in every professional field. On the other hand, particularly the ICT sector holds great potential for the economy but, at the same time, suffers from a shortage of specialised professionals. To counter this lack of skilled labour, Germany must activate and

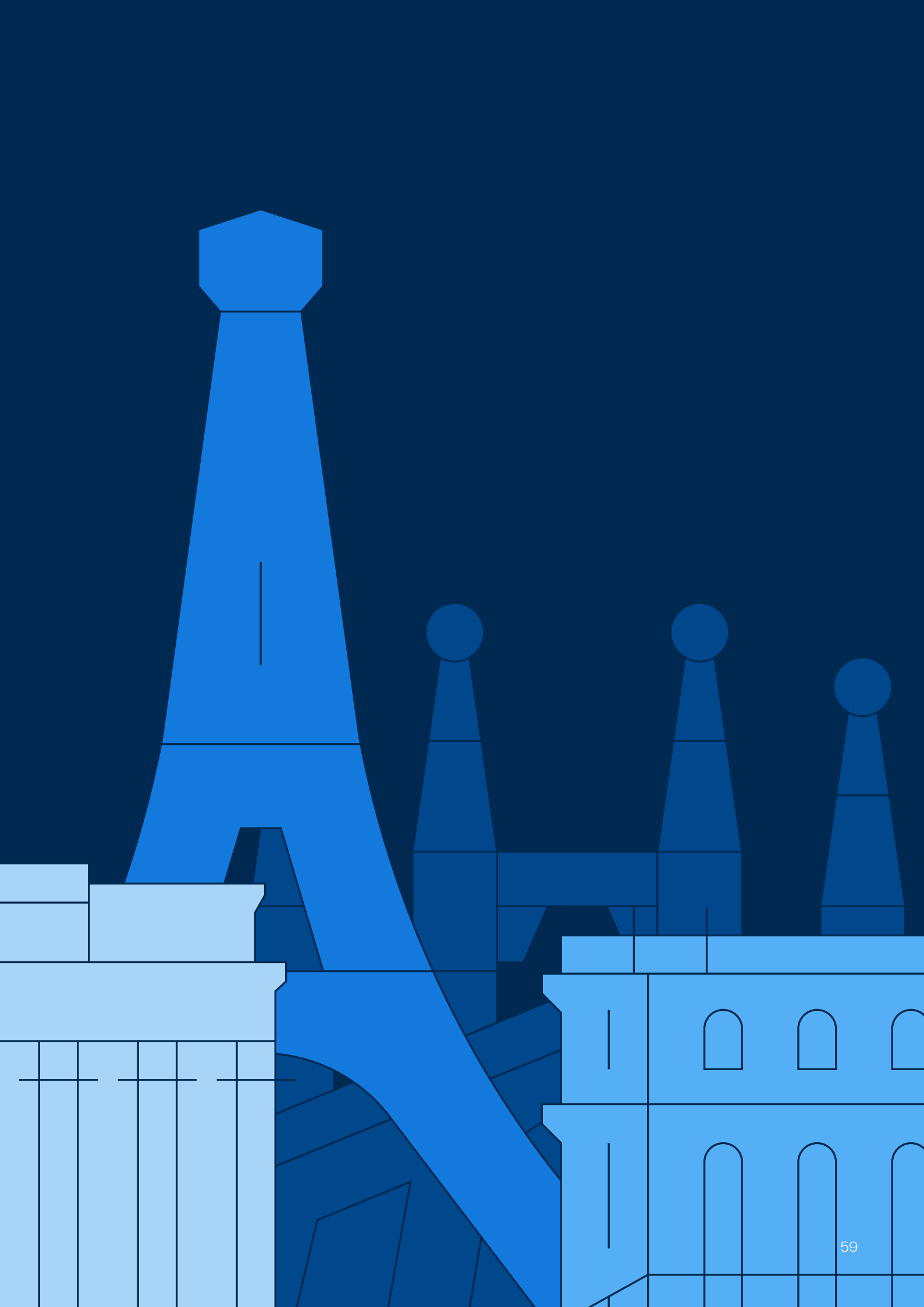
utilise existing potential. Lifelong learning is indispensable, especially in view of the rapid developments in the field of digitalisation. Further qualifying oneself by means of training measures is of great relevance in this context. To this end, it is essential to increase incentives to participate in such training activities. This particularly applies to low-skilled, low-income earners, who are most affected by structural change but are also less likely to seize opportunities for training. The same applies to women, as women in Germany receive less frequent and shorter training programmes than men (Lott 2023). This difference is often due to women being more represented in part-time work. Therefore, the funding for continuing education programmes needs to be further developed in a clearer and standardised fashion. In addition, there is a need to address the problems of the German landscape for training measures, which, so far, lacks consistent minimum standards and is highly complex due to the large number of providers. Additionally, experts suggest establishing professional training as an integral part of the education system (German Council of Economic Experts 2021). Further, a nationwide career counselling initiative can help to better connect existing services and close regional gaps in availability (OECD 2021). At the same time, better childcare services can help to improve opportunities to participate more in the labour market, especially for women. This could also raise the employment potential in the German labour market (EFI 2023). Furthermore, research shows that particularly digital competence has a positive effect on wages (West et al. 2019). Higher digital competence can, therefore, not only ensure greater prosperity and gender equality, but also increase the competitiveness of Germany as a business location.

5. Flexible Regulation of Artificial Intelligence

There is hardly any other area of digitalisation where developments occur so quickly and already have such a major impact on people's lives as AI. Notably, a few large corporations currently drive the major advances in AI development and public research at universities is increasingly falling behind. This situation is problematic, as strong economic interests shape its development, which goes against the "democratising" of AI.

Acceptance of AI varies considerably depending on the area of its application. In this respect, it is hardly surprising that politicians' efforts to regulate AI vary depending on the area of application. However, individual nations should not undertake this task alone, given the transnational effects of AI and global competition. This effort rather needs to be carried out at a supranational level. With the AI Act, the European Union aims to achieve the goal of establishing the world's first AI law (European Parliament 2023). In light of the study results, the corresponding efforts to pursue a risk-based approach to regulation are principally positive. This approach regulates especially high-risk applications of AI more strictly. However, it will be important to take into account the rapid pace of AI development when establishing a suitably flexible regulatory framework. This regulatory framework must be as balanced as possible to avoid unduly restricting innovation potential on the one hand and to limit the potential risks of AI on the other. An appropriate regulatory framework could ultimately also become a competitive advantage for Europe.

Country Profiles



Germany

The German population was found to have a relatively low digital competence in the bidt-Digitalbarometer.international country comparison. The result is not surprising, as Germany has also performed relatively poorly in other country comparisons in terms of digitalisation-relevant indicators.[1, 2] Although awareness of the importance of digitalisation has increased in Germany in the wake of the COVID-19 pandemic, there has been no long-lasting push towards digitalisation.

For instance, only slow progress was made in digitising the German economy in 2022.[3] Therefore, the German government set the goal of improving the framework conditions for digitalisation in the country.[4] Accordingly, the federal government supports the federal states in investing in a digital education infrastructure. Specifically, there is an effort to create easily accessible learning spaces where digitally inexperienced people can receive help in using digital technologies.[5, 6]

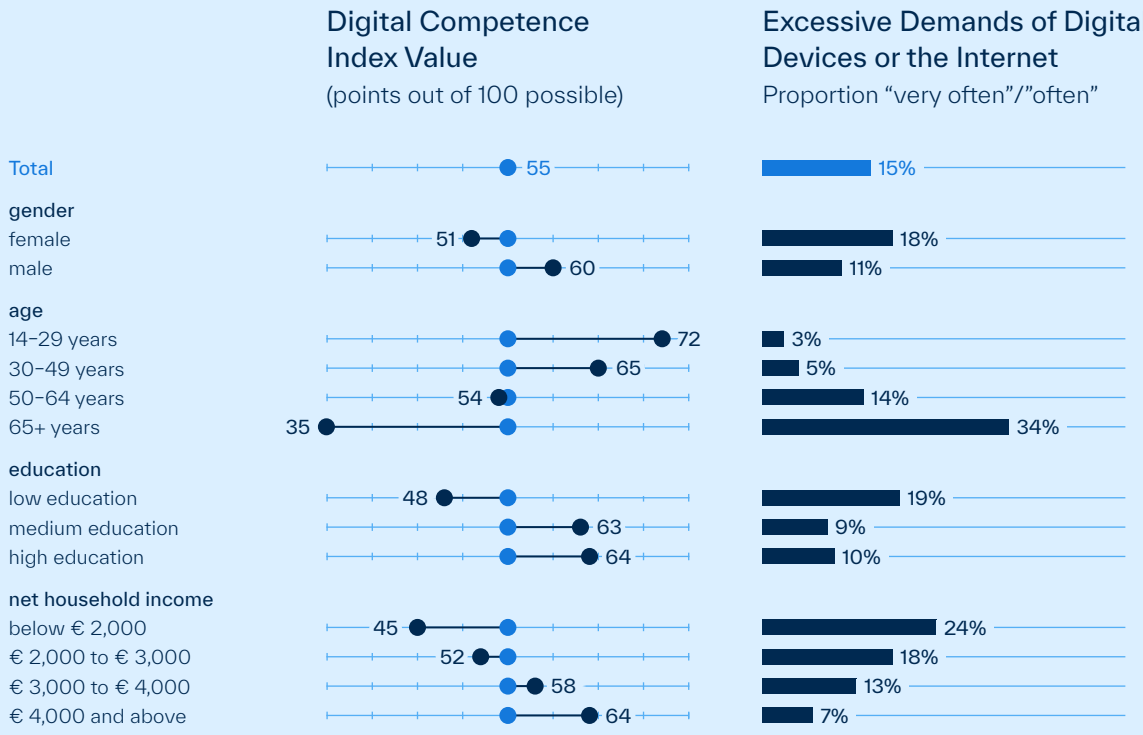
83.24 million[7]
Population size

357,569[8]
Area (in km²)

45.8[9]
Median age (in years)

35,870[10]
GDP per capita (in euros)

4.7[11]
GDP expenditure on education in 2020 (in per cent)

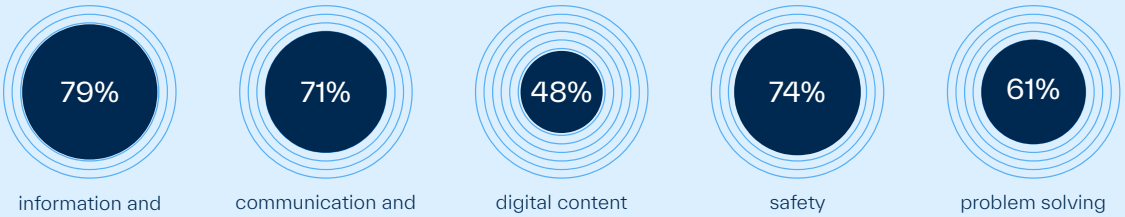


Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = min. 7,862.

Basis: n = 8,913; without "don't know".

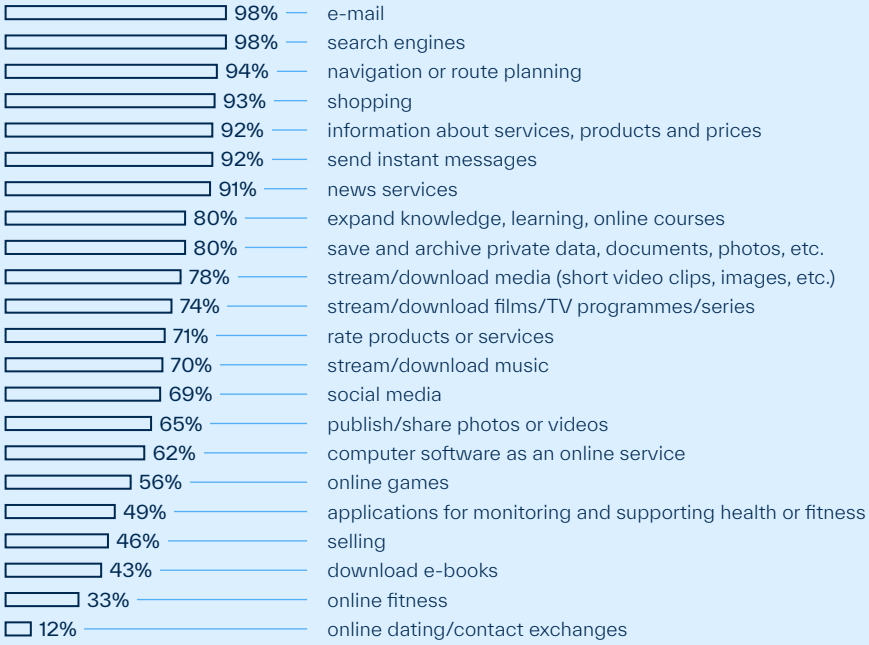
Proportion of People with an Intermediate or Advanced Level of Competence

48 points or more



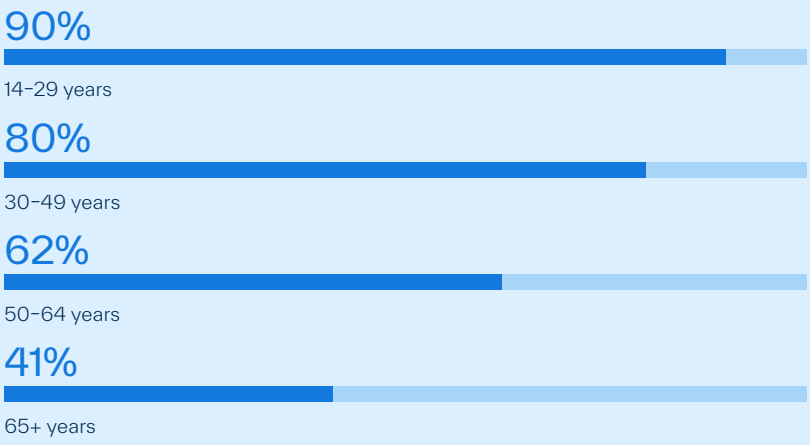
Basis: n = min. 7,862.

Online Activities of Internet Users



Basis: Internet users only; n = min. 7,887; without "don't know".

Social Media Usage of Internet Users



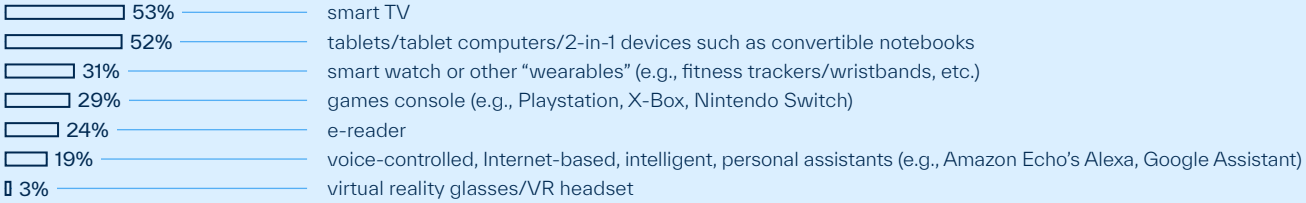
Basis: Internet users only; n = 8,209; without "don't know".

94.5% use the Internet[12]

13th place in the Digital Economy and Society Index[1]

Fibre network coverage of all households: **15%**, 5G coverage in populated areas: **87%**[1]

Use of Technical Devices



Basis: n = 9,044.

Austria

In the bidt-Digitalbarometer.international, the Austrian population has the second-highest level of digital competence of all the countries analysed. The Austrian government initiated a dedicated Digital Competence Initiative to further improve the country's high competence level.[13] It aims to teach everyone in Austria basic digital competences, for example, in learning centres such as clubs and retirement homes. To achieve this, the plan foresees further developments in the school and university system as well as in the further education and training system.[14] Concretely, in the school year 2022/2023, the school subject Digital Basic Education was introduced at secondary schools and general high schools.[15]

In an EU comparison, connectivity in Austria appears to be more problematic.[14] In rural areas in particular, poor coverage with high-speed Internet can impair the digital participation of the population and business activities.

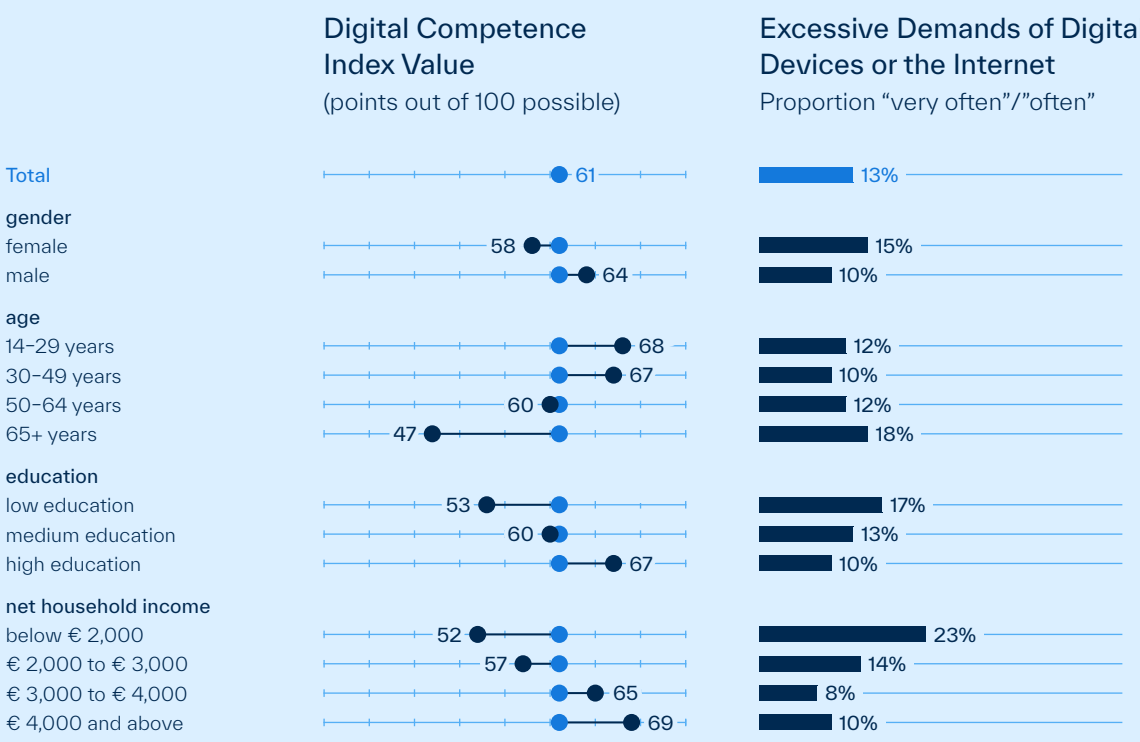
8.98 million[7]
Population size

83,878[8]
Area (in km²)

43.6[9]
Median age (in years)

38,340[10]
GDP per capita (in euros)

5.1[11]
GDP expenditure on education in 2020 (in per cent)



Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = 1,157.

Basis: n = 1,143; without "don't know".

Proportion of People with an Intermediate or Advanced Level of Competence

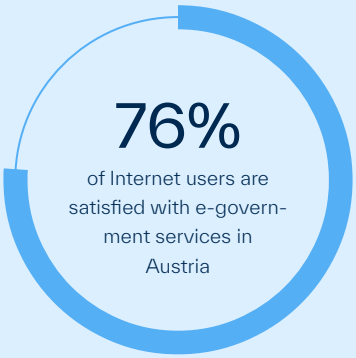
48 points or more

Basis: n = min. 1,154.

Online Activities of Internet Users

99%	e-mail
95%	search engines
91%	navigation or route planning
95%	shopping
91%	information about services, products and prices
94%	send instant messages
91%	news services
81%	expand knowledge, learning, online courses
84%	save and archive private data, documents, photos, etc.
77%	stream/download media (short video clips, images, etc.)
74%	stream/download films/TV programmes/series
79%	rate products or services
74%	stream/download music
88%	social media
82%	publish/share photos or videos
64%	computer software as an online service
60%	online games
57%	applications for monitoring and supporting health or fitness
63%	selling
53%	download e-books
44%	online fitness
25%	online dating/contact exchanges

Basis: Internet users only; n = min. 1,093; without "don't know".



Basis: n = min. 1,118.

User Participation in Social Media

88%
search for specific information, news, or topics

83%
share or send other people's posts

94%
read, watch, or listen to other people's posts

78%
comment on other people's posts

87%
react to other people's posts using "likes" or emojis (e.g., laughing/crying faces)

71%
create your own posts (write texts, upload images or videos)

Basis: social media users only; n = min. 953; without "don't know".

95.2% use the Internet[12]

10th place in the Digital Economy and Society Index[14]

Fibre network coverage of all households: **27%**, 5G coverage in populated areas: **77%**[14]

Use of Technical Devices

52%	smart TV
37%	tablets/tablet computers/2-in-1 devices such as convertible notebooks
29%	smart watch or other "wearables" (e.g., fitness trackers/wristbands, etc.)
27%	games console (e.g., Playstation, X-Box, Nintendo Switch)
25%	e-reader
18%	voice-controlled, Internet-based, intelligent, personal assistants (e.g., Amazon Echo's Alexa, Google Assistant)
3%	virtual reality glasses/VR headset

Basis: n = 1,157.

Spain

In the bidt-Digitalbarometer.international, the population in Spain belongs to the bottom group in terms of digital competence. In terms of competence levels, there are major differences by age and formal education. People with a low level of formal education and those above the age of 64 have very low competence scores in a country comparison. The difference is particularly large compared to people with a high formal education or in the 14 to 29 age group.

The Spanish government addresses this pronounced digital divide with its Pact for Generation D, which aims to promote digital competence and close existing skill gaps.[16] In addition to governmental investment in the digitalisation of the education system, the strong involvement of the private sector is worth mentioning here. In Spain, companies that join the initiative receive government funding but also commit to participating in existing programmes to strengthen digital competence or create new programmes.[17]

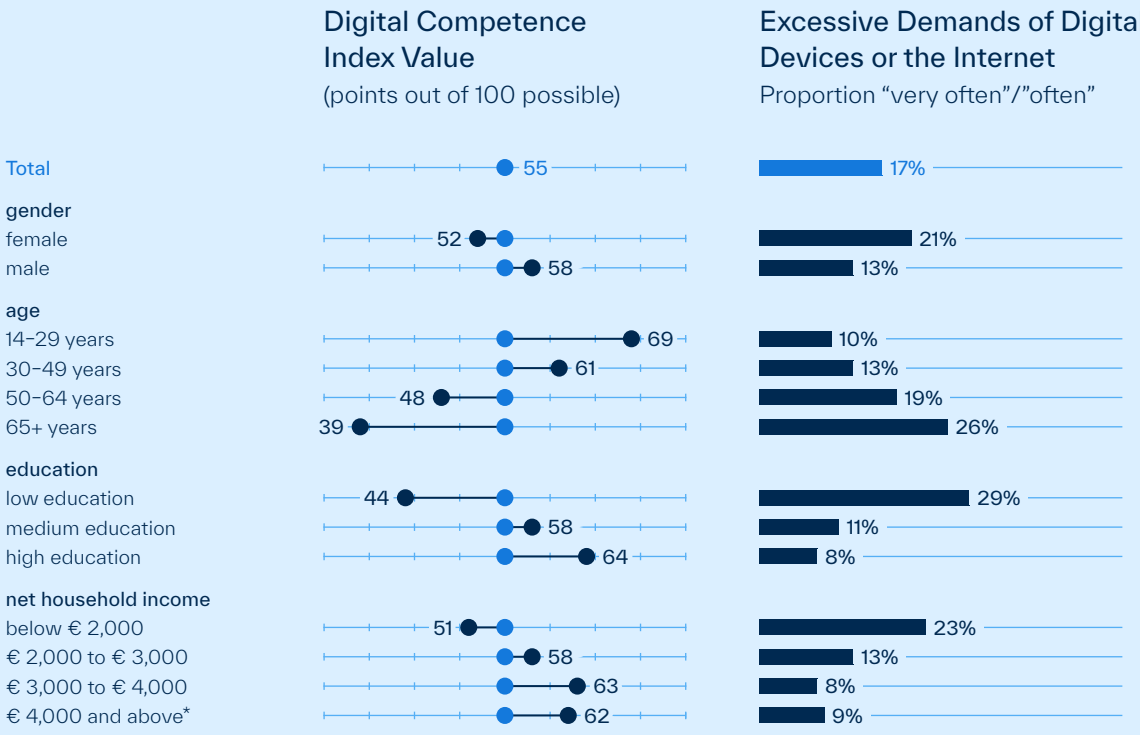
47.43 million[7]
Population size

505,983[8]
Area (in km²)

45.1[9]
Median age (in years)

24,580[10]
GDP per capita (in euros)

4.6[11]
GDP expenditure on education in 2020 (in per cent)



*Case numbers under 100.

Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = 1,690.

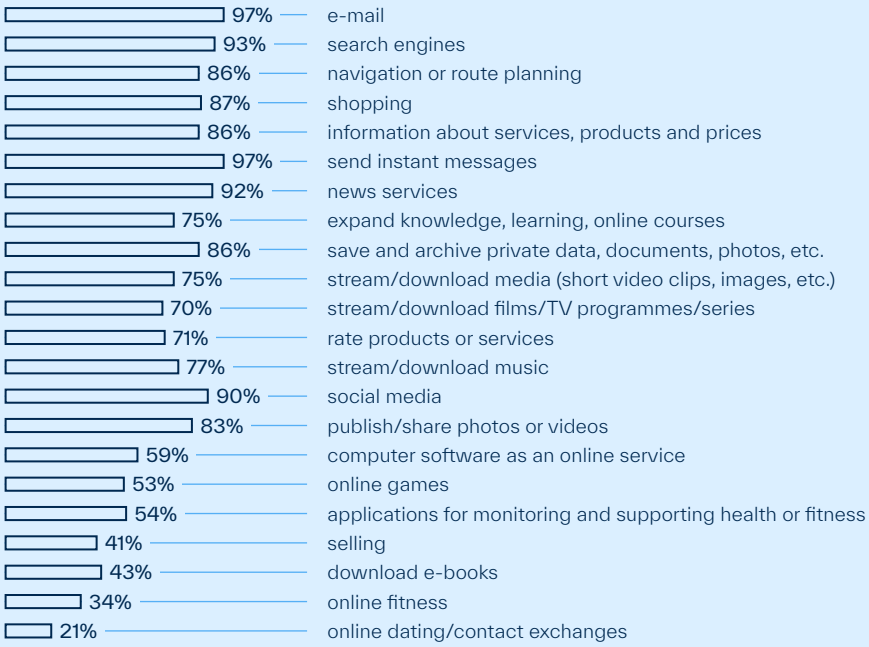
Basis: n = 1,648; without "don't know".

Proportion of People with an Intermediate or Advanced Level of Competence

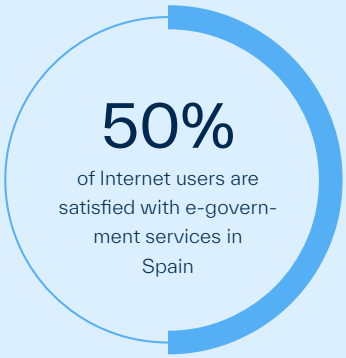
48 points or more

Basis: n = min. 1,675.

Online Activities of Internet Users



Basis: Internet users only; n = min. 1,606; without "don't know".



Basis: n = min. 1,657.

User Participation in Social Media

88%
search for specific information, news, or topics

84%
share or send other people's posts

93%
read, watch, or listen to other people's posts

80%
comment on other people's posts

87%
react to other people's posts using "likes" or emojis (e.g., laughing/crying faces)

74%
create your own posts (write texts, upload images or videos)

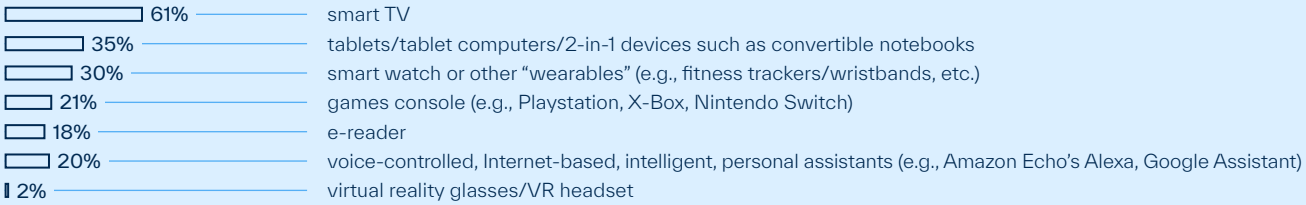
Basis: social media users only; n = min. 1,421; without "don't know".

95.5% use the Internet[12]

7th place in the Digital Economy and Society Index[18]

Fibre network coverage of all households: **89%**, 5G coverage in populated areas: **59%**[18]

Use of Technical Devices



Basis: n = 1,690.

Finland

In the bidt-Digitalbarometer.international, the Finnish population is the top performer in terms of digital competence. This ranking is in line with the good results Finland has already achieved in other country comparisons on the topic of digitalisation.[19, 20]

One reason for this success is the high priority for the topic of digitalisation on the Finnish government's agenda. For example, the Finnish curricula place importance on teaching ICT skills as cross-curricular skills.[21, 22] In addition, skills are also promoted in adulthood, for example as part of free online courses to increase AI competence[23] or through incentives promoting the use of digital technologies in the workplace.[24] Further, Finland is a pioneer in the digitalisation of public administration.[20] This study also shows that the Finnish population is largely satisfied with the e-government offerings.

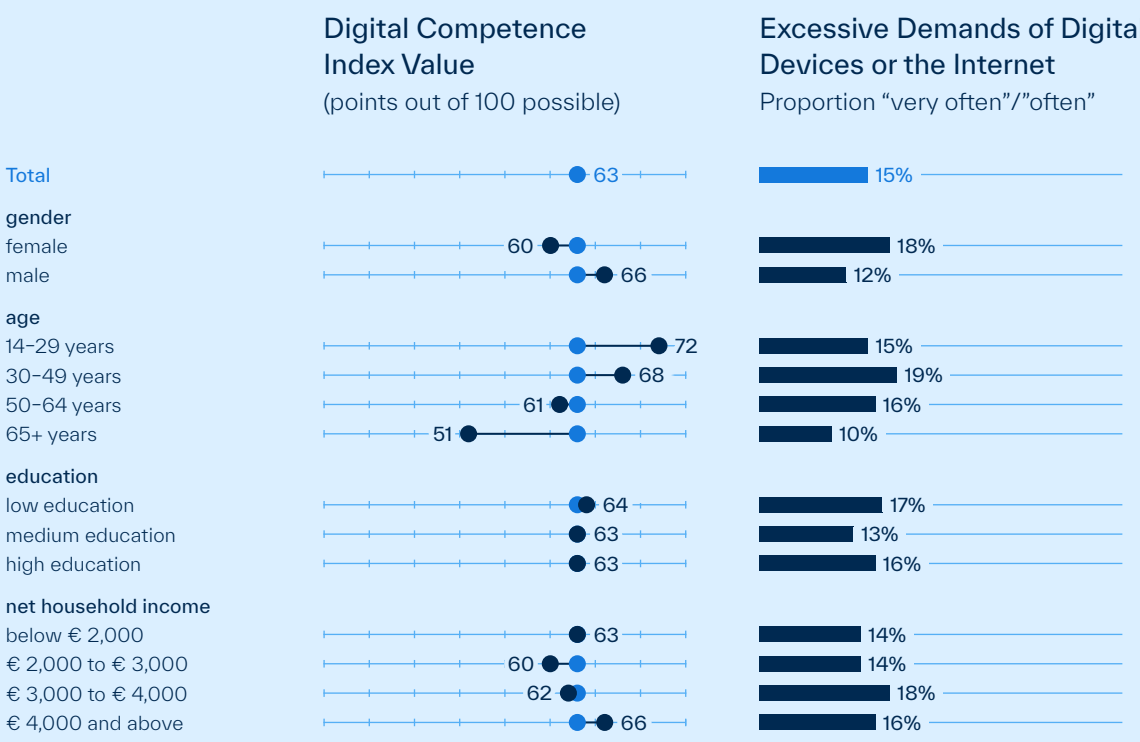
5.55 million[7]
Population size

338,411[8]
Area (in km²)

43.4[9]
Median age (in years)

37,780[10]
GDP per capita (in euros)

5.9[11]
GDP expenditure on education in 2020 (in per cent)



Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = 1,207.

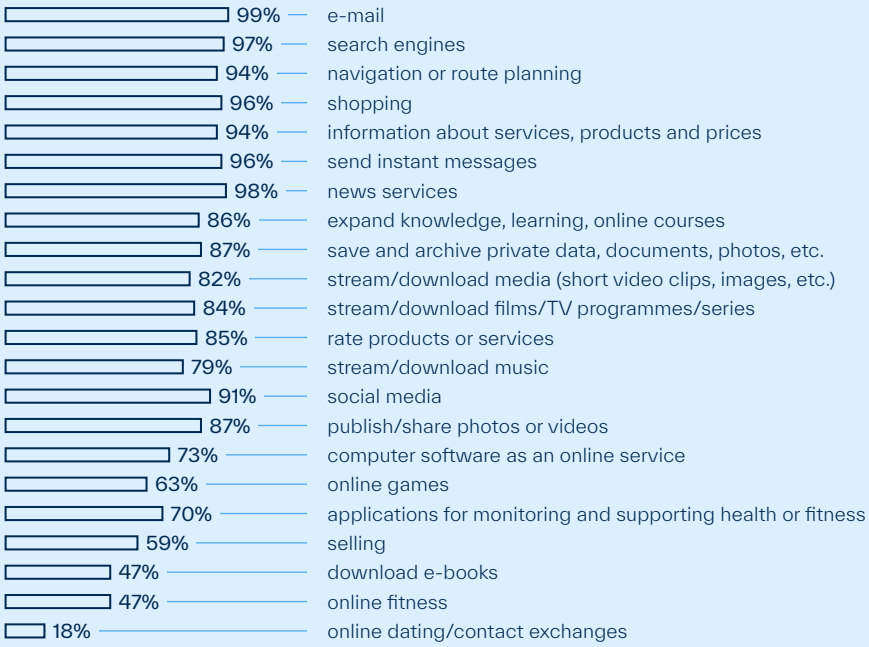
Basis: n = 1,194; without "don't know".

Proportion of People with an Intermediate or Advanced Level of Competence

48 points or more

Basis: n = min. 1,206.

Online Activities of Internet Users



Basis: Internet users only; n = min. 1,146; without "don't know".

Basis: n = min. 1,178.

User Participation in Social Media

88%
search for specific information, news, or topics

75%
share or send other people's posts

94%
read, watch, or listen to other people's posts

83%
comment on other people's posts

88%
react to other people's posts using "likes" or emojis (e.g., laughing/crying faces)

75%
create your own posts (write texts, upload images or videos)

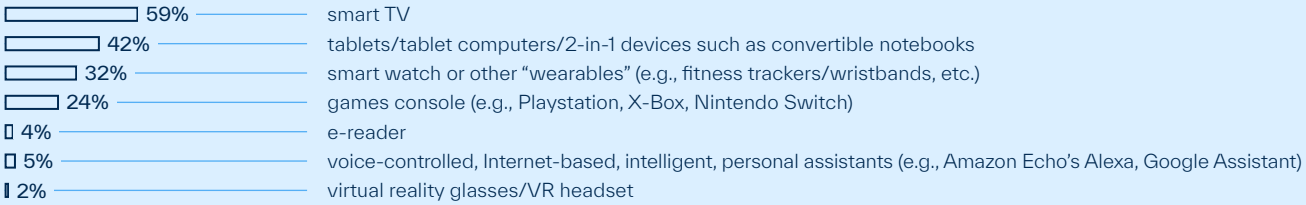
Basis: social media users only; n = min. 1,016; without "don't know".

98.1% use the Internet[12]

1st place in the Digital Economy and Society Index[19]

Fibre network coverage of all households: **40%**, 5G coverage in populated areas: **72%**[19]

Use of Technical Devices



Basis: n = 1,207.

France

In terms of digital competence, the French population is in the middle of the field in the bidt-Digitalbarometer.international survey. This position is in line with the results of the Digital Economy and Society Index (DESI) ranking. There, France also performs above average in terms of digitalisation-relevant indicators, but falls short of the top places.[25] To ensure that the country does not fall behind the frontrunners of digital transformation, the government is promoting digitalisation in various areas.

As part of an investment programme, for example, digital technologies in the areas of quantum and cloud computing as well as AI are receiving government funding.[26] In addition, public administration is being increasingly digitalised in order to increase its accessibility and transparency.[27] To create a coherent ecosystem for digital education, digital education resources are being expanded. Additionally, support is provided for the technological equipment of schools, along with funding for the development of digital competence among teachers.[28]

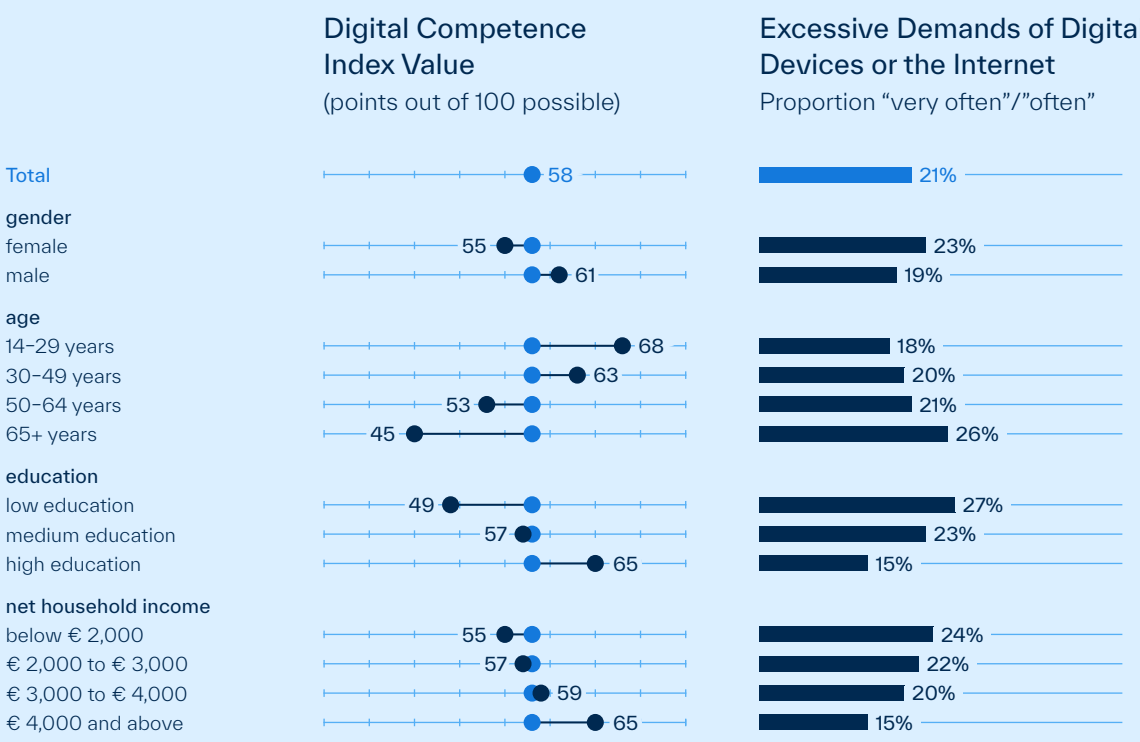
67.87 million[7]
Population size

638,475[8]
Area (in km²)

42.2[9]
Median age (in years)

33,180[10]
GDP per capita (in euros)

5.5[11]
GDP expenditure on education in 2020 (in per cent)



Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = 1,715.

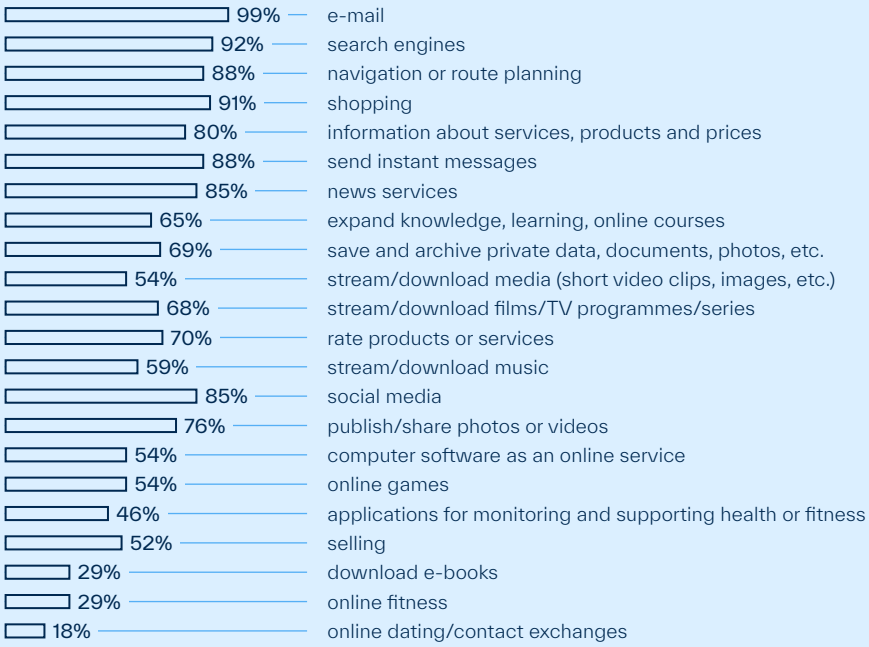
Basis: n = 1,692; without "don't know".

Proportion of People with an Intermediate or Advanced Level of Competence

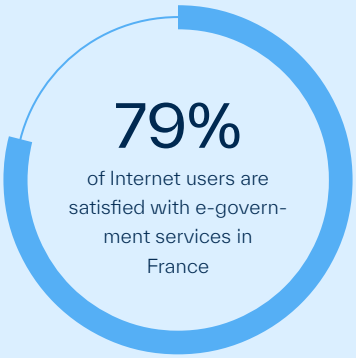
48 points or more

Basis: n = min. 1,696.

Online Activities of Internet Users



Basis: Internet users only; n = min. 1,622; without "don't know".



Basis: n = min. 1,669.

User Participation in Social Media

79%
search for specific information, news, or topics

74%
share or send other people's posts

84%
read, watch, or listen to other people's posts

75%
comment on other people's posts

84%
react to other people's posts using "likes" or emojis (e.g., laughing/crying faces)

65%
create your own posts (write texts, upload images or videos)

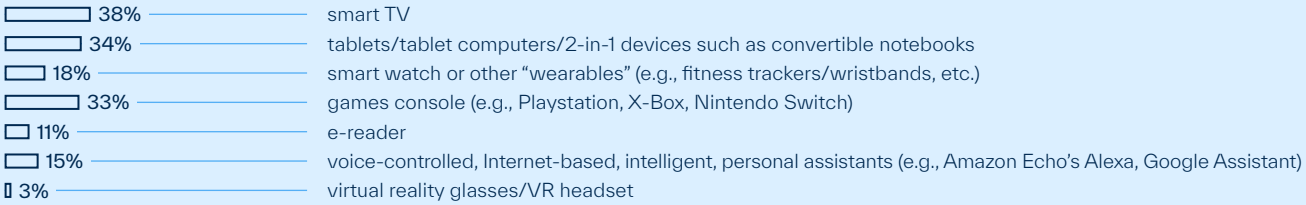
Basis: social media users only; n = min. 1.357; without "don't know".

94.1% use the Internet[12]

12th place in the Digital Economy and Society Index[25]

Fibre network coverage of all households: **63%**, 5G coverage in populated areas: **74%**[25]

Use of Technical Devices



Basis: n = 1,715.

United Kingdom

With regard to their digital competence, the UK is in the middle of the field in the bidt-Digitalbarometer.international survey. Since Brexit, the country is no longer included in the EU-wide DESI survey, thus one of the most important data sources for comparing the country on the basis of digitalisation-relevant indicators is no longer available.[29] Therefore, by including the UK, one of Europe's major countries, this study makes a substantial contribution to a continued comparative analysis of digitalisation in Europe.

The UK government views the availability of employees with high digital competence in all economic sectors as a central factor for the country's economic prosperity.[30] Accordingly, a key part of the national digital strategy concerns the funding of digital competence – from early childhood education to tertiary education and lifelong learning.[30]

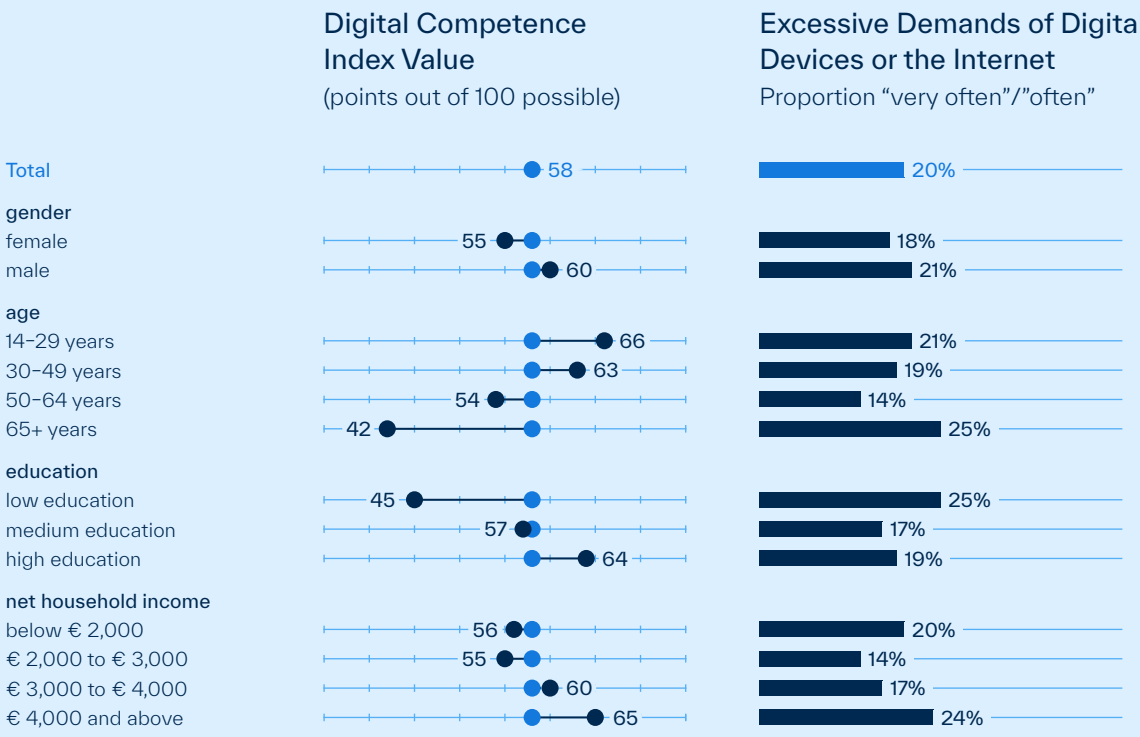
67.03 million[31]
Population size

243,610[32]
Area (in km²)

40.7[31]
Median age (in years)

37,511[33]
GDP per capita (in euros)

5.5[11]
GDP expenditure on education in 2020 (in per cent)



Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = 1,698.

Basis: n = 1,675; without "don't know".

Proportion of People with an Intermediate or Advanced Level of Competence

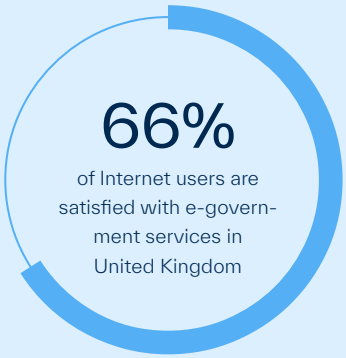
48 points or more

Basis: n = min. 1,688.

Online Activities of Internet Users

99%	e-mail
96%	search engines
89%	navigation or route planning
96%	shopping
88%	information about services, products and prices
93%	send instant messages
90%	news services
73%	expand knowledge, learning, online courses
80%	save and archive private data, documents, photos, etc.
72%	stream/download media (short video clips, images, etc.)
73%	stream/download films/TV programmes/series
84%	rate products or services
69%	stream/download music
90%	social media
83%	publish/share photos or videos
74%	computer software as an online service
65%	online games
56%	applications for monitoring and supporting health or fitness
49%	selling
47%	download e-books
43%	online fitness
24%	online dating/contact exchanges

Basis: Internet users only; n = min. 1,627; without "don't know".



Basis: n = min. 1,623.

User Participation in Social Media

87%
search for specific information, news, or topics

82%
share or send other people's posts

92%
read, watch, or listen to other people's posts

85%
comment on other people's posts

89%
react to other people's posts using "likes" or emojis (e.g., laughing/crying faces)

78%
create your own posts (write texts, upload images or videos)

Basis: social media users only; n = min. 1.431; without "don't know".

98.5% use the Internet[12]

Fibre network coverage of all households: **42%**, 5G coverage coverage outside buildings: **67–77%**[34]

Use of Technical Devices

61%	smart TV
39%	tablets/tablet computers/2-in-1 devices such as convertible notebooks
29%	smart watch or other "wearables" (e.g., fitness trackers/wristbands, etc.)
29%	games console (e.g., Playstation, X-Box, Nintendo Switch)
16%	e-reader
35%	voice-controlled, Internet-based, intelligent, personal assistants (e.g., Amazon Echo's Alexa, Google Assistant)
6%	virtual reality glasses/VR headset

Basis: n = 1,698.

Italy

Compared to other countries in the bidt-Digitalbarometer.international, Italy's population shows rather low digital competence. Furthermore, Italy achieved a below-average result in the EU-wide DESI.[35] In Italy, there is a particular need to catch up in the area of human capital – no other country in the EU has fewer graduates in the tertiary education sector that focus on ICT. To address this issue, a governmental package of measures aims to fund digital education, including the integration of digital competence into curricula at all school levels.[35] Additionally, reforms and programmes in the higher education sector intend to make ICT subjects even more attractive for students. When looking at the digitalisation of public administration, Italy also scores below average compared to other EU countries.[35] In this country comparison, only relatively few people in Italy are satisfied with the e-government offerings.

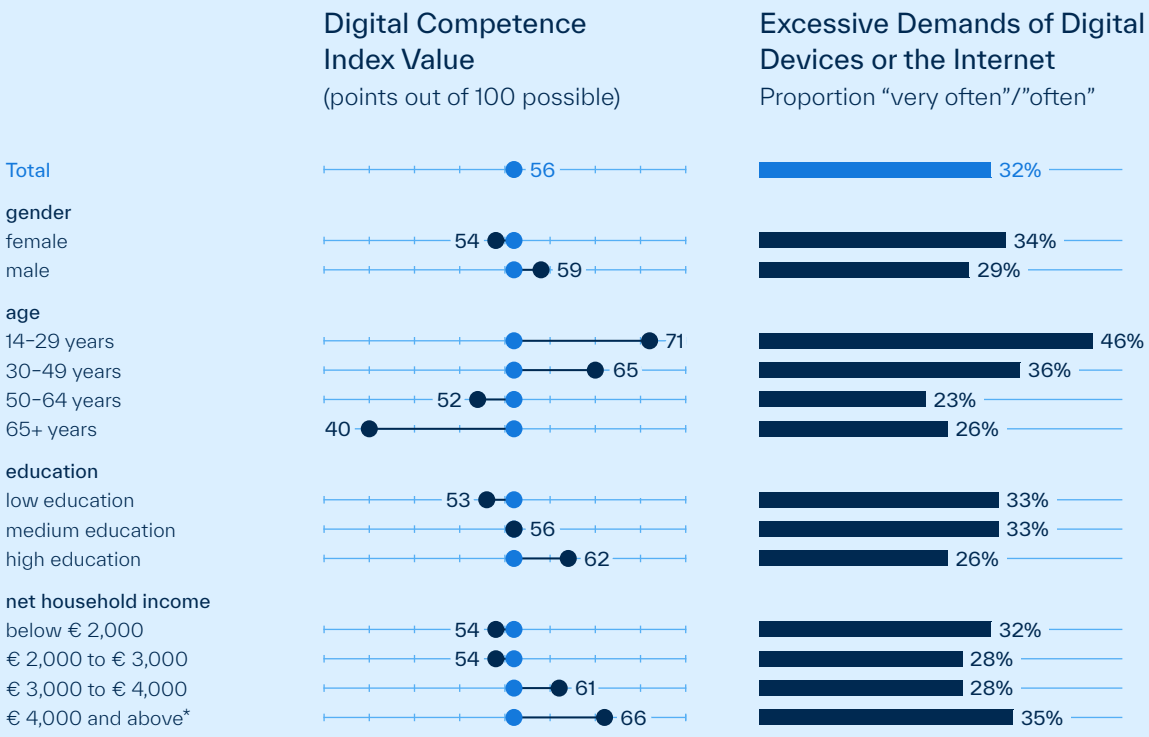
59.03 million[7]
Population size

302,079[8]
Area (in km²)

48.0[9]
Median age (in years)

27,860[10]
GDP per capita (in euros)

4.3[11]
GDP expenditure on education in 2020 (in per cent)



*Case numbers under 100.

Formal education according to ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).
Basis: n = 1,734.

Basis: n = 1,683; without "don't know".

Proportion of People with an Intermediate or Advanced Level of Competence

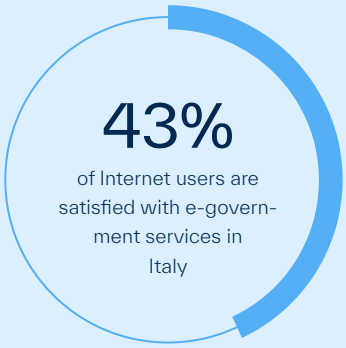
48 points or more

Basis: n = min. 1,720.

Online Activities of Internet Users

97%	e-mail
92%	search engines
86%	navigation or route planning
88%	shopping
83%	information about services, products and prices
97%	send instant messages
92%	news services
68%	expand knowledge, learning, online courses
78%	save and archive private data, documents, photos, etc.
68%	stream/download media (short video clips, images, etc.)
70%	stream/download films/TV programmes/series
80%	rate products or services
67%	stream/download music
87%	social media
83%	publish/share photos or videos
58%	computer software as an online service
53%	online games
51%	applications for monitoring and supporting health or fitness
45%	selling
41%	download e-books
38%	online fitness
28%	online dating/contact exchanges

Basis: Internet users only; n = min. 1,619; without "don't know".



Basis: n = min. 1,665.

User Participation in Social Media

92% search for specific information, news, or topics

84% share or send other people's posts

92% read, watch, or listen to other people's posts

83% comment on other people's posts

88% react to other people's posts using "likes" or emojis (e.g., laughing/crying faces)

79% create your own posts (write texts, upload images or videos)

Basis: social media users only; n = min. 1,484; without "don't know".

90.1% use the Internet[12]

18th place in the Digital Economy and Society Index[35]

Fibre network coverage of all households: **44%**, 5G coverage in populated areas: **99.7%**[35]

Use of Technical Devices

63%	smart TV
32%	tablets/tablet computers/2-in-1 devices such as convertible notebooks
20%	smart watch or other "wearables" (e.g., fitness trackers/wristbands, etc.)
24%	games console (e.g., Playstation, X-Box, Nintendo Switch)
14%	e-reader
26%	voice-controlled, Internet-based, intelligent, personal assistants (e.g., Amazon Echo's Alexa, Google Assistant)
2%	virtual reality glasses/VR headset

Basis: n = 1,734.

Sources Country Profiles

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Appendix

Methodology

The bidt-Digitalbarometer.international follows on from the bidt-SZ-Digitalbarometer 2022 in Germany and enables comparisons between countries on various aspects of digital transformation through surveys in Austria, Finland, France, Italy, Spain, and the UK.

The data collection in Germany took place from 9 August to 13 September 2021. The data collection in the six comparison countries took place from 14 November 2022 to 5 January 2023. The target population was the resident population aged 14 and over whose language skills were sufficient to conduct the survey in the respective national language. In order to draw a representative picture of the respective total population, the surveys were conducted both online (CAWI) and additionally by computer-assisted telephone interviewing (CATI) of non-users and infrequent users of the Internet. Table 1 provides a detailed overview of the field times and the unweighted case numbers by selected socio-structural characteristics for each country.

Table 1: Unweighted Number of Cases and Sample Characteristics

	Germany	Austria	France	Finland	Italy	United Kingdom	Spain
Survey period from/to	09/08/21–13/09/21	14/11/22–21/12/22	21/11/22–05/01/23	28/11/22–05/01/23	21/11/22–05/01/23	21/11/22–05/01/23	21/11/22–05/01/23
Total	9,044	1,157	1,715	1,207	1,734	1,698	1,690
CAWI	7,644	1,032	1,565	1,082	1,534	1,548	1,540
CATI	1,400	125	150	125	200	150	150
By gender							
Male	4,430	561	839	571	844	824	819
Female	4,604	595	874	628	887	866	868
Diverse	10	1	2	8	3	8	3
By age							
14–29 years	580	190	345	237	272	311	263
30–49 years	2,066	332	483	295	485	504	537
50–64 years	2,615	306	385	302	459	401	434
65+ years	3,783	329	502	373	518	482	456
Mean value	*58.5*	*50.8*	*50.0*	*50.5*	*51.4*	*50.6*	*50.9*
By formal level of education*							
Low formal education	5,402	249	425	216	678	388	668
Medium formal education	1,329	592	602	401	709	549	388
High formal education	2,228	299	586	481	324	705	597
Unspecified	85	17	102	109	23	56	37
By net household income							
Under € 2,000	1,926	291	521	281	806	624	688
€ 2,000 up to € 3,000	2,190	240	437	199	431	357	372
€ 3,000 up to € 4,000	1,764	210	359	210	182	263	168
€ 4,000 and more	2,089	215	238	311	82	253	75
Unspecified	1,075	201	160	206	233	201	387

** Formal level of education based on ISCED 2011: low (level 1–2), medium (level 3–4), high (level 5–8).*

Weighting

As sample inconsistencies are generally not randomly distributed, a multi-level, iterative redressment weighting of the data was carried out. The weighting specifications were region, age and gender (combined), as well as a balancing weight between the CATI and CAWI surveys reflecting the frequency of Internet use. Additionally, the international comparative surveys also took into account the level of education as a weighting specification. The target population counts used come from the latest available official statistics. Unless labelled otherwise, this study always presents weighted results.

Categorisation of Educational Qualifications

The differentiation by level of education in this study is based on the UNESCO International Standard Classification of Education (ISCED) 2011. This framework enables the international comparison of different educational qualifications. As an example, the level categorisation is briefly explained using the German education system: levels 1 and 2 cover primary and lower secondary education; in Germany, these are primary schools (usually grades 1 to 4) and lower and intermediate secondary schools (usually grades 5 to 9 or 10). Levels 3 and 4 cover upper secondary education and post-secondary non-tertiary education. This category mainly includes grammar school or equivalent qualifications, but also qualifications from various vocational schools. Levels 5 to 8 include all tertiary qualifications, from short master craftsman training to qualifications from technical colleges and universities of applied sciences, as well as bachelor's and master's degrees or equivalent qualifications through to doctorates.

In the other countries, general and vocational qualifications are sometimes labelled very differently, partly for linguistic reasons, but also for historical reasons. However, applying the ISCED, as illustrated with Germany, helps to categorise and compare these degrees. It is to be considered that the first publication of the German study results (Stürz et al. 2022a) assigned the German "Gymnasium" qualification to high formal education. For reasons of international comparability, however, this publication reclassified the German degrees according to ISCED 2011.

European Reference Framework for Digital Competence and the DigCompSAT Self-Assessment Test

In order to identify and define digital competences uniformly at a European level, the Joint Research Centre of the European Commission created the European Digital Competence Framework (DigComp) in 2013. Since then, the research organisation has continuously developed the framework (European Commission 2021). Identifying and categorising digital competence is a challenge, as competences are often context- and time-dependent (Jisc 2014). The current version DigComp 2.2 from 2022 still consists of five competence areas, which are made up of a total of 21 individual competences (cf. Table 2). The reference framework also defines eight different competence levels and provides examples and use cases for the individual competences (Vuorikari et al. 2022).

Table 2: DigComp 2.2 Competence Areas and Individual Competences

1	Information and data literacy	
	1.1	Browsing, searching and filtering data, information and digital content
	1.2	Evaluating data, information and digital content
	1.3	Managing data, information and digital content
2	Communication and collaboration	
	2.1	Interacting through digital technologies
	2.2	Sharing through digital technologies
	2.3	Engaging in citizenship through digital technologies
	2.4	Collaborating through digital technologies
	2.5	Netiquette
	2.6	Managing digital identity
3	Digital content creation	
	3.1	Developing digital content
	3.2	Integrating and re-elaborating digital content
	3.3	Copyright and licences
	3.4	Programming
4	Safety	
	4.1	Protecting devices
	4.2	Protecting personal data and privacy
	4.3	Protecting health and well-being
	4.4	Protecting the environment
5	Problem solving	
	5.1	Solving technical problems
	5.2	Identifying needs and technological responses
	5.3	Creatively using digital technology
	5.4	Identifying digital competence gaps

At the end of 2020, the Joint Research Centre of the European Commission also presented a self-assessment test for digital competence, which was developed in several pilot studies on the basis of the DigComp 2.1 competence framework. The test consists of 82 individual statements that cover knowledge, skills, and attitudes (Clifford et al. 2020). Here, knowledge refers to the acquisition of information through learning. Skills involve the application of knowledge to solve tasks and problems. Attitudes reflect the motivation for the respective performance, which includes values, aspirations, and priorities (Vuorikari et al. 2022). Respondents answer each individual statement on a four-point scale, with the scales labelled differently depending on the competence type.

The DigCompSAT can be applied to measure individual competences on competence levels 1 to 6. The test does not record competence levels 7 and 8, which include highly specialised digital competences (Clifford et al. 2020). The assessment of competences is based on a self-assessment (Clifford et al. 2020), so the test is not knowledge- or action-based, meaning the possibility of incorrect self-assessment is not taken into account (Nüßlein/Schmidt 2020).

The German bidt-SZ-Digitalbarometer uses a translated version of the 82 individual statements and the three response scales of the DigCompSAT. Further, for the application in German, a standardised and adapted scale for answering attitude questions was used. Also, the respondents had the freedom to deny any information on the individual statements. Further details on translations and response scales can be found in Table 3. The individual statements can be found in Table 4 in this appendix.

Table 3: Response Scales Used for the DigCompSAT

Knowledge	Skills	Attitude	Scale values
I have no knowledge of this/I never heard of this	I don't know how to do it	Does not apply at all	0.00
I have only a limited understanding of this and need more explanations	I can do it with help	Does not apply	0.33
I have a good understanding of this	I can do it on my own	Applies	0.67
I fully master this topic/issue and I could explain it to others	I can do it with confidence and, if needed, I can support/guide others	Applies completely	1.00
No answer	No answer	No answer	–

The German translation of the adapted attitude scale serves as the basis for the international surveys. The Austrian version includes only few slight formulation changes, compared to the version used in Germany in 2021. The Joint Research Centre of the EU Commission provided the translation for the 82 individual statements used in Spain and the UK (Clifford et al. 2020). For the other countries, native speakers from the commissioned market research institute carried out the translations into the respective national languages.

Telephone Adaption of the DigCompSAT and imputations

In order to avoid consuming too much of the respondents' time, only one of the five competence areas was randomly selected for each person surveyed by telephone in Germany. Then all the individual statements from this competence area were assigned to the telephone respondents. This means that, for respondents that took part in the telephone survey, no data is available for four of the five competence areas. For these respondents, the computation of the digital competence index was performed in line with the DigCompSAT calculation. First, for every respondent, the arithmetic mean of the responses to the individual statements was calculated for each of the five competence areas and afterwards standardised to 100 maximum possible points. Statements with unspecified answers were excluded in this process. The index value for a competence area is the average of these arithmetic means of all respondents, representatively weighted with special weighting specifications for this area. Finally, the overall competence index across all five competence areas consists of the arithmetic mean of the five index values for the individual competence areas.

The 2022 international comparative surveys were initially carried out in the same way. However, additionally, the telephone respondents received 21 particularly meaningful individual statements across all five competence areas. Using this additional information, a machine learning procedure (MissForest algorithm, cf. Stekhoven/Bühlmann 2012)[1] was applied to impute the missing values for the remaining individual statements that were not surveyed. The training data for this procedure consists of the data collected by telephone in Germany in 2021 as well as the data from the telephone survey in the six current international comparative surveys.[2]

This means that imputed answers are available for all telephone respondents in the bidt-Digitalbarometer.international survey, including the individual statements that were not surveyed directly. Therefore, for each competence area, a mean value can be calculated for all respondents. In the international comparative surveys, the overall index is calculated from the equally weighted average of the index values of the five competence areas per respondent – analogously to the results for Germany. Although these two survey and calculation methods differ in minor details between the survey in Germany and the international comparative surveys, the results of the summarised digital competence in Germany and the other countries are still comparable. Comprehensive checks of the international data with alternative calculation methods without imputed values, analogous to the procedure in Germany, always yielded qualitatively identical results. Table 4 contains the individual English statements and the corresponding average characteristic values from data of all countries surveyed.

1 The Proportion of Falsely Classified Entries (PFC) was used as a quality criterion for imputation, which is between 3.3% and 6.9% depending on the country and area of expertise.

2 CAWI cases are not suitable as training data because they differ too much from the telephone sample in terms of socio-structural characteristics.

Table 4: DigCompSAT/bidt-Digitalbarometer.international Competence Statements

			GER		AUT		ESP		FIN		FRA		GBR		ITA	
	Associated individual competence of the DigComp 2.1 reference framework	Individual statement (Type/response scale may differ (cf. Table 3): K = knowledge, S = skills, A = attitude)	n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MV
1	1.1	I know that different search engines may give different search results, because they are influenced by commercial factors. (K)	7,762	63.8	1,128	61.5	1,621	48.2	1,197	68.3	1,650	58.7	1,671	53.9	1,665	54.0
2	1.1	I know which words to use in order to find what I need quickly (e.g. to search online or within a document). (K)	7,796	66.1	1,141	68.6	1,647	59.6	1,201	73.8	1,679	67.9	1,672	61.6	1,702	61.9
3	1.1	When I use a search engine, I can take advantage of its advanced features. (S)	7,751	57.8	1,137	62.6	1,644	55.8	1,187	64.3	1,661	59.2	1,649	57.9	1,703	59.2
4	1.1	I know how to find a website I have visited before. (S)	7,810	68.0	1,143	73.7	1,654	69.0	1,196	76.6	1,692	70.6	1,682	76.3	1,703	70.5
5	1.2	I know how to differentiate promoted content from other content I find or receive online (e.g. recognising an advert on social media or search engines). (S)	7,650	63.8	1,127	68.1	1,615	64.7	1,192	77.4	1,645	62.7	1,645	66.9	1,671	63.9
6	1.2	I know how to identify the purpose of an online information source (e.g. to inform, influence, entertain, or sell). (S)	7,612	59.1	1,119	64.0	1,619	61.5	1,190	73.7	1,646	61.0	1,654	64.8	1,663	62.4
7	1.2	I critically check if the information I find online is reliable. (A)	7,812	71.3	1,145	73.9	1,628	65.1	1,181	75.1	1,630	70.2	1,655	65.6	1,706	68.8
8	1.2	I know that some information on the Internet is false (e.g. fake news). (K)	7,768	72.0	1,135	74.3	1,632	64.0	1,199	79.9	1,664	72.2	1,666	68.2	1,701	68.0
9	1.3	I know about different storage media (e.g. internal or external hard disk, USB memory, pen drive, memory card). (K)	7,793	68.4	1,137	68.4	1,642	68.1	1,199	74.0	1,666	67.9	1,673	59.2	1,688	61.8
10	1.3	I know how to organise digital content (e.g. documents, images, videos) using folders or tagging to find them later. (S)	7,738	57.5	1,138	64.8	1,638	61.5	1,191	66.5	1,651	58.9	1,669	62.1	1,681	59.8
11	1.3	I know how to copy and move files (e.g. documents, images, videos) between folders, devices or on the cloud. (S)	7,763	61.6	1,146	67.5	1,651	64.9	1,201	73.9	1,674	65.7	1,670	65.4	1,700	63.3
12	1.3	I know how to manage and analyse data using software (e.g. sorting, filtering, calculations). (S)	7,692	49.4	1,127	56.7	1,636	52.4	1,183	59.0	1,639	54.7	1,656	49.7	1,676	53.5
13	2.1	I know how to send, reply and forward e-mails. (S)	7,864	82.7	1,152	84.5	1,678	77.1	1,205	91.2	1,707	82.2	1,689	85.1	1,719	78.6

			GER		AUT		ESP		FIN		FRA		GBR		ITA
			n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MW
14	2.1	I know that many communication services and social media are free of charge because they are paid for by advertising. (S/K)	7,775	71.2	1,144	73.9	1,654	63.5	1,201	79.1	1,677	68.9	1,672	67.9	1,700	64.6
15	2.1	I know how to use advanced video-conferencing features (e.g. moderating, recording audio and video). (S)	7,739	51.9	1,138	60.6	1,665	58.8	1,193	59.5	1,647	57.0	1,666	56.5	1,691	56.2
16	2.1	I know which communication tools and services (e.g. phone, email, video conference, text message) are appropriate to use in different circumstances. (K)	7,716	68.0	1,134	69.7	1,650	63.6	1,198	76.6	1,666	67.6	1,661	67.2	1,688	63.8
17	2.2	I am open towards sharing digital content that I think might be interesting and useful to others. (A)	7,725	52.1	1,138	59.0	1,635	58.0	1,191	54.2	1,632	60.0	1,634	59.7	1,696	60.3
18	2.2	I know how to use cloud services (e.g. Google Drive, DropBox and OneDrive) to share my files. (S)	7,742	51.7	1,139	61.8	1,667	58.6	1,196	66.0	1,656	56.4	1,671	59.2	1,699	55.6
19	2.2	I know how to change who I share content with (e.g. friends, friends of friends, everyone). (S)	7,696	61.1	1,139	69.6	1,662	67.0	1,188	72.4	1,638	62.9	1,670	70.6	1,681	62.8
20	2.2	I know how to reference the source of documents (e.g. the author or web address) that I found online. (S)	7,649	53.4	1,128	62.5	1,651	55.4	1,183	70.4	1,651	60.0	1,650	58.6	1,684	57.7
21	2.3	I know how to apply for a job using a digital platform (e.g. fill in a form, upload my CV and photo). (S)	6,999	58.5	1,080	69.1	1,632	62.1	1,121	76.6	1,498	66.6	1,593	68.3	1,632	60.0
22	2.3	I know that many public services are available on the Internet (e.g. booking a health visit, submitting tax declaration, requesting birth, marriage, residence and other certificates). (K)	7,786	67.0	1,144	72.0	1,658	67.2	1,201	82.6	1,686	73.9	1,674	69.9	1,705	65.9
23	2.3	I know how to pay for goods and services that I buy online (e.g. using direct bank transfer, credit/debit cards, other online payment systems). (S)	7,788	74.4	1,148	79.6	1,656	69.5	1,201	84.7	1,682	73.7	1,681	80.6	1,698	70.7
24	2.3	It matters to me to debate social or political issues online (e.g. in online forums, news sites, Facebook, Twitter). (A)	7,728	28.5	1,135	37.5	1,626	37.5	1,195	32.3	1,623	40.4	1,644	43.4	1,688	46.3
25	2.4	I understand the benefits of remote collaboration (e.g. reduced commuting time). (A)	7,310	61.8	1,095	65.6	1,605	59.0	1,151	68.8	1,500	61.1	1,599	58.9	1,633	58.5
26	2.4	I know how to edit a shared, online document. (S)	7,645	53.9	1,127	62.6	1,661	59.9	1,174	62.2	1,644	57.8	1,665	62.8	1,673	56.0

			GER		AUT		ESP		FIN		FRA		GBR		ITA
			n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MW
27	2.4	I know how to invite others and give appropriate permissions to collaborate on a shared document. (S)	7,598	42.1	1,115	52.0	1,657	53.9	1,163	56.2	1,611	51.3	1,648	55.4	1,659	49.3
28	2.5	I am aware that I should ask permission from a person before publishing or sharing photos about them. (K)	7,789	78.4	1,140	77.9	1,642	67.9	1,194	81.4	1,664	74.6	1,662	70.3	1,684	68.2
29	2.5	I know how to recognise online messages and behaviours that attack certain groups or individuals (e.g. hate speech). (S)	7,519	54.6	1,110	63.1	1,641	61.4	1,173	70.2	1,632	63.2	1,643	67.3	1,664	62.2
30	2.5	I can take the right measures if someone is doing the wrong thing online (e.g. an offensive comment, threats). (S)	7,461	47.6	1,110	58.9	1,639	56.0	1,146	60.0	1,628	57.2	1,633	62.7	1,660	61.3
31	2.5	I know how to behave online according to the situation (e.g. formal vs informal). (K)	7,638	66.2	1,136	71.0	1,639	66.6	1,193	79.3	1,654	71.9	1,669	71.3	1,685	65.7
32	2.6	I know my digital identity is everything that identifies me in online environments (e.g. usernames, likes and posts on social media, petitions signed online). (K)	7,737	67.9	1,138	72.5	1,638	65.2	1,193	75.3	1,662	70.9	1,662	68.6	1,690	65.1
33	2.6	I know how to create a profile in digital environments for personal or professional purposes. (S)	7,546	51.8	1,122	63.4	1,650	57.7	1,172	68.3	1,629	62.5	1,634	58.4	1,673	59.0
34	2.6	I know that the EU introduced regulation on The Right to Be Forgotten (i.e. to have one's private information removed from the Internet). (K)	7,708	51.5	1,128	57.2	1,624	46.1	1,185	53.2	1,640	56.0	1,656	46.9	1,662	46.7
35	2.6	I know how to configure the settings in my Internet browser to prevent or limit cookies. (S)	7,768	53.2	1,134	60.9	1,665	54.0	1,191	62.4	1,673	57.5	1,665	58.8	1,687	54.5
36	3.1	I know how to create and edit digital text files (e.g. Word, OpenDocument, Google Docs). (S)	7,830	69.0	1,148	70.3	1,652	59.2	1,197	73.6	1,674	62.6	1,674	64.9	1,702	58.8
37	3.1	I know how to express myself by creating digital content on the Internet (e.g. blog post, video on YouTube). (S)	7,589	41.6	1,113	53.3	1,646	47.2	1,161	56.5	1,615	46.4	1,636	49.3	1,675	48.9
38	3.1	I know how to produce a multimedia presentation with text, images, audio and video elements. (S)	7,735	47.3	1,123	53.9	1,655	49.9	1,181	53.8	1,635	49.0	1,655	48.1	1,680	47.6
39	3.1	To express myself, I am careful to choose the right type of digital media depending on the audience and my aim (e.g. using social media to promote a project). (A)	7,087	41.1	1,079	50.1	1,584	54.0	1,164	51.4	1,475	55.6	1,585	54.7	1,636	46.1

			GER		AUT		ESP		FIN		FRA		GBR		ITA
			n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MW
40	3.2	I am keen to create new digital content by mixing and modifying existing digital resources (e.g. a presentation with photos and a soundtrack found on the Internet). (A)	7,462	29.7	1,110	38.0	1,607	38.2	1,183	39.5	1,523	45.2	1,610	39.3	1,662	39.7
41	3.2	I know that some digital content can be reused and reworked legally (e.g. public domain or with Creative Commons licences). (K)	7,614	43.2	1,118	50.2	1,633	38.9	1,186	44.6	1,630	47.9	1,658	43.6	1,661	45.4
42	3.2	I know how to edit or make changes to digital content that others have created (e.g. insert a text into an image, edit a wiki). (S)	7,721	46.6	1,132	52.8	1,654	44.2	1,177	52.6	1,639	46.3	1,652	46.7	1,672	42.8
43	3.2	I know how to create something new by mixing different types of content (e.g. text and images). (S)	7,706	50.3	1,132	58.0	1,653	48.8	1,185	60.5	1,640	51.0	1,657	50.3	1,675	49.2
44	3.3	I am careful to follow the rules about copyrights and licenses of digital content that I find. (A)	7,061	63.4	1,084	65.6	1,590	58.2	1,154	62.2	1,508	66.1	1,588	59.4	1,607	55.3
45	3.3	I know that downloading or sharing digital content (e.g. music, software, films) may have ethical or legal consequences. (K)	7,719	62.6	1,127	64.0	1,642	55.6	1,190	67.6	1,659	62.8	1,667	60.5	1,688	60.0
46	3.3	I can detect when digital content is made available illegally (e.g. software, movies, music, books, TV). (S)	7,590	36.4	1,116	46.3	1,638	43.6	1,162	53.3	1,615	44.0	1,635	41.5	1,657	45.4
47	3.3	I know which different types of licences apply to the use of digital content (e.g. Creative Commons licences). (S/K)	7,622	37.1	1,124	45.5	1,635	35.0	1,185	37.6	1,623	37.7	1,660	38.9	1,652	40.2
48	3.4	I am interested in understanding how a task can be broken down into steps so that it can be automated, for example in software or by a robot. (A)	7,318	37.8	1,106	45.0	1,573	42.1	1,173	41.4	1,464	49.8	1,615	44.1	1,616	42.6
49	3.4	I know that programming languages (e.g. Python, Visual Basic, Java) are used to provide a digital device instructions to carry out a task. (K)	7,684	40.5	1,128	46.0	1,636	38.3	1,186	43.4	1,638	39.9	1,658	38.9	1,655	38.6
50	3.4	I can write scripts, macros and simple applications to automate the execution of a task. (S)	7,687	24.2	1,123	37.0	1,640	29.3	1,176	28.6	1,623	30.1	1,638	29.8	1,653	32.1
51	3.4	I know that there could be different algorithmic solutions to accomplish a specific computational task (e.g. sorting and searching). (K)	7,695	45.1	1,122	50.9	1,636	40.0	1,186	49.8	1,631	45.8	1,655	40.3	1,665	42.5

				GER		AUT		ESP		FIN		FRA		GBR		ITA
			n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MW
52	4.1	I understand the benefits and also the safety risks when using Internet-connected devices or systems (e.g. smart watches, smart home devices). (K)	7,728	60.4	1,140	62.6	1,646	52.7	1,200	63.0	1,658	60.9	1,665	59.2	1,693	57.3
53	4.1	I know about the importance of keeping the operating system, antivirus and other software up-to-date in order to prevent security issues. (K)	7,802	67.0	1,148	68.6	1,652	60.2	1,203	74.2	1,674	66.8	1,671	66.7	1,711	63.1
54	4.1	I know how to configure the settings of a firewall on different devices. (S)	7,787	38.1	1,141	45.4	1,644	33.1	1,196	46.1	1,671	43.6	1,664	40.9	1,679	41.3
55	4.1	I know how to recover digital information and other content (e.g. photos, contacts) from a backup. (S)	7,774	42.4	1,140	51.3	1,655	45.9	1,196	55.1	1,664	48.7	1,671	49.7	1,683	45.5
56	4.2	I know how to restrict or refuse access to my geographical location. (S)	7,796	55.6	1,141	61.9	1,657	52.0	1,195	59.5	1,676	59.2	1,672	56.3	1,695	53.4
57	4.2	I know how to identify suspicious e-mail messages that try to obtain my personal data. (S)	7,804	64.1	1,143	67.7	1,657	59.3	1,199	76.0	1,688	67.0	1,670	67.0	1,700	62.8
58	4.2	I know how to check that the website where I am asked to provide personal data is secure (e.g. https sites, safety logo or certificate). (S)	7,750	53.6	1,143	60.7	1,651	54.4	1,192	67.4	1,677	61.7	1,664	61.6	1,687	56.9
59	4.2	I know which personal data I should not share and display online (e.g. on social media). (K)	7,776	72.1	1,140	72.5	1,651	66.3	1,202	78.0	1,665	68.6	1,660	69.3	1,694	65.3
60	4.2	I am careful about checking the privacy policies of the digital services that I use. (A)	7,751	43.6	1,137	52.7	1,633	52.9	1,188	52.0	1,623	52.3	1,638	60.8	1,684	54.5
61	4.3	I am aware that I should manage the time I spend on my digital devices (A)	7,780	73.7	1,140	72.9	1,632	63.4	1,190	71.8	1,670	65.1	1,649	66.8	1,684	64.6
62	4.3	I know how to protect myself from unwanted and malicious online encounters and materials (e.g. spam messages, identity theft emails). (S)	7,776	55.1	1,138	62.9	1,647	54.8	1,191	66.4	1,670	61.1	1,668	62.1	1,688	59.3
63	4.3	I know about digital tools that can help older people or people with special needs. (K)	7,633	42.4	1,124	50.6	1,643	53.3	1,188	48.2	1,628	47.7	1,657	48.2	1,671	49.5
64	4.4	I seek out ways in which digital technologies could help me to live and consume in a more environmentally friendly way. (A)	7,633	48.2	1,123	55.0	1,627	60.4	1,176	55.5	1,596	59.3	1,615	56.5	1,684	64.3

				GER		AUT		ESP		FIN		FRA		GBR		ITA
			n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MW
65	4.4	I know that old digital devices and consumables (e.g. computers, smartphones, batteries) must be appropriately disposed to minimise their environmental impact. (K)	7,800	76.7	1,146	74.4	1,636	62.3	1,201	77.2	1,652	65.8	1,663	65.2	1,699	66.6
66	4.4	I know how to reduce the energy consumption of my devices (e.g. change settings, close apps, turn off wifi). (S)	7,781	62.4	1,141	65.2	1,650	56.9	1,192	65.9	1,654	52.6	1,665	60.7	1,684	54.1
67	4.4	I know 'green' behaviours to follow when buying or using digital devices (e.g. purchase devices with Eco-label, restrain from unnecessary printing of digital files, do not leave mobile phones and laptop chargers connected without the device). (K)	7,726	63.2	1,129	64.6	1,647	56.3	1,190	67.4	1,654	64.3	1,646	56.3	1,690	63.3
68	5.1	When I face a technical problem, I try step-by-step to identify the problem. (A)	7,809	69.3	1,144	69.6	1,631	59.0	1,196	71.1	1,656	68.4	1,653	68.3	1,699	62.5
69	5.1	I know some reasons why a digital device may fail to connect online (e.g. wrong wifi password, airplane mode on). (K)	7,799	65.5	1,145	67.8	1,664	60.6	1,204	69.4	1,660	54.0	1,681	65.8	1,685	50.2
70	5.1	When I face a technical problem, I am able to find solutions on the Internet. (S)	7,812	60.1	1,144	63.3	1,665	53.5	1,196	64.7	1,683	57.0	1,676	61.3	1,699	54.7
71	5.1	I am able to edit the configurations of the operating system of my digital devices to solve technical problems (e.g. automatic stop/start of services, modify registry keys). (S)	7,785	44.2	1,138	50.0	1,660	46.0	1,193	49.6	1,669	46.3	1,660	41.9	1,691	47.2
72	5.2	I usually try to find out if there is a technology solution that might help me address a personal or professional need. (A)	7,658	58.8	1,126	62.3	1,634	59.1	1,173	65.0	1,618	60.8	1,633	63.0	1,674	58.4
73	5.2	I know the main functions of the most common digital devices (computer, tablet, smartphone). (K)	7,814	69.5	1,146	71.5	1,664	63.4	1,204	73.6	1,684	66.6	1,676	67.9	1,708	62.9
74	5.2	I know how to select the right tool, device or service to perform a given task (e.g. select a smartphone for my needs, choose a tool for a professional videocall). (S)	7,742	52.3	1,136	56.6	1,645	52.2	1,187	61.0	1,667	55.8	1,661	55.9	1,685	55.3
75	5.2	I know technical solutions that can improve the access and use of digital tools such as language translation, magnification or zoom and text-to-voice functionality. (K)	7,757	56.9	1,141	62.0	1,655	55.8	1,199	64.3	1,657	56.6	1,665	54.5	1,696	56.1

			GER		AUT		ESP		FIN		FRA		GBR		ITA	
			n	MV	n	MV	n	MV	n	MV	n	MV	n	MV	n	MW
76	5.3	I know that digital technology can be used as a powerful tool to innovate processes and products. (K)	7,670	55.7	1,130	59.6	1,648	57.3	1,182	60.8	1,637	57.5	1,651	58.6	1,674	55.2
77	5.3	I am willing to take part in challenges and contests, aimed at solving intellectual, social or practical problems through digital technologies. (A)	7,658	23.2	1,121	36.0	1,615	43.0	1,177	29.7	1,558	38.0	1,626	48.8	1,638	42.0
78	5.3	I can use data tools (e.g. databases, data mining and analysis software) that manage and organise complex information to make decisions and solve problems. (S)	7,652	31.2	1,133	41.1	1,638	38.0	1,182	37.4	1,630	42.8	1,653	41.6	1,668	41.4
79	5.4	I am willing to help people in my community improve their digital skills. (A)	7,732	53.1	1,135	58.1	1,635	57.0	1,195	60.0	1,622	61.1	1,625	51.5	1,672	58.1
80	5.4	I am curious about new digital devices and applications and I am keen to experiment with them whenever I find the opportunity. (A)	7,758	44.4	1,133	49.7	1,630	53.1	1,194	56.2	1,622	53.2	1,647	52.9	1,674	57.0
81	5.4	I know how to use online learning tools to improve my digital skills (e.g. video tutorial, online courses). (S)	7,609	54.7	1,130	57.1	1,651	53.9	1,175	61.6	1,642	56.1	1,664	56.8	1,677	53.7
82	5.4	I know about new trends in the digital world and how they impact my personal or professional life. (K)	7,631	47.1	1,128	53.1	1,638	50.3	1,188	54.2	1,625	52.0	1,651	50.9	1,665	51.8

MV = mean value

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