Digitalisation in Europe 2022–2023

Evidence from the EIB Investment Survey

European Investment Bank

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About the EIB Investment Survey (EIBIS)
The EIB Group Survey on Investment and Investment Finance is a unique, annual survey of some 12 800 firms. It comprises firms in all EU Member States, as well as a sample of US firms which serves as a benchmark. It collects data on firm characteristics and performance, past investment activities and future plans, sources of finance, financing issues and other challenges that businesses face. Using a stratified sampling methodology, EIBIS is representative across all Member States of the European Union and for the United States, as well as for firm size classes (micro to large) and four main sectors. It is designed to build a panel of observations to support time series analysis, and these observations can also be linked to firm balance sheet and profit and loss data. EIBIS has been developed and is managed by the Economics Department of the European Investment Bank, with support for development and implementation by Ipsos MORI.

For more information see: http://www.eib.org/eibis.

About this publication
This is a report by the EIB Economics Department. The data source for this report is the EIB Investment Survey (EIBIS) 2022. Results are weighted by industry group (sector), firm size-class and country. The methodology of the EIBIS survey is available at: https://www.eib.org/en/about/economic-research/surveys-data/about-eibis.

Contact: eibis@eib.org.

About the EIB Economics Department
The mission of the EIB Economics Department is to provide economic analyses and studies to support the Bank in its operations and in the definition of its positioning, strategy and policy. Director Debora Revoltella heads the department and its team of 45 economists.

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The views expressed in this publication are those of the authors and do not necessarily reflect the position of the European Investment Bank.

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Overview

The European Union is closing the digitalisation gap with the United States. More than half of European firms responded to the pandemic by investing in digitalisation, and they are rapidly catching up with their US peers in implementing advanced digital technologies. Despite this, Europe is not well positioned in digital innovation, and is at risk of developing dependencies in several critical technologies.

Digitalisation drives firms' resilience to economic disruption and climate change, and it has helped European firms adjust at a time of repeated shocks. Digital companies displayed more resilience to the economic and trade disruptions unleashed by the COVID-19 crisis and the war in Ukraine, suggesting that they found more efficient ways of working. Digital firms generally perform better than non-digital firms, tending to be more productive. They are also more likely to engage in international trade and invest in addressing the physical and transition risks of climate change.

Successfully managing the digital transition and taking advantage of its long-term benefits goes beyond technology adoption. The digital transformation is a societal change. Striking the right technological balance is a complex process for the European Union, which is caught between global players that are defining the cutting edge of digital innovation, national preferences and societal and regulatory patterns that set boundaries on the use of digital technologies. To make the most of the digital transformation, the European Union will need to position itself well in the global environment, creating better internal conditions for innovation in technologies that are crucial to European interests, while staying within the boundaries of the European economic model.

Firms' digitalisation depends on external and internal factors. These include adequate digital infrastructure and competition-friendly regulation, as well as management decisions on investment in employee training and trade with firms in innovative sectors, which accelerates the spread of digital technologies. A coordinated policy framework is crucial to addressing infrastructure gaps, improving digital skills, developing the innovation environment and regulating efficiently. Governments and municipalities also need to embrace digitalisation themselves. For many regions, this implies a coherent approach to digital governance, guided by the needs of people and firms.

Debora Revoltella

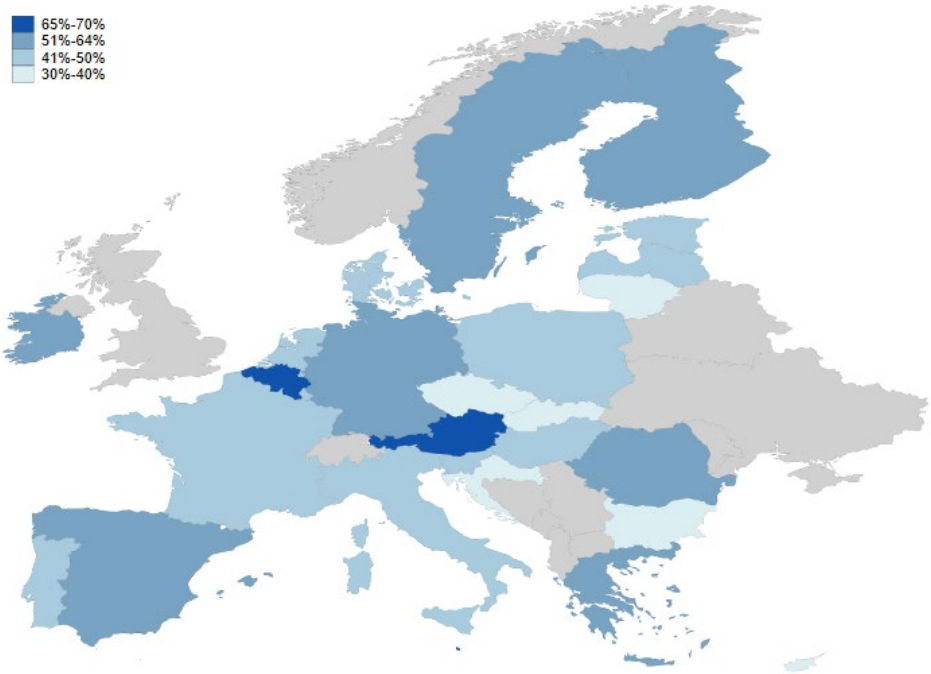
Director, Economics Department

European Investment Bank

Digitalisation in the European Union

More than half of firms invested in digitalisation in response to the COVID-19 crisis. In the European Union, 53% of firms report taking action to become more digital — for example by providing services online — according to the results of the EIB Investment Survey (EIBIS) conducted from April to July 2022 (EIB, 2023). However, significant differences exist between countries and firm sizes (Jaumotte et al., 2023).

Investment in digitalisation as a response to COVID-19 (% of firms)**, by country**

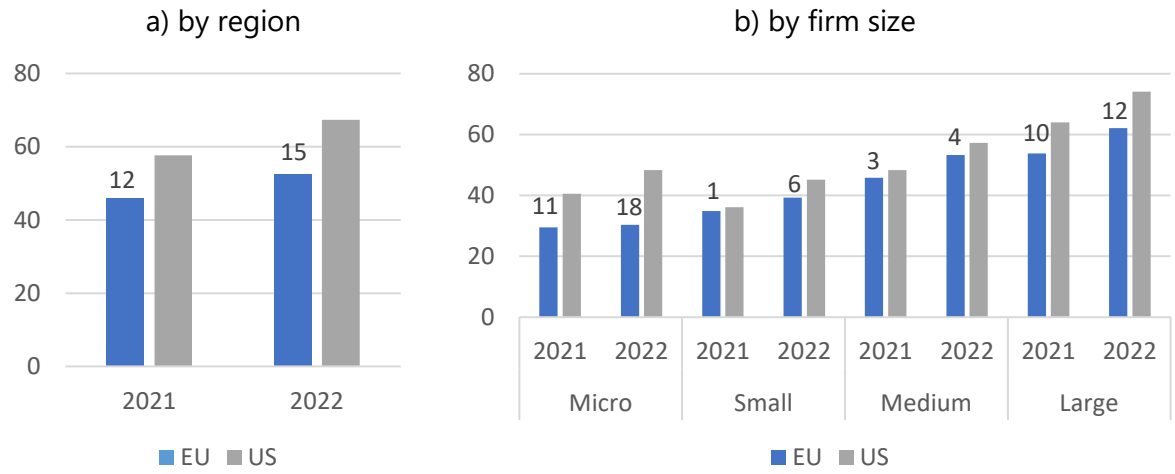


Source: EIBIS 2022.

The share of firms that invested in digitalisation as a response to COVID-19 is higher in the United States than in the European Union, and this gap increased from 2021 to 2022. Micro and small firms are lagging behind medium-sized and large firms. In the European Union, only 30% of microenterprises stated that they took steps to improve digitalisation in 2022, compared with 63% of large firms. European micro and small firms are also less likely than their US peers to report having invested in becoming more digital.

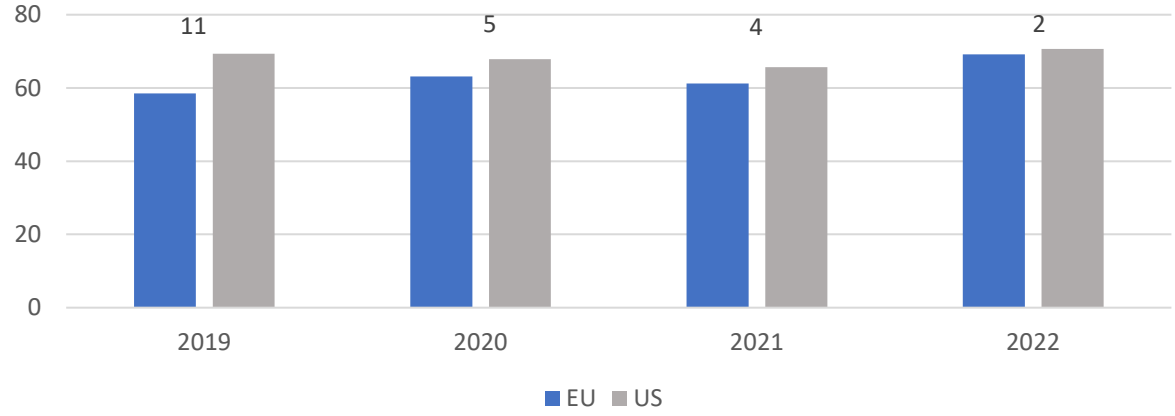
In addition to moving ahead with basic digitalisation, European firms are accelerating the adoption of new, advanced digital technologies after putting these processes on hold in the first year of the pandemic. The European Union has been closing its digital adoption gap with the United States over the past four years. The share of EU firms implementing advanced digital technologies increased from 2021 to 2022, reaching 69% compared with 71% in the United States.

Investment in digitalisation as a response to COVID-19 (% of firms)



Source: EIBIS 2021-2022.
Note: The numbers on top of the bars indicate differences in percentage points between the United States and the European Union.
Question: As a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital (e.g., moving to online service provision)?

Adoption of advanced digital technologies (% of firms)

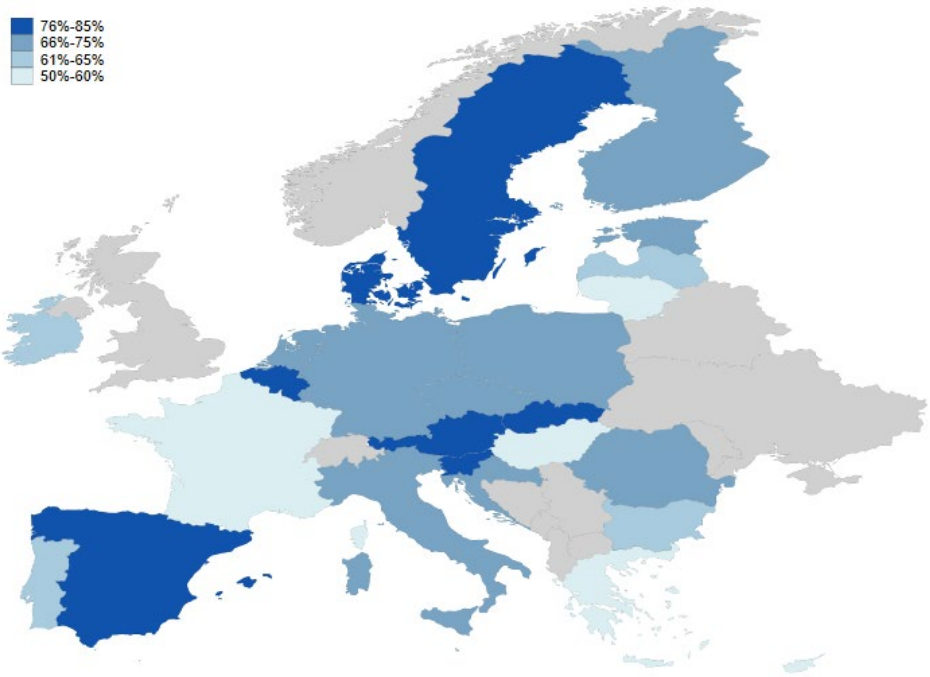


Source: EIBIS 2019-2022.
Note: The numbers on top of the bars indicate differences in percentage points between the United States and the European Union. A firm is identified as having adopted an "advanced digital technology" if at least one digital technology specific to its sector was implemented in parts of the business and/or if the entire business is organised around at least one digital technology. Firms were asked about four different digital technologies specific to their sector (see Box 1).
Question (2019-2021): Can you tell me for each of the following digital technologies if you have heard about them, not heard about them, implemented them in parts of your business, or whether your entire business is organised around them?
Question (2022): To what extent, if at all, are each of the following digital technologies used within your business? Not used in the business; used in parts of the business; entire business is organised around this technology.

However, implementing advanced digital technologies requires more significant investment than simple digitalisation activities such as providing services online. Beyond the short-term response to COVID-19 and the war in Ukraine, the digital transformation of the EU economy will require the adoption of more advanced digital technologies, such as 3-D printing, advanced robotics, the internet of things, big data analytics and artificial intelligence, drones, online platforms and augmented reality.

The uptake of advanced digital technologies varies largely among EU countries. Although there are notable digital success stories in Europe, many countries are still behind the cutting edge of digital technology dissemination and adoption.

Use of advanced digital technologies (% of firms)**, by country**



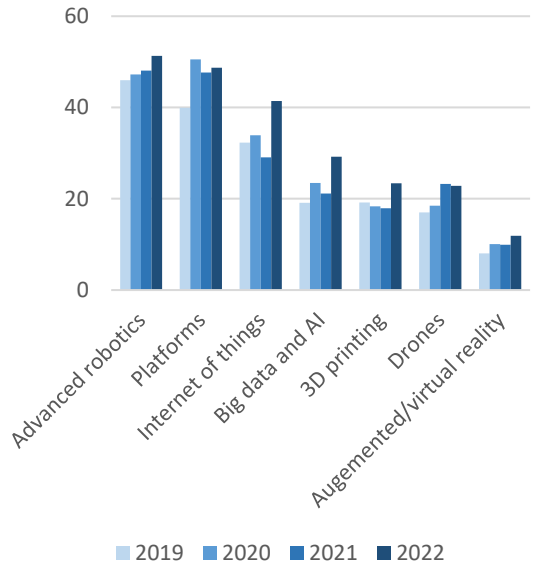
Source: EIBIS 2022.

Advanced robotics and online platforms remain the most widespread digital technologies. The implementation of the most advanced digital technologies has progressed over the past four years. The gap in the adoption of internet of things technologies between the European Union and the United States has narrowed, from 18 percentage points in 2021 to 12 percentage points in 2022.

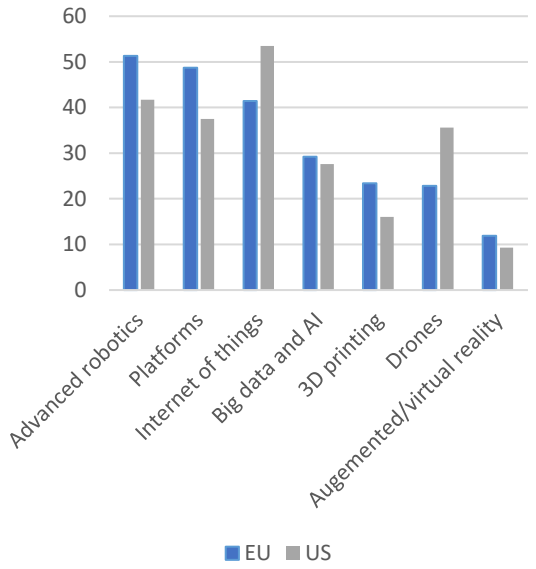
Firm size plays a key role in the adoption of advanced digital technologies. 80% of firms with more than 250 employees use advanced digital technologies, compared with 45% of firms with fewer than ten employees. This disparity is likely to slow the digital transformation in Europe (Revoltella, Rückert and Weiss, 2020). The difference in adoption rates is particularly pronounced for advanced robotics, which supports the idea that certain technologies involve major integration costs, and that large firms are more likely to adopt these technologies (Acemoglu et al., 2022).

Adoption of specific digital technologies (% of firms)

a) European Union, 2019-2022



b) European Union vs. the United States, 2022



Source: EIBIS 2019-2022.

Note: 3-D printing is also known as additive manufacturing (manufacturing, construction and infrastructure). Robotics is automation using advanced robotics (manufacturing). The internet of things refers to electronic devices that communicate with each other without human assistance (all sectors). Big data/artificial intelligence refers to cognitive technologies, such as big data analytics and artificial intelligence (manufacturing, services and infrastructure). Drones are unmanned aerial vehicles (construction). Augmented reality refers to augmented or virtual reality, such as providing information integrated with real-world objects presented using a head-mounted display (construction and services). Online platforms refer to a platform that connects customers with businesses or customers with other customers (services and infrastructure).

Question: See page 3 for the exact wording of the question.

Box 1. Digital technologies in the EIB Investment Survey

In the EIBIS, firms are polled about the use of four advanced digital technologies that are specific to their sector. They are asked the following question: "Can you tell me for each of the following digital technologies if you have heard about them, not heard about them, implemented them in parts of your business, or whether your entire business is organised around them?"

A firm is identified as **"digital"** if at least one digital technology is implemented in parts of the business and/or if the entire business is organised around one digital technology.

Firms in *manufacturing* are surveyed about the use of (a) 3-D printing, also known as additive manufacturing; (b) robotics: automation via advanced robotics; (c) the internet of things, such as electronic devices that communicate with each other without human assistance; and (d) big data/artificial intelligence: cognitive technologies, such as big data analytics and artificial intelligence.

Firms in *construction* are surveyed about the use of (a) 3-D printing; (b) drones: unmanned aerial vehicles; (c) the internet of things; and (d) virtual reality: augmented or virtual reality, such as when information is integrated with real-world objects and presented using a head-mounted display.

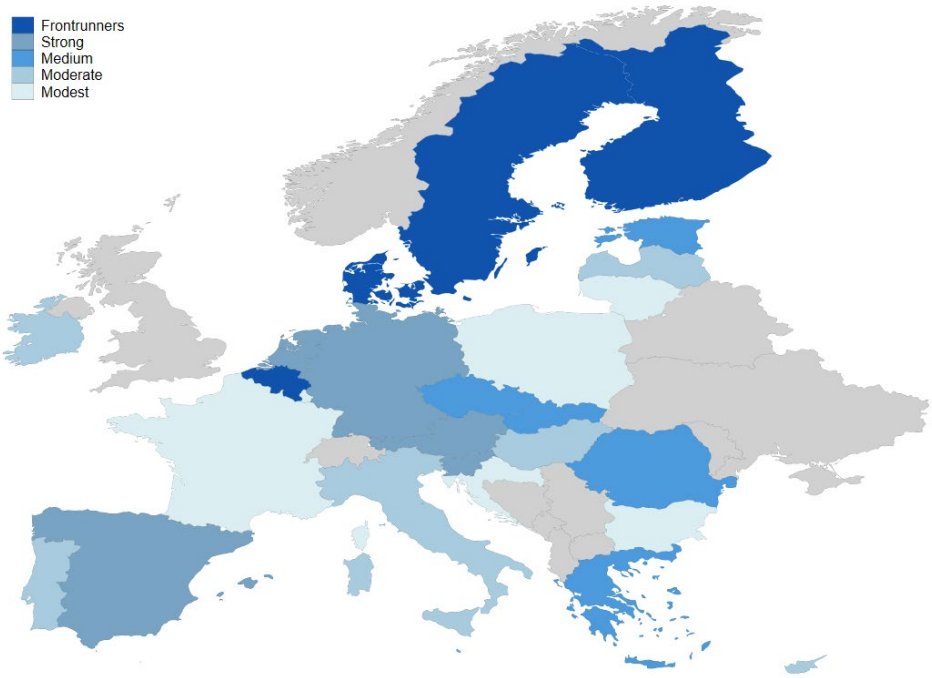
Firms in *services* are surveyed about the use of (a) virtual reality; (b) platforms, which connect customers with businesses or customers with other customers; (c) the internet of things; and (d) big data/artificial intelligence.

Firms in *infrastructure* are surveyed about the use of (a) 3-D printing; (b) platforms; (c) the internet of things; and (d) big data/artificial intelligence.

The EIBIS Corporate Digitalisation Index

The EIBIS Corporate Digitalisation Index explores the degree of digital adoption in the European Union and the United States from various perspectives. This composite index summarises indicators on digitalisation as well as firms' assessments of digital infrastructure and investments. It allows us to group countries according to how firms assess their digitalisation: frontrunners, strong, medium, moderate and modest. The EIBIS Corporate Digitalisation Index consists of six components: use of advanced digital technologies, digital uptake during COVID-19, digital infrastructure, investment in software and data, investment in employee training, and use of a strategic monitoring system. It is based on firm-level data collected by the EIBIS in 2022. Appendix A contains more details on the index and its components.

EIBIS Corporate Digitalisation Index



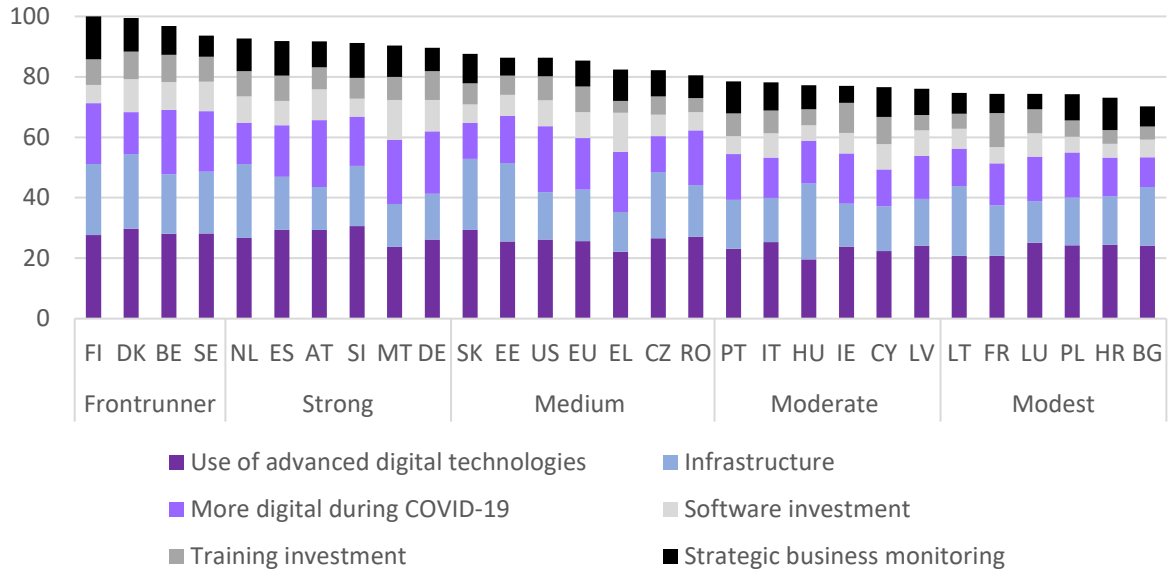
Source: EIBIS 2022.

The key findings of the EIBIS Corporate Digitalisation Index are:

- The European Union has been closing its digital adoption gap with the United States. There are several European countries that outperform the United States.
- European firms tend to perceive digital infrastructure as a major obstacle to investment more often than US firms. What is more, European firms are less likely than US firms to have become more digital during the COVID-19 pandemic.

- Based on the index, Finland and Denmark are the top two digital countries, followed by Belgium and Sweden.
- The top-performing EU countries, in selected areas of digitalisation, are Slovenia for the use of advanced digital technologies, Austria for the uptake of digitalisation during the COVID-19 pandemic, Estonia for digital infrastructure, Malta for investment in software and data, France for investment in employee training, and Finland for the use of formal strategic business monitoring.

EIBIS Corporate Digitalisation Index, by country



Source: EIBIS 2022.

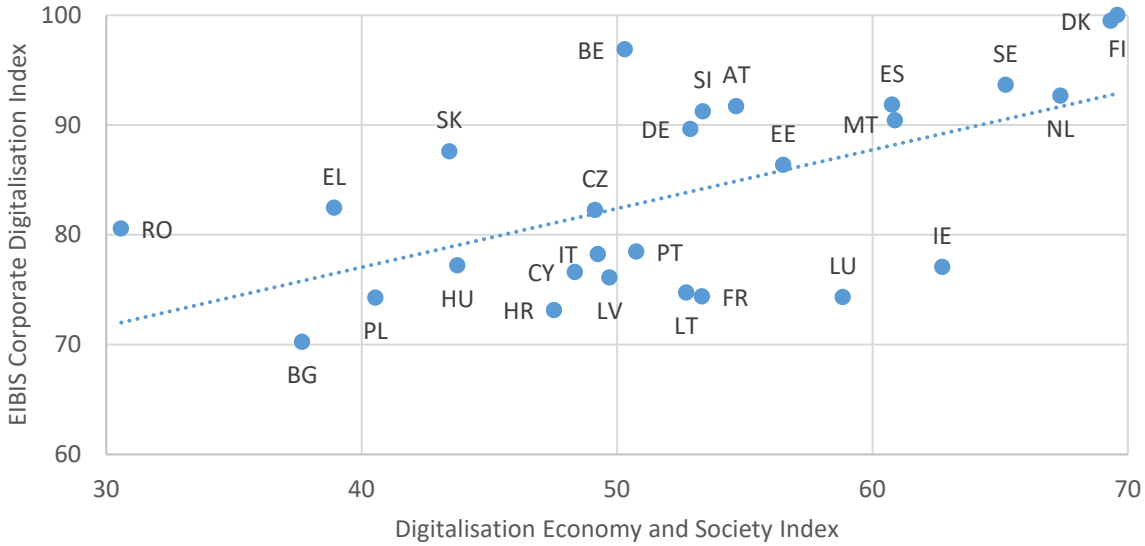
The EIBIS Corporate Digitalisation Index rounds out the European Commission's Digitalisation Economy and Society Index (DESI) by adding firms' perception about digitalisation. However, the two indices display a strong positive correlation across countries. The main differences between the two are:

- All six components of the EIBIS Corporate Digitalisation Index are based on firms' assessment of digitalisation and questions from the same survey, which simplifies comparisons across countries. The various components of DESI combine data on households, individuals, e-government services and enterprises from different sources and data providers.
- DESI does not include US firms, yet the data are of paramount importance for analysing the digitalisation gap or the digital divide between the European Union and the United States.
- The infrastructure component of the EIBIS Corporate Digitalisation Index captures whether firms consider digital infrastructure to be a major obstacle to their investment activities, whereas the connectivity component of DESI

captures the quality of broadband access offered to households in the European Union.

- The EIBIS Corporate Digitalisation Index does not cover digital public services, in contrast to DESI. However, the EIBIS index does capture whether firms use formal strategic business monitoring systems, which is an indicator of management practices. Similarly, as the EIBIS is specifically for firms, it does not cover individuals' use of internet services and online transactions, which are included in DESI.

DESI and EIBIS Corporate Digitalisation Index, by country

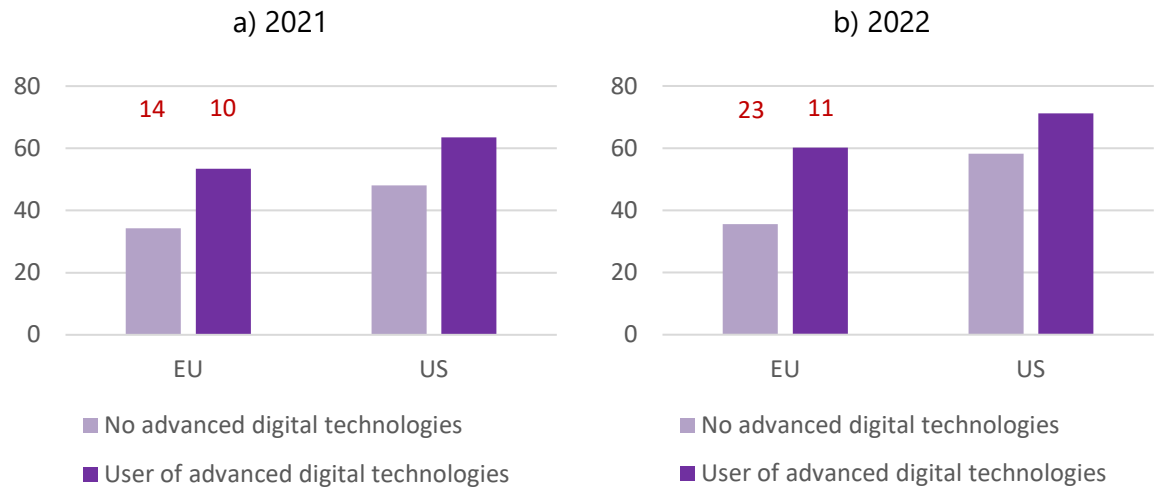


Source: European Commission's Digital Economy and Society Index (DESI) and EIBIS 2022.

Digital divides between European firms

Companies that were already digital before the pandemic are more likely to have invested further in digitalisation in response to COVID-19. The crisis may have further deepened the digital divide, as leading firms have accelerated digitalisation, while laggard firms fell further behind (Rückert et al., 2021; Anderton, Botelho and Reimers, 2023). Only 36% of non-digital firms in Europe have used the crisis as an opportunity to begin investing in their digital transformation, while 60% of firms that were already using advanced digital technologies invested in becoming more digital in 2022. Importantly, the share of European firms that started investing in digitalisation is significantly lower than in the United States, where 58% of non-digital firms invested in becoming more digital in 2022.

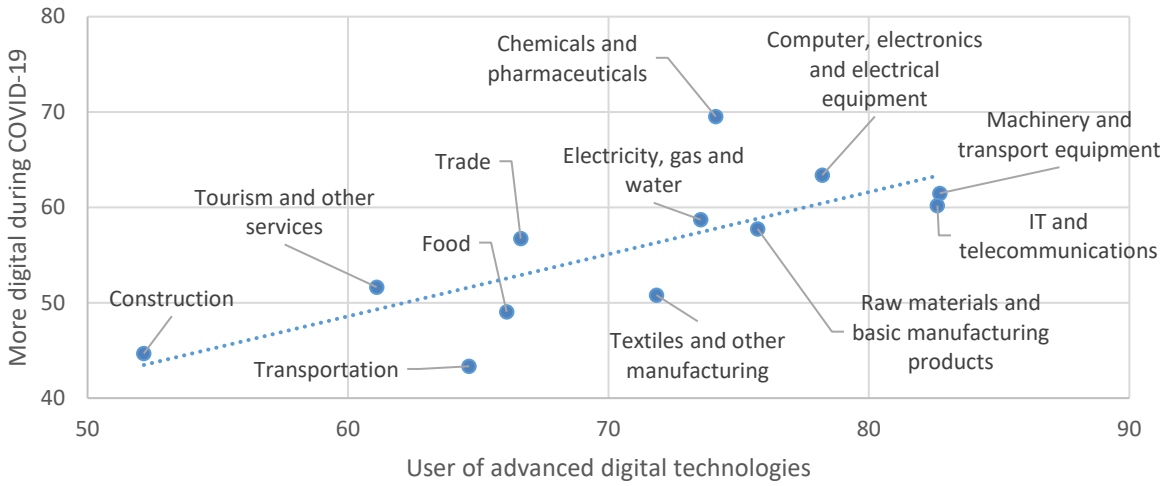
Investment in digitalisation as a response to COVID-19 (% of firms)**, by prior adoption of advanced digital technologies**



Source: EIBIS 2021-2022.
Note: The numbers on top of the bars indicate differences in percentage points between the United States and the European Union.
Question: As a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital (e.g., moving to online service provision)? See Box 1 for the definition of the adoption of advanced digital technologies.

Digitalisation varies widely among economic sectors. For example, 83% of firms in the machinery and transport equipment sector use advanced digital technologies, far more than in the construction sector (52%). One explanation for differing levels of digitalisation is that different industries produce different products, and that only certain tasks can be performed using advanced digital technologies. There is also a strong correlation in all industries between the use of advanced technologies and digital uptake during the pandemic.

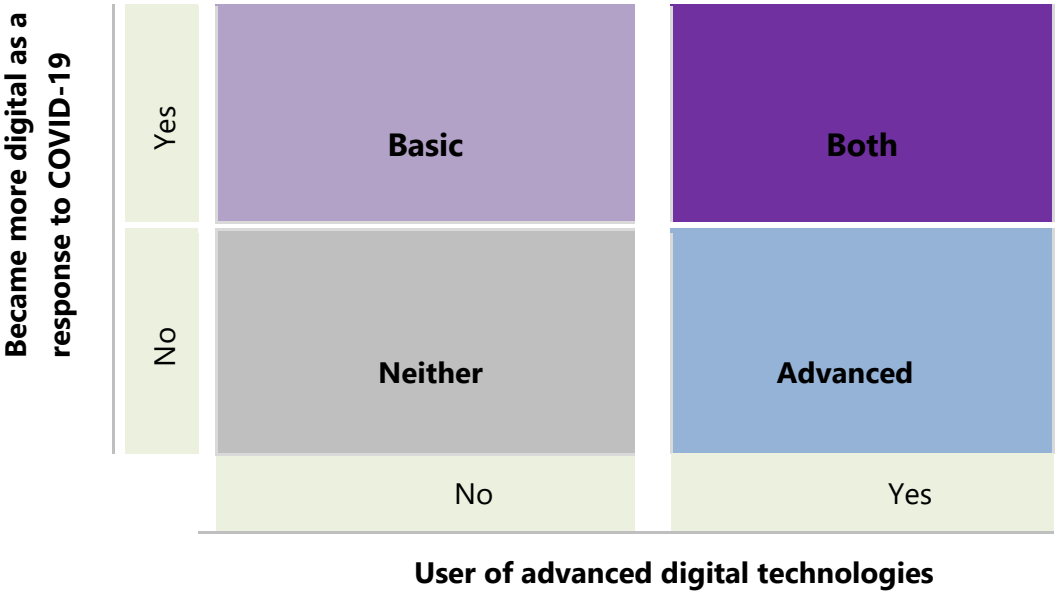
Investment in digitalisation (% of firms)**, by sector**



Source: EIBIS 2022.
Question: As a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital (e.g., moving to online service provision)? See Box 1 for the definition of the adoption of advanced digital technologies.

Firms have been grouped into four different digitalisation profiles to better determine whether gaps are emerging. The four categories — neither, basic, advanced and both — are based on companies' implementation of advanced digital technologies, and the steps they took to become more digital as a response to the COVID-19 crisis.

Corporate digital divide profiles

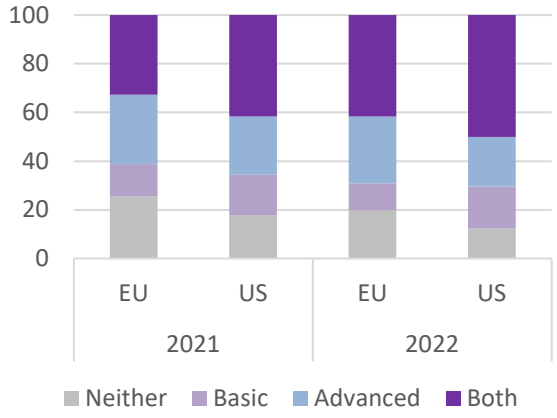


The share of EU firms that did not invest in digitalisation decreased in the second year of the pandemic. Of EU firms, 20% did not invest in their digital transformation in 2022, down from 26% in 2021. The share of people that work for firms in the

"neither" group in the European Union fell from 31% in 2021 to 25% in 2022, but remains significantly above the United States (15%). It is encouraging that, over time, less firms and workers fall into this category. However, firms that fall into the "neither" category may need stronger or specific policy support to prevent them from falling behind, while sustaining business dynamics and ensuring the efficient allocation of resources.

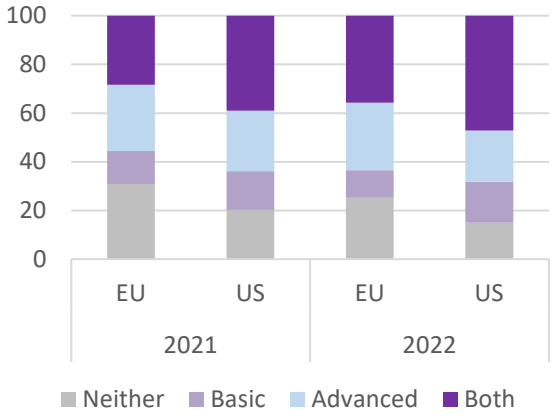
Corporate digital divide profiles

a) Share of firms (in %)



Source: Authors' calculations based on EIBIS 2021-2022, Eurostat and the US Census.
Note: See the figure on page 11 for the definition of corporate digital divide profiles.

b) Share of employment (in %)



Source: EIBIS 2021-2022.
Note: See the figure on page 11 for the definition of corporate digital divide profiles.

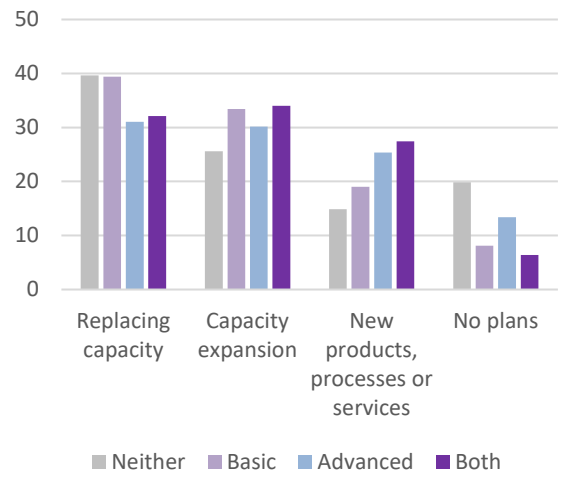
A non-negligible share of firms embarked on their digitalisation journey during the crisis. These companies have not implemented any advanced digital technology in their business yet but have taken action to become more digital as a response to COVID-19 — for example, by providing services online — and are categorised as "basic" digital companies. In the European Union, 13% of firms fall into this category. The share has remained stable over time.

At the other end of the spectrum, 69% of EU firms have already adopted advanced digital technologies. Among firms that have implemented advanced digital technologies in their business, some firms did not invest in increased digitalisation during the pandemic. These firms are categorised as "advanced." Finally, firms that use digital technologies and that also invested further in digitalisation as a response to the pandemic are categorised as "both" because they have fully embraced the digital transformation. 42% of European firms fell into this category in 2022 (a 9 percentage point increase compared to 2021), and one in two firms in the United States.

The digital divide between firms may continue to grow over time. Looking ahead to the next three years, the top investment priorities for more digitally advanced firms are expanding capacity and developing new products, processes or services. For non-digital firms, on the other hand, replacing capacity (including existing buildings, machinery, equipment and IT) is more often mentioned as the investment priority. In addition, about 20% of non-digital firms report that they do not have any investment plans. Firms that are more advanced in digitalisation are also more optimistic about the business prospects in their sector. The differences in investment risk are exacerbating the digital divide.

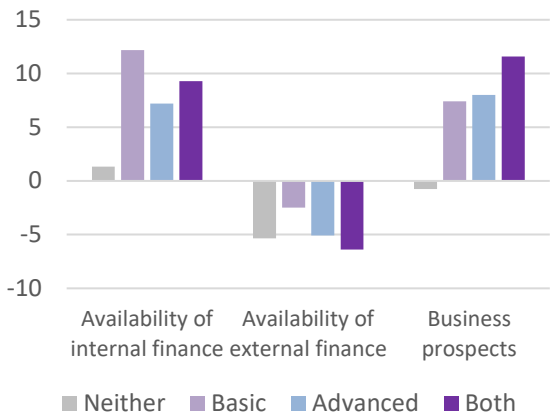
Investment priority over the next three years and outlook (% of firms)**, by digital profile**

a) Investment priority



Source: EIBIS 2022.
Note: See the figure on page 11 for the definition of corporate digital divide profiles.
Question: Looking ahead to the next three years, which of the following is your investment priority?

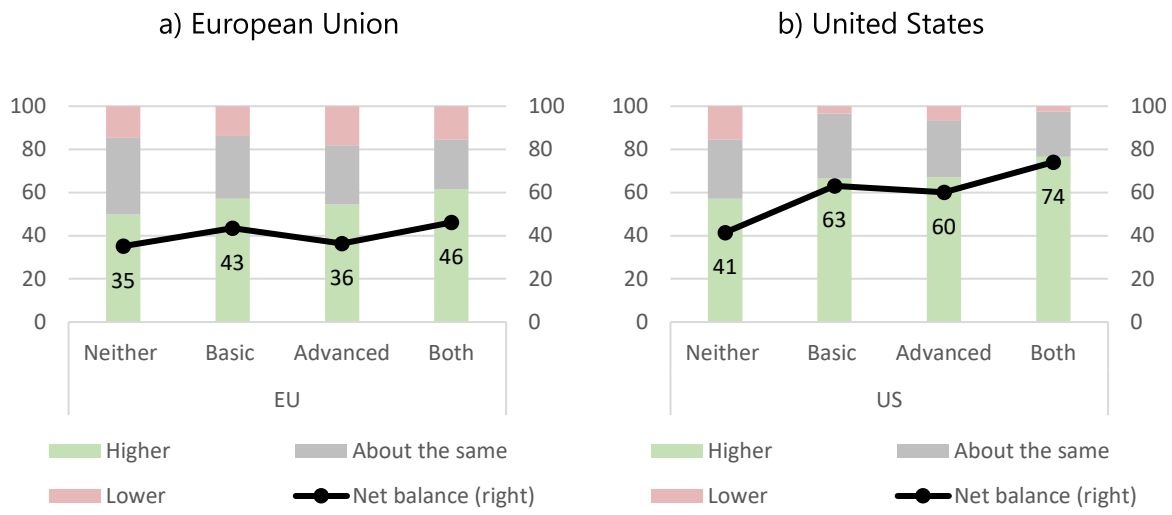
b) Outlook



Source: EIBIS 2022.
Note: See the figure on page 11 for the definition of corporate digital divide profiles.
Question: Do you think that each of the following will improve, stay the same, or get worse over the next 12 months?

At the same time, firms lagging in digitalisation were less optimistic that sales would be higher in 2022 than in 2019. Only 35% of firms in the "neither" group in the European Union expected sales to increase, compared to 46% of firms in the "both" category. This gap was even higher in the United States, at 33 percentage points.

Outlook on sales (% of firms)**, by digital profile**

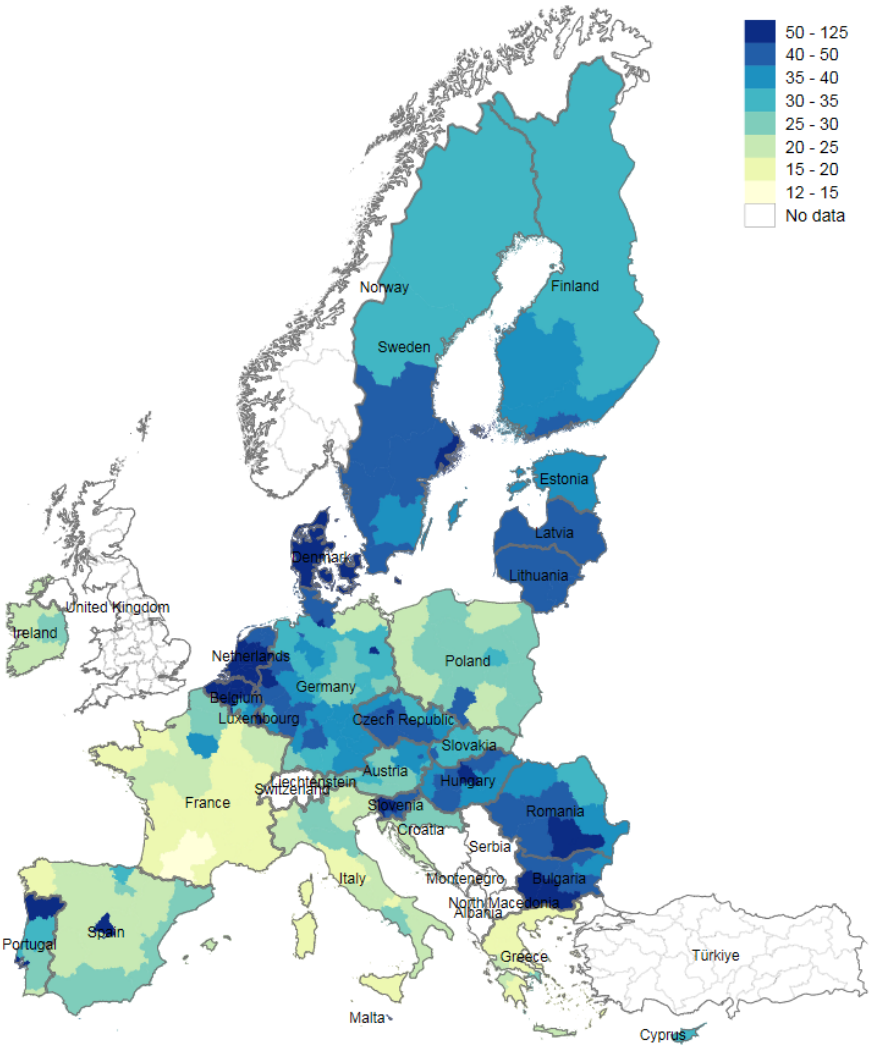


Source: EIBIS 2022.
Note: See the figure on page 11 for the definition of corporate digital divide profiles.
Question: Compared to 2019, do you expect your sales or turnover in 2022 to be higher, lower or about the same?

How digital infrastructure enables firms' digitalisation

Digital infrastructure played a critical role during the COVID-19 crisis. 14% of EU firms surveyed in the EIBIS consider access to digital infrastructure to be a major obstacle to investment. A key consideration is internet access and speed.

Internet speed estimates at NUTS 2[1] level in the European Union in 2019



Source: Authors' calculations based on Ookla.

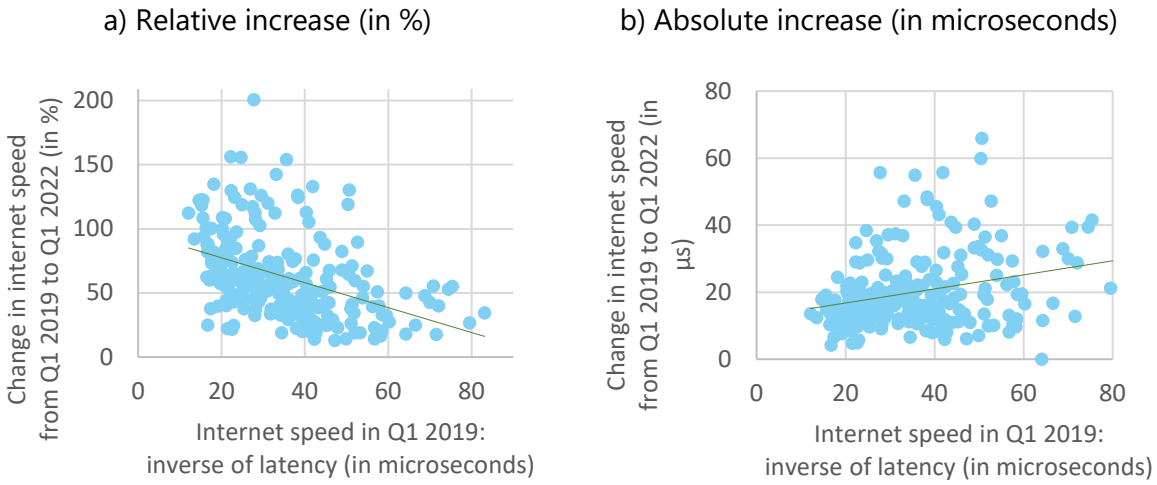
Note: The figure shows data from the first quarter of 2019 and is based on more than 11 million internet speed tests during this period. Internet speed is proxied by the measure of average latency when internet speed tests are performed using the website Speedtest.net. Latency is the time it takes for data

[1] The Nomenclature of Territorial Units for Statistics (NUTS) classification divides up the economic territory of the European Union and identifies regions eligible for support from EU cohesion policy. There are 242 regions in the NUTS 2 classification in the European Union.

to be transferred between its original source and its destination, measured in microseconds. The measure is transformed as the inverse of latency (one over latency) to show a positive increase when internet speed is higher. The original data are provided at the level of mercator tiles (approximately 610.8 metres by 610.8 metres at the equator), which is aggregated to NUTS 2 level averages, using the number of tests as weights.

Persistent and major differences in access to digital infrastructure continue to exist between EU regions. While internet speed has increased throughout the European Union, regions that previously had poor internet access have experienced the greatest relative improvement recently. Internet speed more than doubled from 2019 to 2021 in some EU regions — primarily in France, Poland and Romania. However, the improvement in digital access has not been sufficient to close regional gaps in digital access. Instead, regions that already had better digital infrastructure have increased internet speed more quickly in absolute terms (in microseconds). This suggests that digital infrastructure gaps between regions have been widening over time.

Change in internet speed in European regions, 2019-2021

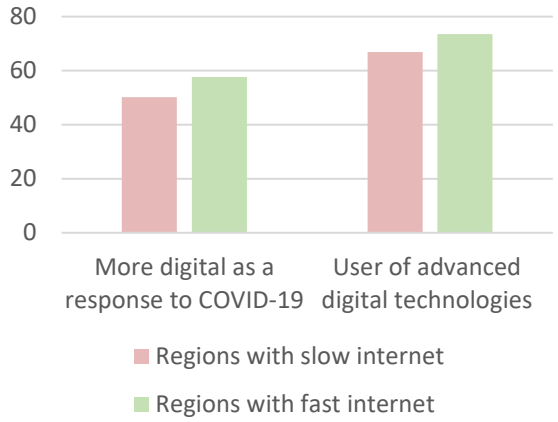


Source: Authors' calculations based on Ookla.
Note: The figure shows data from the first quarter of 2019 to the first quarter of 2022. Each point represents a NUTS 2 region in the European Union. The left panel shows the increase in internet speed (the inverse of average latency) in relative terms, while the right panel shows the increase in absolute terms. See above for the definition of internet speed in a region.

Regions with faster internet speed tend to have a higher share of digital firms. Regions with fast internet (where internet speed is above median internet speed across NUTS regions) have a higher share of firms that use advanced digital technologies and a higher share of firms that invested in becoming more digital as a response to COVID-19. Digital firms that operate in regions with slow internet cite the lack of adequate digital infrastructure as an investment barrier.

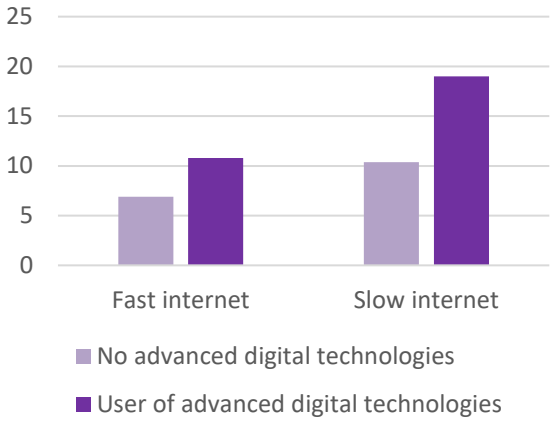
Digital adoption and regional internet speed

a) Digital uptake (% of firms)



Source: Authors' calculations based on EIBIS 2022 and Ookla 2021.
Note: See page 16 for the definition of internet speed in a region. See Box 1 for the definition of the adoption of advanced digital technologies.
Questions: As a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital (e.g., moving to online service provision)? Thinking about your investment activities, to what extent is access to digital infrastructure a major obstacle?

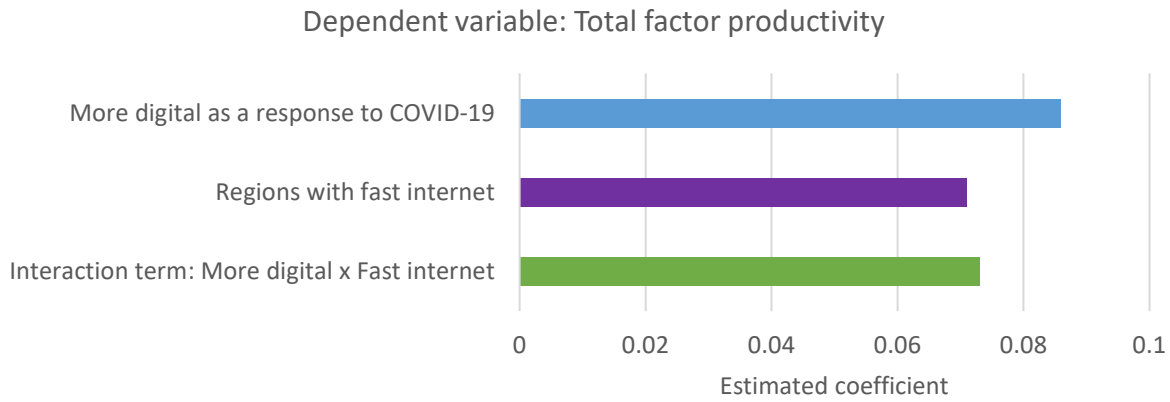
b) Digital infrastructure as obstacle (% of firms)



Source: Authors' calculations based on EIBIS 2022 and Ookla 2021.
Note: See page 16 for the definition of internet speed in a region.
Questions: Thinking about your investment activities in the last financial year, to what extent is access to digital infrastructure an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all?

The returns from digitalisation are greater for firms located in regions with better infrastructure and faster internet speed. Better digital infrastructure has provided additional productivity gains for firms that invested in becoming more digital as a response to COVID-19. In regression analysis, the effect can be seen as the positive interaction between investment in digitalisation and fast internet (EIB, 2023). This highlights how critical digital infrastructure was in supporting firms' rapid digital transformation during the pandemic (Jaumotte et al., 2023). More generally, it also illustrates how complementary public and private digital investments can improve firm performance and economic resilience (Anderton, Botelho and Reimers, 2023; Harasztosi, Rückert and Weiss, 2023).

Digital adoption, digital infrastructure and firm productivity



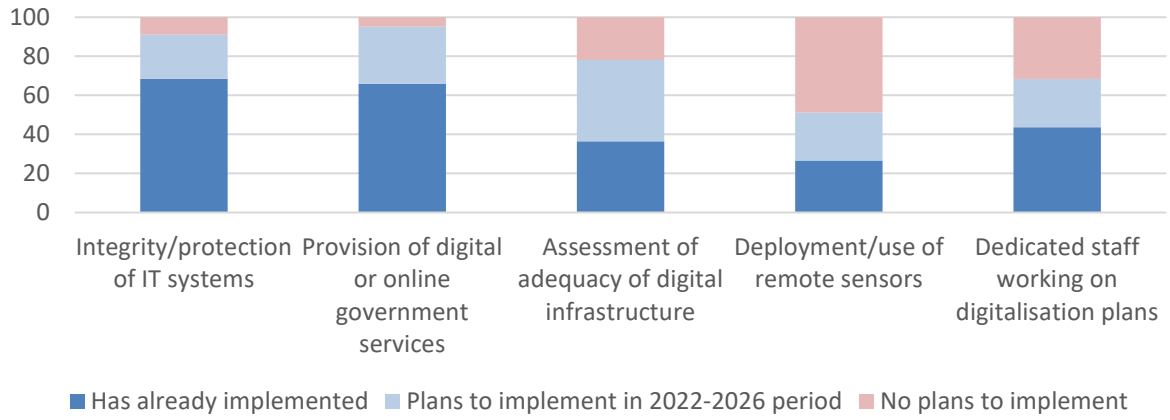
Source: Authors' calculations based on EIBIS 2022 and Ookla 2021.
Note: Firms in the EU27. Total factor productivity is expressed in natural logarithms. The ordinary least squares (OLS) regressions control for firm size, firm age, country and sector (three groups of EU countries and four macroeconomic sectors). Region with slow internet: NUTS 2 region with average latency higher than the median latency across all regions (based on Ookla data). See page 16 for the definition of internet speed in a region.

Investment in digital infrastructure by European municipalities

The EIB Municipality Survey 2022 asked municipalities in the European Union about the development and deployment of different digital capabilities. These included (1) ensuring the integrity and protection of IT systems (cybersecurity); (2) providing digital or online government services; (3) systematically assessing the adequacy of digital infrastructure; (4) deploying and using remote sensors (such as real-time traffic or weather monitoring); and (5) employing staff to work exclusively on digitalisation plans. The municipality survey response can be used to create an indicator of digital capability and sophistication, acting as a proxy for the degree to which municipalities are addressing the challenges of digitalisation. Municipalities are considered to have advanced digital capability and sophistication if they have implemented at least three of the five digital capabilities included in the survey.

Municipalities in Central and Eastern Europe tend to be less digitally advanced. About one-third of municipalities in Central and Eastern Europe can be classified as digitally advanced, compared with half of municipalities in Southern Europe and 45% of municipalities in Northern and Western Europe.

Municipal administrative digital capability and sophistication (% of municipalities)



Source: EIB Municipality Survey 2022.

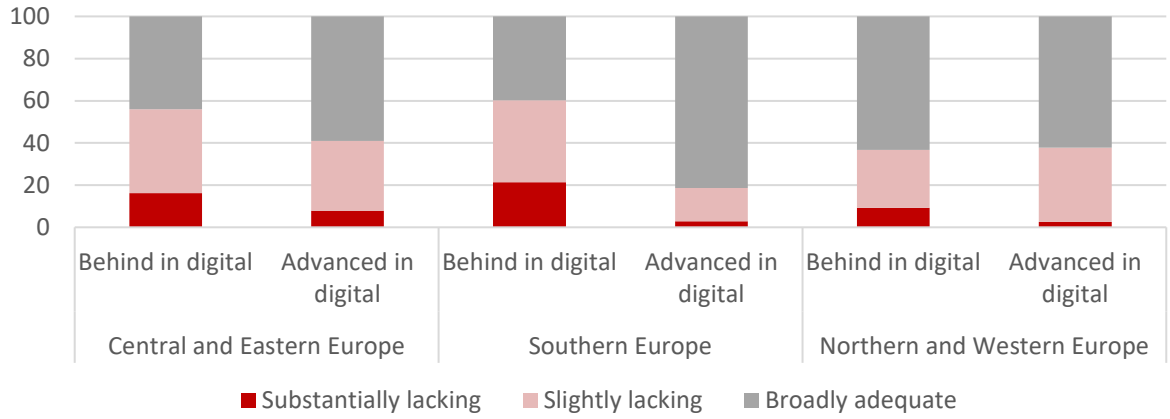
Question: Thinking about digital technologies: for each of the following, please tell me whether your municipality has already implemented, has plans to implement in the 2022-2026 period or has no plans to implement in the 2022-2026 period.

The coronavirus pandemic forced municipalities to find new ways of working. Most municipalities in the European Union have already implemented measures to support the integrity and protection of IT systems. Most municipalities also provide digital or online government services. However, deploying remote sensors and

employing staff to work exclusively on digitalisation plans appear to be less of a priority in the short to medium term (2022 to 2026).

Municipalities with greater digital capability and sophistication are less likely to report a lack of investment in digital infrastructure. This correlation is particularly strong in Southern Europe, where digitally advanced municipalities are more likely to judge their investment in digital infrastructure to have been broadly adequate over the last three years (from 2019 to 2021) than municipalities that are digital laggards.

Assessment of digital infrastructure (% of municipalities)**, by digital capability**

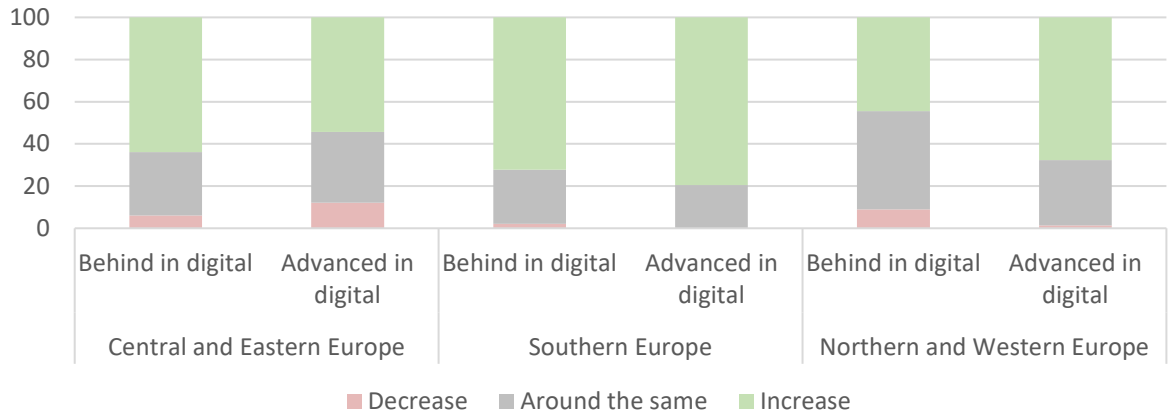


Source: EIB Municipality Survey 2022.
Note: See page 19 for the definition of municipalities with advanced digital capabilities.
Question: In the last three years, that is to say, between 2019 and 2021, would you say that within your municipality the level of investment in digital infrastructure projects was broadly adequate, slightly lacking or substantially lacking?

What is more, municipalities that have advanced, more sophisticated digital capabilities are more likely to state that they are planning to increase investment in digital infrastructure. A large share of municipalities that are behind in digital capabilities, in particular in Northern and Western Europe, do not plan to increase investment in infrastructure between 2022 and 2026. This could exacerbate the infrastructure gap with municipalities that have advanced digital capabilities. Policy support will be key to reducing disparities in access to digital infrastructure across EU regions.

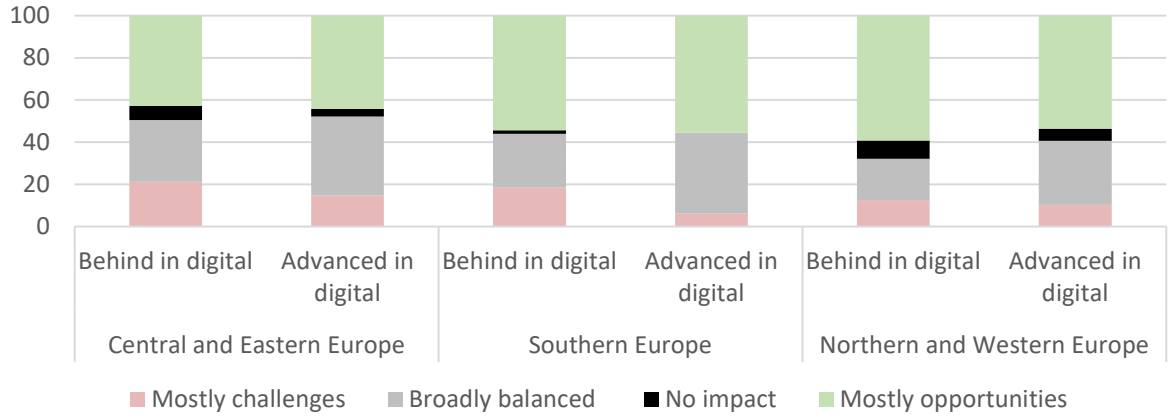
Municipalities that have lower digital capabilities and sophistication tend to be less optimistic about the digital transition. In contrast, municipalities that have advanced digital capabilities feel that digitalisation offers more opportunities than challenges. Overall, this evidence suggests a growing digital divide between municipalities.

Outlook for digital infrastructure spending (% of municipalities)**, by digital capability**



Source: EIB Municipality Survey 2022.
Note: See page 19 for the definition of municipalities with advanced digital capabilities.
Question: For digital infrastructure, if you compare the average annual infrastructure investment you are planning for the 2022-2026 period vs. the average annual infrastructure investment recorded in 2019-2021, does your municipality expect to increase, decrease or have around the same level of spendings on infrastructure investment?

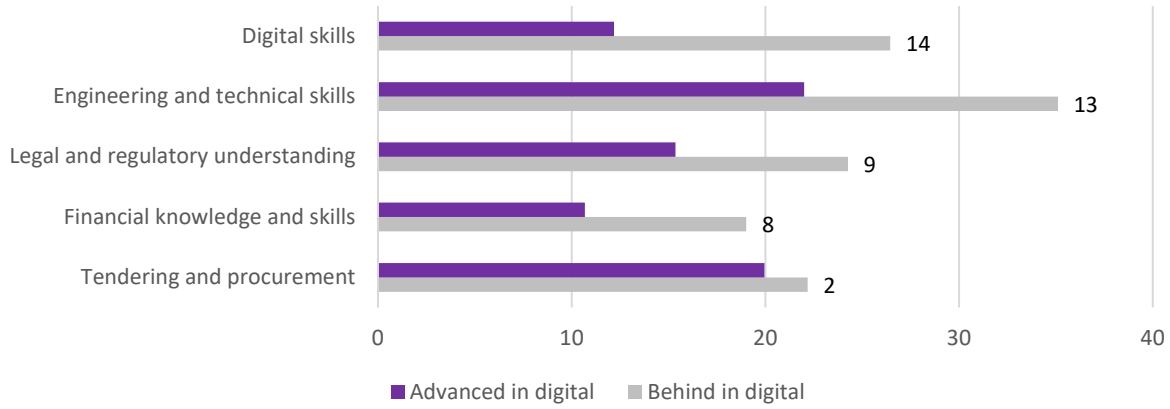
Opportunities and challenges posed by digitalisation (% of municipalities)**, by digital capability**



Source: EIB Municipality Survey 2022.
Note: See page 19 for the definition of municipalities with advanced digital capabilities.
Question: Thinking about digitalisation, do you expect this global trend to present opportunities or challenges to your municipality?

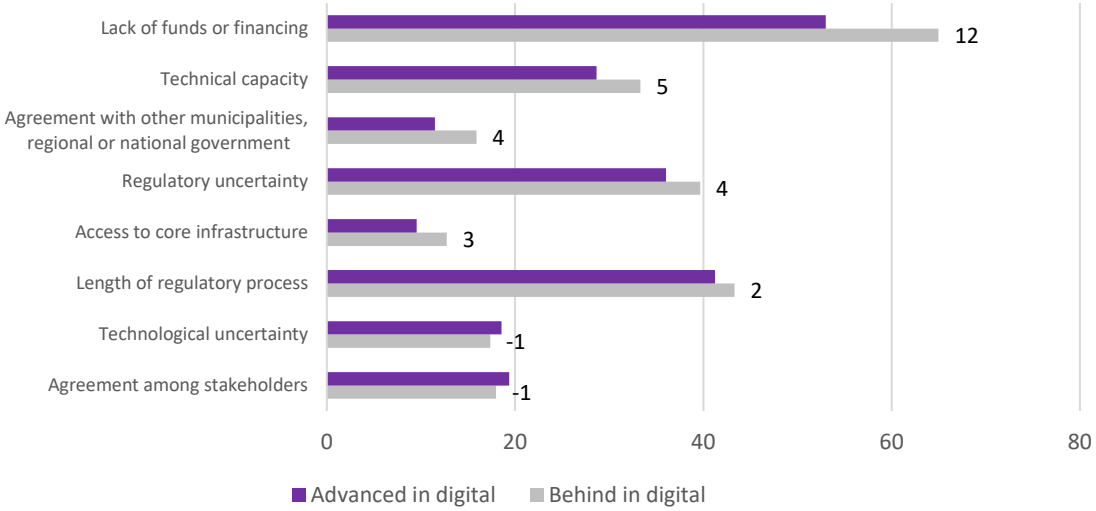
Access to digital and technical skills represent major obstacles to the digital transformation of municipalities in the European Union. These obstacles are more prevalent among municipalities that are behind in digital capabilities. Improving digital capabilities and sophistication is not only about financing digital infrastructure investments but also about the skills that are required.

Skills and expertise as major barriers to digitalisation (% of municipalities)**, by digital capability**



Source: EIB Municipality Survey 2022.
Note: See page 19 for the definition of municipalities with advanced digital capabilities.
The numbers to the right of the bars indicate the difference in percentage points between municipalities that are digitally behind and municipalities that are digitally advanced.
Question: For each of the following areas, to what extent is access to experts a major problem to the delivery of your municipality's investment programme?

Major obstacles to implementation of infrastructure investment activities (% of municipalities)**, by digital capability**



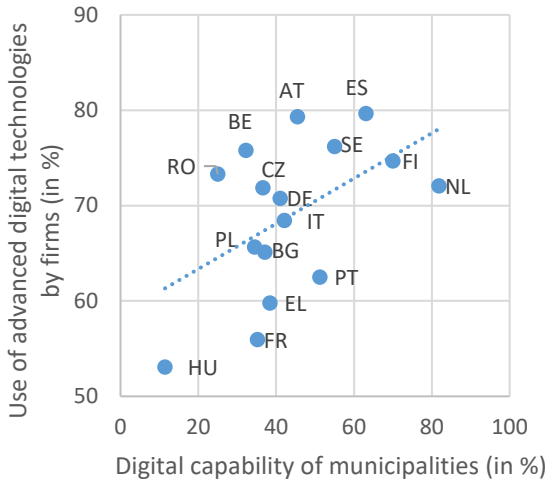
Source: EIB Municipality Survey 2022.
Note: See page 19 for the definition of municipalities with advanced digital capabilities.
Question: To what extent is each of the following an obstacle to the implementation of your infrastructure investment activities? Is it a major obstacle, a minor obstacle or not an obstacle at all?

Municipal digital capabilities are positively correlated with firms' uptake of digital technologies. Firms have higher rates of digital adoption in countries where a high share of municipalities are digitally sophisticated. In addition, there is a slightly negative correlation

between the municipal adoption of digital technologies and the share of firms reporting digital infrastructure as an investment obstacle.

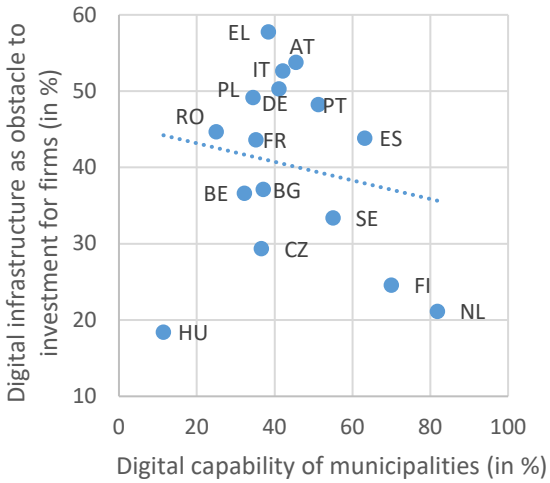
Digital capability of municipalities (% of municipalities) **and digital activities of firms** (% of firms)

a) Use of advanced digital technologies



Source: EIB Municipality Survey 2022 and EIBIS 2022.
Note: See page 19 for the definition of municipalities' digital capabilities and Box 1 for the definition of firms' use of advanced digital technologies. Only municipalities with at least 30 observations are considered.

b) Digital infrastructure as obstacle to investment

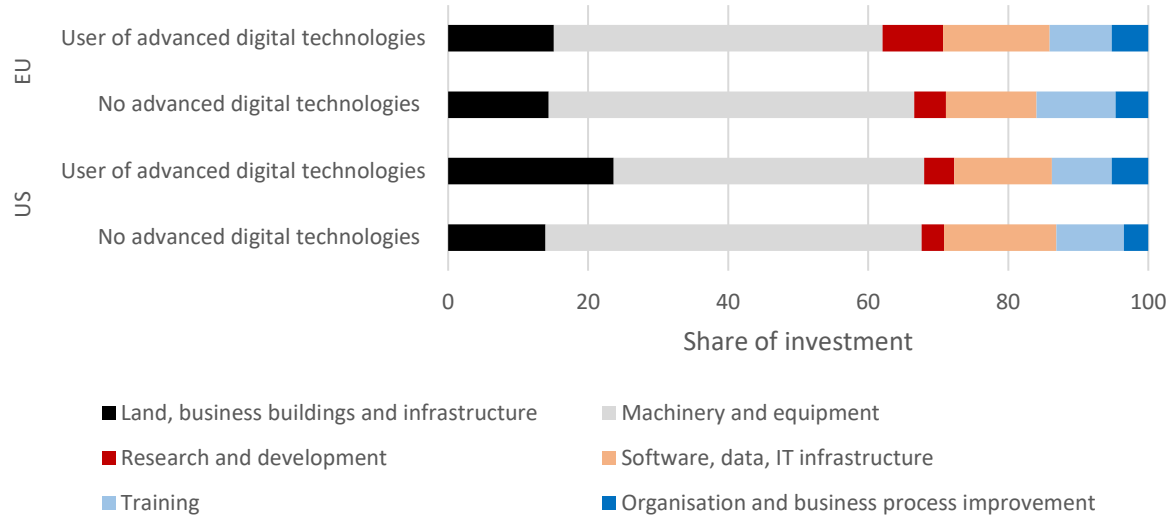


Source: EIB Municipality Survey 2022 and EIBIS 2022.
Note: See page 19 for the definition of municipalities' digital capabilities.
Question: Thinking about your investment activities, to what extent is access to digital infrastructure an obstacle? Only municipalities with at least 30 observations are considered.

Intangible investment and innovation

Digital firms tend to invest more, especially in research and development. In the European Union and in the United States, more advanced digital firms have a higher investment intensity (defined as investment spending over turnover). This higher investment intensity can be explained by the higher productivity of digital firms and the stronger demand for their goods and services. Firms that have adopted advanced digital technologies tend to allocate a larger share of their investment activities to R&D, especially in the European Union. Nevertheless, the correlation between investment in digitalisation and the wide range of firm performance metrics considered in this report — such as productivity and innovation activities — does not necessarily imply causation.

Composition of investment (in %)



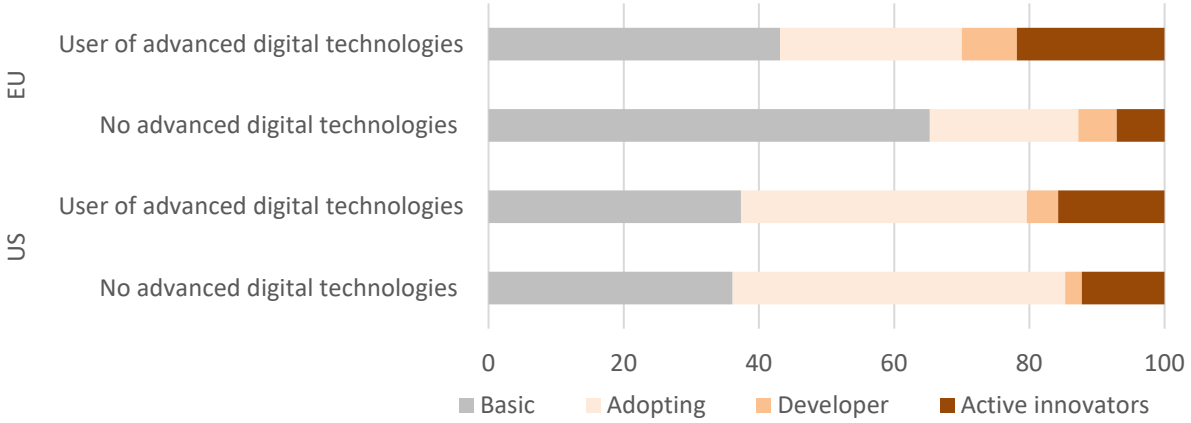
Source: EIBIS 2022.

Digital firms tend to invest more in innovation. The share of active innovators — either incremental or leading innovators, such as firms that invest in R&D and that introduce new products, processes and services to the company or to their market — is higher among digital firms. At the same time, non-digital firms are less likely to invest in innovation. In other words, they are less likely to conduct R&D and to develop new products, processes or services. There tends to be a greater difference between digital and non-digital firms' investment in innovation in the European Union than in the United States.

Operating in a more innovative environment helps firms to digitalise. Firms operating in highly digitally innovative environments were more likely to invest in digitalisation as a response to COVID-19. At the same time, highly digitally innovative regions and weaker regions show no significant difference in the use of advanced

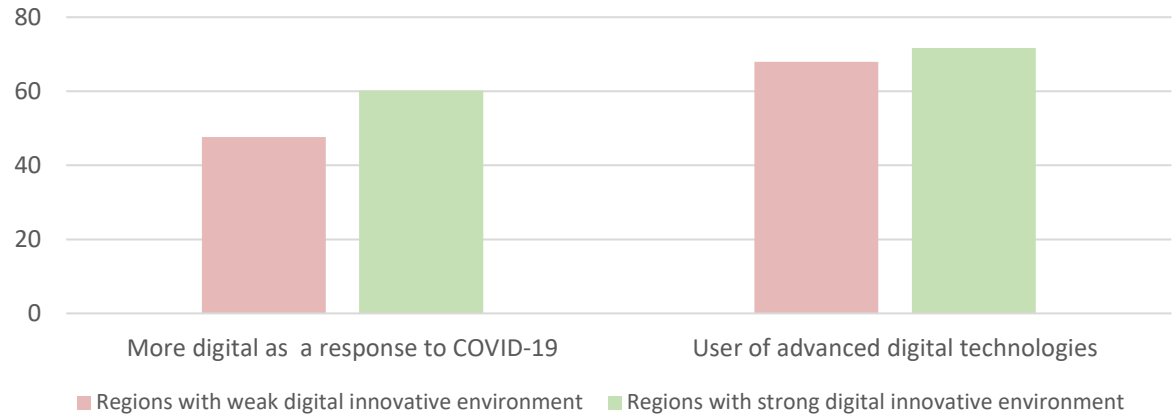
technologies. This suggests that, while the innovative environment may have played a role in fostering digital transformation during the pandemic, the adoption of advanced digital technologies does not necessarily depend on location, and other factors are at play.

Innovation profiles (% of firms)



Source: EIBIS 2022, firms in the EU27.
Note: See Veugelers et al. (2019) for the definition of innovation profiles and the figure on page 11 for the definition of corporate digital divide profiles.

Digital adoption and innovative environments (% of firms)

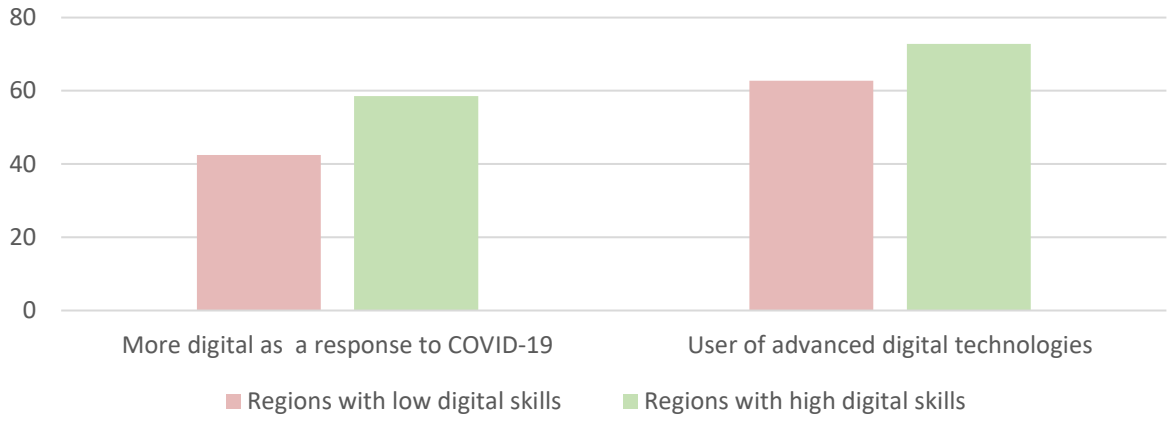


Source: EIBIS 2022 and PATSTAT (PCT) data prepared in collaboration with the Expertise Centre for Research and Development Monitoring (ECOOM).
Note: The digital innovative environment in a region is considered strong if the digital patent intensity (the share of digital patents out of all patents held in the region) is above the 75th percentile of the distribution of digital patent intensity across NUTS 2 regions.
Question: As a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital (e.g., moving to online service provision)? See Box 1 for the definition of the adoption of advanced digital technologies.

Digital skills, employment and management

The availability of workers with digital skills supports the digital transformation. Firms operating in regions where the population has above-average digital skills are more likely to have implemented advanced digital technologies. They also tend to have invested in becoming more digital as a response to COVID-19 more often. This could be because firms usually prefer hiring skilled labour already available on the market rather than bearing the costs of in-house training (Brunello et al., 2023). To fully reap the benefits of digitalisation, improvements in education and training systems will be needed, as well as online learning for groups that are currently excluded from the digital economy.

Digital adoption and digital skills (% of firms)



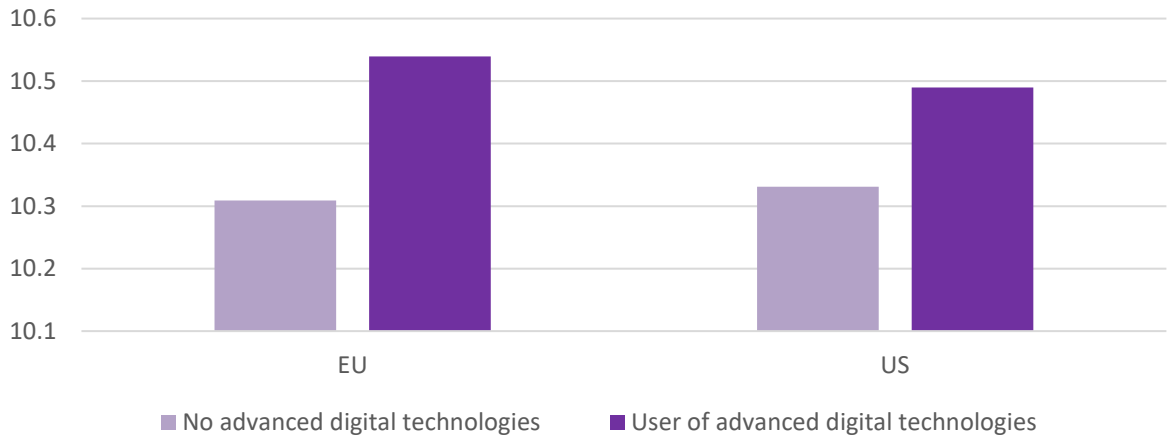
Source: EIBIS 2022, Regional Innovation Scoreboard (RIS, 2021) and European Innovation Scoreboard (EIS, 2021).

The growing digital divide poses risks for the labour market. In Europe, 36% of employees are associated with firms that have not adopted advanced digital technologies, compared with approximately 32% in the United States. Part of this is because there are many more small firms in the European Union than in the United States. Smaller firms tend to be less digital, which has implications for the workers they employ. As shown below, non-digital firms tend to pay lower wages and are less likely to create new jobs. During the pandemic, they were also less likely to train their workers.

Digital firms pay higher wages on average. Many economists argue that digital technologies — such as artificial intelligence, machine learning and industrial robots — have an impact on employment, wages, the demand for skills and job polarisation because of automation and skill-biased technological change (Acemoglu and Autor, 2011; Autor, 2015; EIB, 2018; Frank et al., 2019; Acemoglu and Restrepo, 2020). The higher demand for skilled workers is reflected in the higher average wages paid by

digital firms. The digital transformation often goes hand in hand with the automation of routine jobs. This automation often comes at the expense of demand for low and medium-skilled jobs. On the other hand, to use digital technologies, firms need to have a pool of qualified personnel with the right skills. While digitalisation can disrupt employment and tasks, the jobs created by digital firms often appear to be relatively well paid.

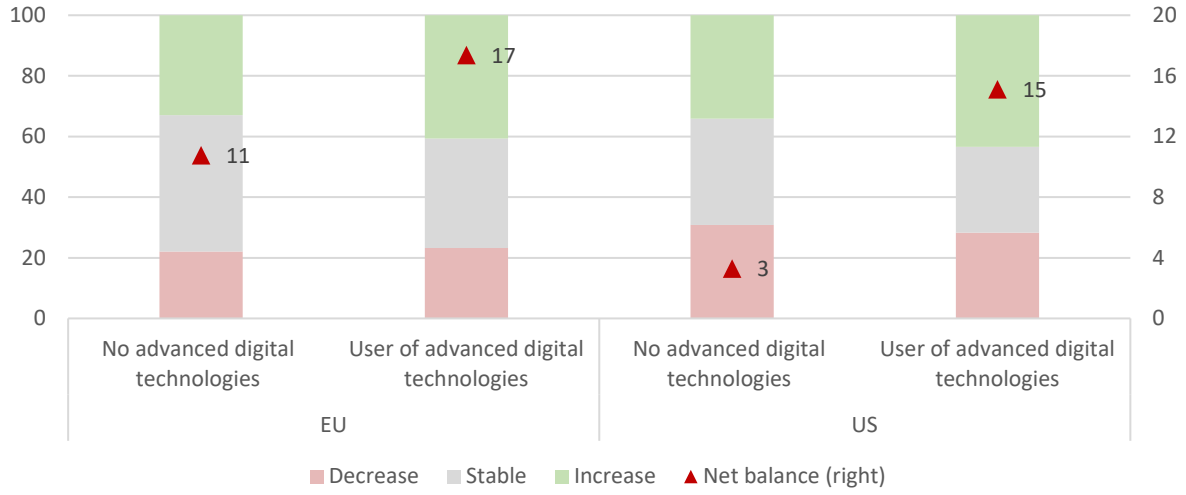
Median wage per employee (in logarithm)



Source: EIBIS 2022.
Note: The figure shows the median wage per employee for firms that adopted advanced digital technologies and firms that did not. The wage per employee is computed as the wage bill divided by the number of employees.

The most advanced digital firms were able to increase employment in the European Union compared to before the pandemic. On average, EU firms that adopted advanced digital technologies and invested in becoming more digital during the coronavirus pandemic have increased the number of workers they employ since the beginning of 2020. In the European Union, furloughed workers remained employed in part because of short-time work schemes and relaxed obligations to file bankruptcy. By contrast, the United States relied on direct transfers and loans to support households and firms, independent of whether existing employment continued. Most advanced digital firms in the United States were also better able to keep staff than non-digital firms.

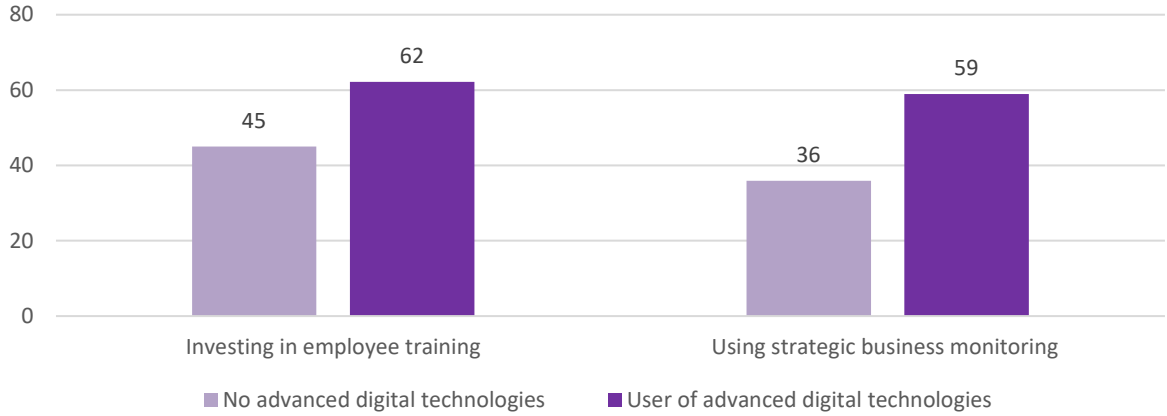
Employment growth since beginning of 2020 (in %)



Source: EIBIS 2022.

Firms driving structural change can support the adaptation of skills. Firms adopting new digital technologies tend to be more profitable and are in a better position to invest in the human capital of their employees. Similarly, investment in digital skills — and an environment that is conducive to learning about them — is more likely to come from digital companies than those not investing in digital transformation. Fostering the spread of technologies could also help to increase and gradually broaden participation in training.

Investment in employee training and use of a strategic business monitoring system (% of firms)



Source: EIBIS 2022, firms in the EU27.
Note: To compute the share of firms investing in training, the percentage of firms that invest more than EUR 50 per employee in training was used.

Digital transformation may also come with downsides for employment. Digital firms are more optimistic about how digitalisation will help create jobs in the future. However, certain specific digital technologies must be examined because they are expected to induce job losses. For example, the introduction of advanced robotics in

recent years has contributed to net job creation so far. But, looking ahead, many firms expect automation using robots to lead to a reduction in employment. This is particularly true of firms in Central and Eastern Europe (EIB, 2021). In contrast, the employment effects of other digital technologies, such as platforms or big data/artificial data, are expected to be more neutral.

The most advanced digital firms tend to implement better management practices than non-digital firms. Digital companies use formal strategic business monitoring systems (with key performance indicators) more often than non-digital companies. This EIBIS-based evidence is in line with results from previous studies highlighting the importance of management practices for technology adoption and firm performance (Bloom et al., 2019). The European Union and its members need to create incentives for firms to improve their track record on environmental, social and corporate governance metrics — an area where digital technologies may help firms monitor progress.

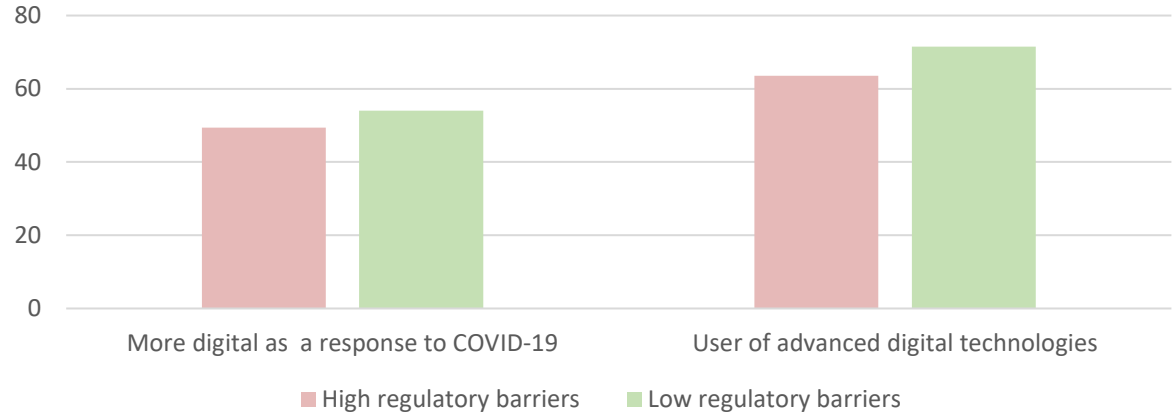
Product market regulation and market power

Regulation has a direct impact on competition and innovation. Policymakers are paying increasing attention to the role competition regulation plays in innovation and digital adoption. Several studies highlight the positive impact that a competition-friendly regulatory environment has on innovation (Akcigit, Ates and Impulliti, 2018; Perla, Tonetti and Waugh, 2021). However, while competition may lead firms to innovate more, it may also decrease firms' incentives to innovate due to decreasing rents from innovating (Aghion et al., 2005; Griffith and van Reenen, 2021). In addition, trade regulation affects competition for imports and innovation, but the effects differ between countries and firms (Shu and Steinwender, 2019). Policymakers therefore face a crucial trade-off between rewarding inventors with monopoly power and fostering competition to expand the technology frontier.

Lower regulatory barriers to firm entry and competition tend to enhance digitalisation. Firms that operate in countries with lower regulatory barriers — proxied by the OECD Product Market Regulation indicators at the country level — tend to invest more in digitalisation. Moreover, leading innovators are more prevalent in countries with low regulatory barriers. The association with investment in digitalisation suggests that national regulatory systems can play an important role in the ability of firms to react to crises.

Digitalisation is at the centre of the policy discussion on rising market concentration and competition policies. Digital technologies often come with features such as scale and synergies, which give an advantage to large firms and foster market concentration (Haskel and Westlake, 2017). This contributes to the superstar firm phenomenon, where a few firms can dominate a very large share of their market (Philippon, 2019; Autor et al., 2020). In the past two decades, there has been a rising productivity gap between firms at the global frontier and laggards (Andrews, Criscuolo and Gal, 2016). Frontier firms are typically larger, more innovative and have higher rates of digital technology adoption. The trends of rising market concentration and markups tend be more pronounced in sectors in which digital technologies, especially digital services, are developed or widely adopted (Calligaris, Criscuolo and Marcolin, 2018; Diez, Leigh and Tambunlertchai, 2018). The rapid increase in the adoption of digital technologies and its acceleration during the pandemic have added new layers to this debate on polarisation and winner-takes-all market dynamics (Rückert et al., 2021).

Digital adoption and regulatory environment (% of firms)



Source: Authors' calculations based on EIBIS 2022 and OECD Product Market Regulation indicators 2018.

Question: As a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital (e.g., moving to online service provision)? See Box 1 for the definition of the adoption of advanced digital technologies.

Firms operating in more concentrated markets tend to be more digital. Competition (or the lack thereof) can be measured with the share of sales of the top five or top ten firms in a country and industry.[2] Firms operating in markets where the top five (or top ten) firms play a more dominant role are more likely to be digital (EIB, 2023). In other words, market concentration is strongly associated with digital adoption.

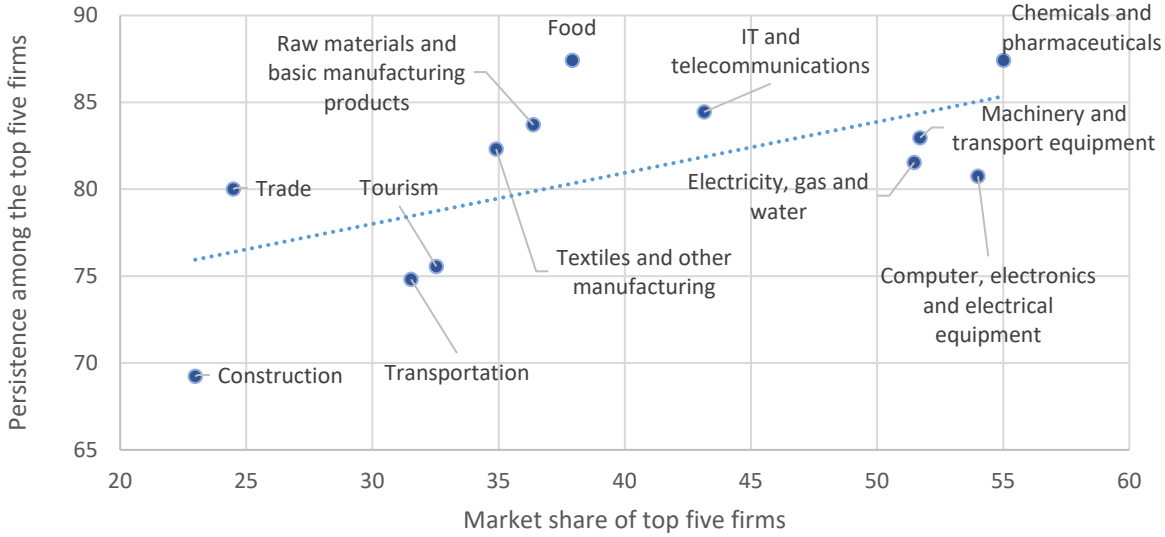
In more concentrated markets, firms are more likely to remain among the top market leaders. Sectors where the top five (or top ten) firms play a dominant role in market share tend to have lower turnover among top firms. This winner-takes-all market dynamic is particularly strong in the chemicals and pharmaceuticals sector and in utilities (electricity, gas and water), but also in the digital sectors, such as computer and electronics, machinery and transport equipment, and IT and telecommunications. These sectors are also those that experience stronger digital adoption.

Policymakers should focus on the conditions and incentives needed to help smaller firms transform digitally. The results linking market concentration to digital adoption do not indicate the direction of causality. However, the positive correlation between market concentration and digital adoption is in line with previous studies. For example, Acemoglu et al. (2022) argue that the high adoption costs of advanced digital technologies can be a major issue for small firms, creating advantages for large firms in the adoption and use of these technologies. This dynamic, in turn, further drives market concentration. Therefore, policymakers should develop measures to support the digital transformation of smaller firms, as this may contribute to more dynamic and

[2] Using Orbis data, Bajgar et al. (2019) measure market concentration using the top four, top eight and top 20 firms in an industry.

competitive markets. Smaller firms might otherwise fall victim to bigger firms with excessive market power, and their disappearance might result in lower market contestability and openness to innovation. Such issues are particularly relevant for Europe's strategic autonomy in certain industries, keeping in mind that Europe needs to increase the resources available for research, innovation and critical technologies.

Market concentration and persistence of top firms (in %)**, by sector**



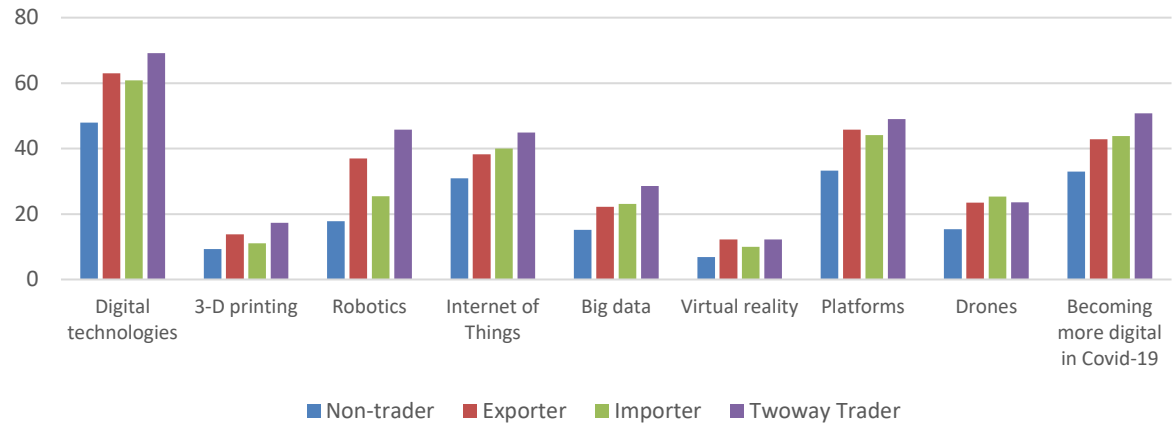
Source: Authors' calculation based on Orbis.
Note: Persistence refers to the annual probability of remaining among the top five firms in terms of market share.

International trade and firms' resilience

The rise of the internet and digital technologies has improved trade-related information flows and reduced communication costs. They have made it easier for firms to find foreign customers and to integrate foreign suppliers into their production processes, enhancing participation in global value chains and reaping the benefits of economies of scales (Abel-Koch, 2013; WTO, 2019). Trade in digital services from the European Union has also grown rapidly in the past decade.

Firms that engage in international trade are more likely to use advanced digital technologies or build their business around such technologies. Exporters and importers are over 10 percentage points more likely to adopt advanced digital technologies than non-traders. The difference for firms that both export and import (two-way traders) is even higher, by more than 20 percentage points. This is in line with evidence showing that exporters and importers are more likely to invest in the development of new products and modern technologies to maintain their market share (Melitz and Redding, 2021).

Probability of digitalisation (in %)**, by trade profile**



Source: EIBIS 2022.

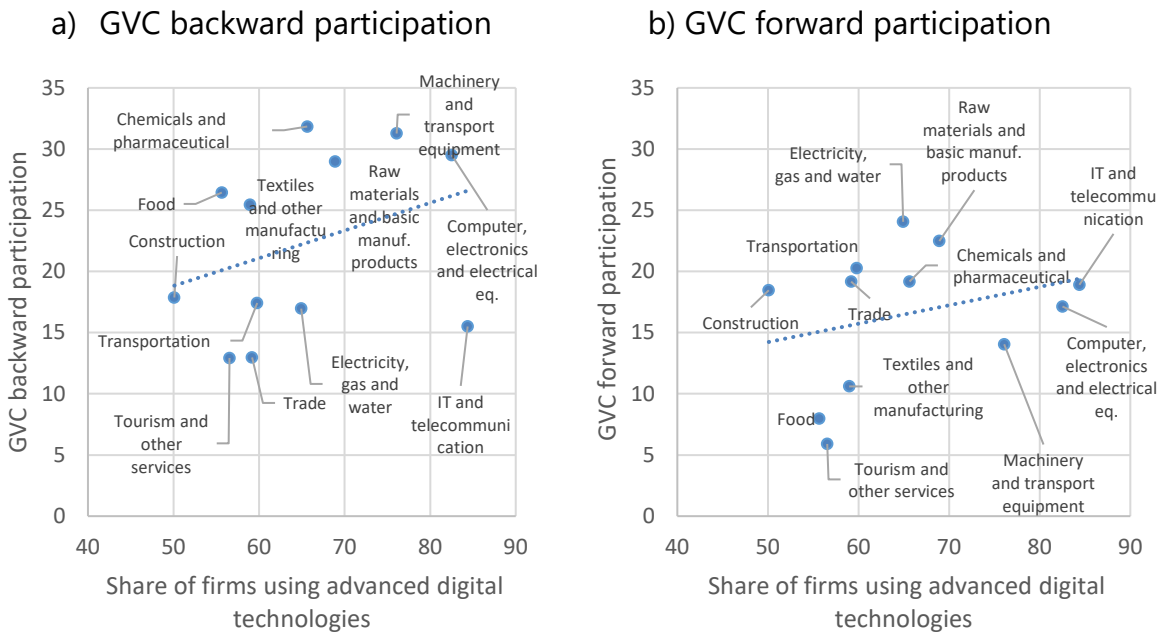
Note: The bars represent the probability of digitalisation by trade profile, estimated from logistic regressions. The regressions control for country and sector (27 EU countries and the United States, and 12 sectors).

Questions: In 2021, did your company export or import goods and/or services? To what extent, if at all, are each of the following digital technologies used within your business? Please, say if you do not use the technology within your business. And as a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital?

International traders were more likely to increase their digitalisation efforts as a response to COVID-19. One-third of non-trading firms invested to increase digitalisation during the pandemic, compared to 40% of exporters and importers and more than 50% of two-way traders.

Firms in sectors that are more integrated in the world economy through global value chains tend to be more digital. The most digitalised manufacturing sectors, such as manufacturing of machinery and transport equipment and manufacturing of electronic devices (see page 11), are more likely to rely on foreign produced inputs (backward participation) than less digitalised sectors. In addition, these sectors are more likely to provide inputs to enterprises in other countries (forward participation).

Digitalisation and global value chain (GVC) participation



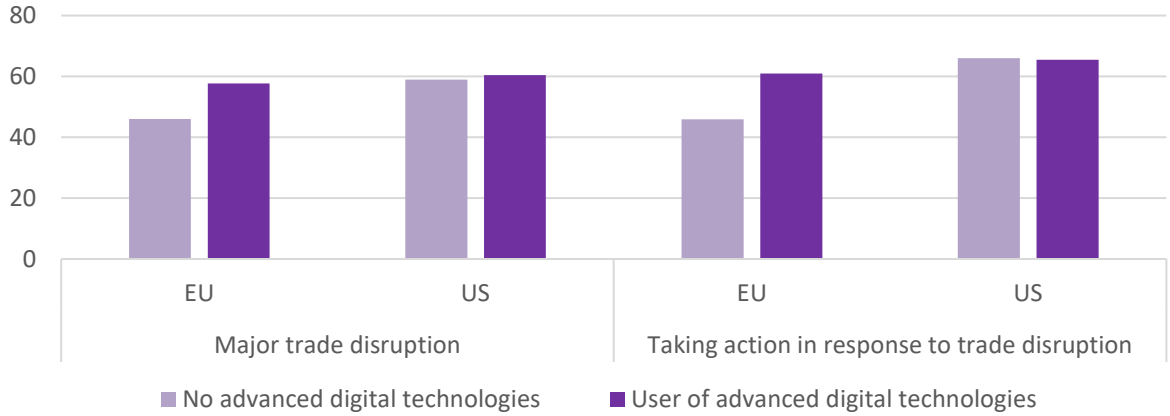
Source: Authors' calculations based on EIBIS 2022 and OECD Trade in Value Added (TiVA) database 2021 edition.

Note: The left panel shows the average backward participation, while the right panel shows the average forward participation of a sector against the average share of digitalised companies in the same sector. The backward participation expresses to what degree the exports of a sector relied on imported value added. The forward participation means the degree to which the export value of a sector is used in other countries' production. See Box 1 for the definition of the adoption of advanced digital technologies.

Digital firms are more likely to have reported major trade disruptions since the start of the pandemic. This is not surprising, as firms engaged in international trade are more likely to be affected by disruptions to global value chains, logistics, access to materials or new trade regulations. However, this finding holds even when taking into account firms' trade engagements.

Digital firms are more likely to take action to mitigate the adverse effects of trade disruptions. The right panel of the following figure reveals that firms using advanced digital technologies are more likely to take action to mitigate the adverse effects of trade disruptions — by either diversifying across trade partners or looking for domestic markets. This finding suggests that digitalisation increases the resilience and adaptive capacity of the economy to unexpected large economic shocks.

Probability of trade disruption and taking action in response (in %)



Source: EIBIS 2022.

Note: The bars represent the probability of trade disruption (left) and the probability of taking action in response to trade disruption (right), estimated from logistic regressions. The regressions control for country and sector (27 EU countries and the United States, and 12 sectors). The regressions in the left panel also control for trade status, the regressions in the right for trade status and major disruption reported.

Questions: In 2021, did your company export or import goods and/or services? To what extent, if at all, are each of the following digital technologies used within your business? Please, say if you do not use the technology within your business? And as a response to the COVID-19 pandemic, have you taken any actions or made investments to become more digital? Since 2021, did any of the following present an obstacle to your business's activities? Is your company taking any actions to mitigate the impact of these disruptions?

Investment in climate change

The development of new green and digital technologies is stagnating, a trend that should be a warning signal for policymakers. If emerging digital technologies are properly employed, they can play an essential role in tackling environmental challenges. Examples include smart urban mobility, precision agriculture, sustainable supply chains, environmental monitoring and disaster prediction. In addition, digital technologies can be instrumental in monitoring climate change and facilitating the much-needed shift towards a circular economy. The cloud, in combination with mobile and social media, can shift products or even entire industries fully online. Moreover, 3-D printing creates opportunities for manufacturing biodegradable inputs (Lacy and Rutqvist, 2015; IPCC, 2022).

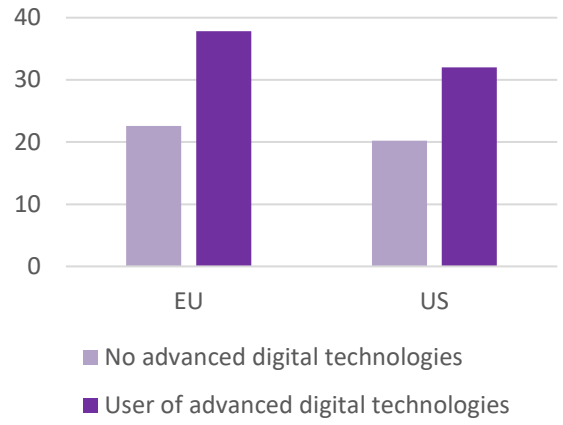
Digital technologies are put forward as key enablers of the green transition and the achievement of the sustainability goals defined in the European Green Deal. To maintain its long-term competitiveness, the European Union clearly has a role to play in combining digital technologies with innovations devoted to addressing the challenges of climate change. If Europe wants to live up to its ambition, significant investments in digitalisation are required, especially if it hopes to catch up with the United States' strong head start in digital innovation (Veugelers et al., 2023).

Digital firms have invested more in measures to build resilience to the physical risks of climate change. They are more likely to report that they have invested in adaptation strategies, or strategies that involve changing procedures and/or operations to increase the organisation's resilience. The link between firms' digital profiles and investments in avoiding or reducing exposure to climate risks is more pronounced in the European Union than in the United States. Digital firms also invest more in measures to reduce greenhouse gas emissions.

Firms that are more advanced in digitalisation tend to invest more often to tackle the challenges of climate change. Digital firms tend to report more often that they have already invested and plan to invest more in climate adaptation in the next three years. If used in the right way, emerging technologies could be critical to tackling environmental challenges and supporting the twin green and digital transition.

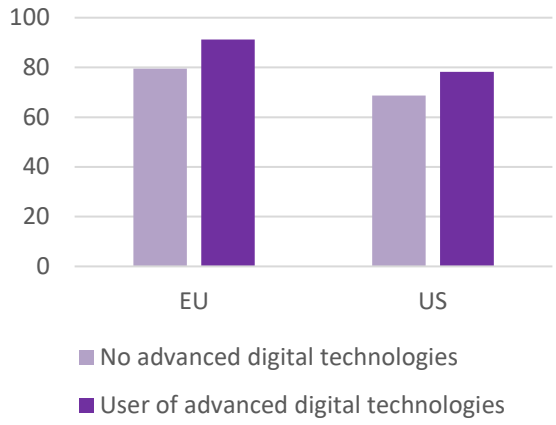
Climate investment (% of firms)

a) Investments to mitigate the physical risk of climate change



Source: EIBIS 2022.
Question: Has your company developed or invested in any of the following measures to build resilience to the physical risks to your company caused by climate change?

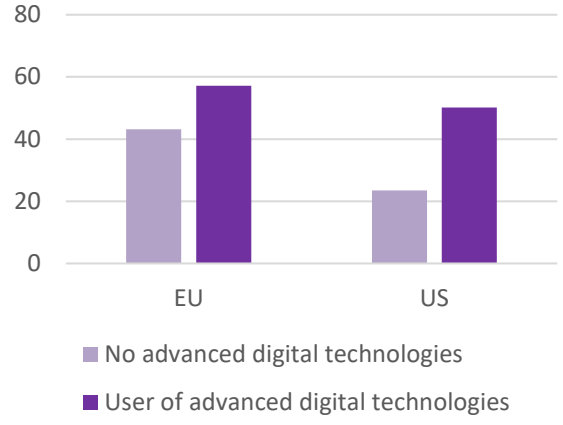
b) Investments to reduce greenhouse gas emissions



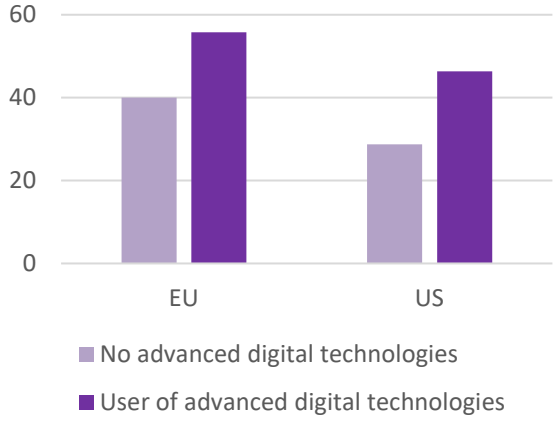
Source: EIBIS 2022.
Question: Is your company investing or implementing any of the following to reduce greenhouse gas emissions? Less polluting technologies, energy efficiency, renewable energy, waste minimisation, recycling, sustainable transport options.

Investments to tackle climate change (% of firms)

a) Already invested



b) Plans to invest



Source: EIBIS 2022.
Question: Which of the following applies to your company regarding investments to tackle the impacts of weather events and to help reduce carbon emissions? Company has already invested, company invested this year, company intends to invest over the next three years.

Conclusion and policy recommendations

Digitalisation drives firms' resilience to economic disruption and climate change, and it has helped European businesses resist repeated shocks. Digital companies displayed more resilience to the economic and trade disruptions unleashed by the COVID-19 crisis and the war in Ukraine, suggesting that the crisis forced firms to find more efficient ways of working. Digital firms generally perform better overall than non-digital firms and tend to be more innovative and productive. They are also more likely to engage in international trade and invest in addressing the physical and transition risks of climate change. Digital technologies will be key to meeting the ambitious goals of the European Green Deal.

Successfully managing the digital transition and taking advantage of its long-term benefits goes beyond technology. The digital transformation is a societal change. Striking the right technological balance is a complex process for the European Union. It is caught between global players that are defining the cutting edge of digital innovation, national preferences and societal and regulatory patterns that set boundaries on the use of digital technologies. To make the most of the digital transformation, the European Union will need to position itself well in the global environment, creating better conditions for innovation in technologies that are crucial to European interests and taking full advantage of the benefits of digitalisation, while staying within the boundaries of the European economic model.

Policymakers need to pay equal attention to measures aimed at facilitating the use of digital technologies and to those addressing potential problems, such as the automation of tasks. While potential productivity gains from digital technologies are large and the risk of not keeping up with digital developments high, digitalisation does present potential problems for industries and societies. New technologies tend to reinforce the need for skilled labour and can replace low-skilled workers who perform routine tasks. The European Year of Skills, which puts skills centre stage, is thus a highly welcome initiative. It helps people obtain the right skills for quality jobs and helps companies, in particular small and medium enterprises, address skills shortages in the European Union. Policy measures need to ensure that the labour force can upskill and reskill to make the best use of new digital technologies in their workplace. More than ever, accomplishing these diverse aims will require finding synergies between private and public investment.

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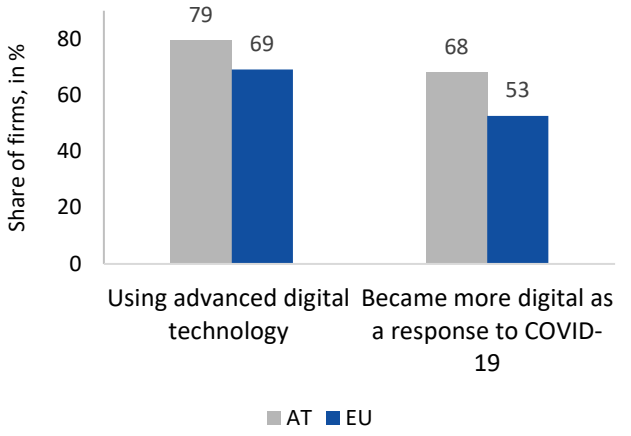
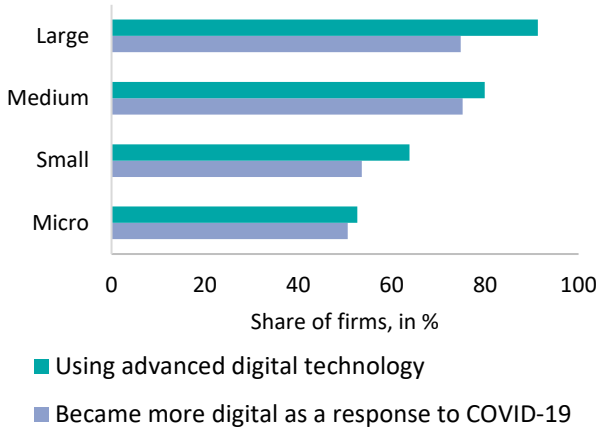
Austria (AT)

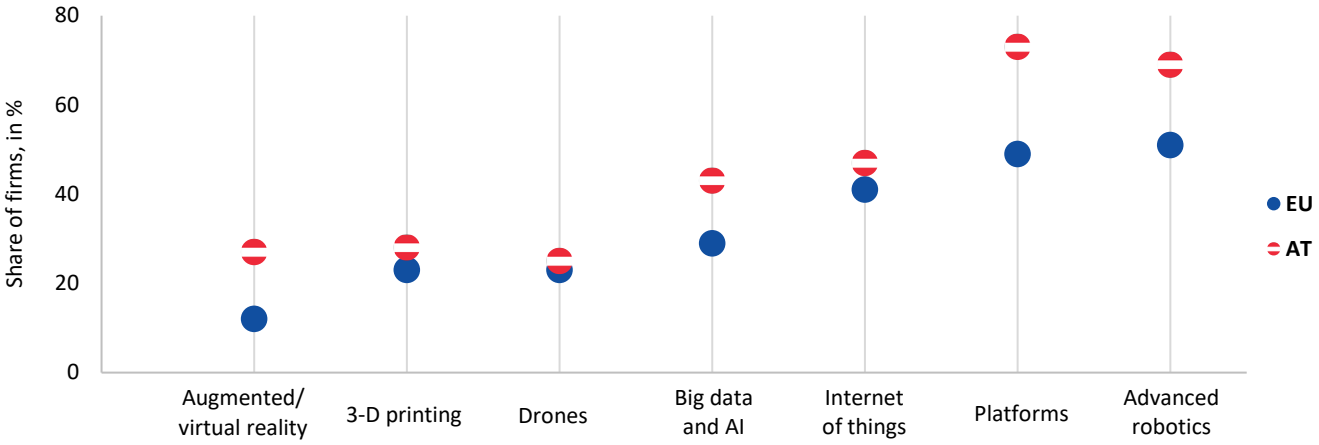
Digital adoption in firms



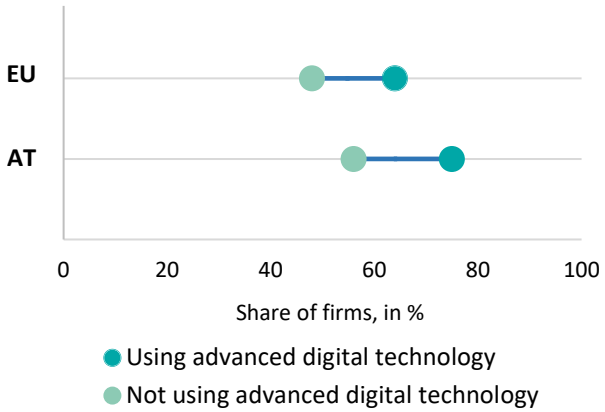
Digital adoption by firm size in AT



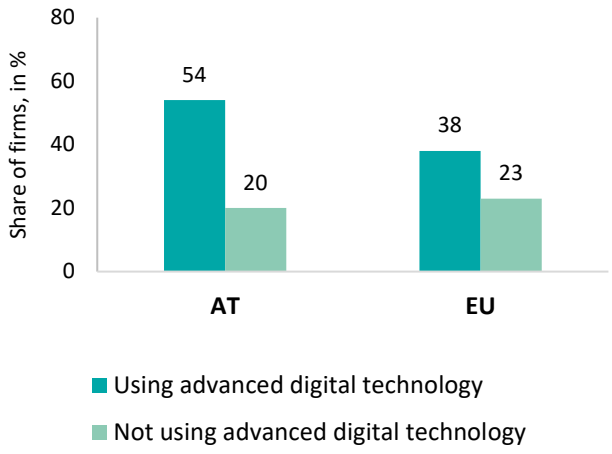
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



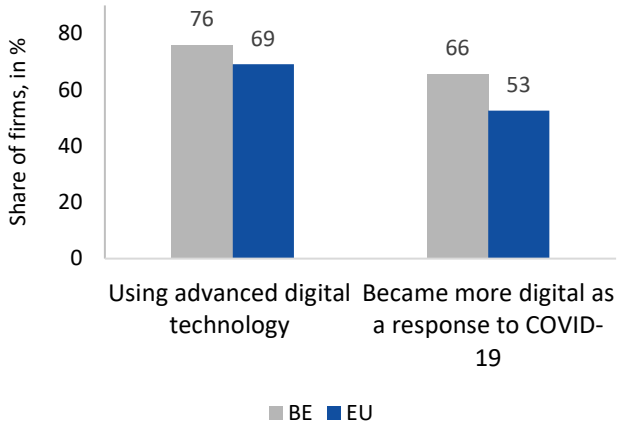
Firms taking action to protect against physical climate risks



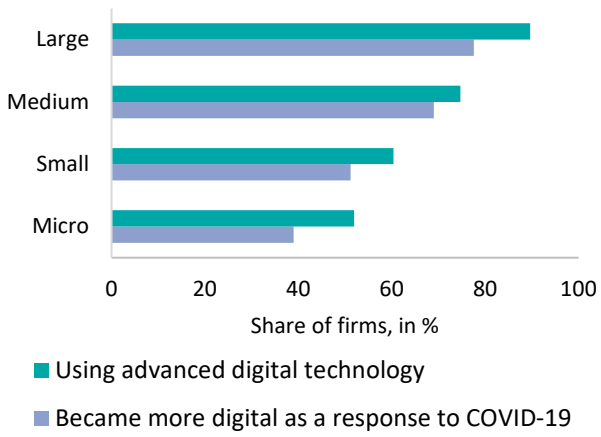
Source: EIBIS 2022.

Belgium (BE)

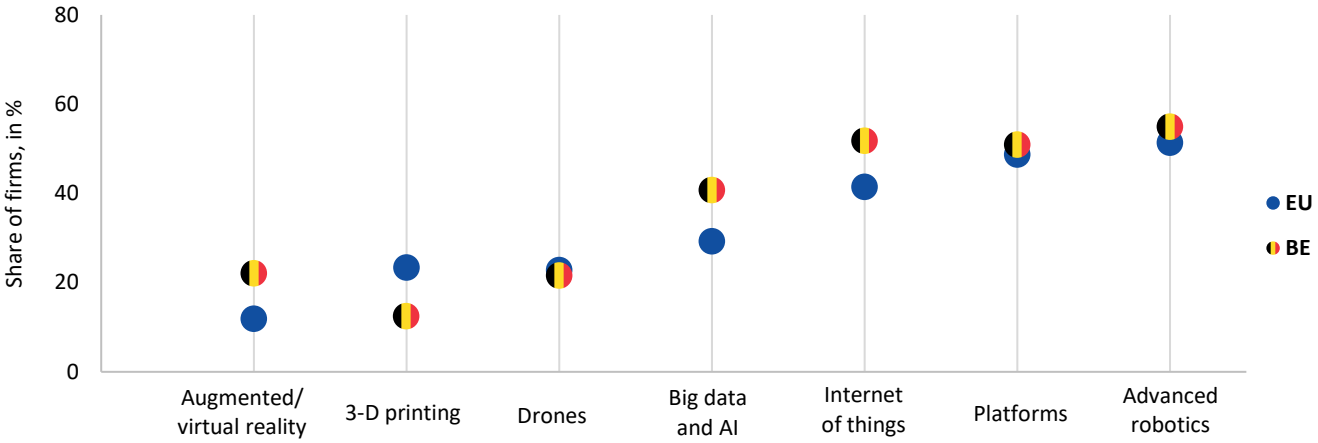
Digital adoption in firms



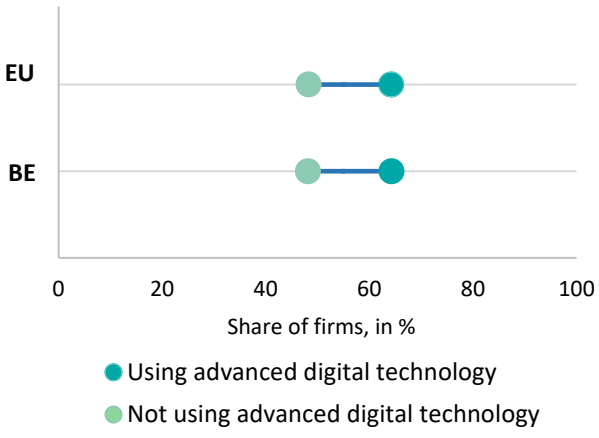
Digital adoption by firm size in BE



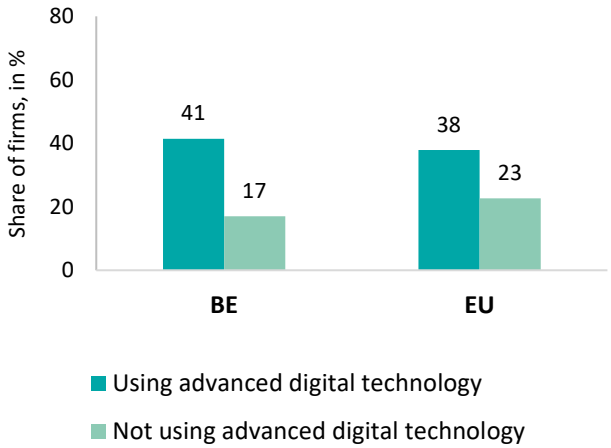
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



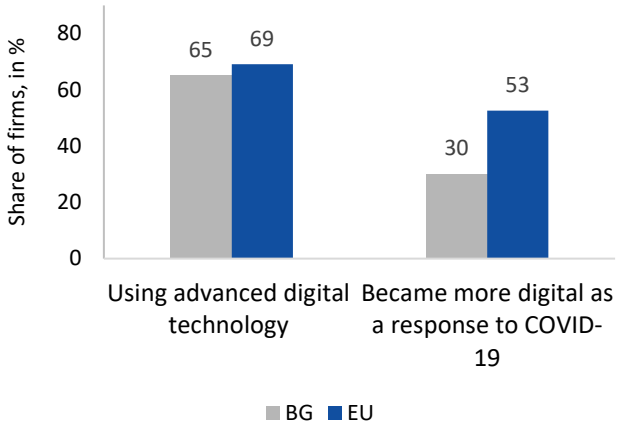
Firms taking action to protect against physical climate risks



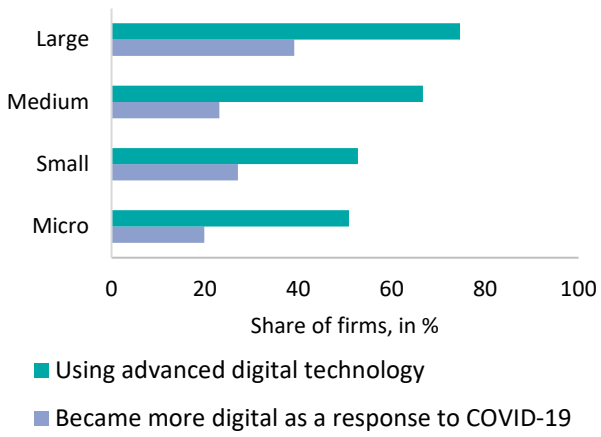
Source: EIBIS 2022.

Bulgaria (BG)

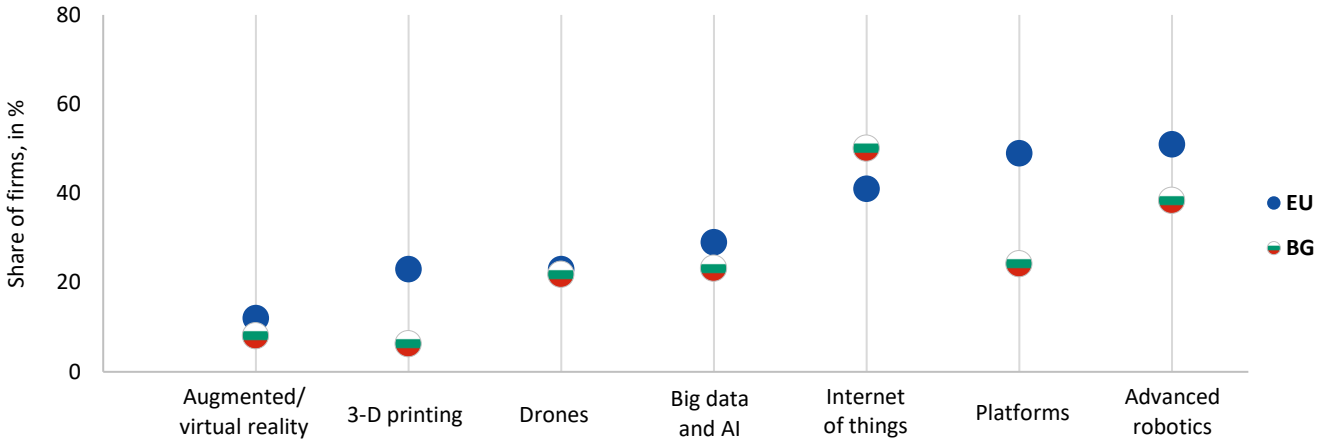
Digital adoption in firms



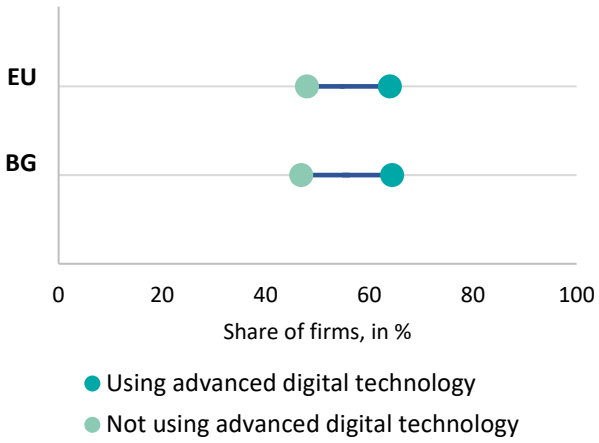
Digital adoption by firm size in BG



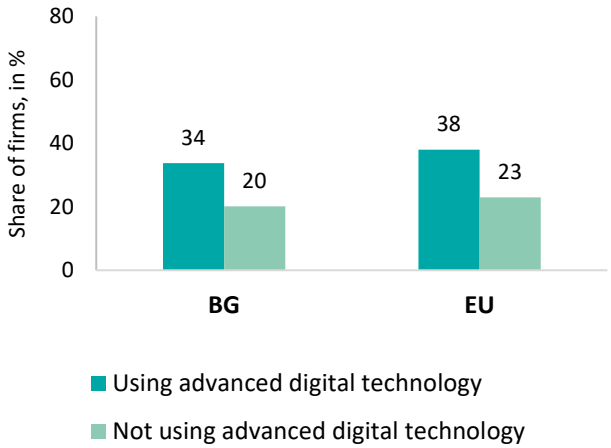
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



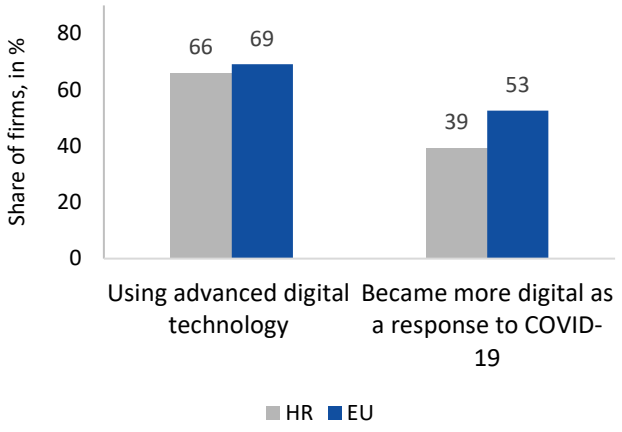
Firms taking action to protect against physical climate risks



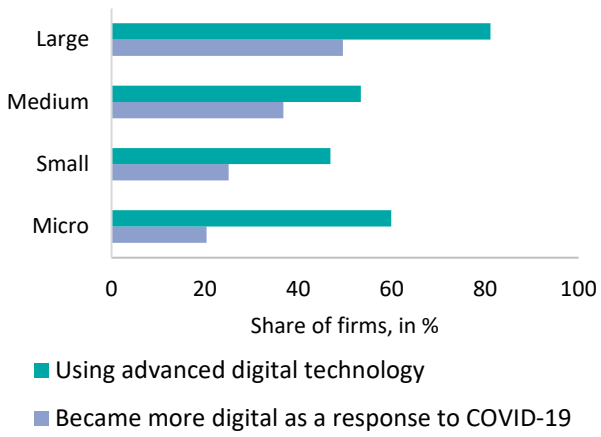
Source: EIBIS 2022.

Croatia (HR)

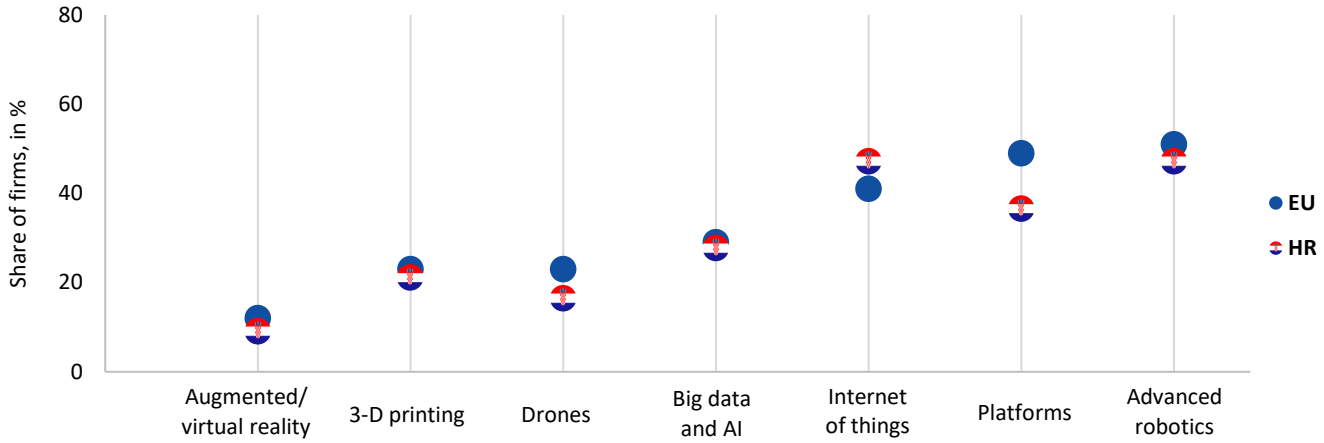
Digital adoption in firms



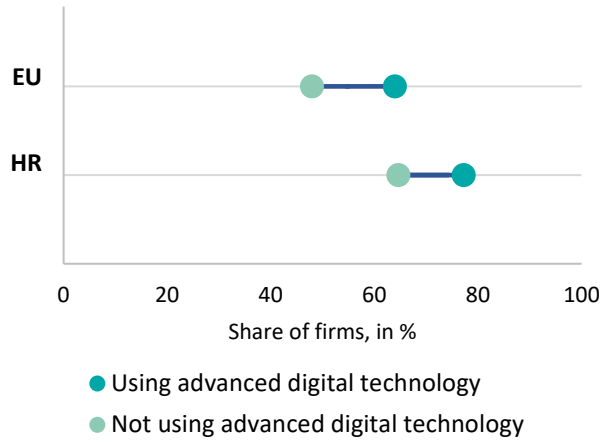
Digital adoption by firm size in HR



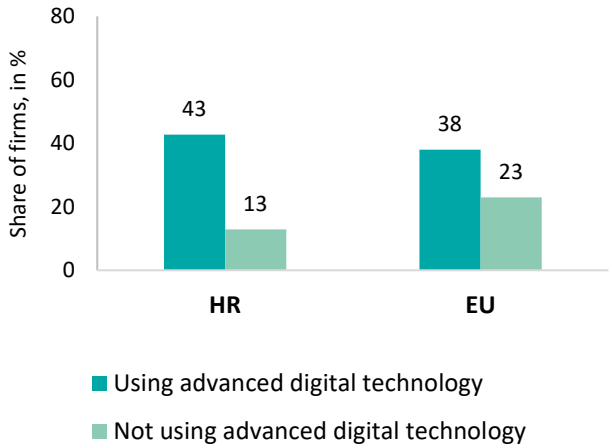
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



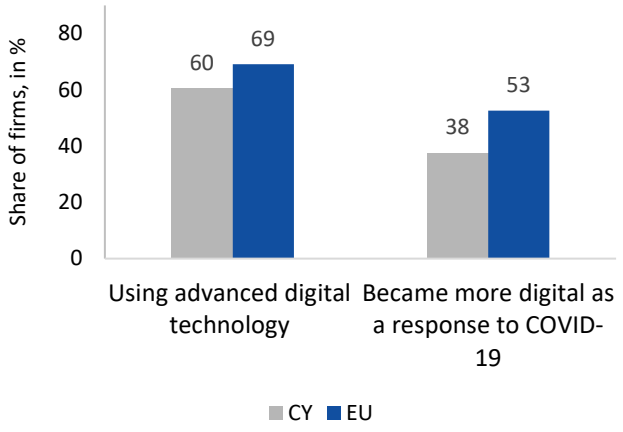
Firms taking action to protect against physical climate risks



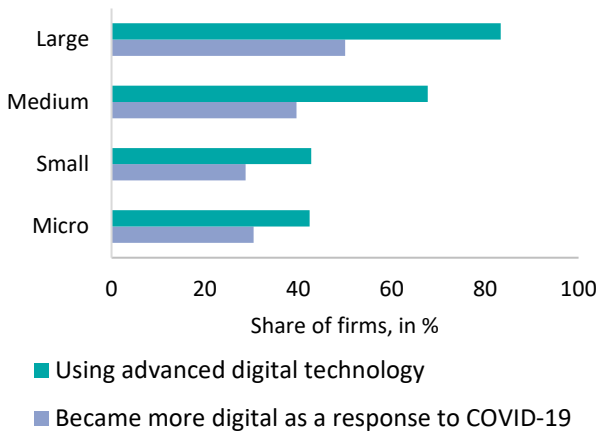
Source: EIBIS 2022.

Cyprus (CY)

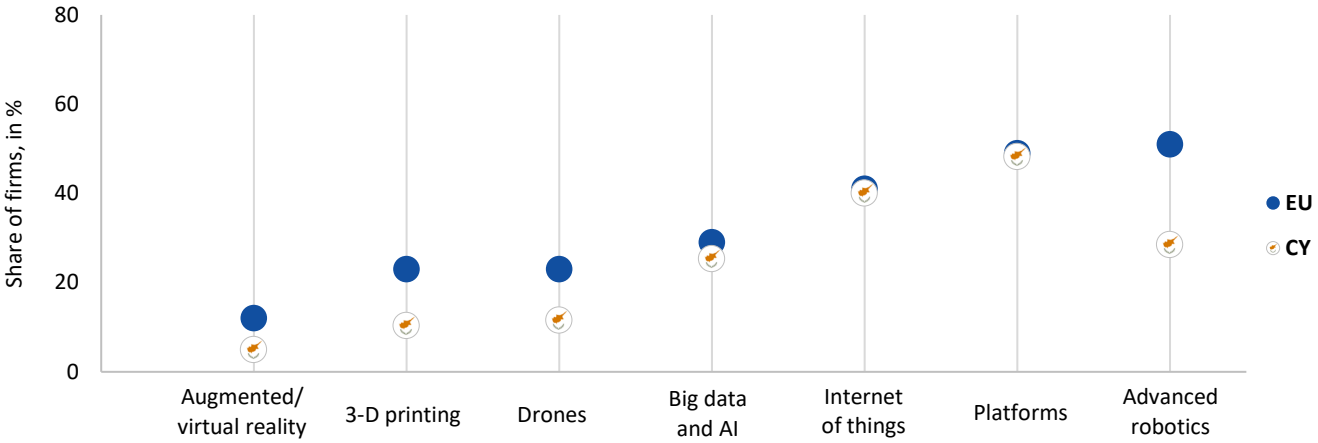
Digital adoption in firms



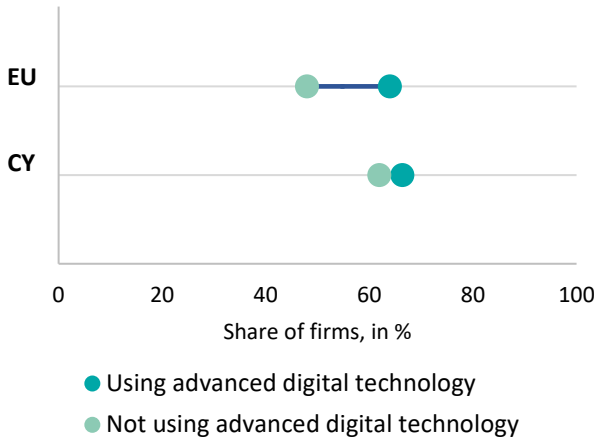
Digital adoption by firm size in CY



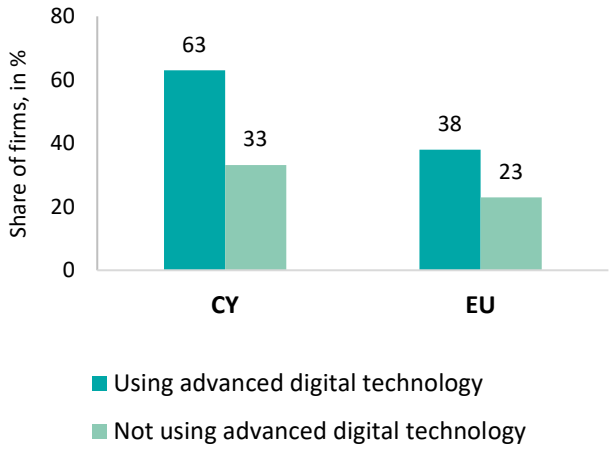
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



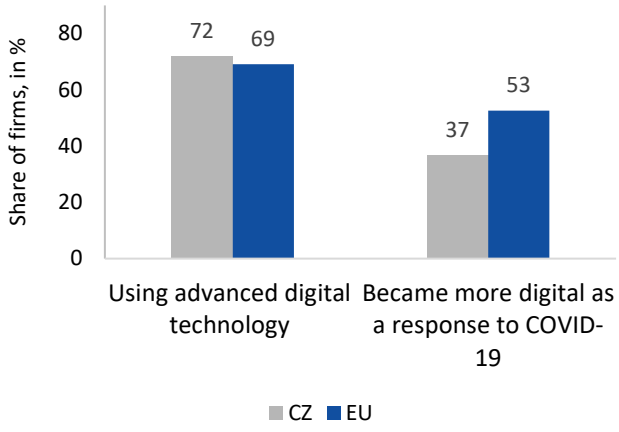
Firms taking action to protect against physical climate risks



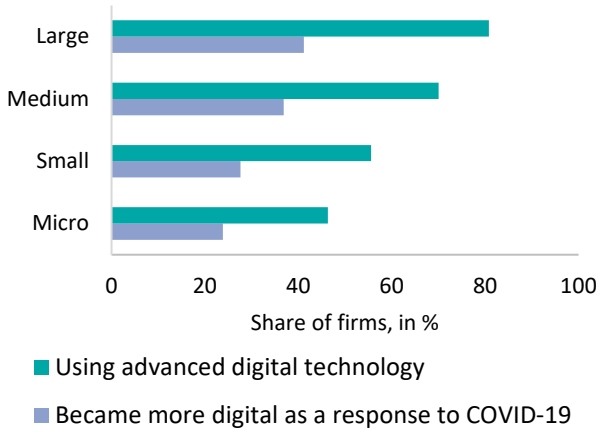
Source: EIBIS 2022.

Czech Republic (CZ)

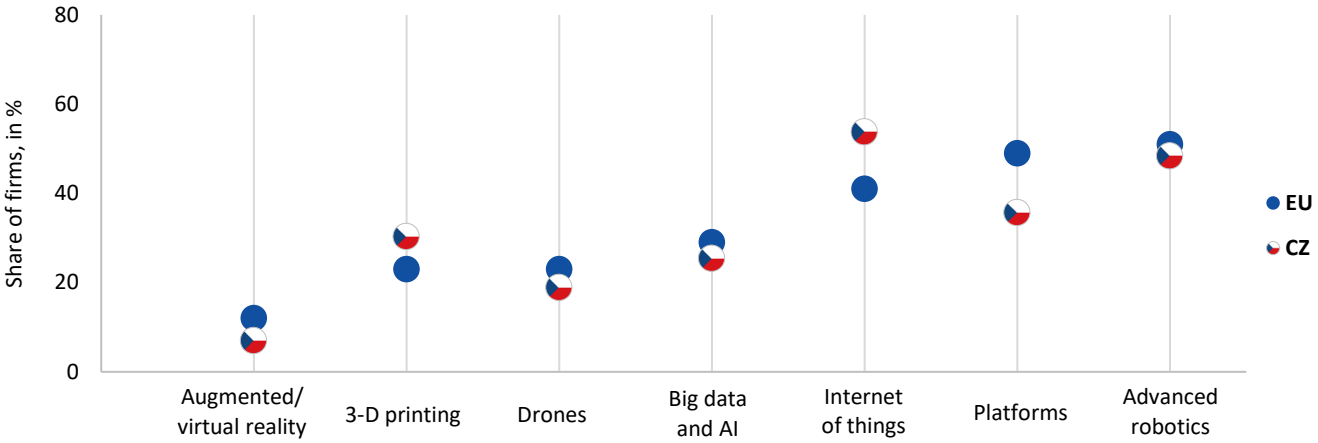
Digital adoption in firms



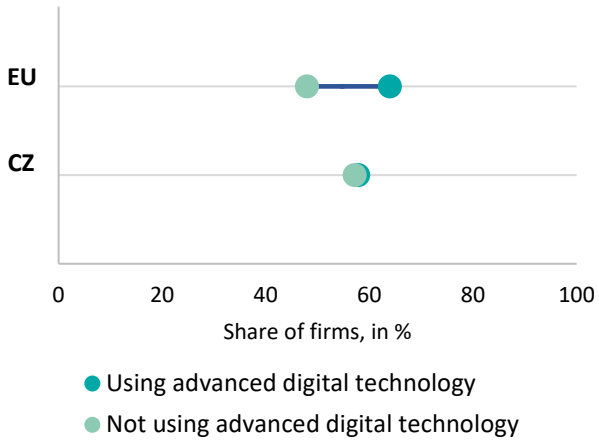
Digital adoption by firm size in CZ



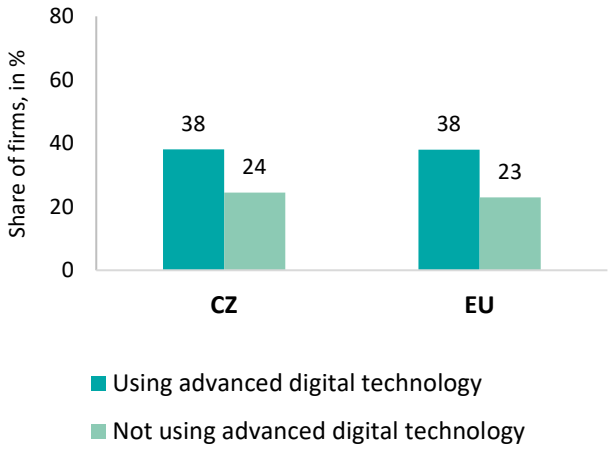
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



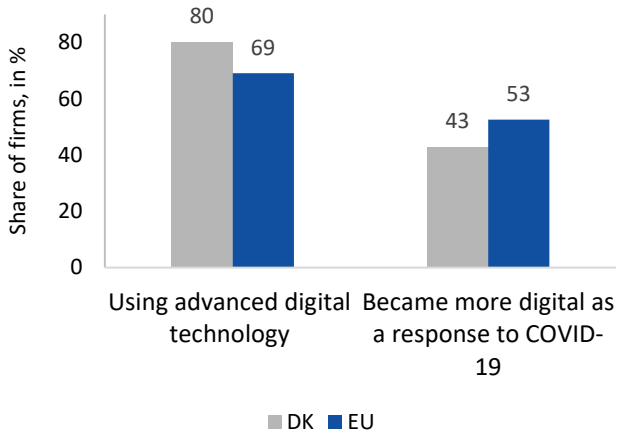
Firms taking action to protect against physical climate risks



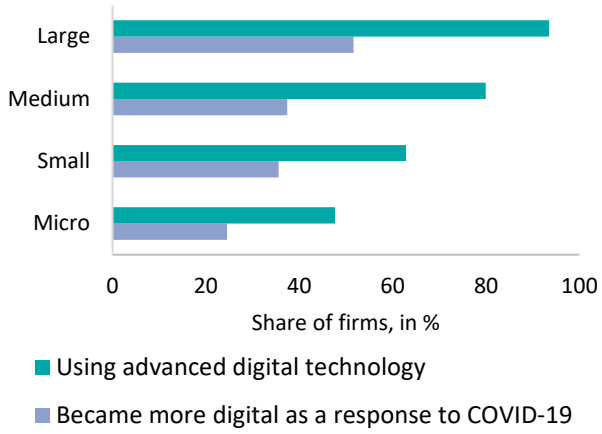
Source: EIBIS 2022.

Denmark (DK)

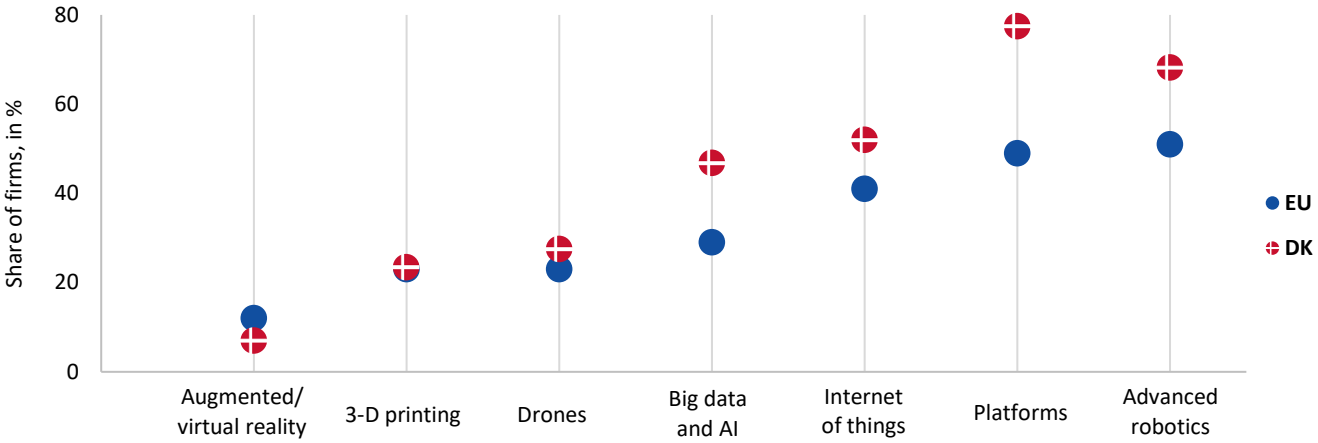
Digital adoption in firms



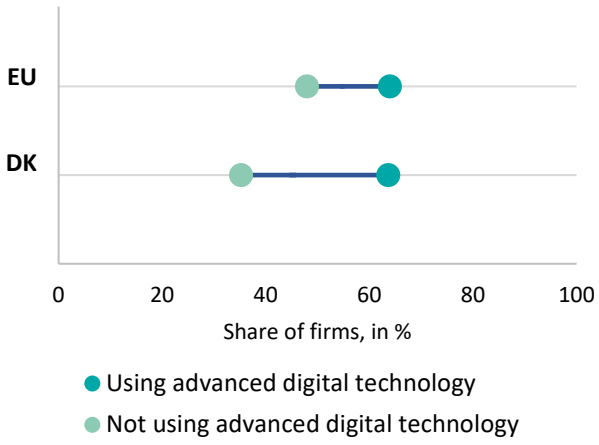
Digital adoption by firm size in DK



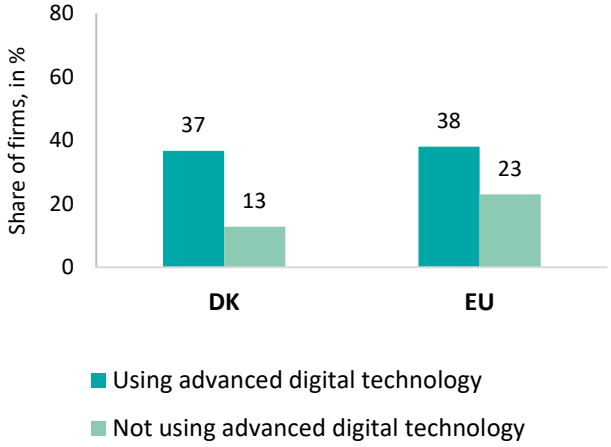
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



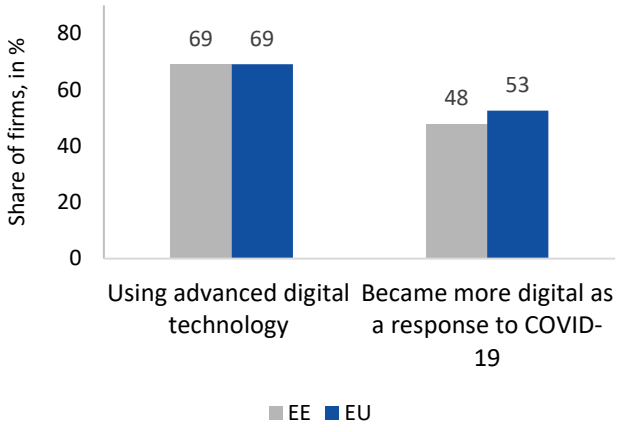
Firms taking action to protect against physical climate risks



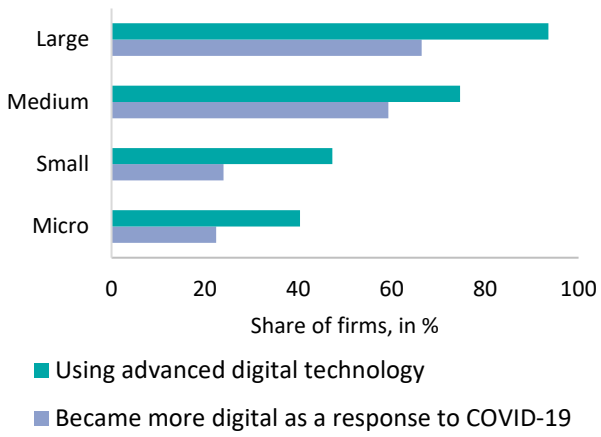
Source: EIBIS 2022.

Estonia (EE)

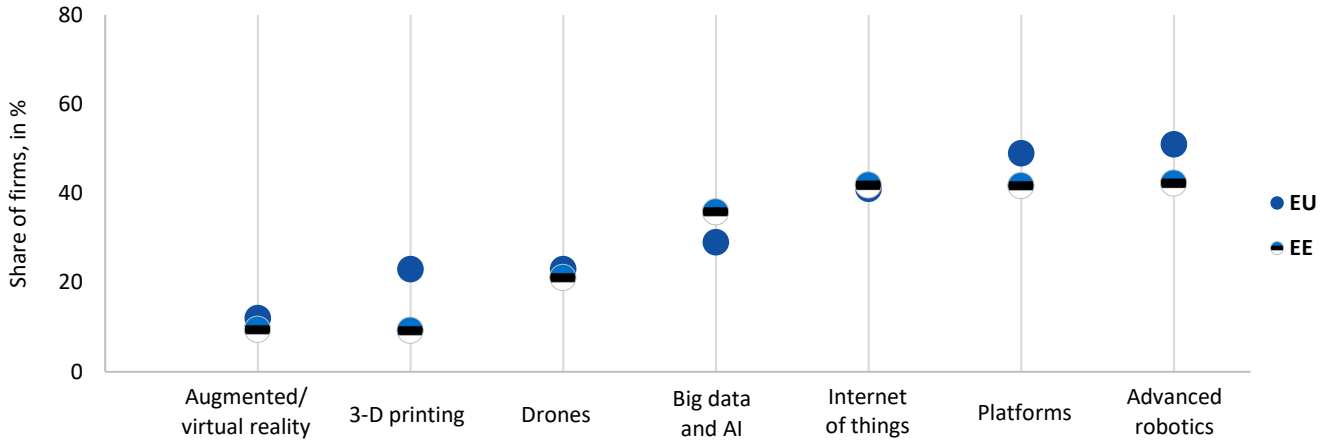
Digital adoption in firms



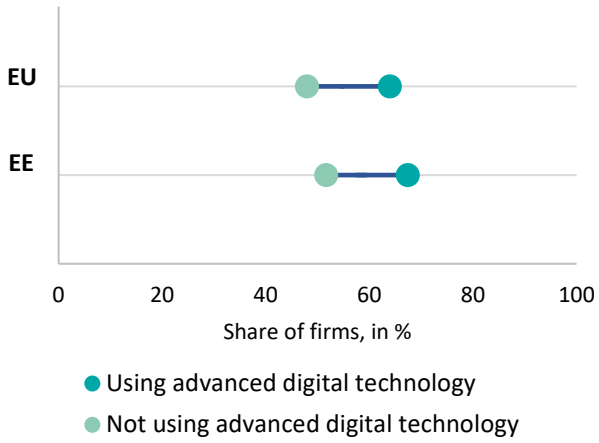
Digital adoption by firm size in EE



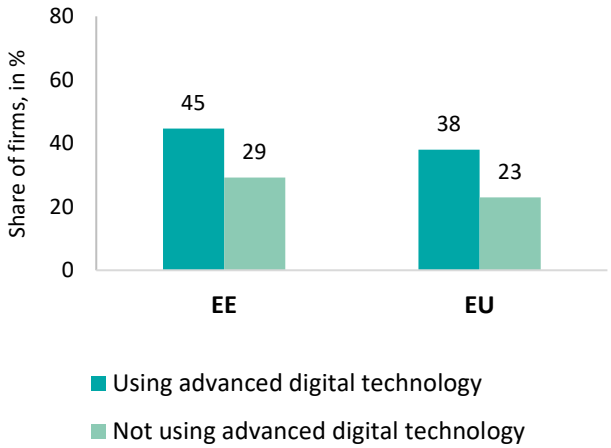
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



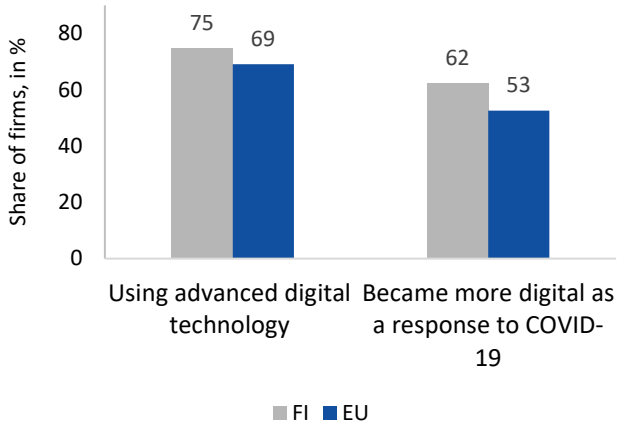
Firms taking action to protect against physical climate risks



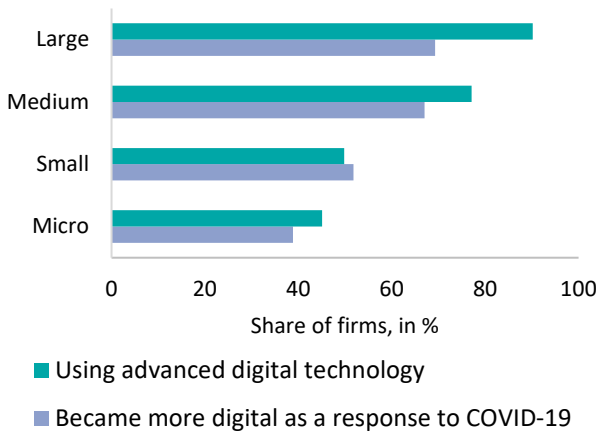
Source: EIBIS 2022.

Finland (FI)

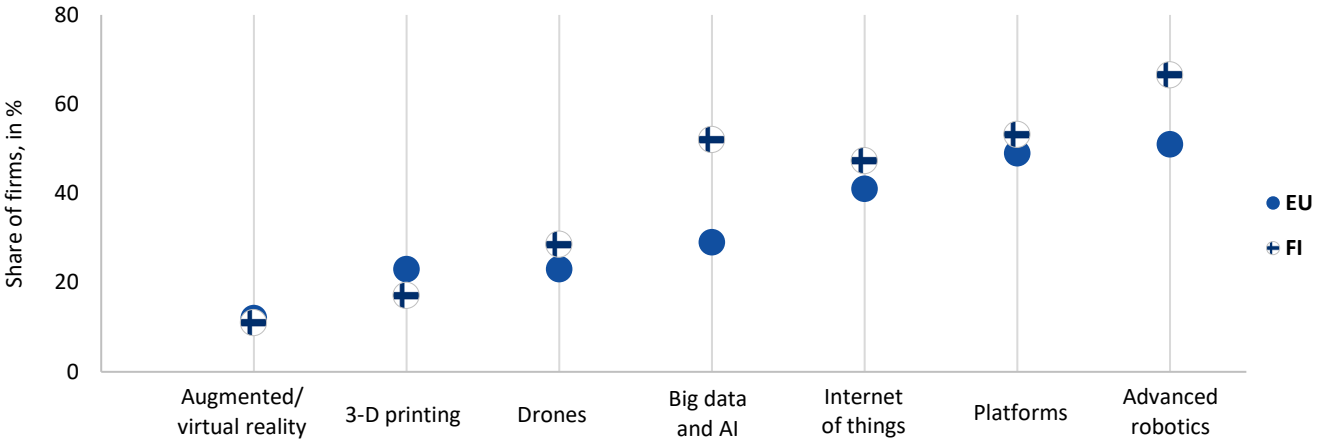
Digital adoption in firms



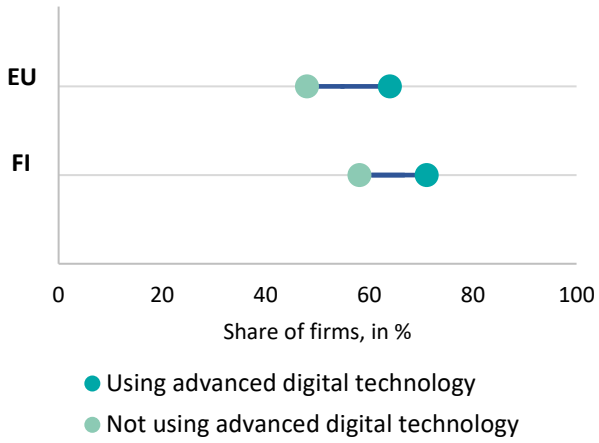
Digital adoption by firm size in FI



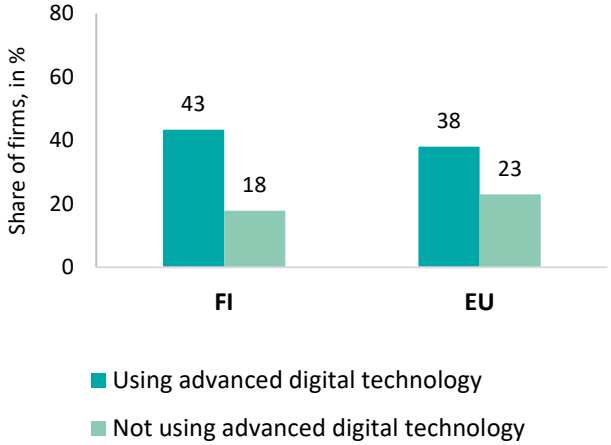
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



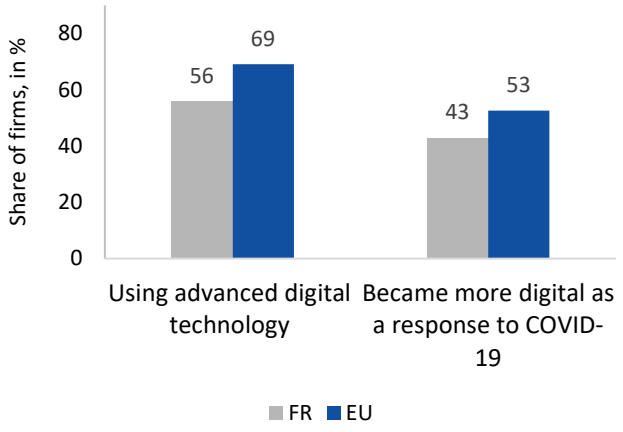
Firms taking action to protect against physical climate risks



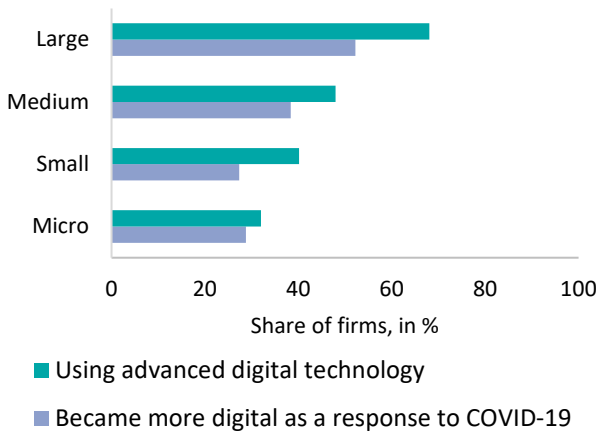
Source: EIBIS 2022.

France (FR)

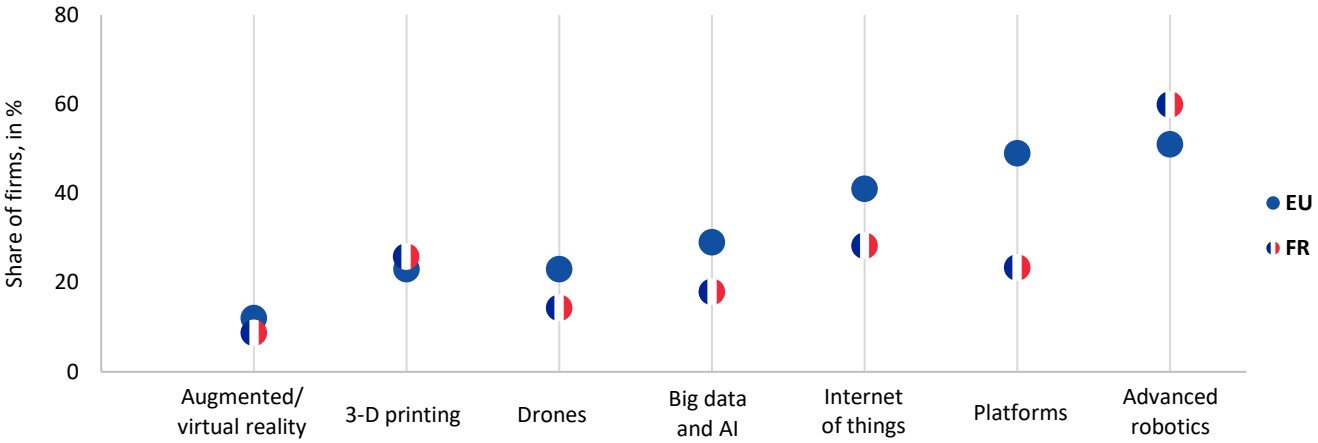
Digital adoption in firms



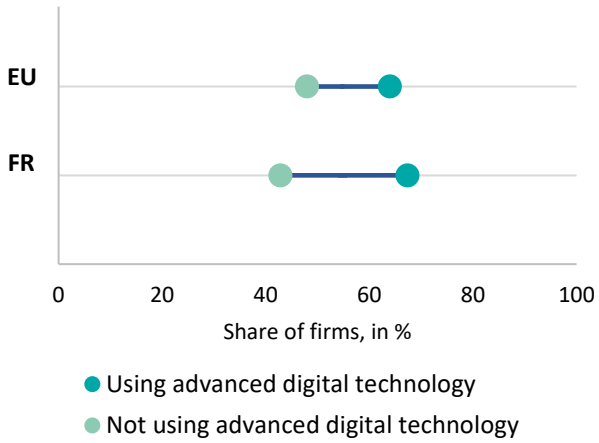
Digital adoption by firm size in FR



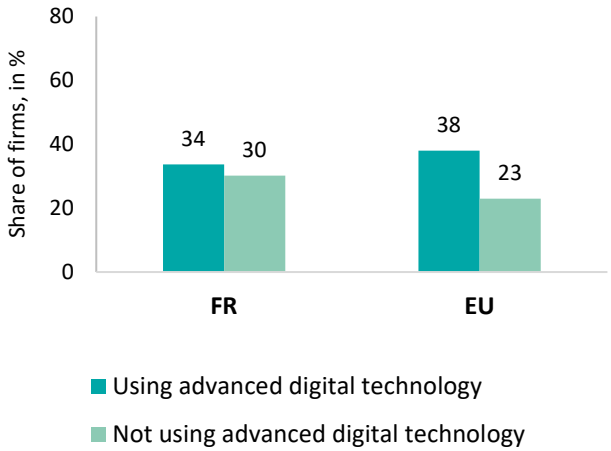
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



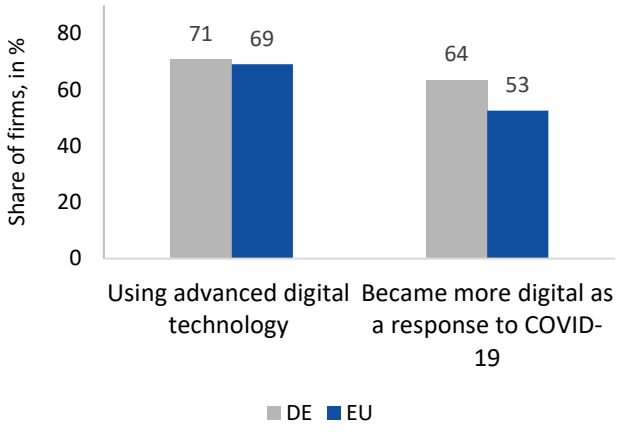
Firms taking action to protect against physical climate risks



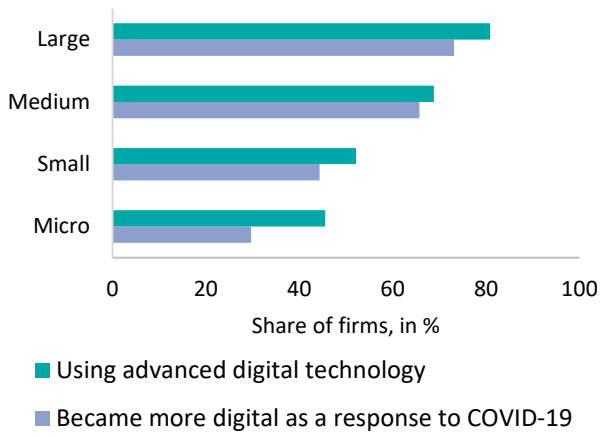
Source: EIBIS 2022.

Germany (DE)

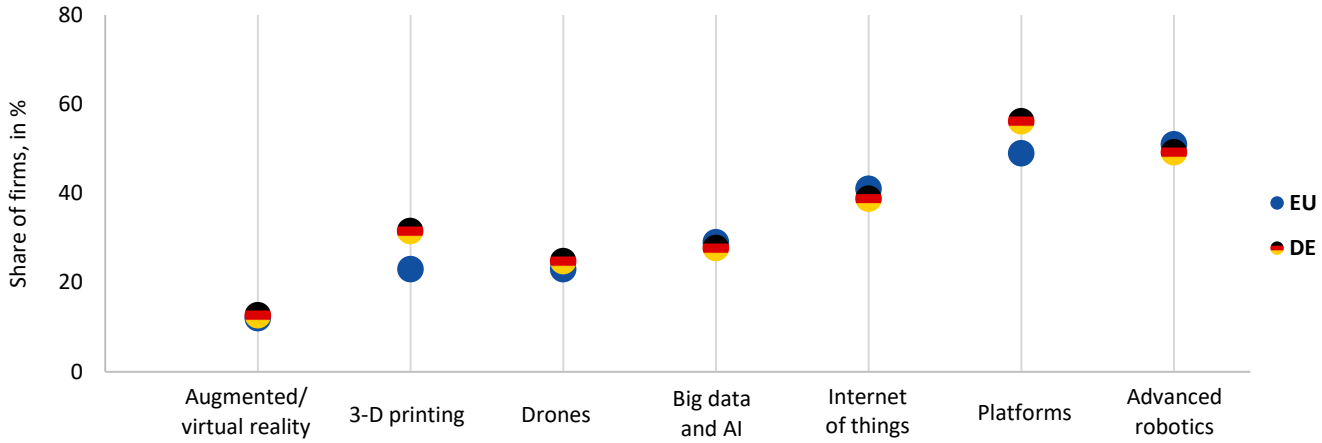
Digital adoption in firms



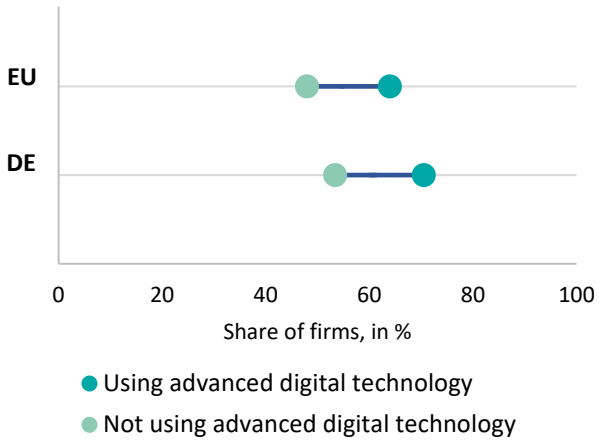
Digital adoption by firm size in DE



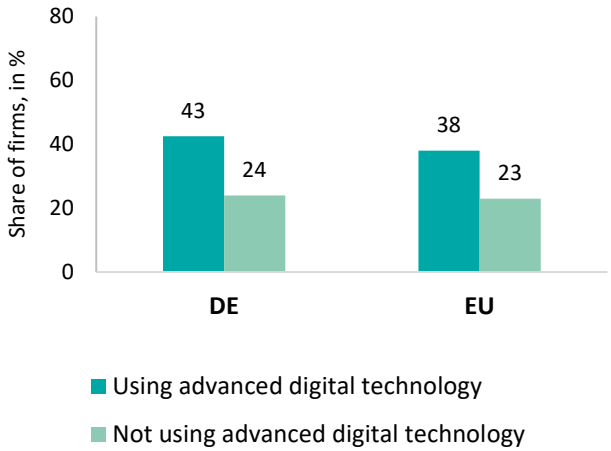
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



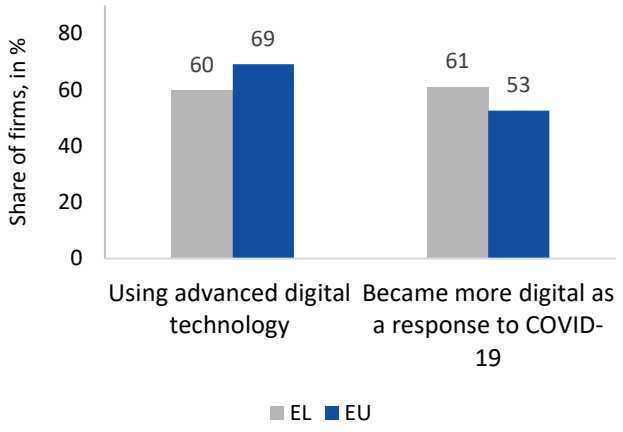
Firms taking action to protect against physical climate risks



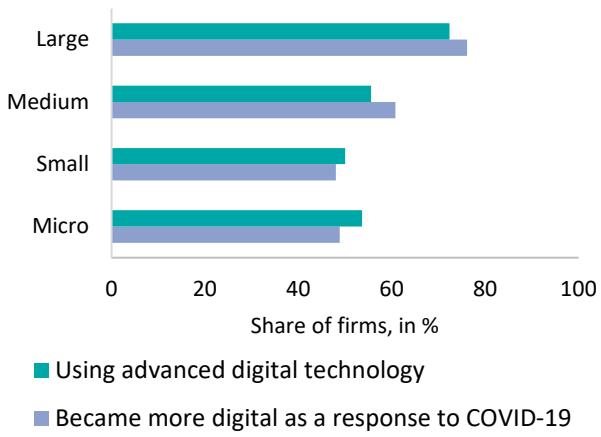
Source: EIBIS 2022.

Greece (EL)

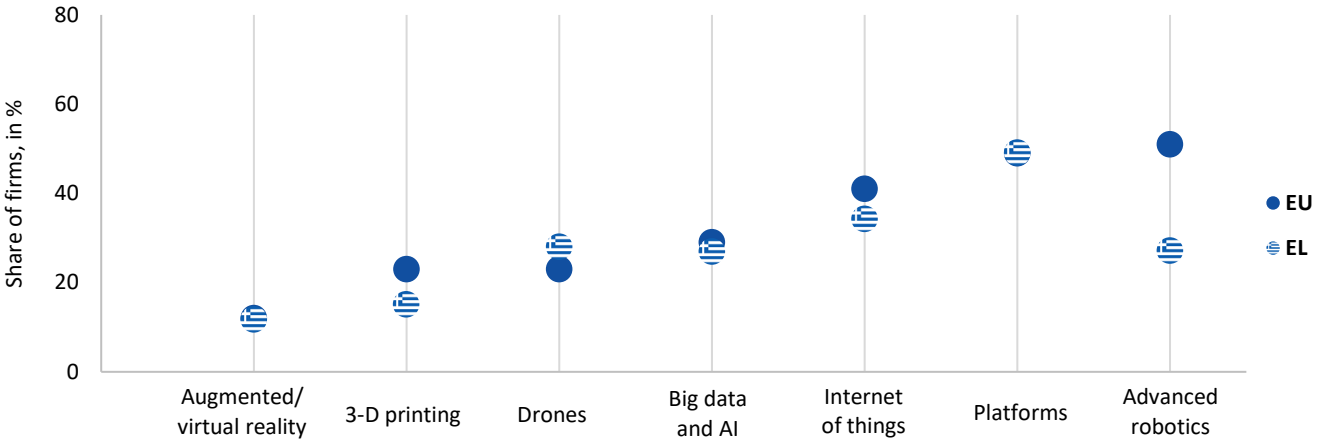
Digital adoption in firms



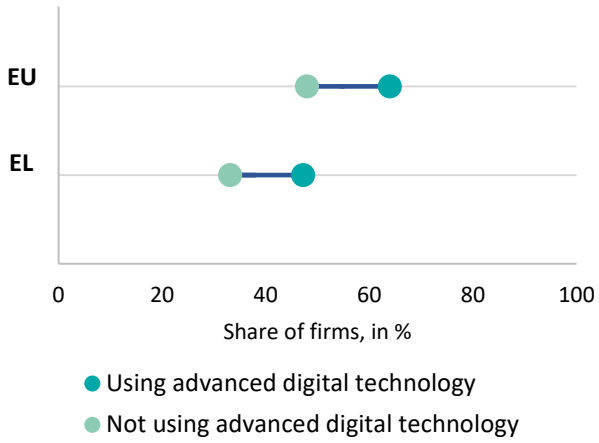
Digital adoption by firm size in EL



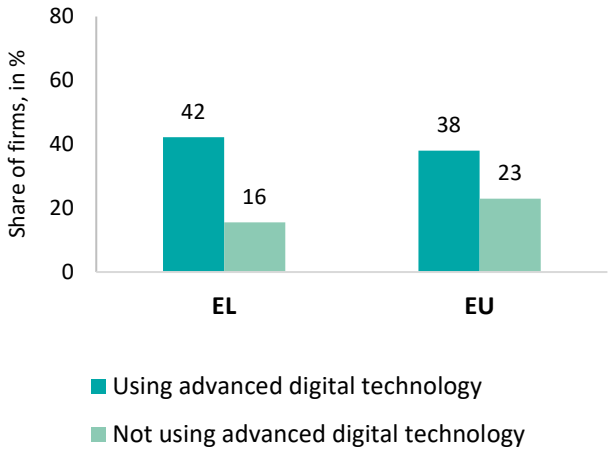
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



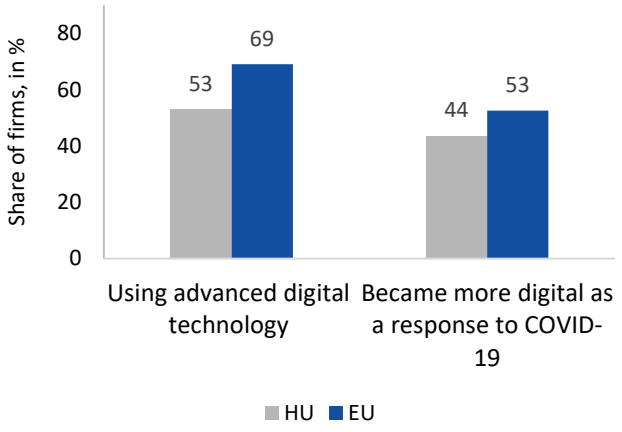
Firms taking action to protect against physical climate risks



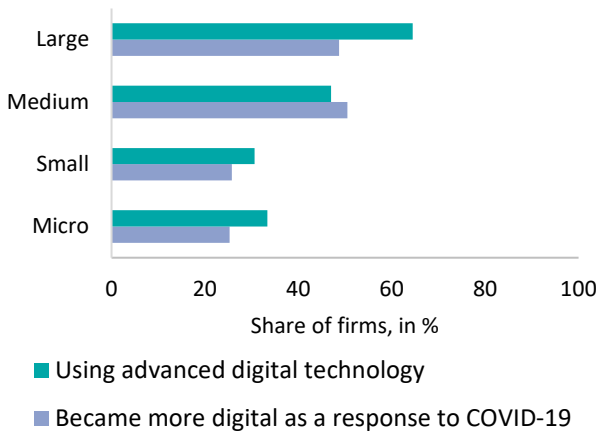
Source: EIBIS 2022.

Hungary (HU)

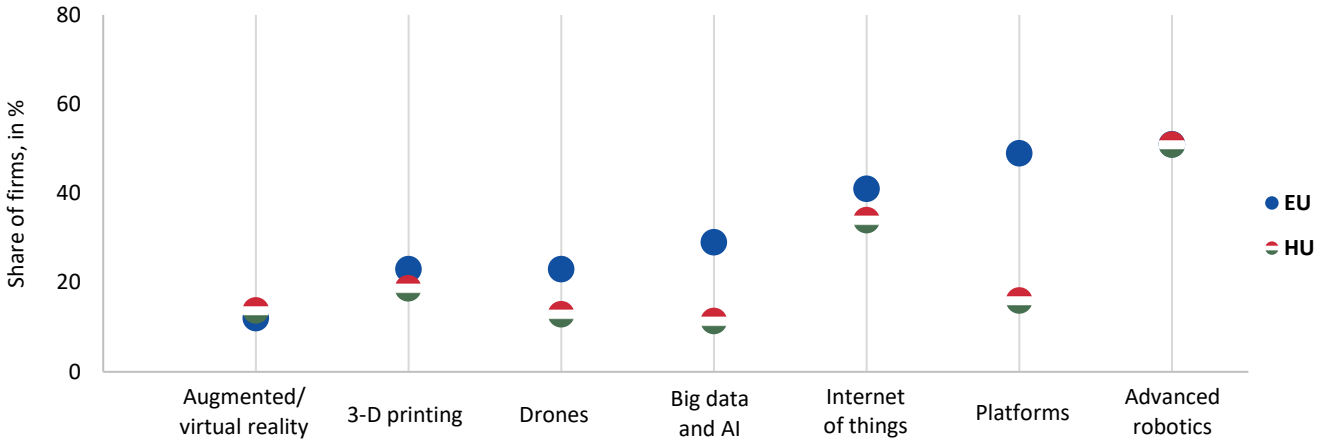
Digital adoption in firms



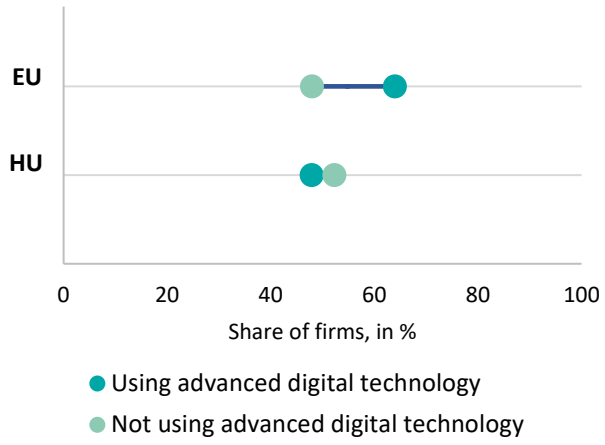
Digital adoption by firm size in HU



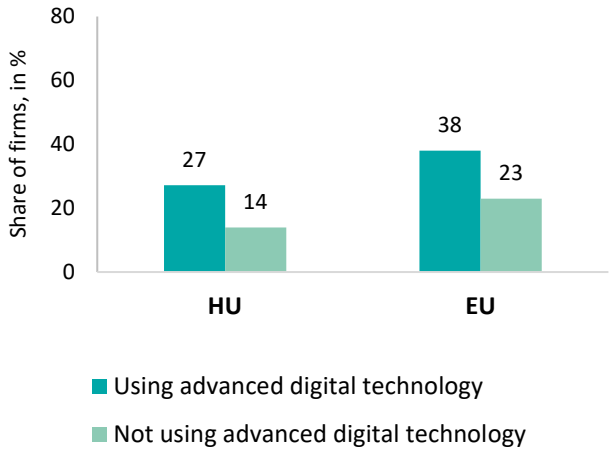
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



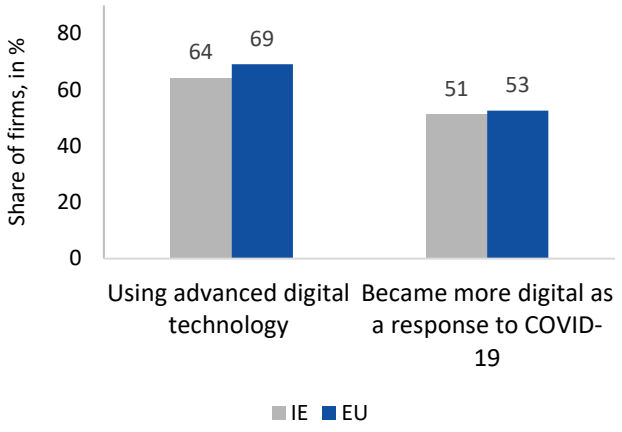
Firms taking action to protect against physical climate risks



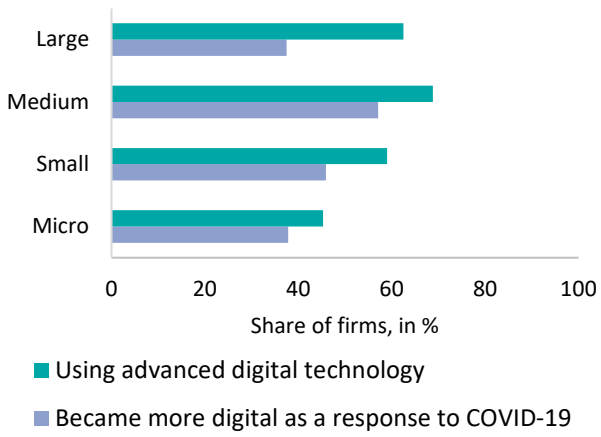
Source: EIBIS 2022.

Ireland (IE)

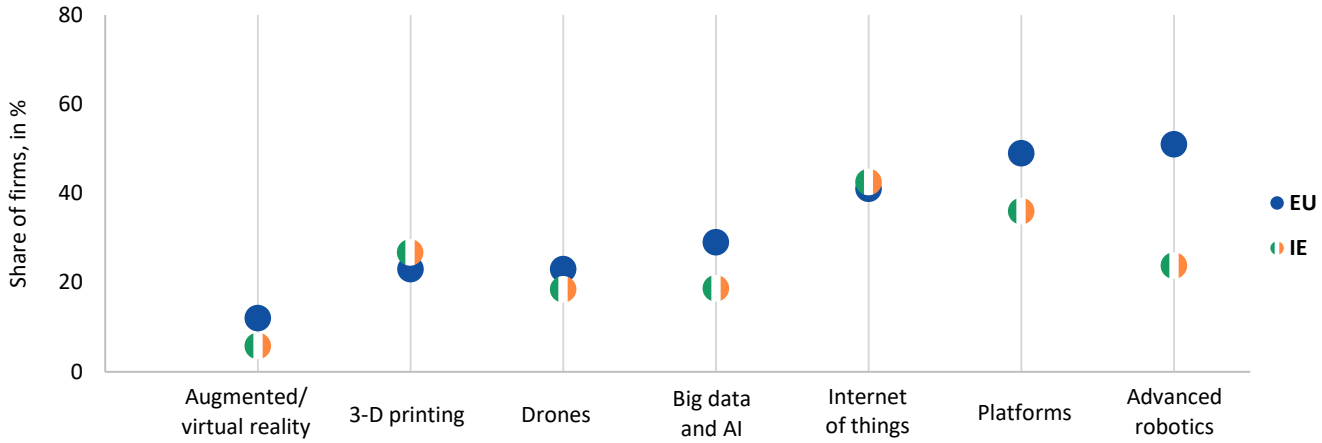
Digital adoption in firms



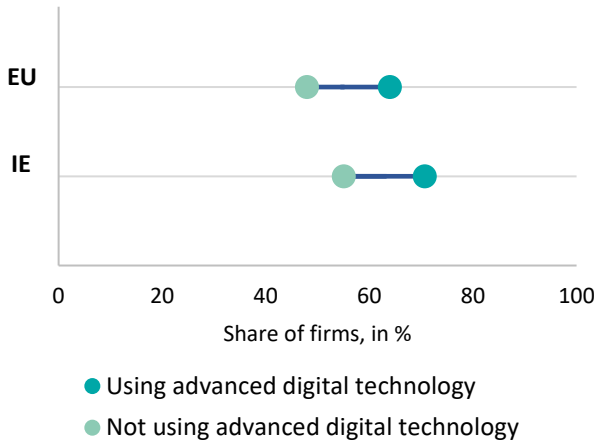
Digital adoption by firm size in IE



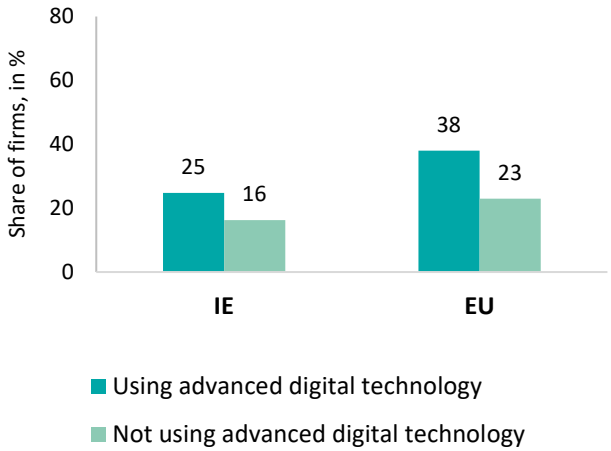
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



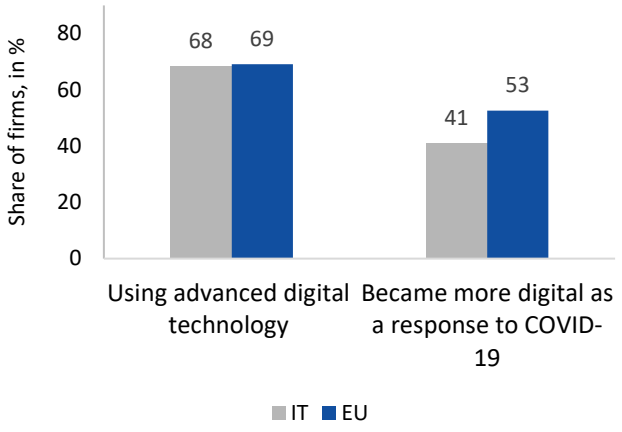
Firms taking action to protect against physical climate risks



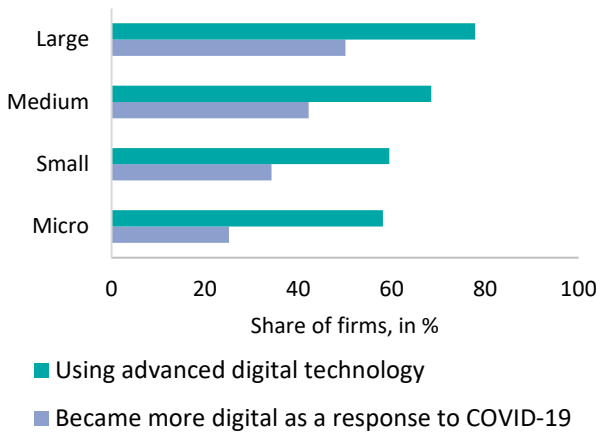
Source: EIBIS 2022.

Italy (IT)

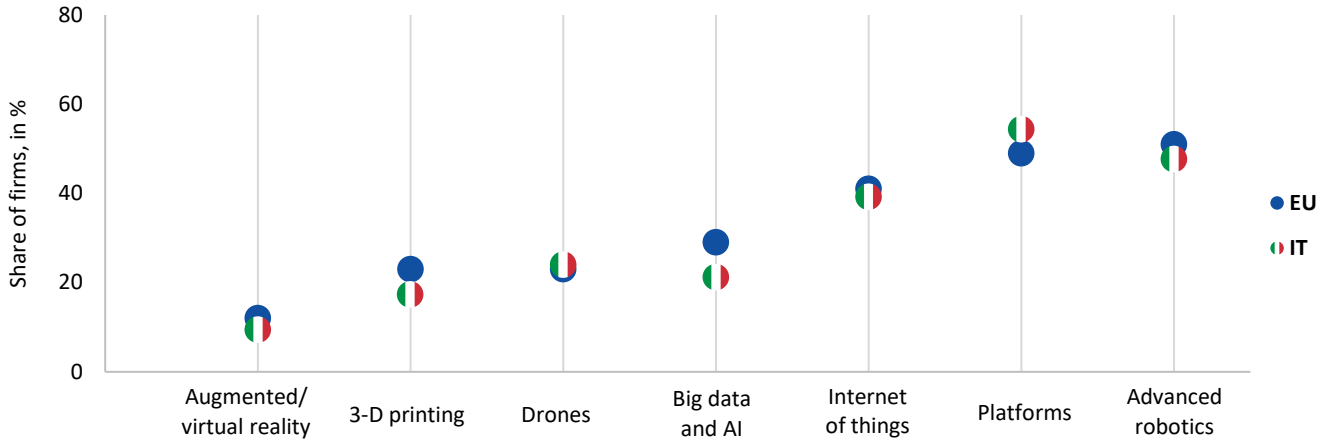
Digital adoption in firms



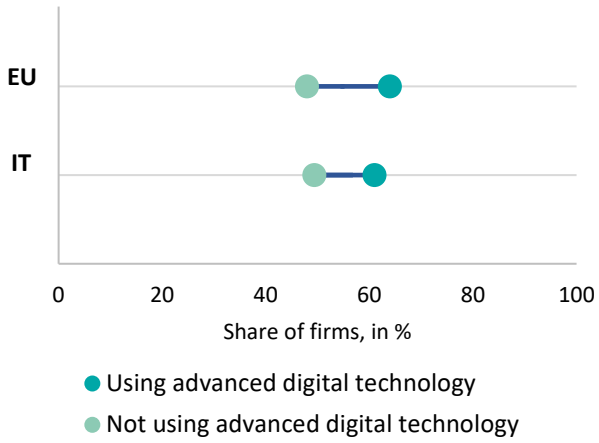
Digital adoption by firm size in IT



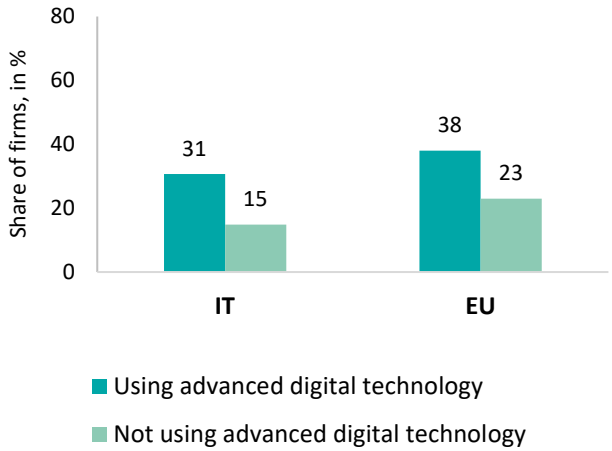
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



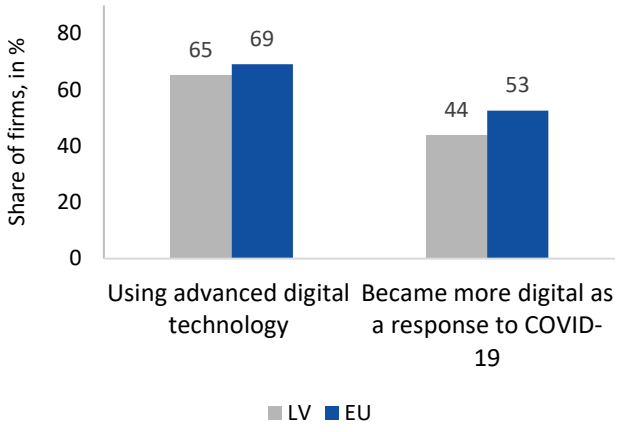
Firms taking action to protect against physical climate risks



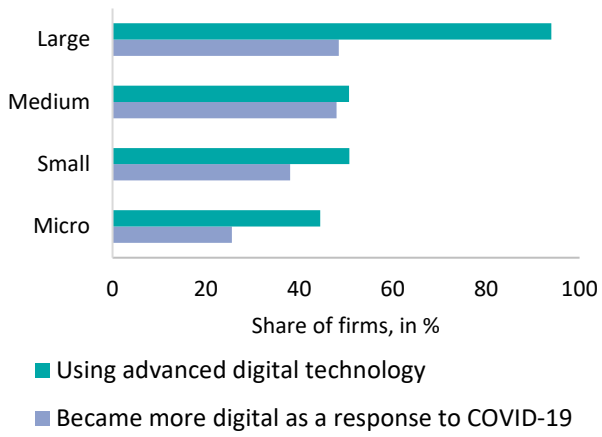
Source: EIBIS 2022.

Latvia (LV)

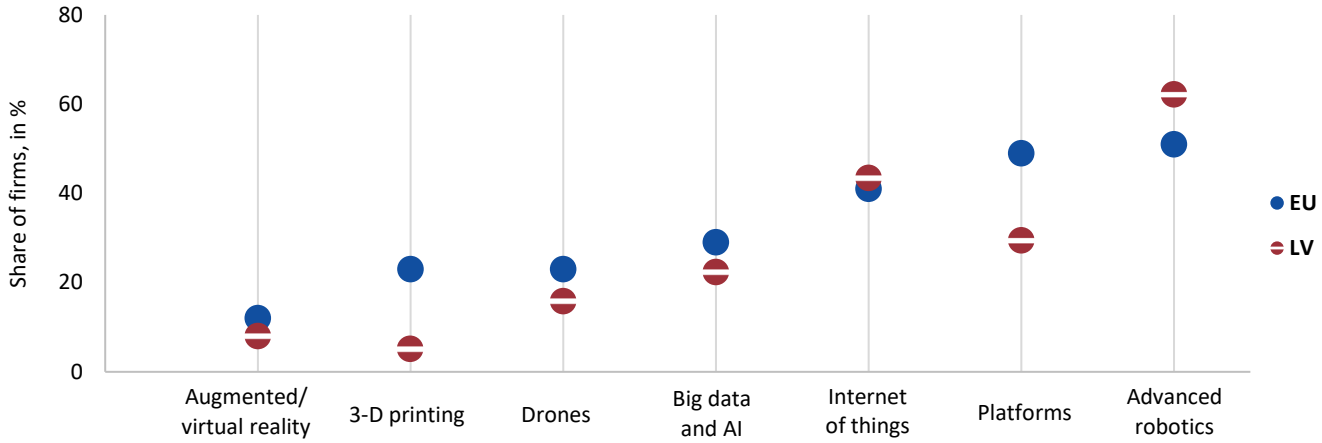
Digital adoption in firms



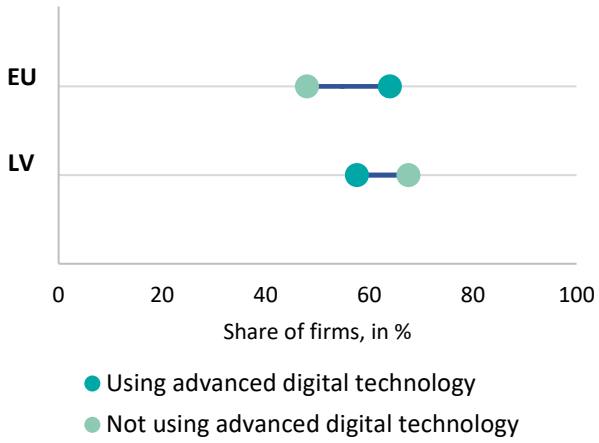
Digital adoption by firm size in LV



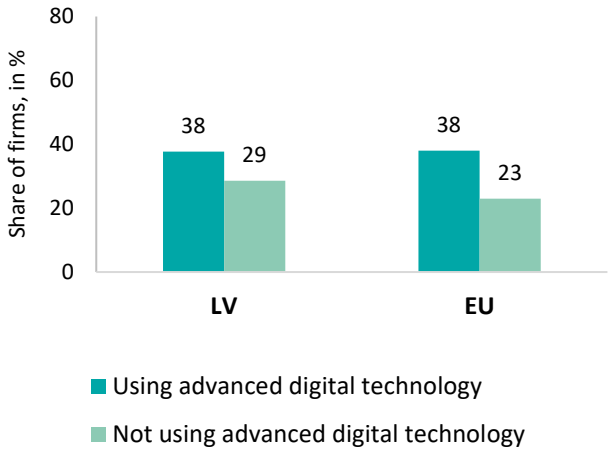
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



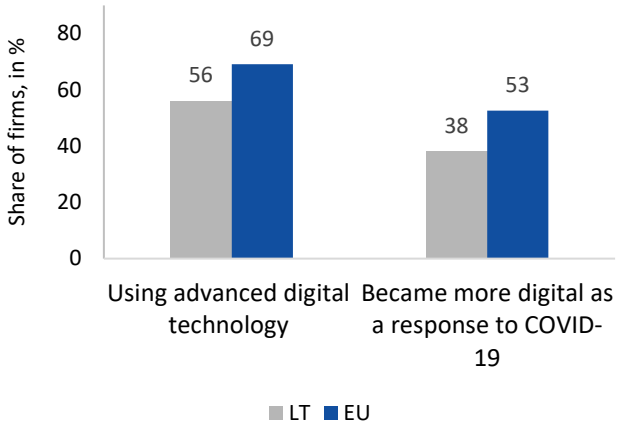
Firms taking action to protect against physical climate risks



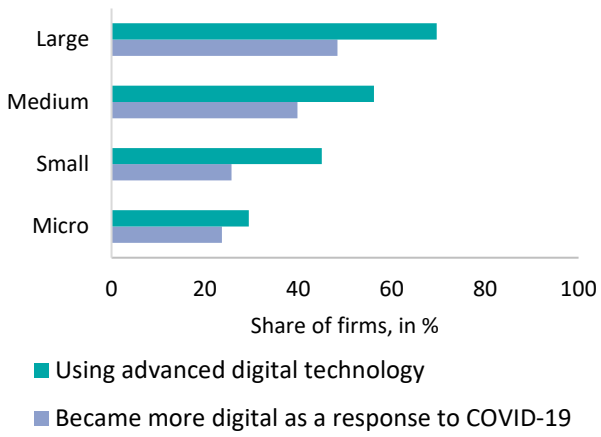
Source: EIBIS 2022.

Lithuania (LT)

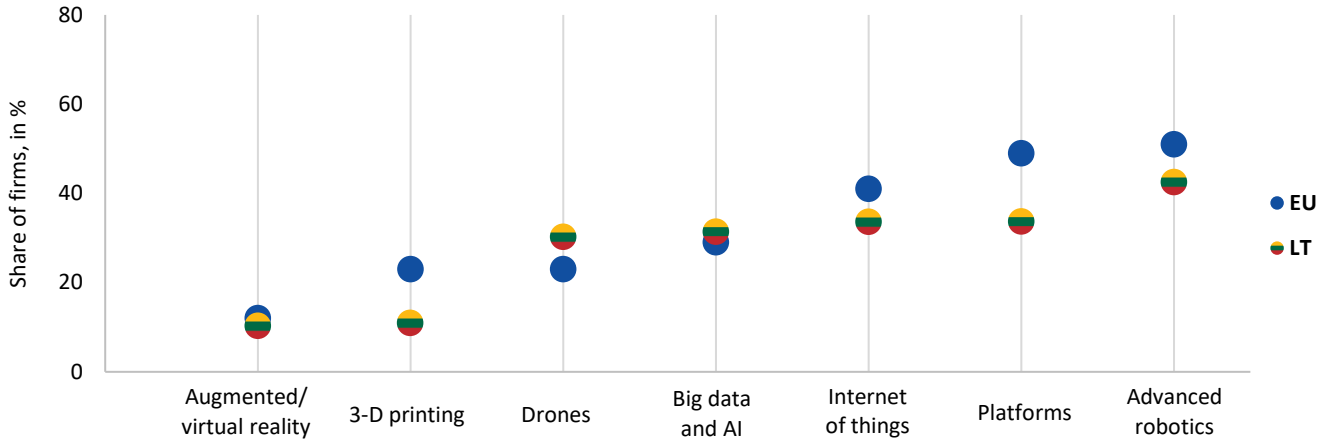
Digital adoption in firms



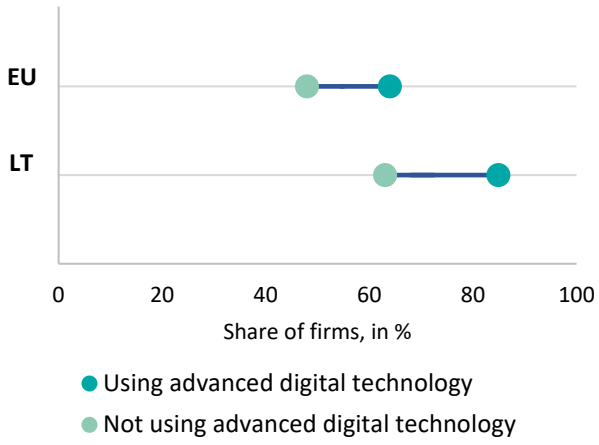
Digital adoption by firm size in LT



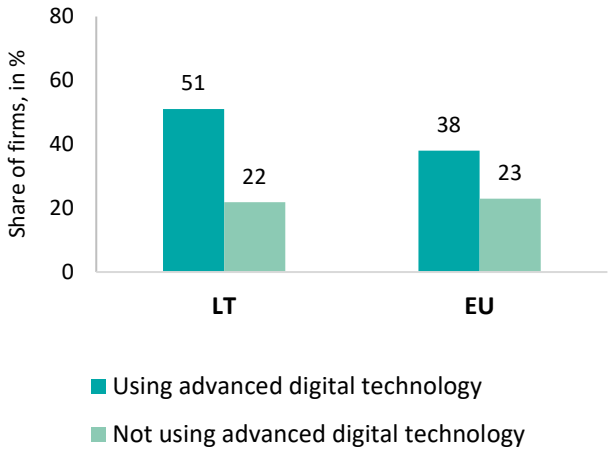
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



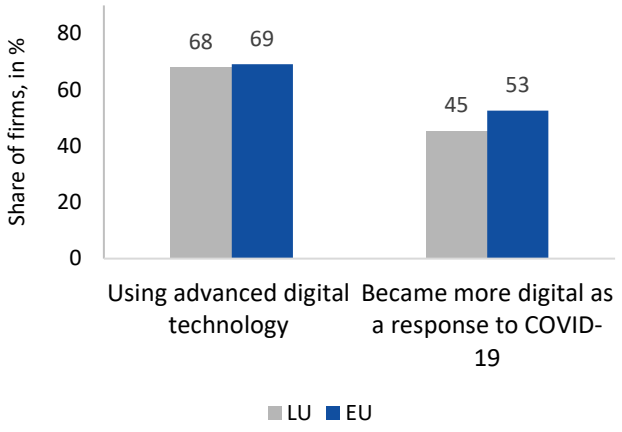
Firms taking action to protect against physical climate risks



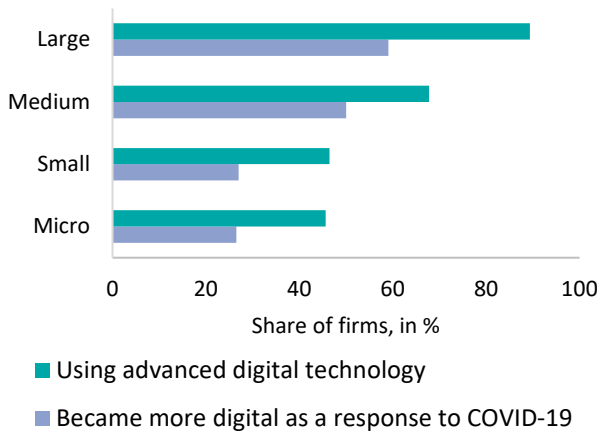
Source: EIBIS 2022.

Luxembourg (LU)

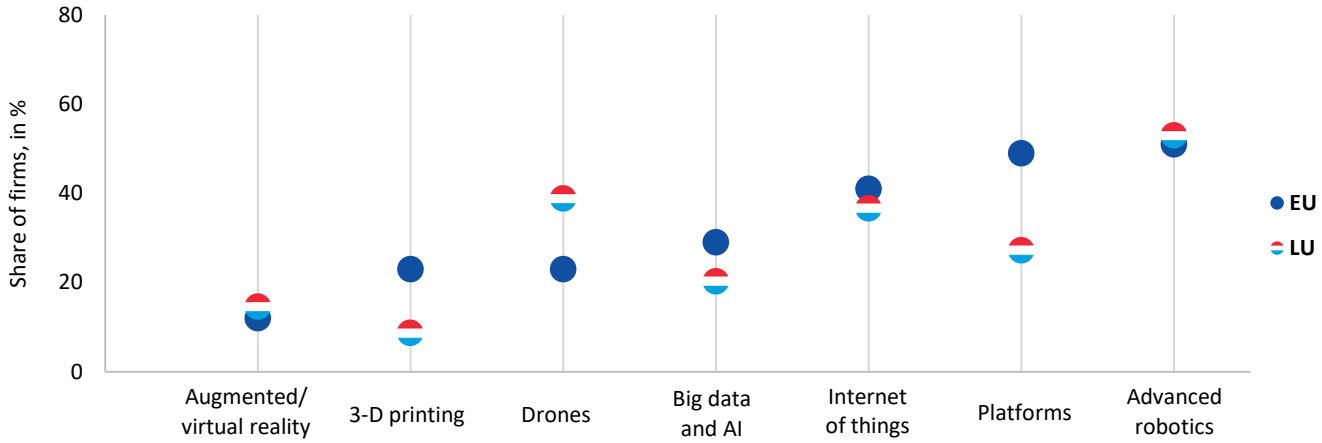
Digital adoption in firms



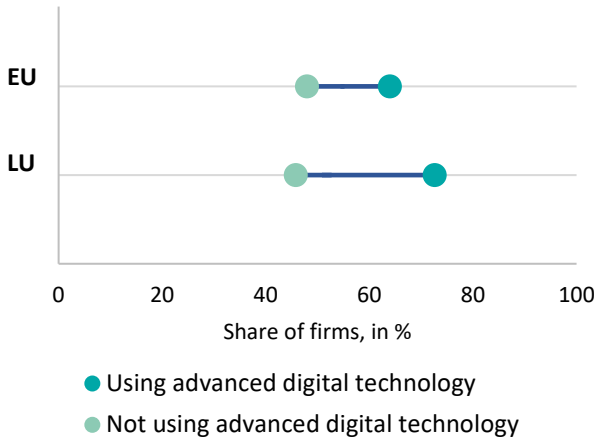
Digital adoption by firm size in LU



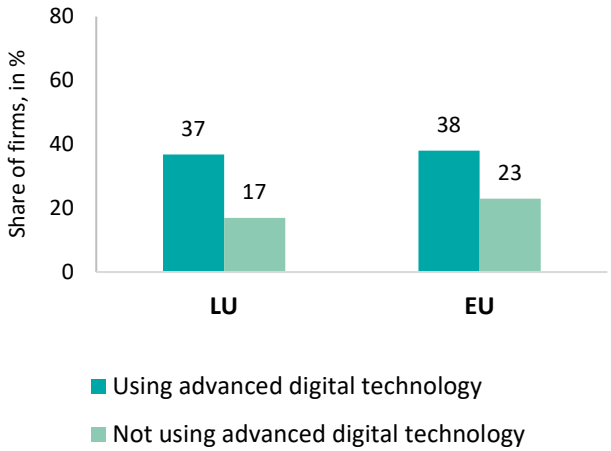
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



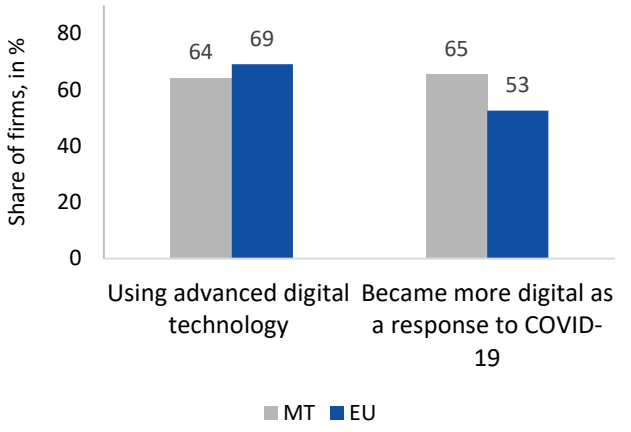
Firms taking action to protect against physical climate risks



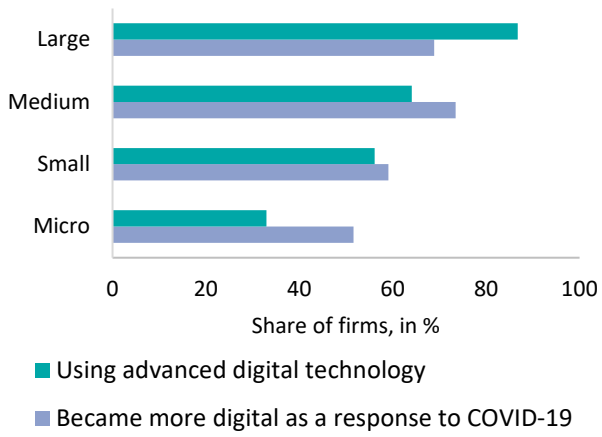
Source: EIBIS 2022.

Malta (MT)

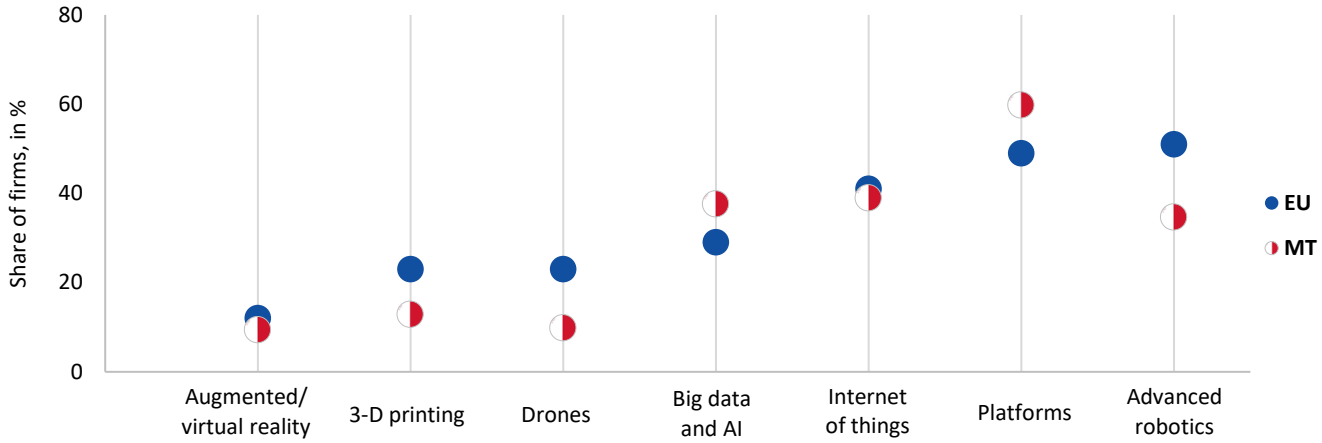
Digital adoption in firms



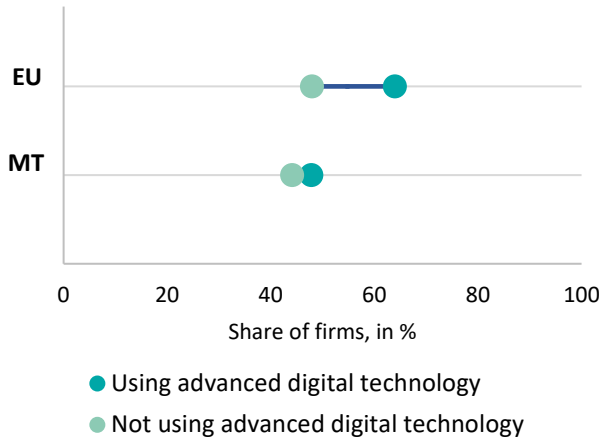
Digital adoption by firm size in MT



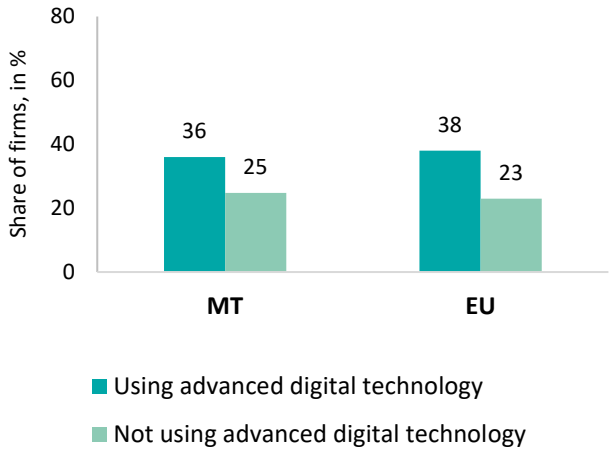
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



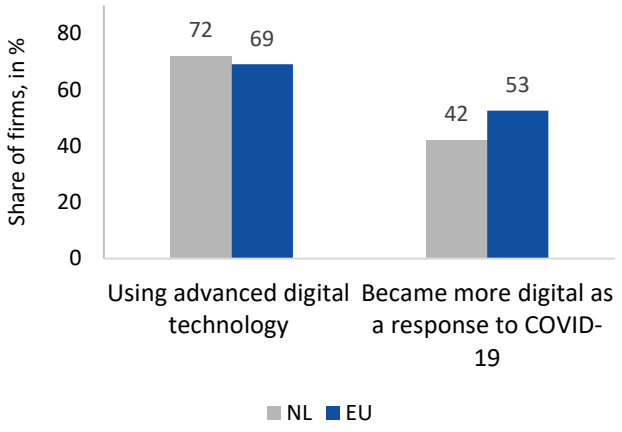
Firms taking action to protect against physical climate risks



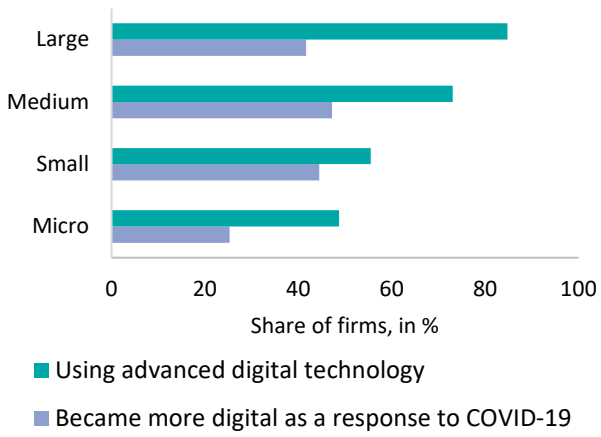
Source: EIBIS 2022.

Netherlands (NL)

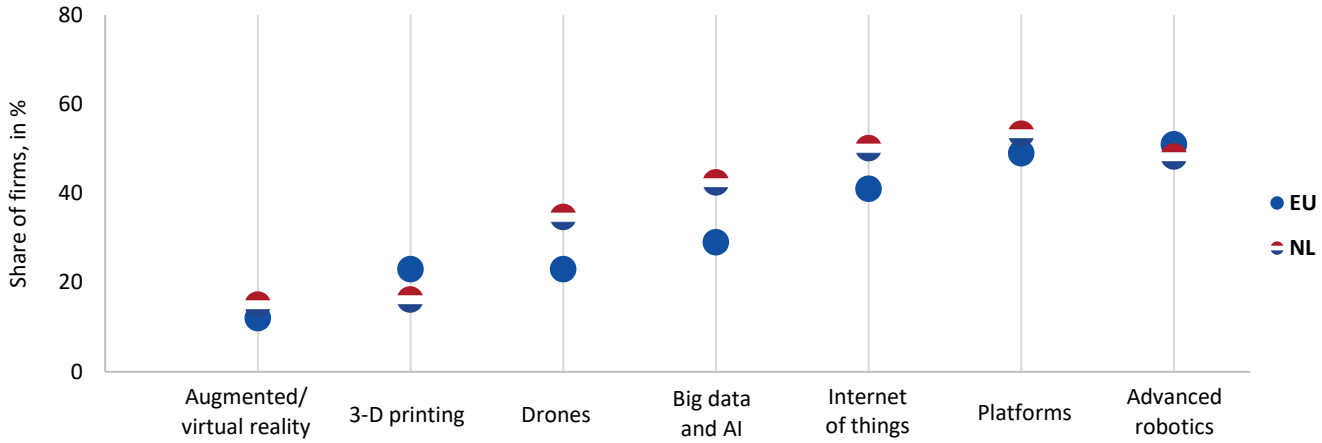
Digital adoption in firms



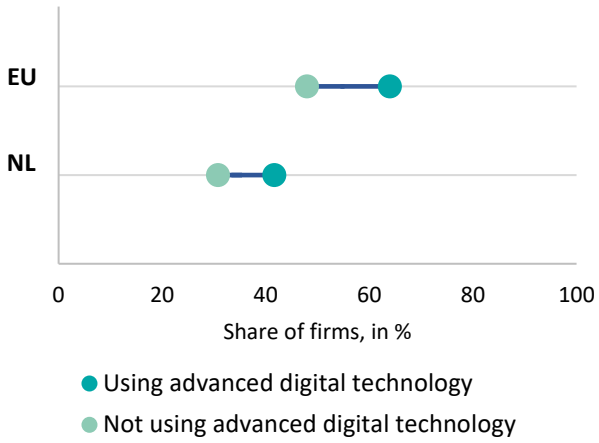
Digital adoption by firm size in NL



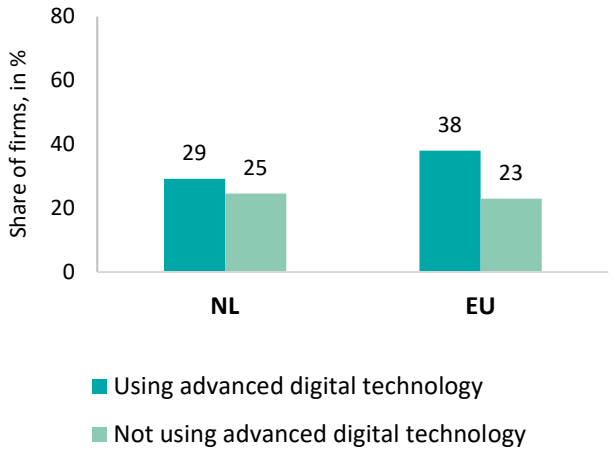
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



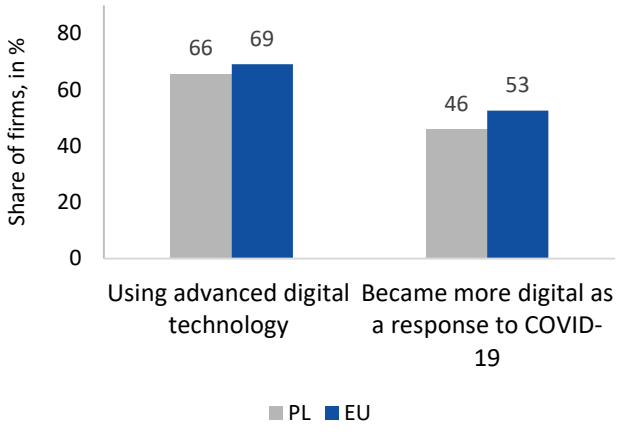
Firms taking action to protect against physical climate risks



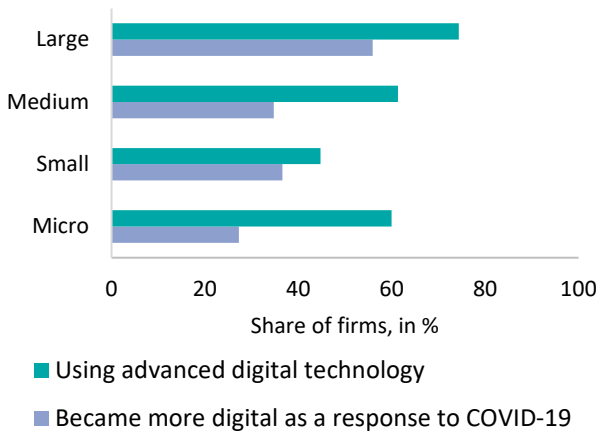
Source: EIBIS 2022.

Poland (PL)

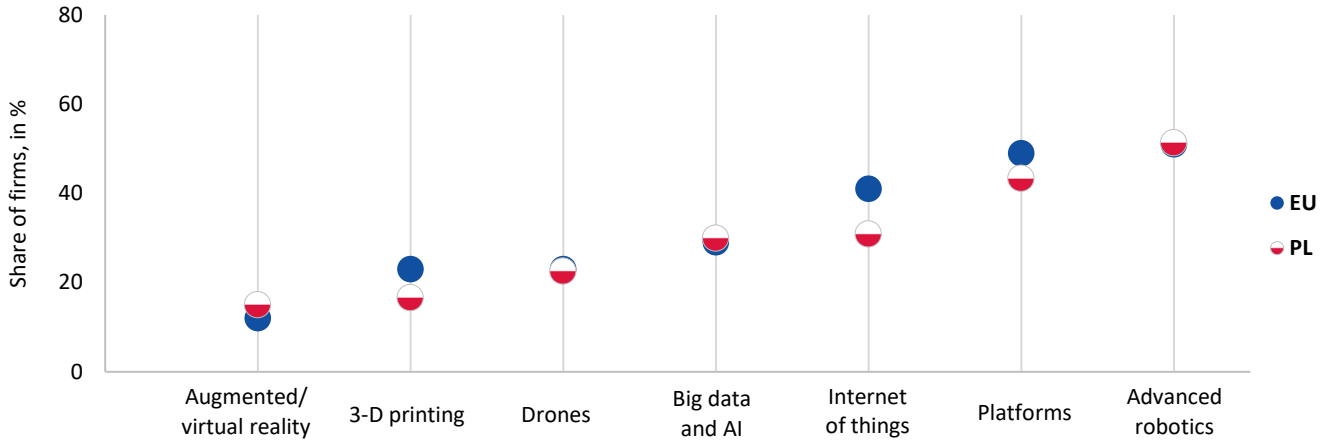
Digital adoption in firms



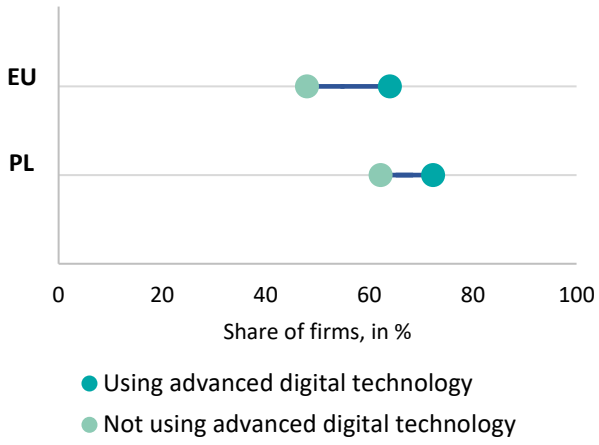
Digital adoption by firm size in PL



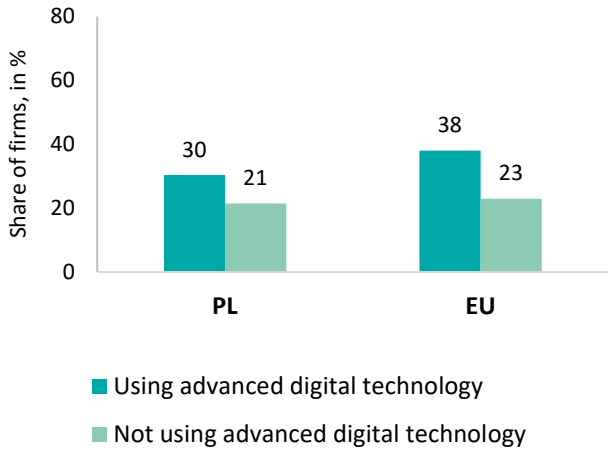
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



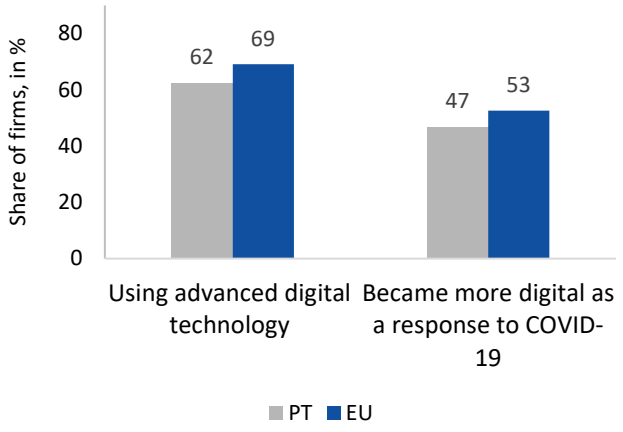
Firms taking action to protect against physical climate risks



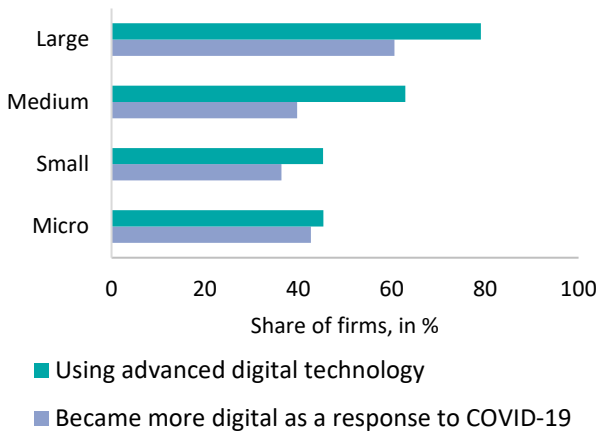
Source: EIBIS 2022.

Portugal (PT)

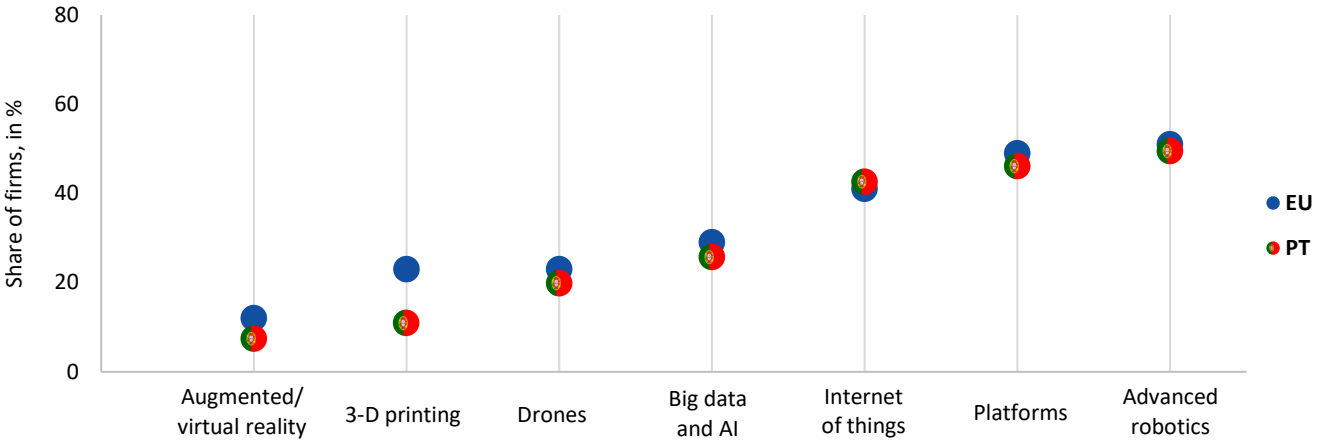
Digital adoption in firms



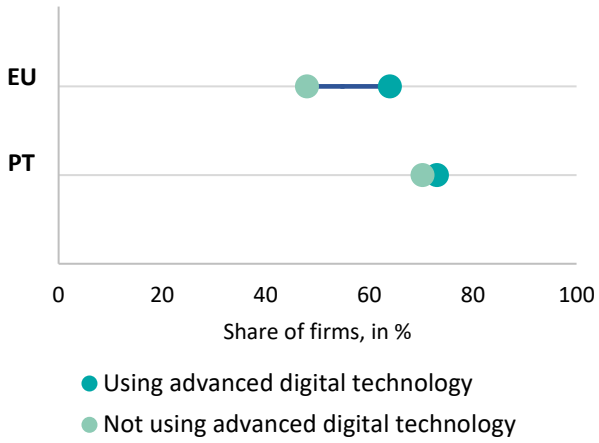
Digital adoption by firm size in PT



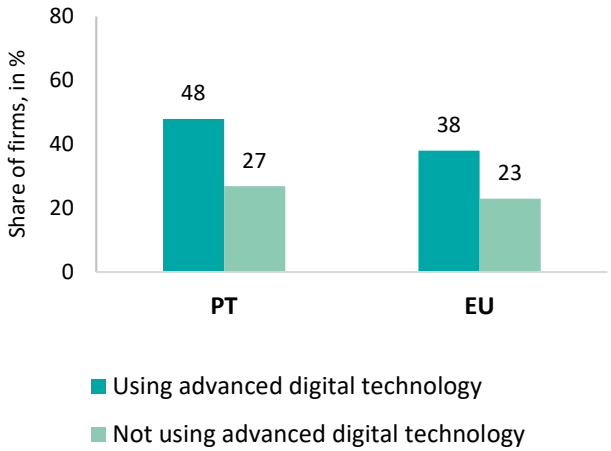
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



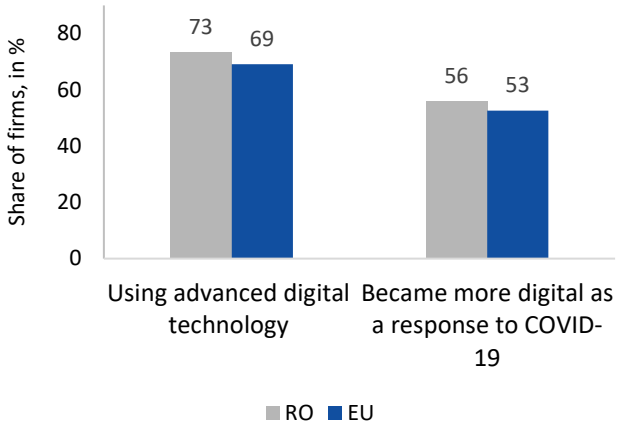
Firms taking action to protect against physical climate risks



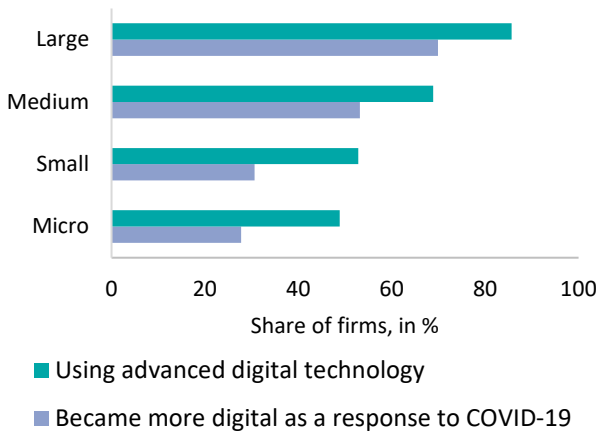
Source: EIBIS 2022.

Romania (RO)

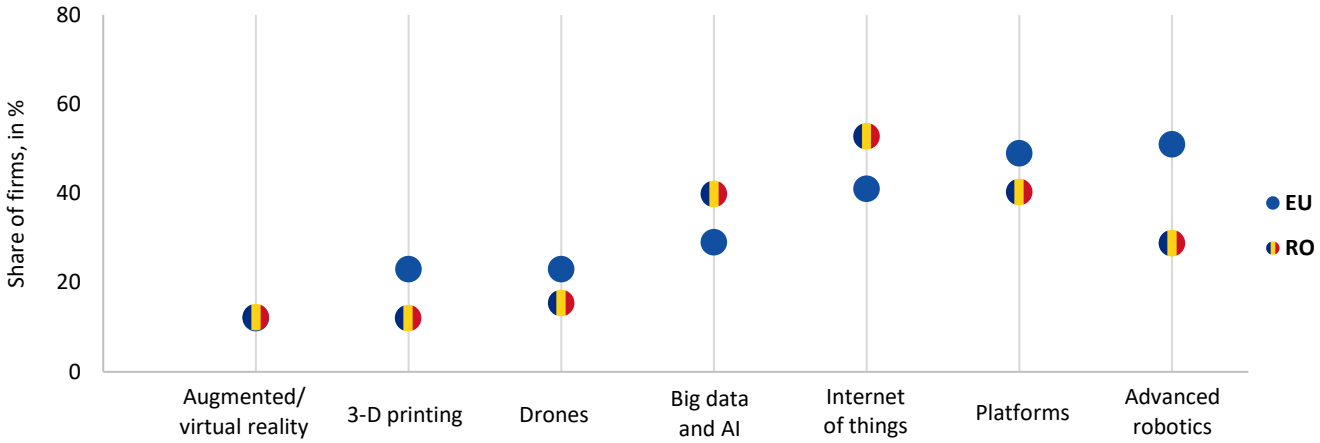
Digital adoption in firms



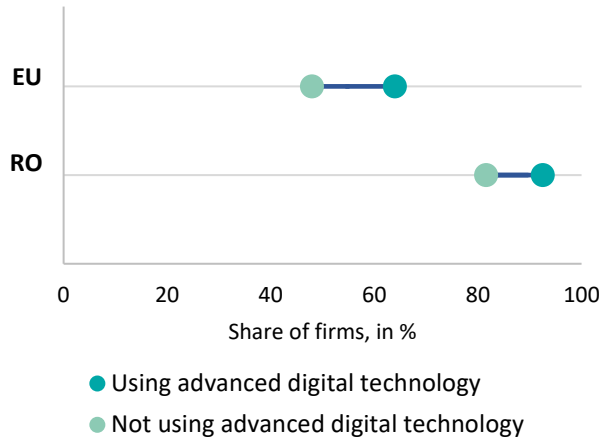
Digital adoption by firm size in RO



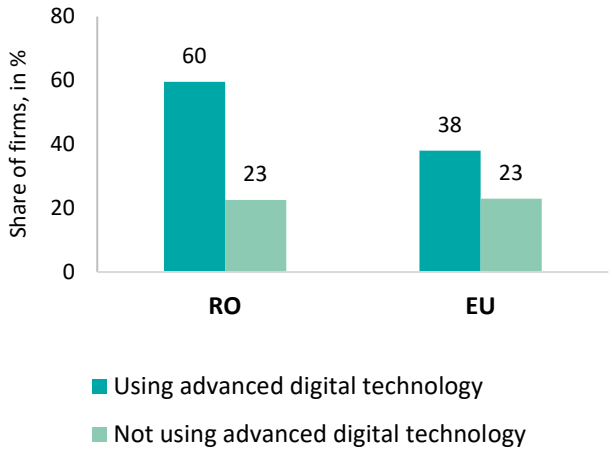
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



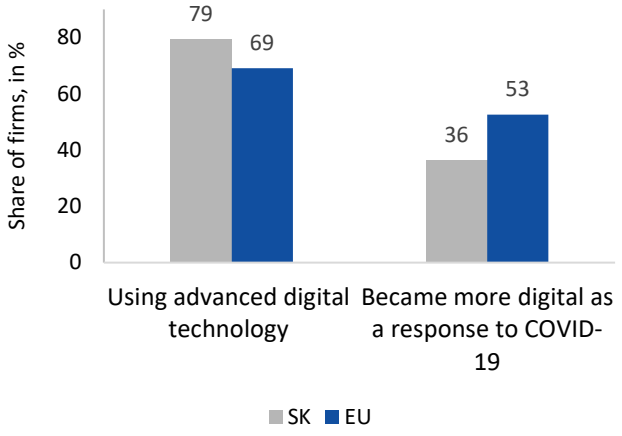
Firms taking action to protect against physical climate risks



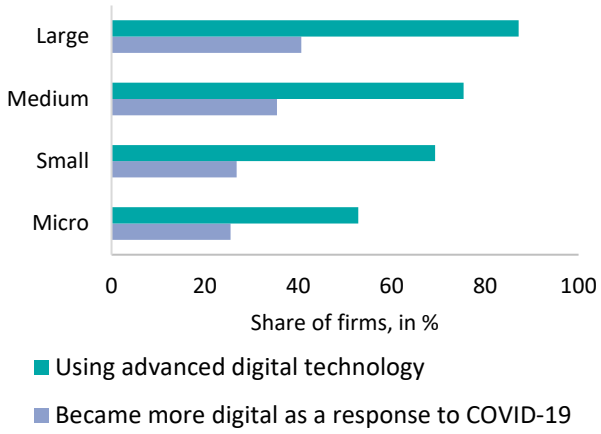
Source: EIBIS 2022.

Slovakia (SK)

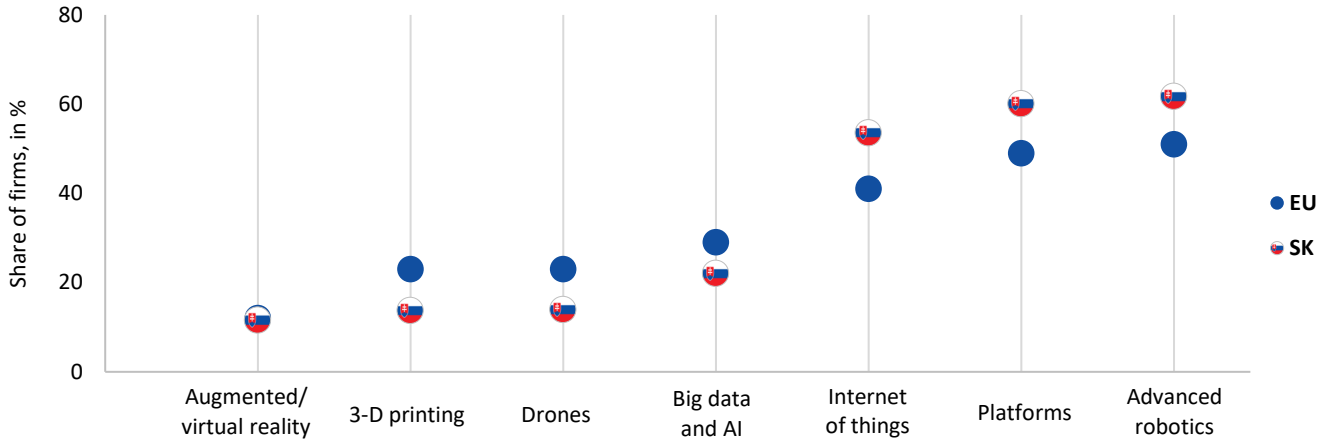
Digital adoption in firms



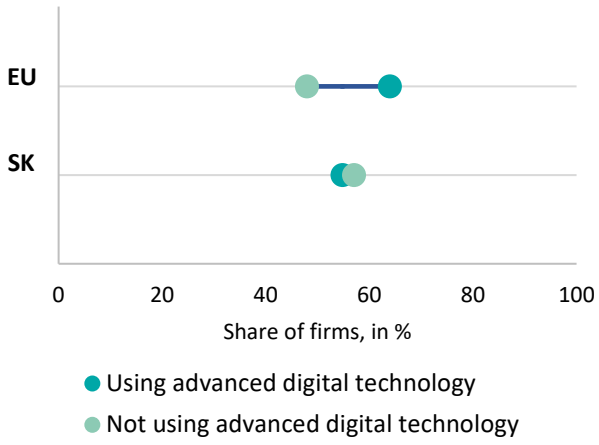
Digital adoption by firm size in SK



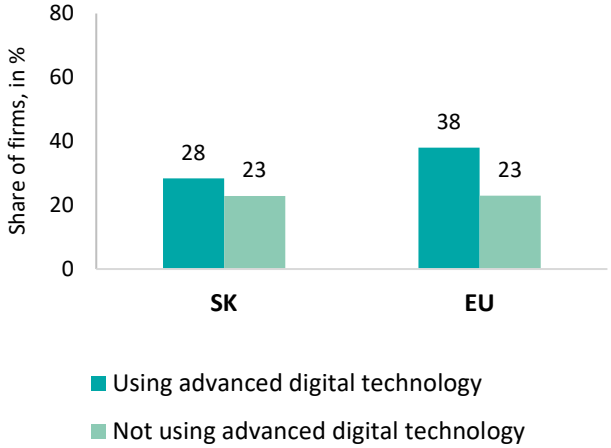
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



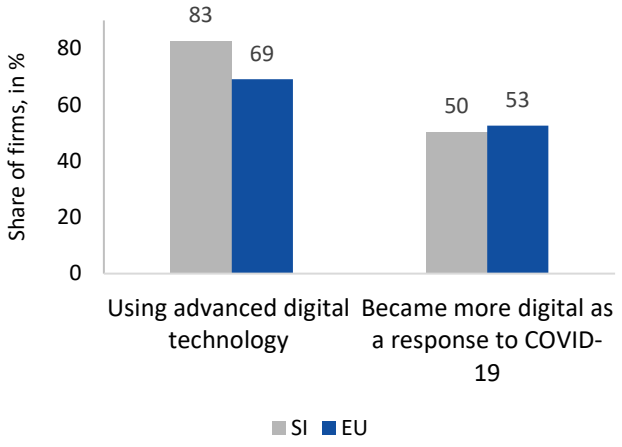
Firms taking action to protect against physical climate risks



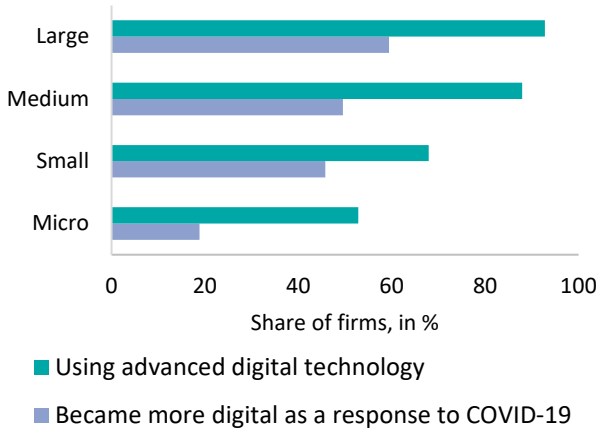
Source: EIBIS 2022.

Slovenia (SI)

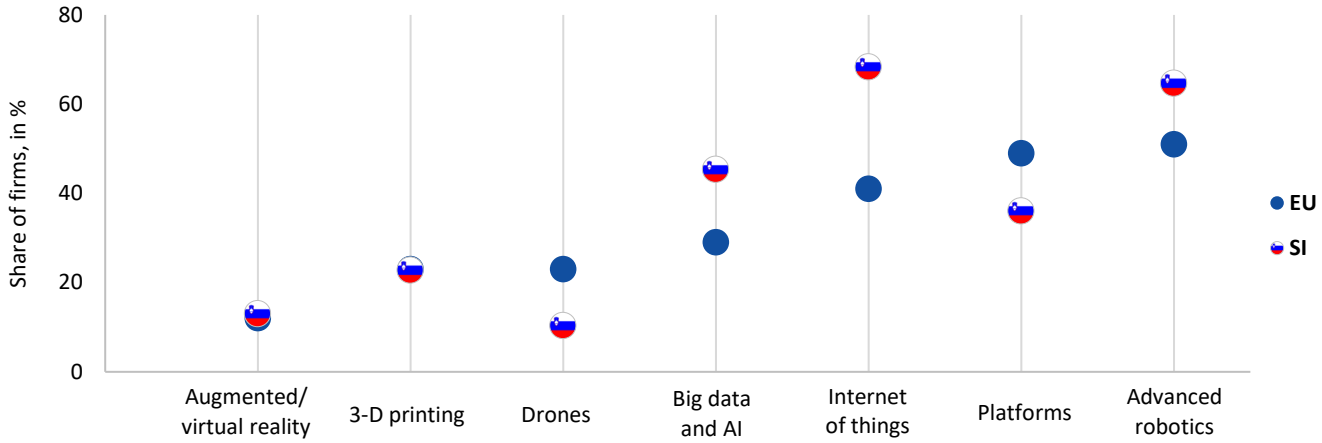
Digital adoption in firms



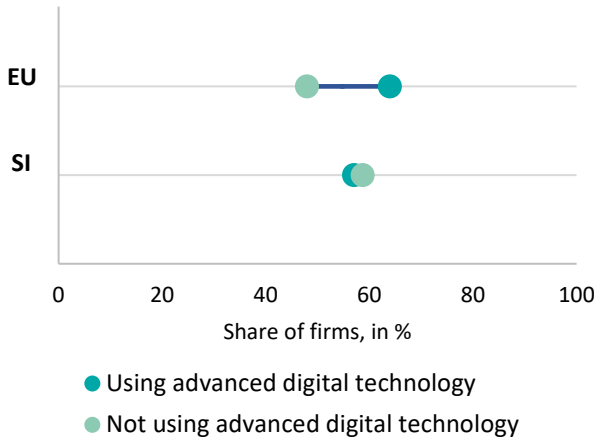
Digital adoption by firm size in SI



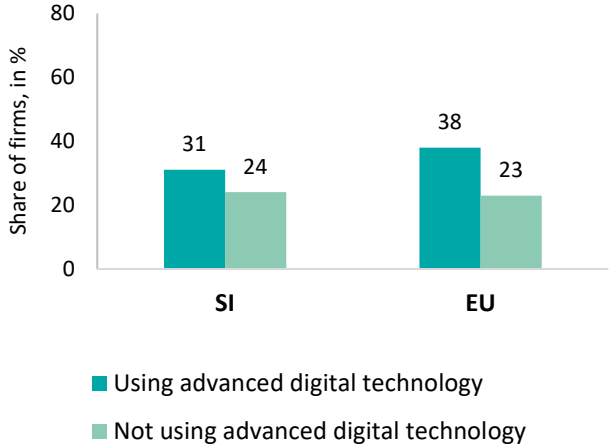
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



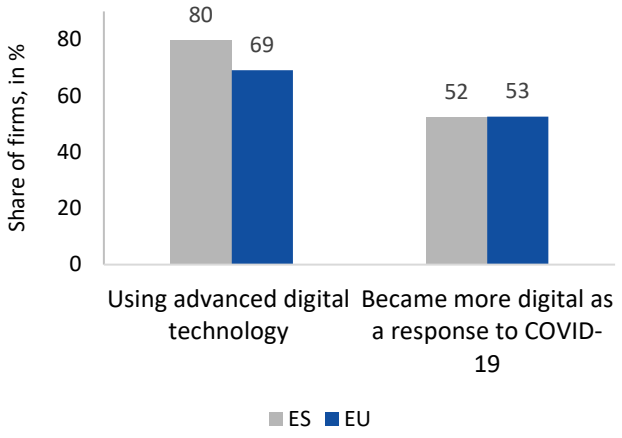
Firms taking action to protect against physical climate risks



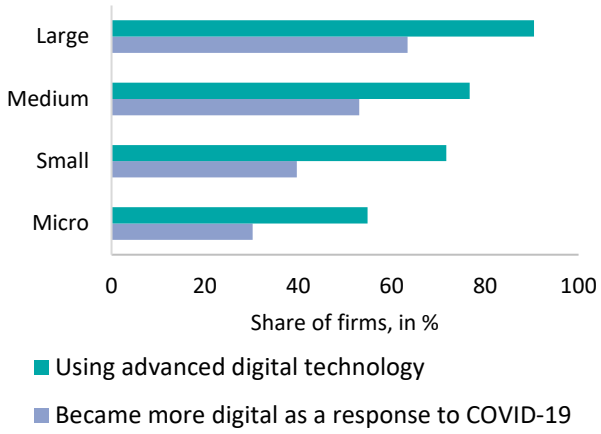
Source: EIBIS 2022.

Spain (ES)

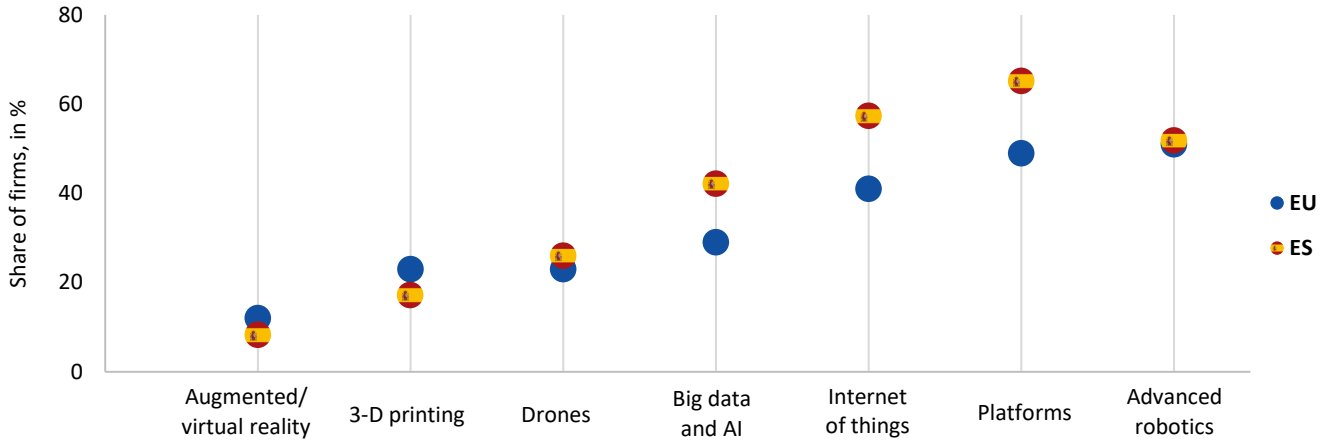
Digital adoption in firms



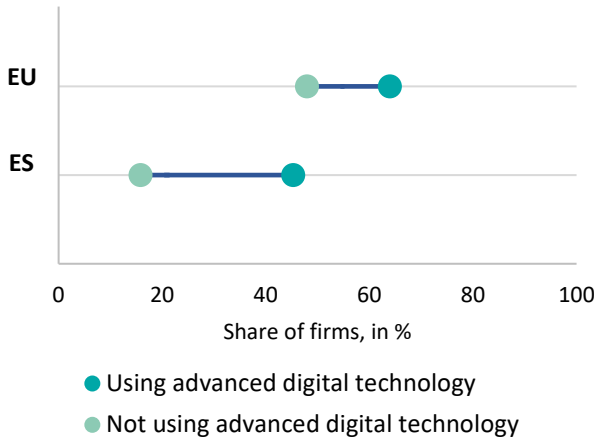
Digital adoption by firm size in ES



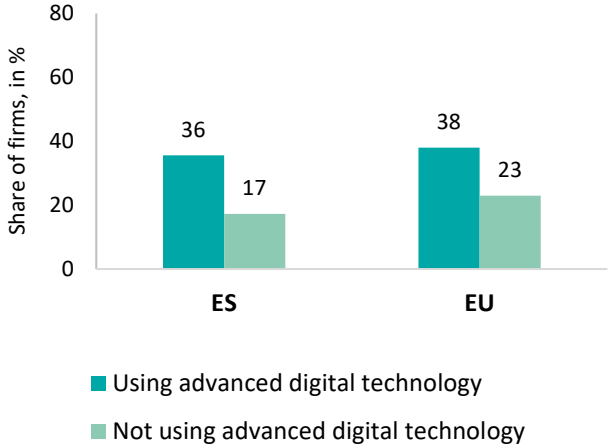
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



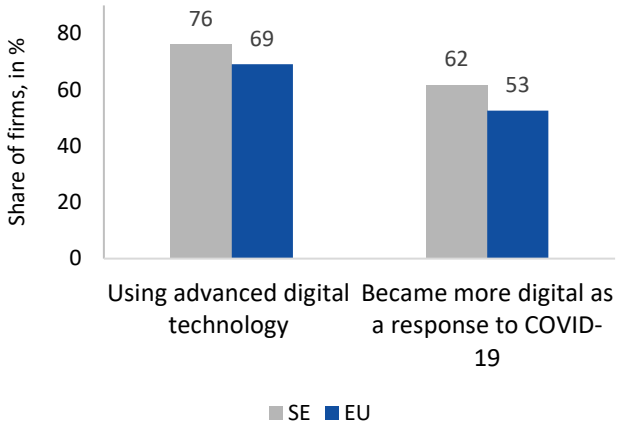
Firms taking action to protect against physical climate risks



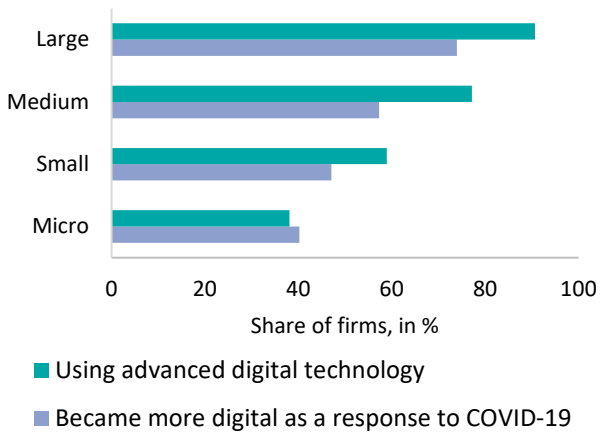
Source: EIBIS 2022.

Sweden (SE)

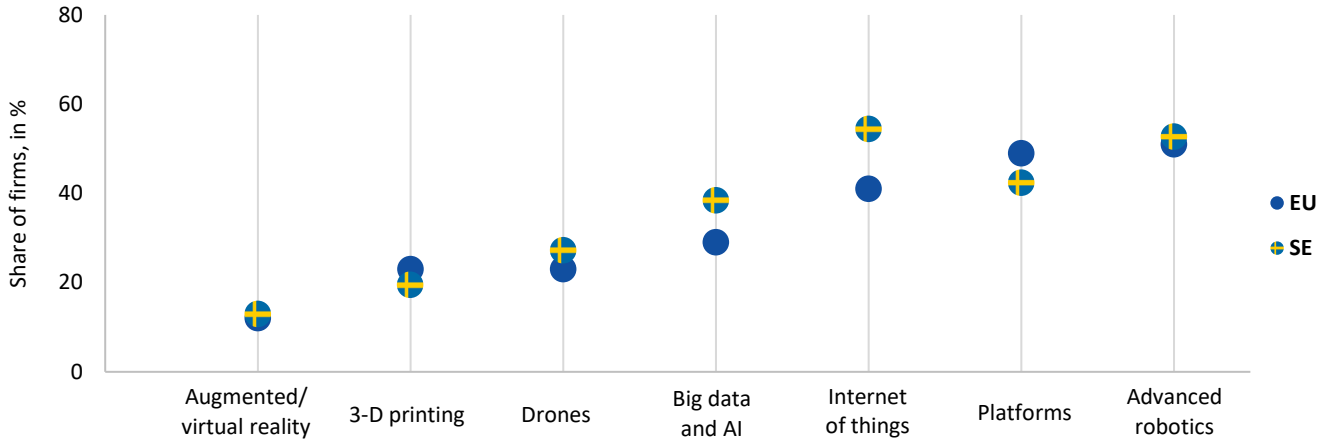
Digital adoption in firms



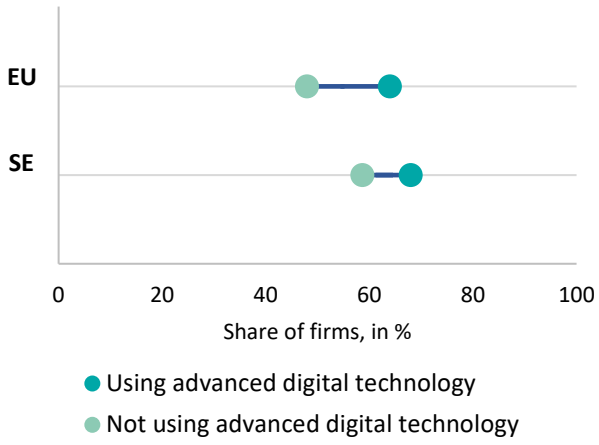
Digital adoption by firm size in SE



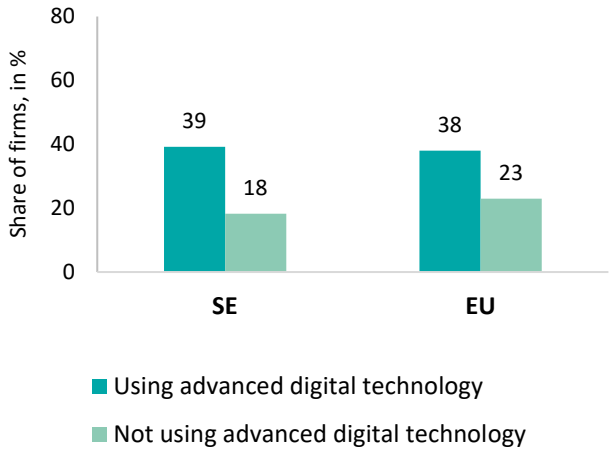
Use of advanced digital technology in firms, by technology type



Traders taking action to protect against trade shocks



Firms taking action to protect against physical climate risks



Source: EIBIS 2022.

Appendix A: The EIBIS Corporate Digitalisation Index

The EIBIS Corporate Digitalisation Index is based on firm-level data provided by the EIB Investment Survey (EIBIS) in 2022. It consists of six components: adoption of advanced digital technologies, digital infrastructure, investment in software and data, investment in training, use of a strategic monitoring system and uptake of digitalisation during COVID-19.

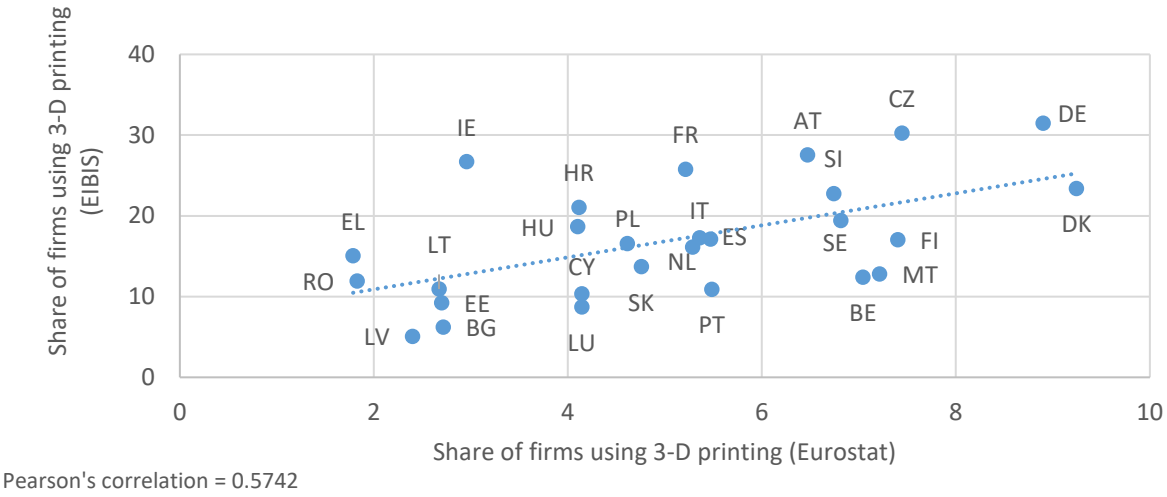
Advanced digital technology adoption is based on the question highlighted in Box 1. Digital infrastructure is based on a question asking firms whether access to digital infrastructure is an obstacle to investment. Investment in software and data is measured as a percentage of total investment in the previous fiscal year. Investment in training is based on firms' investment in employee training. The strategic monitoring system component is based on a question asking whether the firm uses a formal strategic business monitoring system or not. The uptake of digitalisation during COVID-19 is based on a question asking whether firms invested in becoming more digital as a response to COVID-19.

The six components of the EIBIS Corporate Digitalisation Index are aggregated at the country level and given the following weights: 0.3 to advanced digital technology adoption, 0.2 to digital infrastructure and digital uptake during COVID-19 and 0.1 to the other three components. The final scores for each country are divided by the score of Finland, the top-performing country (whose value of the index is equal to 100).

Appendix B: Comparing the EIBIS to other data sources

Data on digital technologies in the EIBIS and the different components of the EIBIS Corporate Digitalisation Index are highly correlated across countries with data from external sources, such as Eurostat or the different components of the European Commission's Digital Economy and Society Index (DESI).

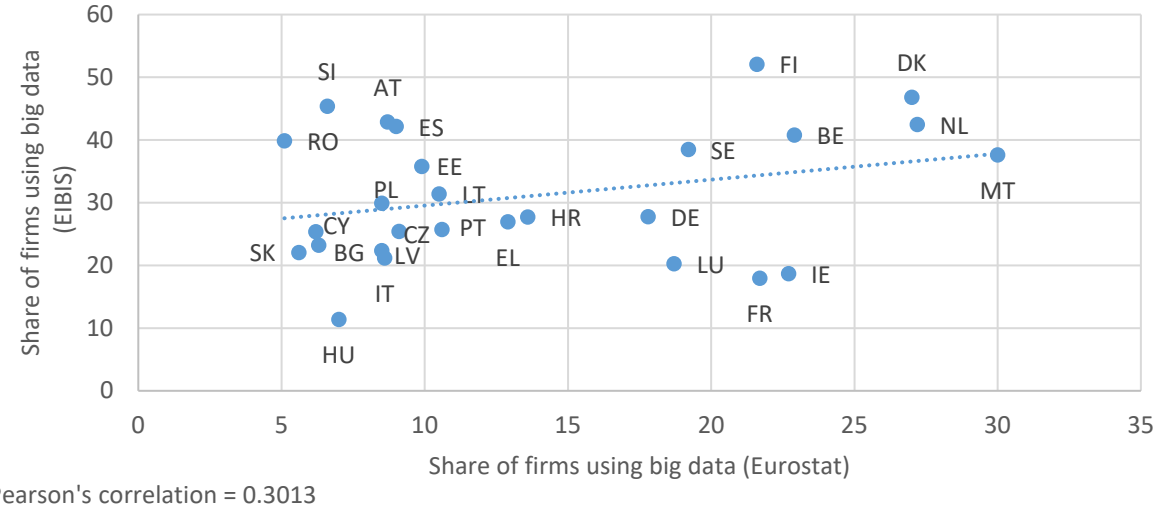
Share of firms using 3-D printing according to Eurostat and EIBIS (in %)**, by country**



Pearson's correlation = 0.5742

Source: Eurostat 2020 and EIBIS 2022. *Note:* Eurostat data for Greece were only available for 2018.

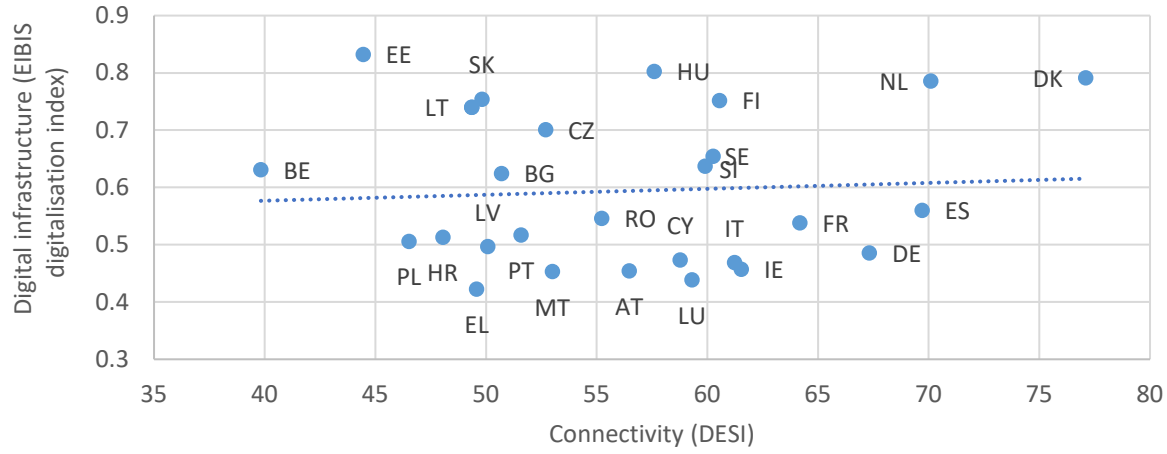
Share of firms using big data according to Eurostat and EIBIS (in %)**, by country**



Pearson's correlation = 0.3013

Source: Eurostat 2020 and EIBIS 2022.

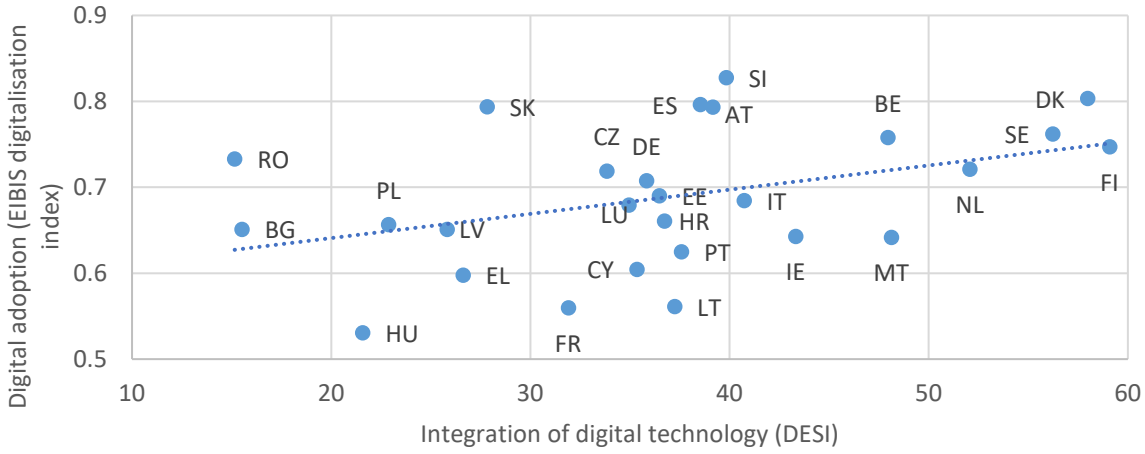
Component on connectivity (DESI) and component on digital infrastructure (EIBIS Corporate Digitalisation Index), by country



Pearson's correlation = 0.067

Source: European Commission's Digital Economy and Society Index (DESI) and EIBIS 2022.

Component on integration of digital technology (DESI) and component on implementation of advanced digital technologies (EIBIS Corporate Digitalisation Index), by country



Pearson's correlation = 0.4085

Source: European Commission's Digital Economy and Society Index (DESI) and EIBIS 2022.

Digitalisation in Europe 2022–2023

Evidence from the EIB Investment Survey

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