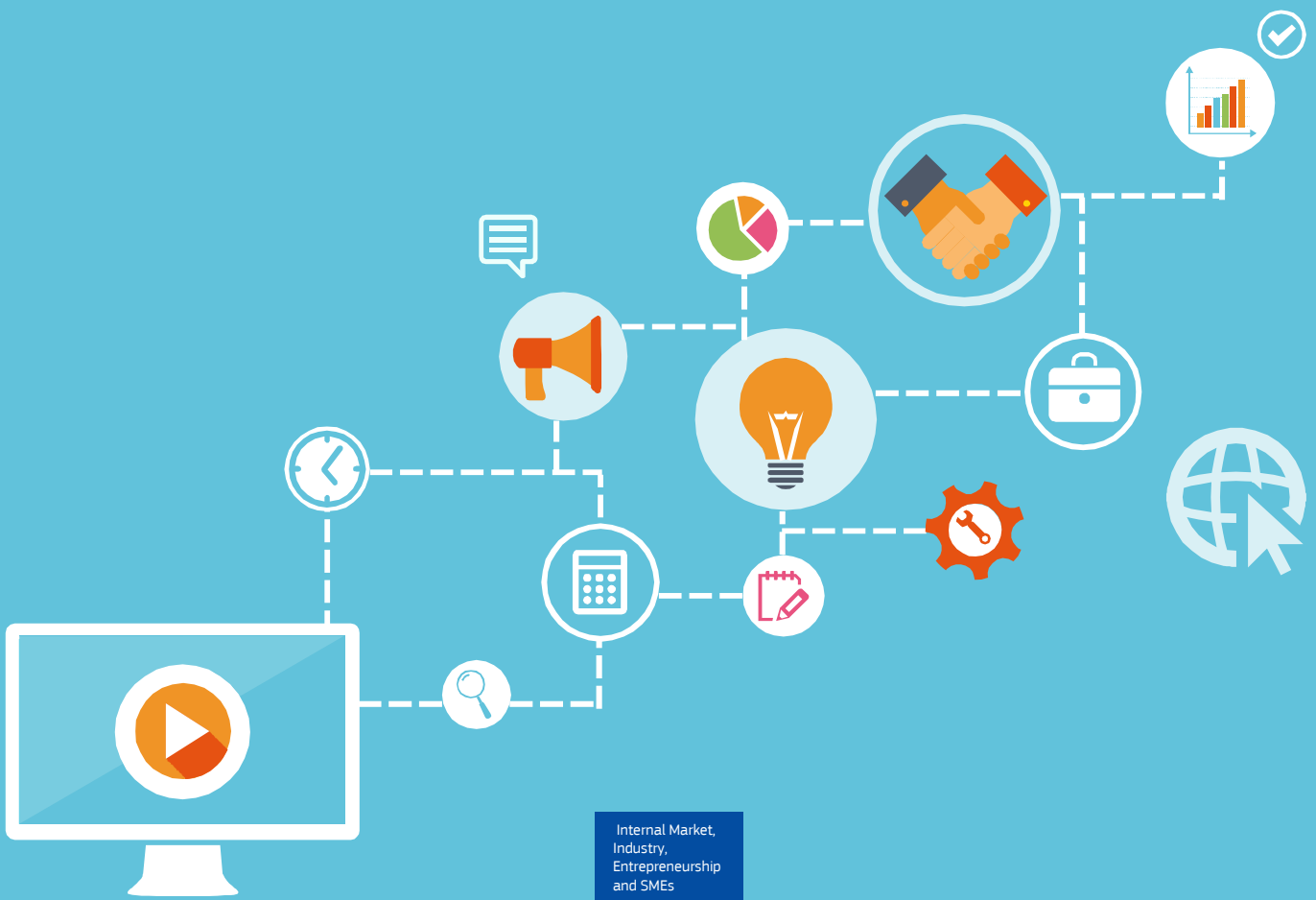




Digital Transformation Scoreboard 2017: Evidence of positive outcomes and current opportunities for EU businesses

January 2017



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About the Digital Transformation Monitor

The Digital Transformation Scoreboard is part of the Digital Transformation Monitor (DTM). The DTM aims to foster the knowledge base on the state of play and evolution of digital transformation in Europe. The site provides a monitoring mechanism to examine key trends in digital transformation. It offers a unique insight into statistics and initiatives to support digital transformation, as well as reports on key industrial and technological opportunities, challenges and policy initiatives related to digital transformation.

Web page: <https://ec.europa.eu/growth/tools-databases/dem/>

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Foreword



Commissioner Elżbieta Bieńkowska
*Internal Market, Industry,
Entrepreneurship and SMEs
(DG GROW)*

The fourth industrial revolution driven by the uptake of advanced technologies, innovative business models and processes not only has an impact on the way we live, learn or entertain ourselves, but also influences the way industries and enterprises of all sizes reinvent their businesses, offering new value propositions, smart products and smart services, and reaching out to new clients. Releasing the full additional growth potential of a connected Digital Single Market (DSM) is estimated to unlock around €415 billion in new growth per year and completing the implementation of the DSM Strategy will remain high on the agenda in 2017. Our Start-up and Scale-up Initiative is part of the strategy to make a deeper and fairer single market, creating opportunities for consumers and businesses and, helping SMEs and start-ups to grow.

European industry and Member States are alert and intensifying efforts. More than 30 national and regional initiatives for digitising industry have been launched across Europe in recent years. With value chains increasingly distributed across Europe, further digitisation of industry brings challenges that can only be resolved through a collective EU-wide effort pulling together national initiatives.

That is why the Commission set up the European Platform of National Initiatives on Digitisation of industry, with a view to coordinate and join forces across the EU and ensure efficient and smooth articulation between the various actions to be conducted at national, regional and EU level.

No progress can be realised if it is not measured. This is why the Commission issues the Digital Transformation Scoreboard. It assesses and monitors the performance of the 28 EU Member States in the digital transformation of their industries and enterprises. It provides evidence and key insights towards a better understanding of the challenges faced by Europe's industry and enterprises in their transformation journey. The findings of the Scoreboard and more particularly the country profiles reports point out to the solutions best adapted to tackle digital challenges both at EU and national level. This is the second in a series of annual releases allowing the tracking of progress on this critically important issue.

Ambition, vision and coordinated action is needed to confirm Europe's industrial leadership and social welfare. This Digital Transformation Scoreboard serves as a clearinghouse of information to support the work that is now underway to develop operational plans and boost investments to accelerate the transformation of European industry and enterprises. This work requires close collaboration among all stakeholders, not only political and business leaders but also academia and civil society to build a resilient digital European economy spurring sustainable long-term growth and conducive to job creation in Europe.

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Digital transformation: a source of business opportunities with major societal impact

- The vast majority of survey respondents have adopted a first wave of digital technologies, but the new wave of technology adoption is more challenging.
- Survey respondents largely regard digital as an opportunity; however, investment in digital technologies remains limited.
- Technology adopters among the survey respondents benefit from positive results in productivity gains and annual turnover.
- EU companies are using digital technologies to enhance particular business functions rather than to disrupt or radically transform their businesses.
- The digital-skills gap is hampering the acceleration of digital adoption in Europe, and survey respondents do not consider reskilling strategies to be a priority.
- Digital adoption mainly enables survey respondents to keep their employee numbers stable. Among survey participants, the number of jobs created surpassed the number of jobs destroyed.

Digital transformation of European industry

- Considerable disparities prevail when it comes to the specific digital technologies adopted by industry.
- The motivation behind digital adoption also differs, even if the key aims across industries remain to better engage with customers and to be more competitive.
- About one in three EU companies in the three investigated industries do not have the necessary skills to exploit digital technologies.
- Almost half of European businesses in these industries have not yet implemented strategies to reskill their workforce.

EU technology landscape

- The EU's technology landscape is heterogeneous.
- **Technology adoption is driven by large businesses.**
- The top two technologies adopted that had a positive impact are mobile services and social media, followed by cloud technology and robotic and automated machinery.
- Mobile services and social media also top the list of the most adopted key digital technologies.

Digital Technology Integration Index (DTII)

Belgium, Denmark, Finland, Ireland, the Netherlands and Sweden are leading the way in terms of digital technology integration.

There are high disparities between EU Member States as regards digital transformation performance.

At the bottom of the scale, **Bulgaria, Greece, Hungary, Latvia, Poland and Romania are lagging behind.**

The correlation between EU Member States' performance in terms of "changes in ICT start-ups" and performance in the Digital Technology Integration Index enables the classification of EU Member States into the following four categories:

- Today's leaders;
- Rising stars;
- Established ICT environment; and
- Unrealised potential.

Geographic clustering of EU digital transformation enabling environments

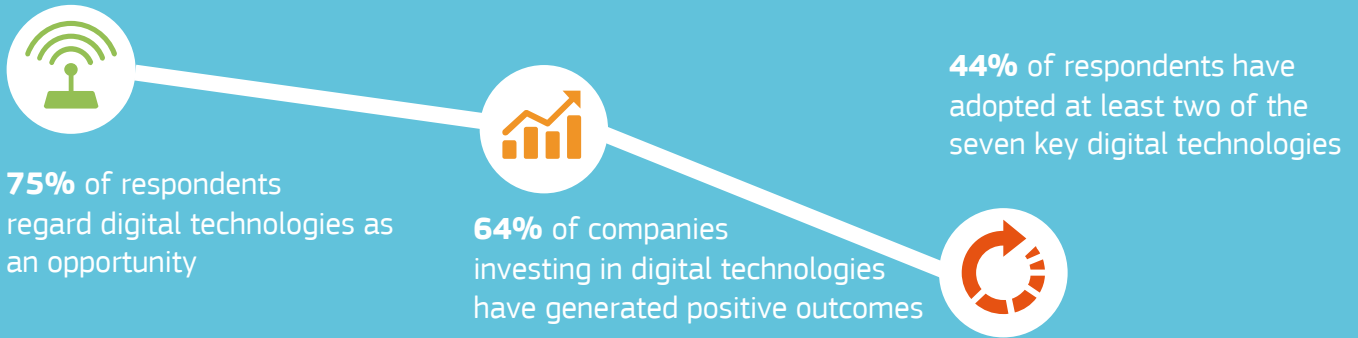
The clustering analysis of Member States based on the performance of their enabling conditions with respect to the EU-28 index average indicates that **mostly Nordic and north-western Member States benefit from the allocation of the best framework conditions** in terms of infrastructure, investment, skills, e-leadership and entrepreneurial culture. The analysis has helped define the following four principal groups of Member States based on their enabling conditions:

- **Best enabling environment:** Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands and Sweden
- **Good enabling environment:** Austria, France, Ireland, Malta, Spain and the UK
- **Moderate enabling environment:** Cyprus, the Czech Republic, Estonia, Italy, Lithuania, Portugal, Slovakia and Slovenia
- **Modest enabling environment:** Bulgaria, Croatia, Greece, Hungary, Latvia, Poland and Romania

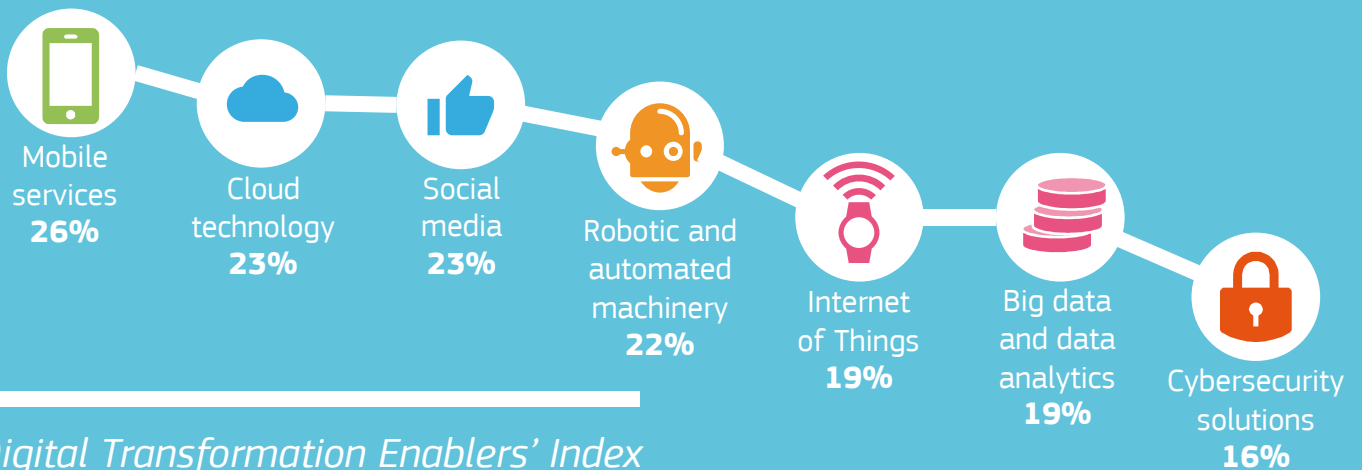
The more powerful the enablers are, the better a Member State's digital transformation is.

- A comparative analysis of Member States according to their rank in terms of digital technology integration as a function of their rank in the Digital Transformation Enablers' Index (DTEI) indicates that in general, **the higher a Member State ranks in the DTEI, the higher it is likely to rank in the DTII.** This result provides an insight into the positive relationship between digital transformation and the set of enabling conditions.

A recognised yet untapped opportunity with positive outcomes



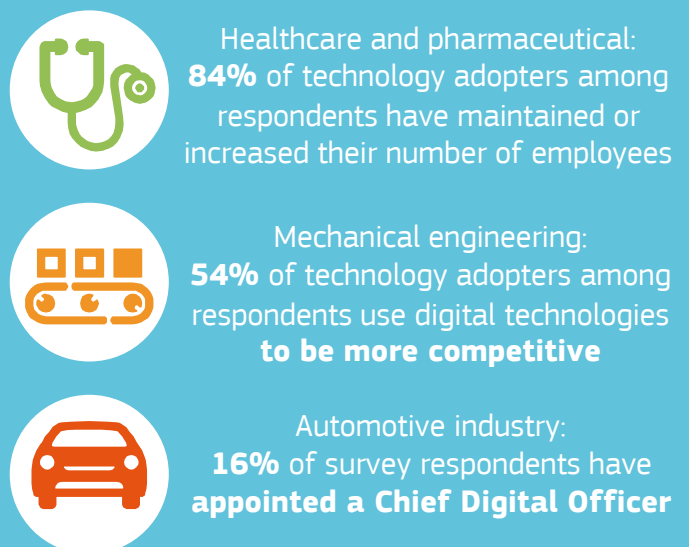
Low adoption rate of the seven key technologies in the three surveyed industries



Digital Transformation Enablers' Index



Industry characteristics



Introduction

Objectives of the scoreboard



Digital technologies have created new markets and unprecedented business opportunities. In Europe, the key challenge is to ensure that such opportunities are fully captured by industry and service companies, leveraging digitalisation to create growth and new jobs. The aim of the Digital Transformation Scoreboard 2017 is to assess to what extent this is the case and to provide evidence on the extent of digital transformation in Europe. The evidence gathered will help decision-makers at EU and national level to create policies supporting EU companies in the digital transformation processes. It will enable companies to understand why digital technologies are important and how they can create (or reinforce) their own digital strategy.

Introduction to the Digital Transformation Scoreboard (DTS)

The principal objective of the Digital Transformation Monitor (DTM) is to **monitor the transformation of existing industry and enterprises**. In particular, the scoreboard measures the changes to key indicators of digital transformation through qualitative and quantitative information from many of the non-ICT sectors, such as automotive, mechanical engineering and healthcare, where Europe occupies a leading or competitive position compared to international competitors. 2016's results are presented in this Digital Transformation Scoreboard.

General approach of the Digital Transformation Scoreboard 2017

The scoreboard is based on two main tools: the qualitative part, focusing on monitoring digital transformation based on the survey results; and the quantitative part, revolving around monitoring digital transformation based on indicators enabling us to statistically monitor progress on the enabling conditions for digital transformation.



Survey-based approach to monitoring digital transformation



Indicator-based approach to monitoring digital transformation

Content of the scoreboard

The scoreboard is divided into the following six main sections:

- 1) The **Introduction** presents in more detail the aim, content approach and scope of the scoreboard, including which industries and which technologies were considered;
- 2) Section 3, **Digital transformation: a source of business opportunities** with major societal impact, uses the survey to explore whether the three sectors identified have adopted digital technologies and what how this has impacted on their businesses;
- 3) The fourth section, **Digital transformation of the European industry**, provides an overview of the extent to which digital technologies have been adopted in Europe, by which type of company, whether one technology adoption was coupled with another one, and whether companies saw benefits in this adoption;
- 4) The overview is completed in section 5, **Technology landscape in Europe**, by the same exercise carried out for each of the seven technologies identified for the Digital Transformation Scoreboard;
- 5) In section 6, **Geographic focus**, the enabling conditions for digital transformation, as well as the outcomes, are identified. Each EU-28 Member State is ranked based on its situation regarding each of the five identified enabling conditions;
- 6) Finally, section 7, **Country profiles**, provides a country-specific description of the enabling conditions, outcomes, strengths, areas for improvement and interesting policy practices for the EU-28 Member States.

Survey-based monitoring of digital transformation

Objectives of the survey

The survey captures the most recent uptake of digital technologies and digital transformation at firm level. It measures the output dimension at firm level, and results are then aggregated and segmented at national and sectorial levels.

The target audience for the survey was companies in the automotive, mechanical engineering, healthcare and pharmaceutical sectors across the 28 EU Member States.

3 industries



Automotive

The automotive industry is one of the most digitised in Europe. At the same time, the impact of digitisation will only increase with the penetration of new and disruptive technologies. It is estimated that 30–40% of the value added in the automotive value chain will shift from traditional car manufacturers towards digital platforms¹ in the near future. The impact of this shift for European companies and employment needs to be better understood.



Healthcare and pharmaceutical

Like the automotive industry, the healthcare industry has also entered the new digital era. New technologies, such as big data and digital platforms, are bound to revolutionise the industry, with the entire patient experience currently being redefined. The large volumes of data generated through equipment and machines provide significant opportunities to develop new business models, improve and optimise services, and ultimately bring about considerable economic and social benefits. Companies conducting medical practice activities (such as hospitals and dentists) are also considered.



Mechanical engineering

As with the automotive and healthcare industries, mechanical engineering is a sector in which Europe has a leading/competitive position compared to international competitors. It is thus essential for Europe's economy. Digitisation is already having a profound impact at the core of this industry, and this impact will only increase.

826 C-level executive respondents

32 indicators at country level

28 EU Member States covered

7 key technologies



Social media

Social media has a wide-ranging impact on digital entrepreneurs, such as providing a better insight into customer behaviour and improved office productivity with internal networks. Recent trends include social media going company-wide beyond marketing and community-building functions, and a decline in email use as instant messaging becomes an office fixture, allowing for real-time communication and information sharing.



Mobile services

Mobile devices are technological advances that are transforming traditional businesses. Monitoring the use of mobile services is a prime indicator of how digital technologies influence the way in which businesses work.



Cloud technologies

The convergence of the cloud is promoting the growth of centrally coordinated applications that can be delivered to any device. Important business data, forms and other documents can now be accessed from virtually anywhere, and cloud computing is making it easier to do business, creating a more dynamic entrepreneurial culture.



Internet of Things

As mobile devices proliferate, serving the needs of the mobile user in diverse environments is now of paramount importance. Phones and wearable devices are now part of an expanded computing environment including – among others – consumer electronics and connected screens in the workplace. This network of Internet of Things (IoT) will raise management challenges for IT organisations as they lose control of user-endpoint devices.



Cybersecurity solutions

Cybersecurity has never been more essential, as companies have more digital assets than ever before and these assets are worth more than they used to. The increasingly used hybrid cloud architecture requires a more sophisticated approach to cybersecurity. The pervasive use of mobile devices by employees means that corporate IT now has to manage the security of many more devices.



Robotic and automated machinery

Robotics can disrupt business models and shift the labour/capital mix while managing societal expectations. End-user industries are rapidly adopting robots for industrial purposes to improve the quality of products and reduce manufacturing costs.



Big data and data analytics

Companies are beginning to utilise big data and data analytics to gain business insights. As analytical technologies mature, they will leverage what computers do best, while freeing decision-makers from complex data analysis to deliver “intelligence in the moment”. This “information advantage” will speed the transition from data to insight and drive better business decisions and actions, thus generating superior business results.

Indicator-based monitoring of digital transformation

The indicators developed under the Digital Transformation Monitor have been updated to provide a relevant view of the current state of play of European businesses in the field of digital transformation and digital entrepreneurship.

The statistical analysis of the indicators are aggregated through the Digital Transformation Scoreboard to provide a **comparative assessment of the factors supporting the development of digital transformation in the EU-28 Member States**. The statistics should help Member States assess the areas where they need to concentrate their efforts in order to boost their digital-transformation performance.

This statistical information is presented using a **five-category typology of ‘enablers’** that captures the principal aspects of digital transformation in the EU-28 Member States to enable countries to be ranked. The effects of digital transformation, namely the increase in ICT start-ups and the integration of digital technology, are captured through indicators in **two ‘output’ categories**.

The table below provides an overview of the enablers and outputs.

Presentation of the enablers

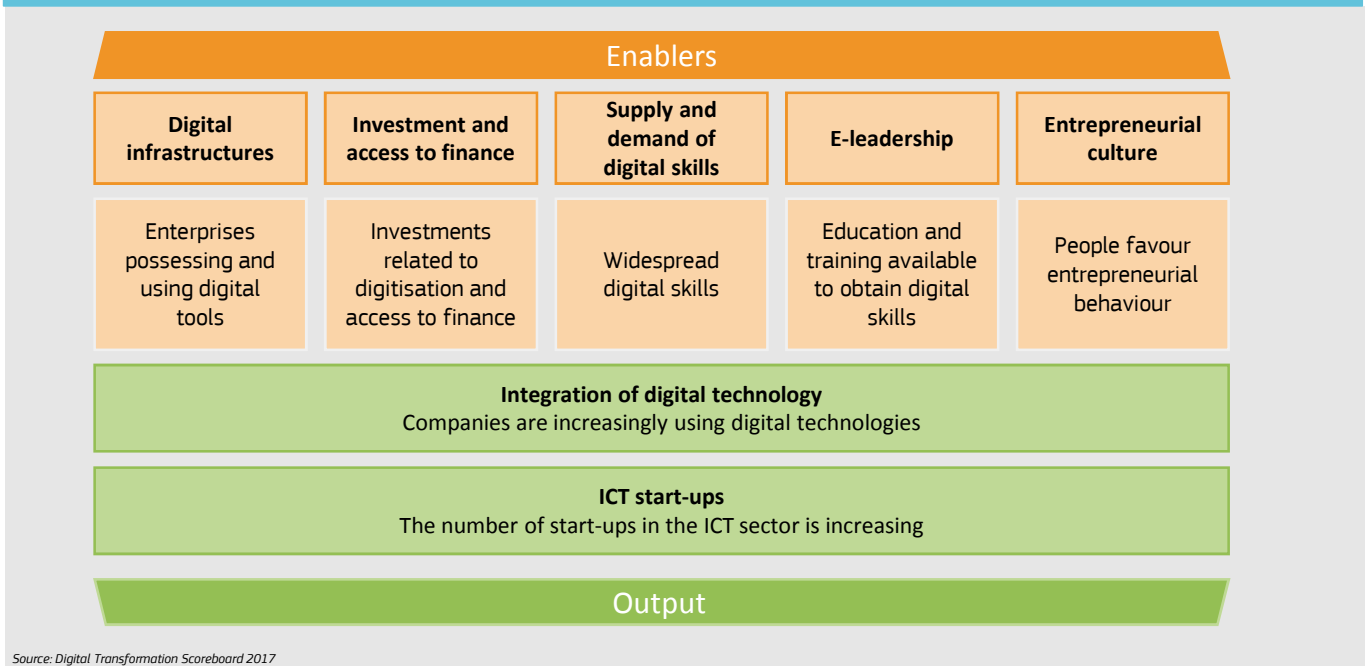
- **Digital infrastructures:** three indicators capturing the availability of digital infrastructures
- **Investment and access to finance:** six indicators capturing investment in activities related to digitalisation and how access to finance for funding them is facilitated.
- **Supply and demand of digital skills:** four indicators capturing the availability of digital skills within the population.
- **E-leadership:** three indicators capturing to what extent education and training are available to facilitate the acquisition of digital skills.
- **Entrepreneurial culture:** three indicators assessing the business-friendliness of the environment and the level of the entrepreneurial culture.

Presentation of the outputs

The set of indicators included in the “output dimension” will reflect the outcomes of the digital entrepreneurial process, namely the digital transformation of traditional businesses and the creation of digital start-ups.

- **Integration of digital technology** (eight indicators)
- **ICT start-ups** (three indicators)

Figure 1: Overview of the general approach to the indicator-based monitoring of digital transformation



Country profiles

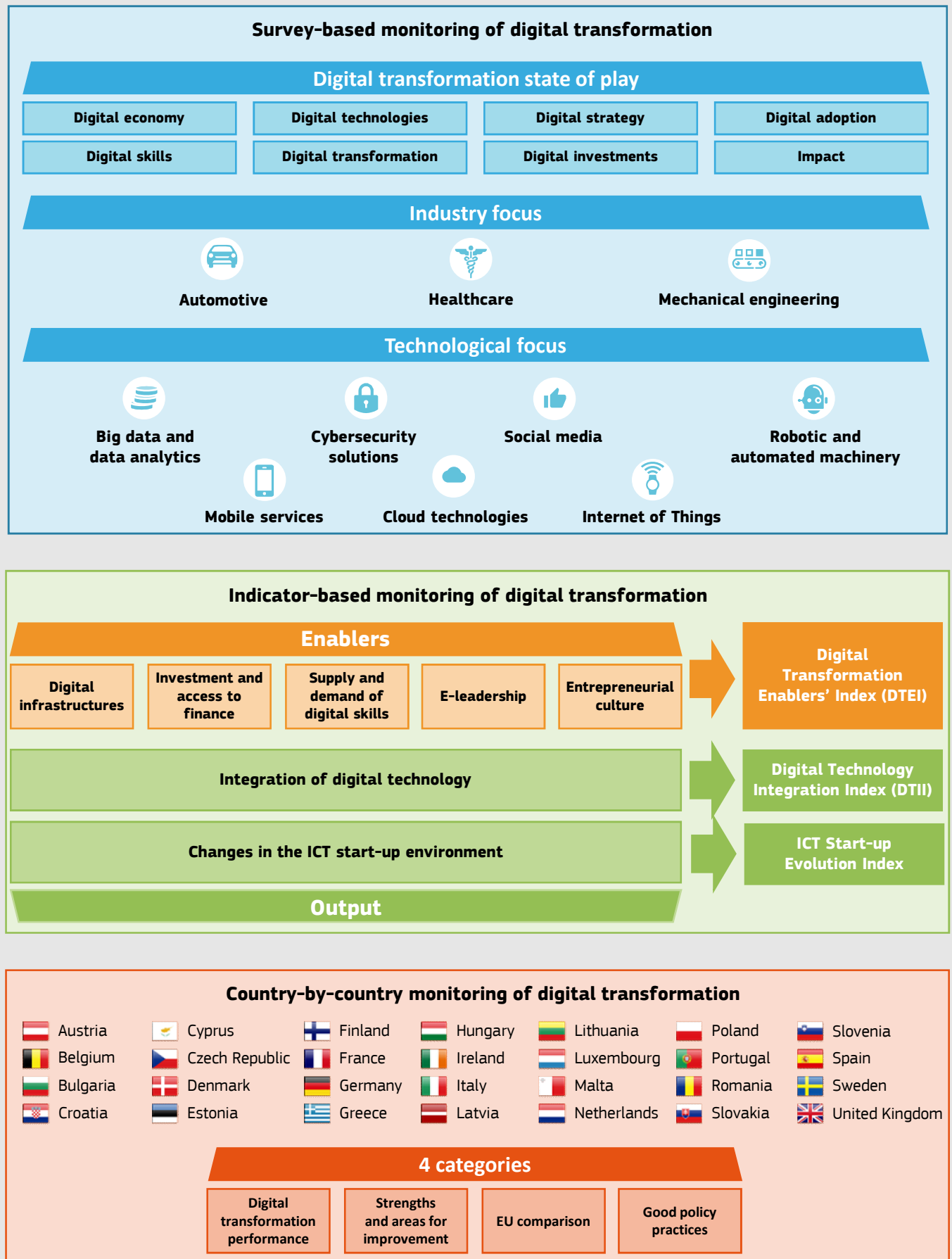
The country profiles are composed of 28 two-page sheets. A country profile has been created for each Member State, providing an overview of the identified key statistics through charts and figures to show strengths and areas of development regarding the enablers and outputs described above. Each sheet includes:

- A **general overview** of how the country supports digital entrepreneurship;
- A highlight of the **country’s strengths and areas for improvement**;

- A short assessment of where the country stands **compared to other Member States**;
- A focus on initiative(s) considered **good practices**.

Wherever possible, the selected initiatives are linked to key economic sectors for the country, and the impact of policy intervention on the uptake of digital technologies is underlined.

Figure 2: Framework of the Digital Transformation Scoreboard 2017



Source: Digital Transformation Scoreboard 2017

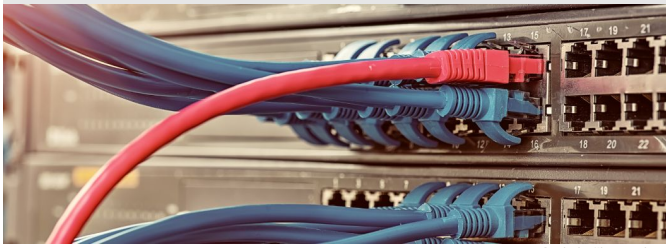
Background

Digital transformation: a source of business opportunities with a major societal impact



Digital transformation and technological advances are giving rise to disruptive business models that profoundly impact on industries, businesses and citizens. Firms around Europe and across industries are wrestling with the far-reaching complexities of a continuously changing digital environment. The ever-increasing amount of data in all forms produced today by companies and individuals offers unparalleled opportunities for companies to innovate, create new products and improve the way in which they deliver services. However, business leaders are struggling to implement effective strategies to use the digital world as a source of innovation for their customers or users. At the same time, policymakers need to understand how these new technological applications work in order to better grasp their social, economic and regulatory implications to ultimately set the framework conditions that will allow Europe to take full advantage of digital opportunities.

3.1 The overwhelming majority of EU firms have adopted a first wave of digital technologies, but the new wave of technology adoption is more challenging



75% of respondents regard digital technologies as an opportunity

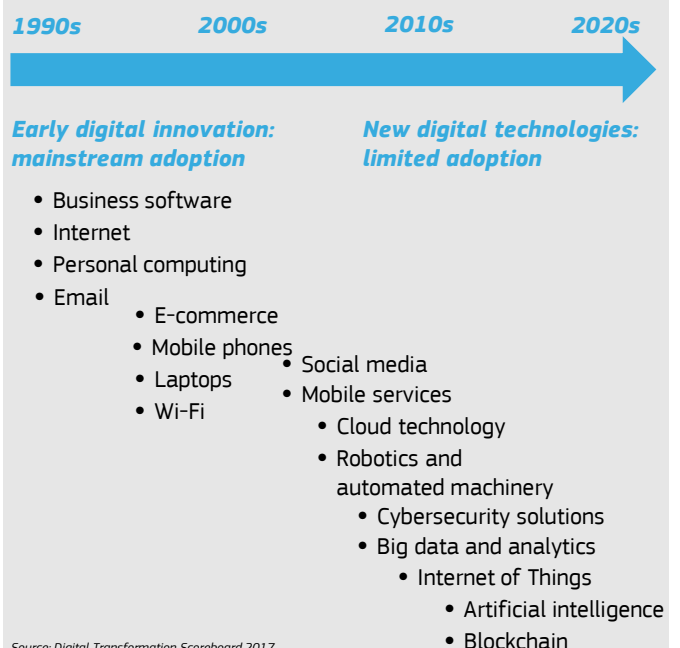
Digital transformation recognised as an opportunity by EU firms

Three out of four European companies regard digital technologies as an opportunity. According to the DTS survey results, European firms seem to have understood that unlimited opportunities await businesses that can transform themselves ahead of the digital curve. Digital technologies are thus increasingly seen as an opportunity to innovate, grow and thrive to remain competitive in the global marketplace. From the start of a business online to the improvement of customer experience, the possibilities for European firms to leverage the digital revolution are limitless and exist all along their value chain.

The digital economy: a transformative process

Thanks to digital technologies, **business opportunities that once appeared unlikely are now becoming all too real.** Innovation, business expansion and disruption are goals that can nowadays hardly be reached without the drive of digital technology. Digital technologies are therefore used more than ever to create new products and business processes, reshape existing ones, raise capital, share knowledge and ideas, interact with customers, improve skills, attract new talents and much more.

Figure 3: Waves of digitisation



Source: Digital Transformation Scoreboard 2017

A gap from digital awareness to investment in digital solutions

The opportunities to do business better in a digital economy are limitless and European businesses recognise the digital trend as an opportunity. However, only a few European companies are taking advantage of these opportunities.

The adoption rate of new digital technologies is slow

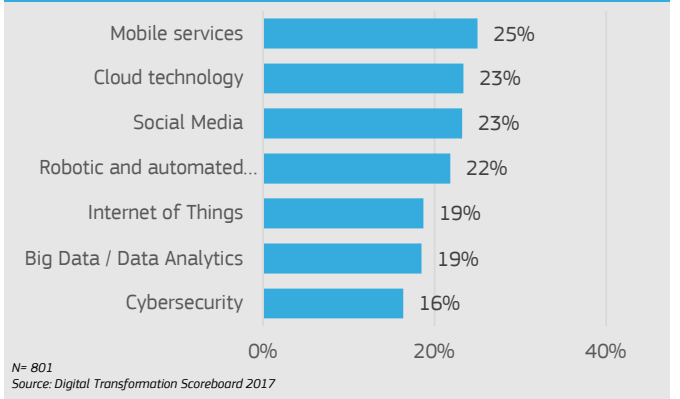
Only 44% of DTS survey respondents have adopted at least two of the seven digital technologies investigated by the survey. Mobile services, cloud technology and social media are the most widely used digital technologies with 25%, 23% and 23% of survey respondents having integrated these technologies respectively. Even though these technologies are the most commonly implemented, their level of adoption remains quite low (especially given their potential to contribute to business improvements). What is even more worrisome is that cybersecurity solutions are the least widespread digital technologies, with less than one in five companies among business respondents having set up a cybersecurity process.

European companies favour “mainstream technologies” from the “first digital wave” over new digital technologies

The considerable gap between the percentage of survey respondents regarding digital as an opportunity and the percentage of survey respondents integrating at least two of the seven key digital technologies investigated by the DTS survey can be explained in particular by the preference among EU companies to adopt “mainstream technologies”. These mainstream technologies correspond to more “basic technologies” (i.e. broadband access and greater bandwidth, IT infrastructure, digital tools for accounting, CRM applications, etc.). They can also be referred to as **technologies from the “first digital wave”**. EU companies already benefit from employees with the required skillset to integrate these technologies which could explain their widespread integration.

44% of respondents have adopted at least two of the seven key digital technologies.

Figure 4: Level of technology adoption among all survey respondents



Lack of skills and costly processes preventing simultaneous investments in at least two of the seven key digital technologies

By contrast, the adoption of at least two of the seven key digital technologies investigated in the survey requires particular skill sets and the existence of a specific digital transformation strategy to reap their full benefits. Large firms are more likely than SMEs to have employees with these required skills, which explains the higher rate of large firms adopting key technologies. In addition, SMEs often lack awareness of the positive outcomes for their businesses that could arise from setting up an integrated digital transformation strategy involving investment in at least two of the seven key technologies. They would therefore be less likely to bear the short-term operational costs associated with such investments.

3.2 Concrete positive results stemming from digital transformation



The DTS survey demonstrates that investing in digital technologies can lead to positive outcomes such as an increase in turnover and higher productivity gains. Overall, **64% of survey respondents consider that positive outcomes were generated thanks to the integration of digital technologies.**

Technology adoption leads to positive results for productivity gains

The DTS survey highlights a great deal of evidence supporting the positive outcomes of digital technologies for EU businesses, especially regarding productivity gains.

64% of companies investing in digital technologies have generated a positive outcome

Among DTS survey respondents, **54% of technology adopters have seen their productivity increase or significantly increase.**

Unlocking EU companies’ full potential for productivity growth

The DTS survey results demonstrate a connection between technology adoption and productivity growth. However, a higher productivity boost could be achieved, should companies have the required skilled employees to reap the full benefits of the seven key digital technologies investigated in the survey in order to engage in a radical digital transformation.

Technology adoption leads to positive results in annual turnover

Among DTS survey respondents, **53% of technology adopters have seen their annual turnover increase or significantly increase.**

European firms that achieve digital transformation have seen an increase in turnover by **gaining a competitive edge when they transformed their business to respond to the needs of an increasing amount of digitally savvy customers and consumers.** The integration of new digital technologies such as social media, mobile services or IoT enables digital adopters to act more quickly on business opportunities and to increase customer retention, which can ultimately translate into turnover growth.

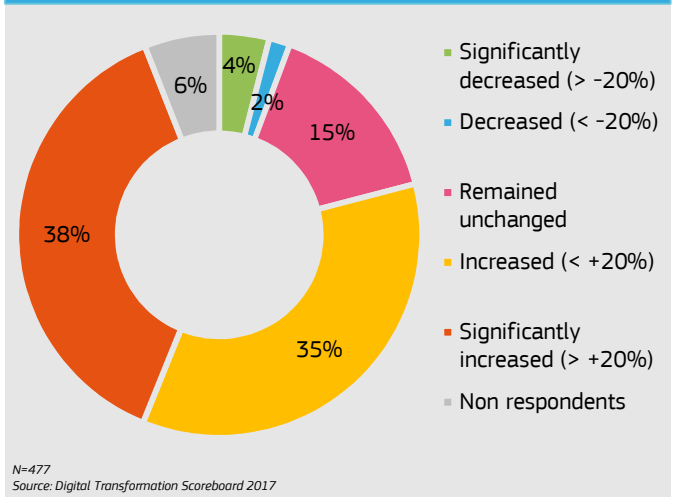
Figure 5: Impact of technology adoption on annual turnover and productivity gains over the last 3 years



Impact on operational costs

Among DTS survey respondents, **only 6% of technology adopters have seen their operational costs decrease or significantly decrease.** However, a high share of technology adopters actually saw their operational costs increase or significantly increase (73%).

Figure 6: Impact of technology adoption on operational costs over the last 3 years



Implementing a digital strategy focusing on harmonised long-term efforts rather than fast short-term gains

Though challenging, long-term cost reduction can be achieved by taking full advantage of new digital technologies in the short term and when all investment depreciation is taken into account in the mid and long term. In addition, by exploiting digital tools (e.g. big data and analytics for predictive maintenance), business leaders can reduce operational costs by increasing flexibility and reducing uncertainty. Digitally enabled businesses can create value whilst helping reshape internal processes, enabling companies to transform into lean and efficient organisations.

53% of companies investing in digital technologies have increased their annual turnover



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Purpose of adoption

The DTS survey results provide a key insight into how different business functions are being impacted by diverse digital technologies. They also shed new light on the purpose of digital adoption for EU businesses.

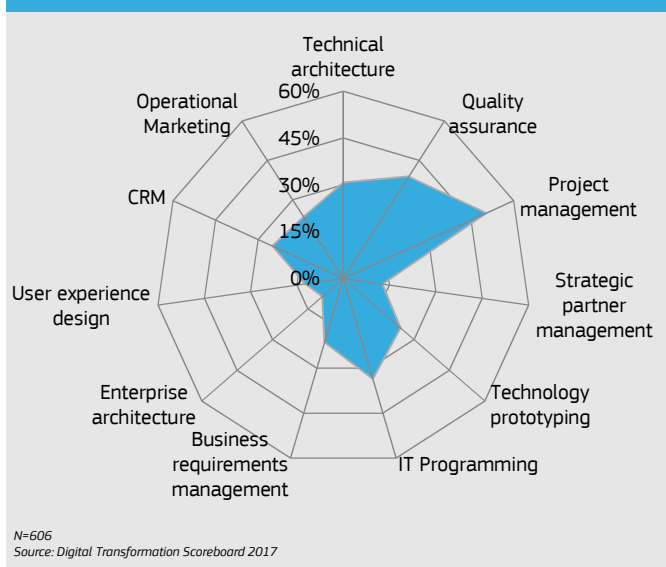
EU companies are mainly using the seven key digital technologies to enhance rather than transform their businesses

Only 12% of survey respondents have appointed a Chief Digital Officer (CDO), reflecting the lack of an overall vision for digital transformation shown by the majority of EU companies. Even though almost two out of three businesses have included the adoption of digital technologies in their innovation strategy, the use of digital technologies to digitally disrupt the company remains rare. Only a few EU businesses have managed to carry out digital transformation initiatives as part of a coordinated strategic approach likely to lead them to reshape the business model to better innovate and grow.

Business functions most impacted by the adoption of the seven key digital technologies

Businesses with an overall digital transformation strategy will deem it too critical to focus on only one functional area and therefore appoint a CDO or create an independent body to supervise the implementation of the digital transformation strategy. However, the majority of DTS survey respondents focus their digital efforts on selected business functions. **Project management is the business function most widely impacted by technology adoption**, followed by quality assurance, IT programming and technical architecture. Although technical architecture and – to a greater extent – technology prototyping lag behind other business functions, a considerable amount of DTS survey respondents are adopting digital technologies to transform these business functions.

Figure 7: Business functions impacted by technology adoption



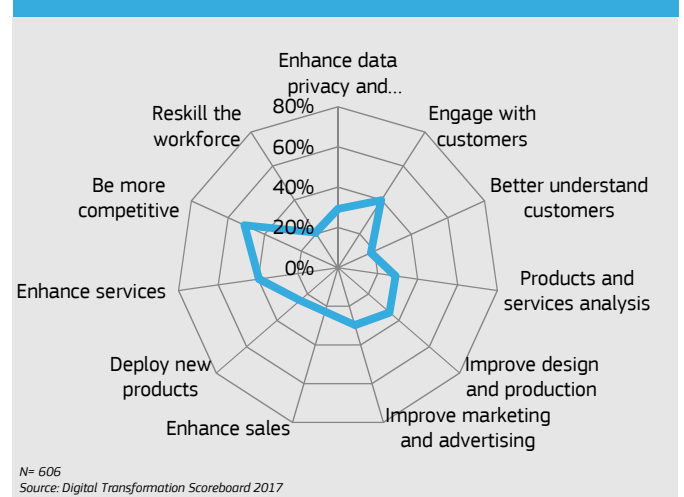
73% of respondents invest in digital technologies to transform project-management operations

Addressing changing customer expectations and transforming internal functions: the main rationale for technology adoption

The considerable applications of mobile services and social media serve as prime evidence of EU firms' awareness that consumers are increasingly connected and use technological means to reshape their preferences and expectations. This therefore reflects the will of European businesses to be more responsive to rapidly changing consumer expectations. Consequently, the use of social media and mobile services has helped to enhance services, engage with customers and improve competition. It therefore reflects the **increasing capacity of businesses to adapt and respond to evolving consumer habits**.

The adoption of key digital technologies such as analytics mainly favours the transformation of the project-management function and affects competitiveness, design improvements and production, as well as helping businesses to better understand information that comes from the market. These changes serve as an indication of the **efforts by businesses to better adapt internal functions and tailor products and services to meet changing customer habits**.

Figure 8: Purpose of digital adoption



12% of respondents have appointed a Chief Digital Officer (CDO)

3.3 Digital skills: a new competitive edge for European businesses



54% of technology adopters have maintained or increased their number of employees

European businesses are not always fully aware of the importance of digital skills in enabling their business to thrive and grow in an increasingly competitive world. About **one in two survey respondents believe that they have the necessary skills to adopt new digital technologies**. This high percentage of lacking ICT skills reflects the extent of the digital-skills gap in Europe.

Why do digital skills matter?

According to the DTS survey, 60% of technology adopters considered that they had the necessary skills to integrate digital technologies. This result suggests that European businesses need employees who have with the right skill set to harness digital technologies before they engage in a digital transformation strategy.

Reskilling and upskilling the workforce: an untapped opportunity

Technological advancements and disrupted business models require employees to acquire new or improved skills. However, few European businesses have taken concrete steps to retrain their workforce. As demonstrated by the DTS survey, only **28% of survey respondents have engaged a strategy to reskill their workforce in order to integrate digital capacities**, even though one in two recognise that they do not have the employees with the skills needed to integrate digital solutions.

Upskilling the workforce is no longer an option: it's an imperative

According to the European Commission, **32% of the EU workforce has little or no digital skills** and 15% has never used the Internet.² Differences vary greatly between EU Member States; however, the digital-skills gap remains a pressing issue for all Member States, especially since the race for digital talent is global. The European Commission³ also estimates that 28% of the EU population has obtained some ICT skills through formal educational institutions, at school, college or university, which leaves plenty of leeway for companies to implement upskilling strategies to provide employees with the ICT skills needed.

Overcoming barriers to the launch of reskilling and upskilling schemes

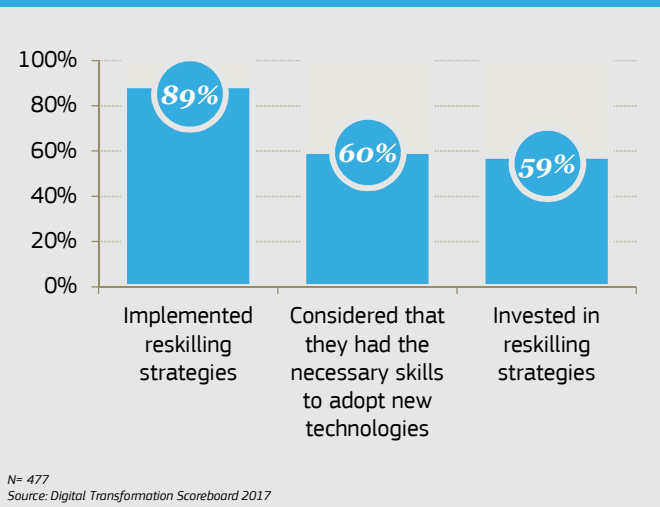
Reskilling and upskilling programmes are expensive and businesses often believe that they do not necessarily produce benefits that are worth the cost. However, these high upfront costs preventing businesses from investing in reskilling and upskilling strategies could be compensated by the positive outcomes that a company could generate through integrating digital technologies.

Upskilling programmes enable workers to develop updated task-specific skills that can contribute to the implementation of digital technologies and therefore help companies move forward in the digital era. These **continuous learning programmes act as a gateway to new and advanced production methods**, creating dynamic business functions and processes that are responsive to the rapid pace of change.

Avoiding a digital divide

Upskilling the workforce also enables business leaders to play a role in preventing a digital divide from being created. They can also contribute to the development of educational curricula that are more in line with their needs, by working directly with local and national governments, as well as social partners and education providers.

Figure 9: Skills and reskilling needs of companies that have adopted one of the seven technologies



47% of survey respondents considered that they had the necessary skills over the last 3 years to adopt new technologies

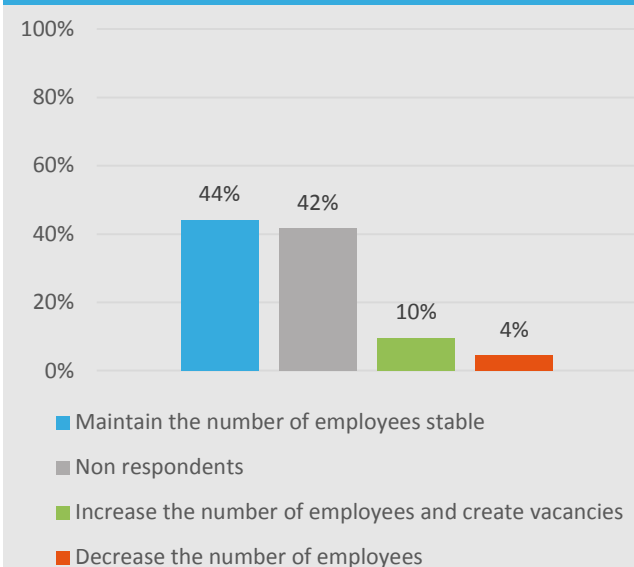
Job demographics remain unchanged for now

Effects of digital adoption: job creation outpacing job destruction

Many Europeans currently fear that an increasing number of jobs are going to be lost due to automation. This fear of the job-destroying effects of technology is all the more important given the growing **general concern that over the medium term, the amount of job destruction due to technological advances will outpace the positive effects in terms of job creation.**

Findings from the DTS survey demonstrate that digital technologies do not necessarily lead to job destruction. On the contrary, the DTS survey indicates that the **integration of digital solutions mostly enables technology adopters to keep their employee numbers stable** (44%). The integration of digital technologies was detrimental to workers in only a few cases. Overall, 10% of technology adopters have increased their headcount or created new job opportunities, while 4% of technology adopters decreased their headcount.

Figure 10: Impact of digital adoption on number of employees



N=417
Source: Digital Transformation Scoreboard 2017

Harnessing the benefits for job creation prompted by digital transformation

According to the European Commission, there will be more than **756,000 unfilled vacancies for ICT professionals in the EU by 2020.**⁴ **Digital transformation should therefore be seen as an opportunity for job creation**, which could help contribute to an increase in employment rates. However, obsolete jobs are also going to be destroyed and replaced by promising jobs for the future. According to the World Economic Forum's report "The Future of Work", 5 million jobs will be lost globally due to automation by 2020, and this number is expected to keep growing. More attention should thus be focused on equipping workers with the skills required for the jobs of today and tomorrow.

Envisioning and enabling a digital society with positive outcomes for all

Preparing businesses, individuals, policymakers and society as a whole for the digital shifts to come

As with any new major change, there are a certain amount of societal concerns prompted by the profound implications of all the current and upcoming digital shifts for society. The survey findings outlined in the report are **a clear signal that much more needs to be done to communicate better and to make necessary information on the effects of digital transformation** more easily available to businesses, individuals, policymakers and society as a whole.

Staying ahead of digitally driven changes

Communicating better on digital transformation entails clear messages to **explain to the EU workers of today and tomorrow what the current and future implications of the advent of the digital age mean for them.** In particular, the importance of **digital skills and lifelong upskilling needs** should be highlighted. A strong emphasis should also be put on the unlimited opportunities for growth and the ability of all stakeholders to undertake **joint efforts to enable all citizens to benefit from such opportunities.**

Rising societal challenges are resulting from the digitisation of industry, and it is the responsibility of political and industry leaders to prepare individuals to adapt to the unavoidable digital transformation.

Finding innovative ways to transform potential digital challenges into positive opportunities for society

Growing concerns are emerging as to individuals' ability to adapt to digital changes. The following recommendations could allow all concerned stakeholders to envision and enable a digital society with positive outcomes for all:

- Invest in reskilling the workforce
- Reform national education systems
- Create partnerships between education providers, industry leaders and policymakers to adapt curricula to industry needs and to prepare the future workforce for the jobs of tomorrow
- Better inform citizens on digital challenges and opportunities



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Industry focus

Digital transformation of the European industry



The survey of the Digital Transformation Scoreboard focused on three industries essential for Europe's economy and in which Europe has traditionally a competitive advantage. The mechanical engineering, healthcare and automotive industries represent key industries in which SMEs constitute a large share of value added and employment at the EU level but which at the same time have still a lot of catching-up to do regarding the deployment of elements of digital infrastructure, tools, platforms and management capabilities and policies. The advent of digital technologies is however already having a profound impact at the core of these industries and its impact will only increase with the penetration of new and disruptive technologies. The following presents key insights into the impact of new digital technologies on these three key industries and directions to shape different stakeholders' response to emerging digital challenges and opportunities faced by leaders in these three industries.

4.1 Awareness of the digital economy



81% of respondents in the automotive sector believe there are business opportunities in the digital economy

Ubiquitous digital technologies: an opportunity for EU businesses

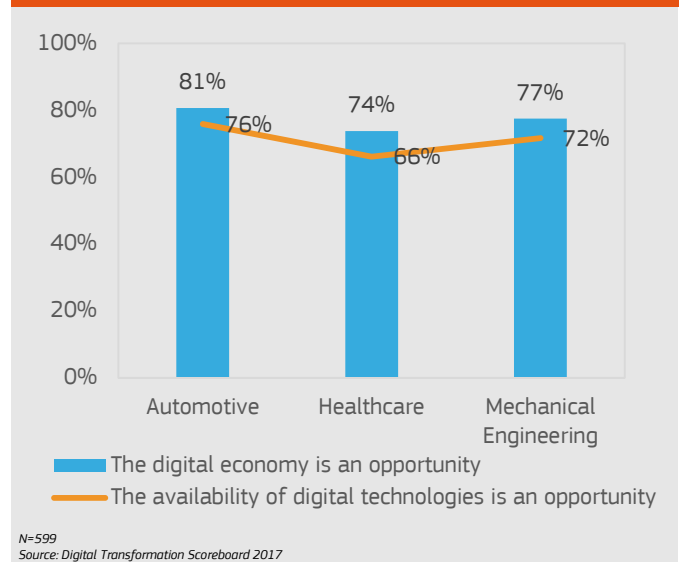
The digital age and the ubiquitous nature of the Internet open doors to a multitude of opportunities for all kinds of European businesses. As evidenced by the survey, 75% of survey respondents are fully aware of the new prospects brought by the digital revolution. European business leaders from the automotive sector are the most persuaded that the digital economy will bring about positive opportunities. 81% of them are convinced of the importance and benefits of digital technologies compared to 74% in the healthcare sector and 77% in the mechanical engineering sector.

Fostering a better understanding of what new digital technologies are and how they can help capture value

Digital transformation does not just happen on its own. Being aware of the benefits of digital technologies is not enough and can certainly not serve as an indication of a firm's ability to transform digital opportunities into concrete results. European companies are massively adopting what we could refer to as "mainstream technologies" (see figure 4, p.11). The integration of this first wave of digital technologies is however not sufficient to develop a meaningful digital strategy able to fully unlock the growth and innovation potential of European companies. As the survey results demonstrate, not even half of survey respondents (45%) in the automotive, healthcare and mechanical engineering sector have been able to take full advantage of the opportunities offered by digital technologies by translating them into tangible results

Business leaders in these three industries should therefore reassess their digital maturity to better understand which new digital technologies are right for their businesses. This careful examination would help them rethink how digital capabilities could be integrated in their overall business strategy to transform their company to reap the benefits of the digital economy.

Figure 11: Share of businesses considering the digital economy as an opportunity by industry



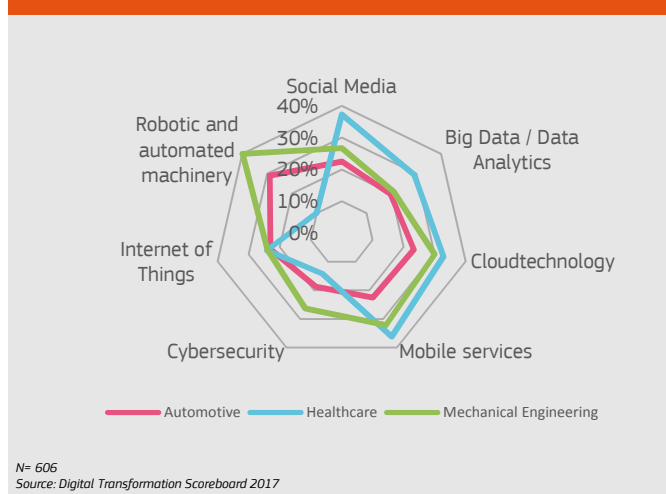
A slow digital adoption pace

The pace of digital adoption processes differs quite significantly across industries in Europe. In the automotive and mechanical engineering sectors, only 20% to 30% of European businesses aware of the importance of the digital economy had integrated specific digital technologies such as social media, big data analytics, cloud technology, mobile services, cybersecurity solutions, Internet of Things, and robotic and automated machinery. Considerable disparities prevail when it comes to the specific technologies adopted.

Diverse digital needs in the healthcare sector

In the healthcare sector, the level of digital adoption greatly depends on the digital technology. The adoption of social media, data analytics, cloud technologies and mobile services is progressing rapidly with about 30 to 40% of companies having already adopted these technologies. About 40% of companies in the healthcare sector report the use of mobile services, which almost double the percentage of companies using the same technology in the automotive sector. Nearly a quarter of companies in the healthcare sector indicated the use of Internet of Things, as did companies from the automotive and mechanical engineering sectors. On the other hand, less than 20% of digitally-aware companies in the healthcare sector have adopted robotic and automated machinery or integrated cybersecurity tools. In a sector where patient data and privacy will be the core of future business development, a higher adoption rate of cybersecurity solutions should be expected.

Figure 12: Use of digital technologies by industry

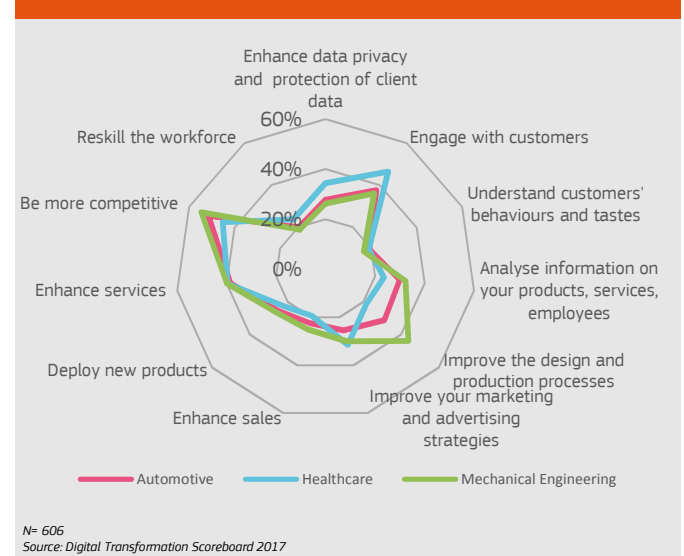


Wide-ranging positive benefits to digital transformation

The adoption of digital technologies affects different business function within companies. In general, quality assurance, project management, technology prototyping and IT programming are the most likely to be subject to digital transformation processes across the three industries. However, these functions are mainly oriented towards manufacturing and supply within businesses although the scope of potential benefits from the adoption of novel digital technologies can be much wider. Indeed, some key functions related to the demand side of the industry (e.g. CRM, use experience design and strategic partner management) will still be affected through the digital transformation of businesses.

The digital transformation of companies in the automotive, healthcare and mechanical engineering industries has led to concrete results and outcomes. About half of the surveyed businesses (approximately 45% per industry) stated that digital transformation through the adoption of digital technologies had already allowed them to turn opportunities into concrete results. Interestingly, more than 87% of these businesses indicate that these concrete results were positive. This observation reflects the high correlation between digital transformation through the adoption of digital technologies, and positive outcomes for businesses.

Figure 13: Purpose of digital adoption by industry



87% of respondents who have concrete results from digital transformation indicate that the effects on their organisations have been considerably positive.

4.2 Skills to harness the potential of digital technologies



65%

More than 65% of respondents indicate that the necessary skills to engage in digital transformation are available, and more than 42% are willing to develop these skills further

Digital skills: a scarce commodity?

The availability of skilled labour to fully adopt digital technologies is key for digital transformation. **These technologies requires in many cases specific trainings to upgrade the skills of the workforce.** It becomes essential for decision makers to understand how the availability of skills in the digital economy can affect the pace and success of digital transformation processes.

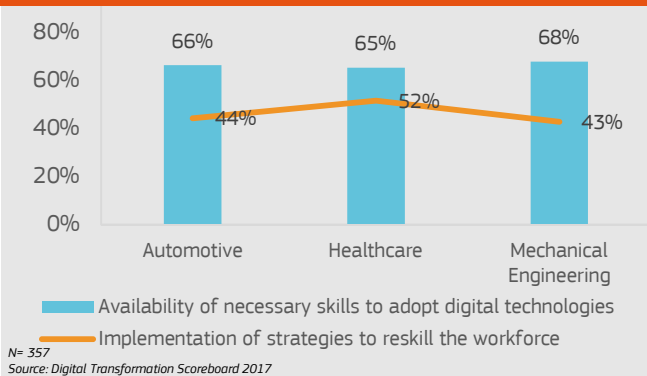
In addition, depending on the skills required, different trainings or several adaptations of curricula may be desired which reinforces the need for an accurate diagnostic of the available and required skills. Consistent views from surveyed businesses suggest that **skilled professionals are available but not to the extent necessary to cover all demand requirements.** The DTS survey provides data on the actual and perceived reality regarding skills issues for European businesses in the healthcare, automotive and mechanical engineering sectors.

Defining upskilling and reskilling strategies to accelerate digital transformation processes

Digital transformation is ultimately about getting the right talent with the required skillset to fully participate in the digital economy. It is therefore in the best interests of European businesses to find and retain skilled professionals able to ensure the complete integration of digital capacities.

The DTS survey reveals that about **1 out of 3 companies in the automotive, healthcare and mechanical engineering sectors in Europe struggles to find the necessary skills to exploit the opportunities offered by the digital era.** However, research shows that when businesses are deprived of talented human resources to create new digital capacities, they are being prevented from competing with other firms at the national and global levels. The digital skills shortage is therefore hamstringing for European business and the immediate impact of this shortage could be far-reaching.

Figure 14: Availability of digital skills by industry



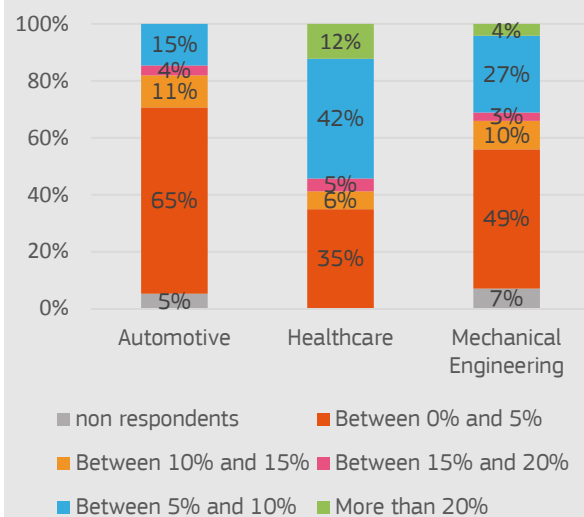
The quest for digital talents ready to hit the ground running

European businesses need the best skills to fully harness the opportunities offered by digital technologies. In many cases, European firms invest a large portion of their time and effort in finding professionals with the required digital skillset to hit the ground running and demonstrate all the right competencies at the outset. However, hiring digital talent is not the unique solution to meet companies skills requirements.

Most of the time, businesses already have in-house skilled employees with the potential to acquire appropriate digital skills to deliver value for the company. The DTS survey shows that **nearly half of European businesses in the automotive (44%), healthcare (51%) and mechanical engineering (53%) sectors are still not implementing strategies to reskill their workforce.**

European businesses can simply no longer afford to under-develop the potential and under-utilize the skills, knowledge and creativity of large segments of their employees.

Figure 15: Percentage of annual turnover invested in upskilling strategies by industry



Getting investments in upskilling strategies right

The looming skills gap forces European companies to rethink their training and upskilling strategies. Nowadays, employers have to navigate through the complexities of the digital revolution where rapid technological advances call for a continuous enhancement of employees' skills. The deployment of re-skilling strategies acts as a key solution to enable employees to carry their companies forward into the digital future. Upskilling strategies therefore represent critical investments for any business willing to transform the way it operates in a digital economy.

Low investment levels in upskilling strategies

Being a key driver for success is not enough to turn upskilling into a business priority. DTS survey results indicate that **businesses deploying re-skilling strategies only spend a small share (of up to 5%) of their annual revenues for this purpose.**

This assessment holds particularly true for firms in the automotive sector where two out of three companies investing in upskilling strategies only allocate up to 5% of annual revenues in this matter (compared to one out of three companies in the healthcare sector and half of businesses in the mechanical engineering sector).

In addition, among companies investing in re-skilling, only 12% of companies in the healthcare sector and just about 4% of companies in the mechanical engineering sector invested more than 20% of annual revenues in this regard.

Digital technologies: a threat or an opportunity for job creation?

The adoption of digital technologies is often seen as a threat or as an opportunity for job creation. If the DTS survey indicates that a large share of technology adopters among survey respondents benefitted from concrete positive results on business performance, **when it comes to implications on the workforce structure, results are not as straightforward.**

A majority of companies in the automotive industry (54%), in the healthcare industry (77%) and in the mechanical engineering industry (60%) have managed to maintain their number of employees stable following the adoption of digital technologies. On the other hand, a smaller share of companies (20% in automotive industry, 7% in the healthcare industry and 18% in the mechanical engineering industry) have increased their number of employees through the creation of vacancies. **The cumulative share of businesses in the three sectors presents positive effects on the job market.**

Only in a few cases (in general about 5%), businesses with positive results stemming from the adoption of digital technologies reported that digital technology integration led to job destructions.

Jobs and automation in the automotive, healthcare and mechanical engineering industries:

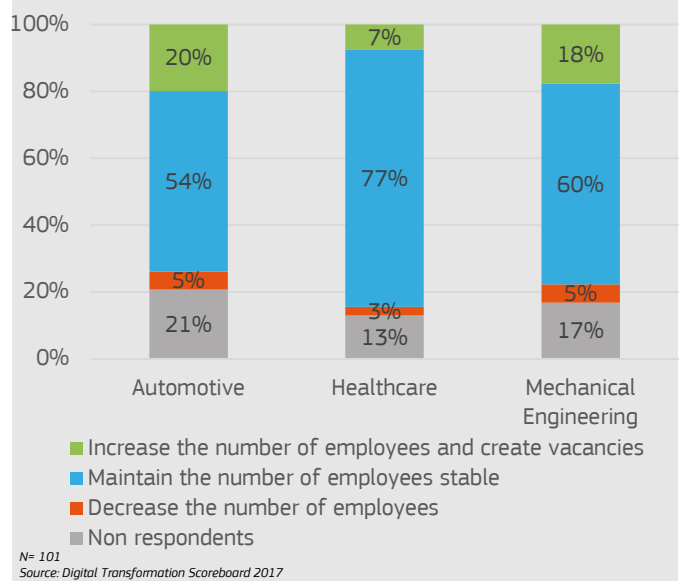
Overall, descriptive evidence indicates that the digital transformation of businesses in the automotive, healthcare and mechanical engineering sectors has had a positive impact on jobs for survey respondents. Nevertheless, it should be noted that it is not straightforward to generalise survey findings at the micro-level to the macro-level. In this respect, the implications of digital technology integration by businesses on the EU workforce structure remain fairly hard to quantify and to anticipate with certainty.

A digital transformation likely to disrupt the labour market

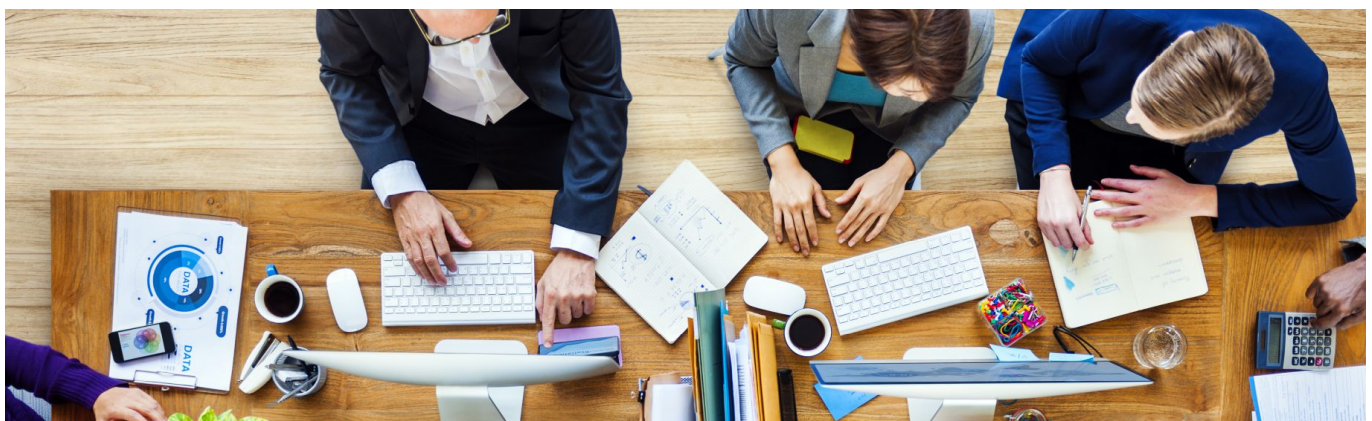
Recent analyses have attempted to capture the number of jobs at risks of being automated. Findings from a 2013 study on *"The Future of Employment"*⁵ demonstrate that a significant share of occupations are at "risk of computerisation". On a similar note, the OECD published a paper⁶ suggesting that on average **across the 21 OECD countries, 9 % of jobs are likely to be automated.**

However, as findings from the DTM survey demonstrate, business functions are mostly impacted by digital technology adoption. It is therefore likely that **specific tasks rather than occupations are at risk of automation.** Further attention should therefore be given to evolving job functions and to **upskilling strategies to ensure that workers can be equipped with the skills needed to adapt to a digital work environment.**

Figure 16: Impact of digital adoption on number of employees by industry



79% More than 79% of respondents who benefit from concrete results from the adoption of digital technologies have at least maintained their number of employees or created job vacancies.



4.3 Investments for take-up of digital technologies



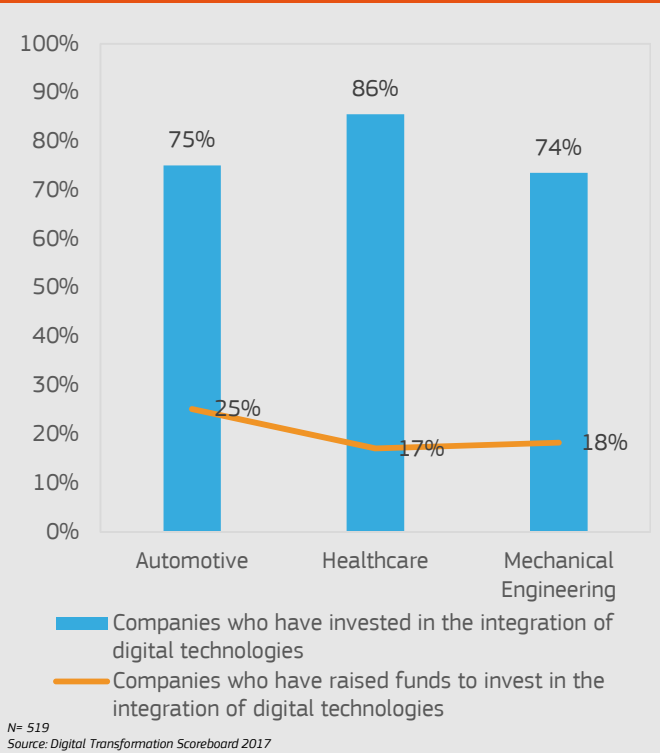
Investing in the integration of digital technologies

Investments in digital technologies are a signal of the efforts and costs businesses are **willing to allocate and pay to ensure a successful digital transformation** of their processes and harness the opportunities and benefits this change offers. Evidence from the industry survey indicates that a large share of businesses across the three industries have made investments for the adoption of novel digital technologies over the past three years.

Furthermore, **investment in these technologies seems to be often made in the form of self-financing** as only less than a quarter of businesses indicate they were able to raise funds (either through external investors or lenders) to invest in the adoption of digital technologies during the past three years.

This observation shows that **businesses are seldom able to attract growth capital for digital transformation**. In contrast to the observations on the awareness of risks and on the adoption of novel digital technologies by businesses in the three European industries; it is important to note that it is businesses themselves who believe in the potential brought by the digital economy, and who bear the effort, cost and risk of adopting digital technologies.

Figure 17: Investments in digital technologies and funding raised for digital investments by industry



7%

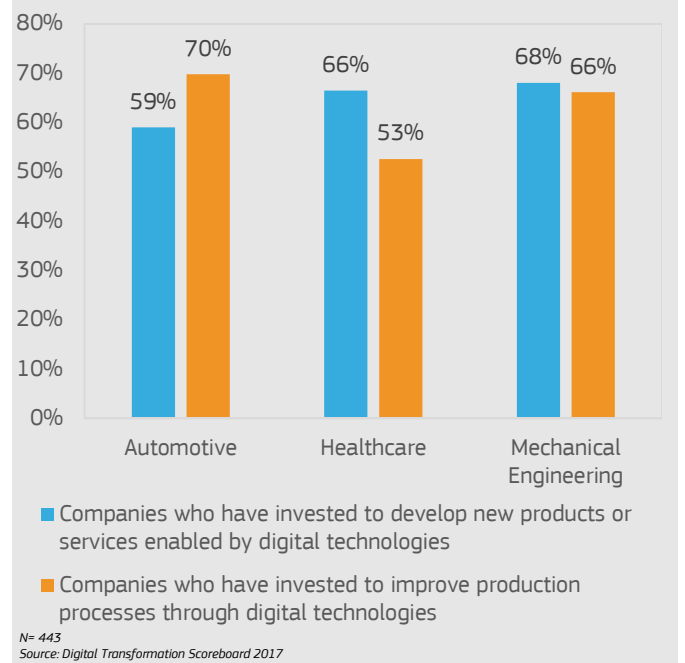
of businesses in healthcare who have integrated novel digital technologies during the past three years used public investments from European funds and programmes for digital transformation

Main objectives behind investments in digital technologies

Businesses are investing in the integration of digital technologies to ensure success in their digital transformation, in general 75% of businesses in the automotive sector, 86% in the healthcare and 74% in the mechanical engineering have made investments to adapt their infrastructure, organisation and governance approaches. Their objectives are **to develop new products or services** enabled by novel digital technologies, and **to improve their production processes** through the use of technologies.

As it is suggested by results from the industry survey, a larger share of businesses in the healthcare and the mechanical engineering sectors have made these investments with the purpose of developing new products and services, while in the automotive sector businesses seem to opt for investments in the improvement of production processes through digital technologies.

Figure 18: Function of investments in digital technologies by industry



This observation shows that the specificities of different industries are key factors that determine the purpose and utilisation of funds invested in the integration of digital technologies.

Businesses are investing in their digital capabilities, either on the output side through the development of new products and services or on the production process through the optimisation of their production capabilities to increase efficiency.

In both cases, these investments are key factors that enable businesses in the digital paradigm to meet an increasingly changing consumer demand.

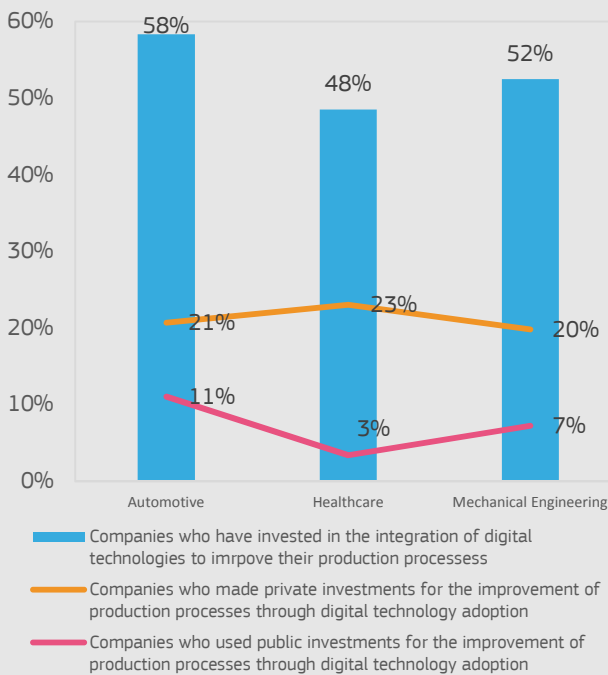
Focus on investment for the improvements of production processes and the nature of invested funds

The capacity of European businesses in the three industries to raise funds for the implementation of their digital transformation strategies is quite limited as it is previously described. Nevertheless, there is an interest **to understand the nature of funds invested** to ensure success in the digital transformation process.

Indeed, an important mass of businesses (58% in automotive, 48% in healthcare, and 52% in mechanical engineering) who had already integrated digital technologies also declare to have made investments for the adoption of digital technologies with the aim to improve their production processes during the past three years.

The distribution of investment types across those businesses who had integrated digital technologies shows that about 20% of these businesses used **private investment to improve their production processes** through digital technologies, while smaller shares (from 3% in healthcare to 11% in automotive) used public investments from European funds and programmes for this purpose.

Figure 19: Purpose of digital investments and type of funding by industry



N= 443
Source: Digital Transformation Scoreboard 2017

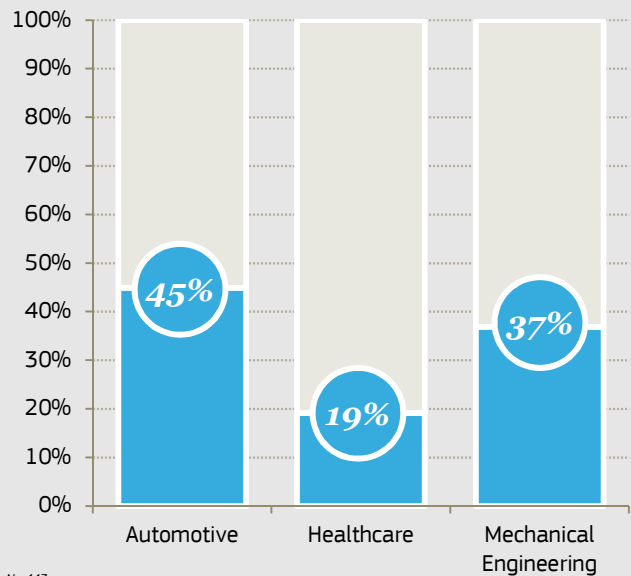
Are investments in digital transformation a strategic or rather a necessary call?

Private investments and public funding (in particular European funds and programmes - Horizon 2020, EIB/EIF, EFSI etc.) are used by nearly half of the businesses, who have integrated digital technologies, to improve their production processes; following this observation it is important to highlight that there are **important differences between the amounts of public and private investment in use.**

In general, **public investment usually and only adds up to 5%** of annual revenues in all three sectors while higher bands of public investments are declared to be marginal. Private investments follow a similar trend since private investments mainly represent between 0 and 10% of annual revenues in all three sectors as well.

However, given the observed awareness of businesses on the operational risks stemming from the adoption of digital technologies, one may only assume that risk awareness combined with small shares of annual revenues invested in digital transformation reflect a potential adoption of novel digital technologies not only for strategic reasons but also as a necessity.

Figure 20: Proportion of the businesses respondents in the 3 sectors that invested between 0 and 5% of their turnover in digital technologies



N= 443
Source: Digital Transformation Scoreboard 2017

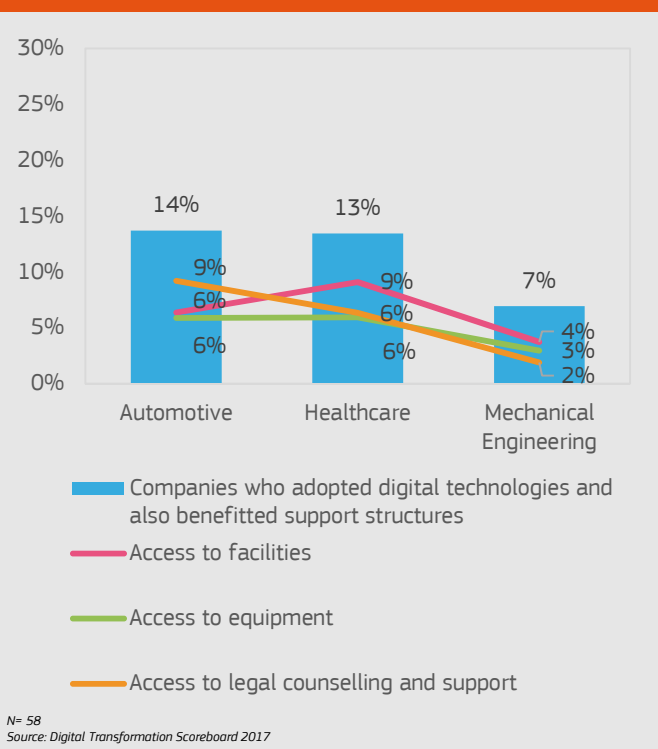
Accelerating access to business support structures

As in any other industry, business leaders in automotive, healthcare and mechanical engineering industry are often struggling to meet the challenges of digital transformation. **Access to support services such as technology parks, incubators and accelerators** constitute key elements to improve businesses' access to common resources and knowledge that would help them ease and accelerate technology adoption and development, proof of concept, and commercialisation.

However, the **magnitude of access to or utilisation of such support structures still seems to be very low**. Only 14% of businesses respondents in the automotive sector, 13% in the healthcare sector and 7% in the mechanical engineering sector have benefited from these support structures. These extremely low figures reflect the need for more efforts to provide business support structures to companies in these industries.

The support structures which have been found most useful are access to facilities and legal counselling. This observation is perhaps due to specificities across industries and business characteristics.

Figure 21: Access to facilities, equipment and legal counselling by industry



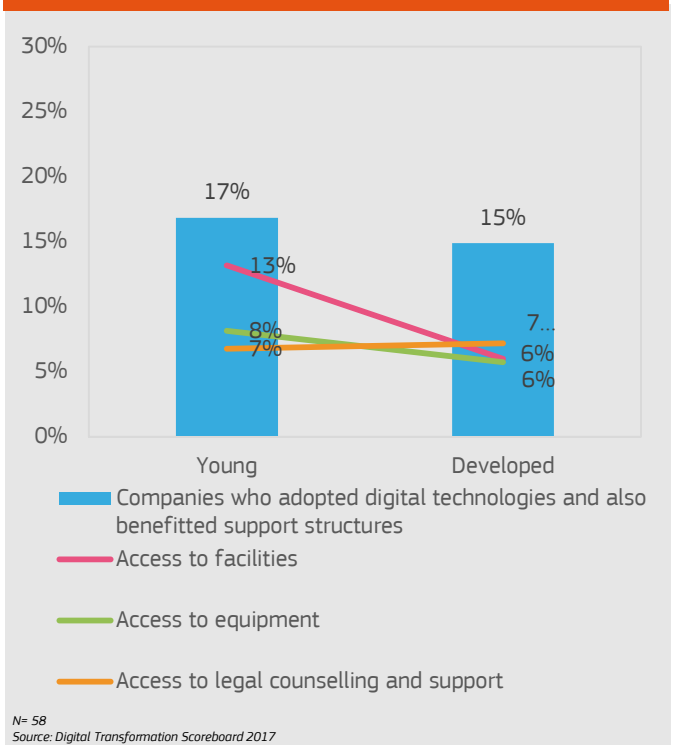
17% of young companies declare to benefit from access to support services. 13% of young companies also find that access to facilities is the most useful support service they can benefit from

Business support structures for all types of businesses

Young businesses include companies that consider themselves as start-ups, under development or growth phase. Developed businesses are companies developed within the national market, within the European market or internationally recognised. DTS survey results indicate that young businesses across all industries are slightly more likely to benefit from support services (17% against 15% for already developed businesses).

Furthermore, young businesses declare that access to facilities is by far the most useful support service they can benefit from (nearly twice as much as developed businesses), although both young and developed businesses have a nearly equal view on the utility brought by access to equipment and legal counselling.

Figure 22: Access to facilities, equipment and legal counselling by company development stage



4.4 Strategic role of digital technologies



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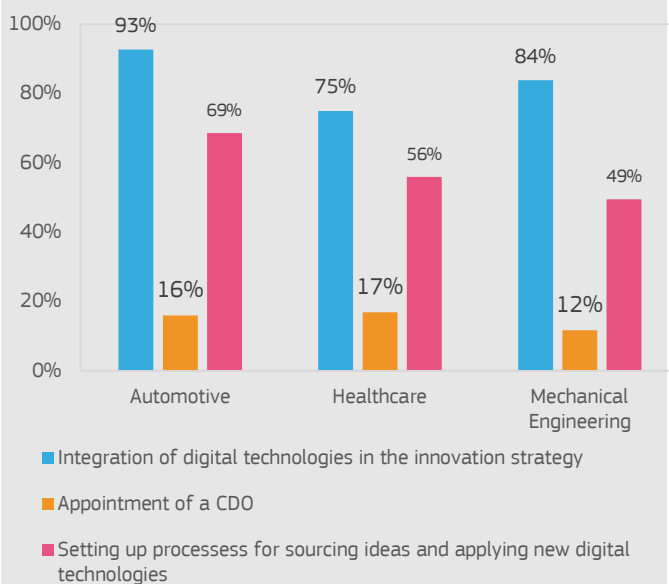
84% of businesses survey respondents integrated digital technologies in their innovation strategy

General strategies

As businesses are affected by the digitisation trend, it will be in the interest of decision makers to better understand **how these businesses define long term strategies** regarding building and consolidating digital capabilities to ensure future growth and face competitiveness threats. From a top-down perspective, one would expect that human resource profiles and functions, such as **a chief digital officer, responsible for leading the digital transformation of businesses** be defined within businesses to set a vision and path for the implementation of a digital transformation.

Adopting this perspective, as the **digital economy relies on information with the characteristics of a public good** (non-depletable and non-excludable resource), leading profiles would need to rely on collaborative processes enabling the flow and appropriation of ideas to review and validate this strategic vision to benefit from cumulative effects of shared and common knowledge. Approaches that may serve the purpose of defining the digital strategy of businesses may thus include externalisation processes to source ideas with the objective of solving business problems such as internal brainstorming, outsourcing through consulting services, collaborating with other firms, and crowdsourcing.

Figure 23: Digital strategies by industry



N= 477
Source: Digital Transformation Scoreboard 2017

15% of technology adopting businesses respondents have appointed a Chief Digital Officer

Chief Digital Officers are still not perceived as critical for digital transformation

Results from the survey indicate that digital strategies within businesses do integrate the notion of digital technology adoption, although the implementation of their digital transformation does not seem to follow a top-down strategic perspective since **only a small share of businesses (12 to 17% across industries) have appointed a digital leader** such as a chief digital officer.

Nevertheless, **businesses do seem to seize the importance of setting new processes for sourcing ideas and apply new digital technologies to solve business problems**. Indeed, an important share of businesses who have adopted digital technologies recognises having integrated the adoption within their innovation strategy, while a smaller yet large share recognize having set up collaborative processes to source ideas and apply these technologies (69% of businesses adopting digital technologies in the automotive sector, 56% in healthcare and 49% in mechanical engineering).

This observation stresses the importance of digital strategies that not only integrate adoption processes but also recognise the importance of collaborative processes to harness the potential and opportunities brought by the digital transformation

Collaborating with third parties to accelerate the digital transformation process

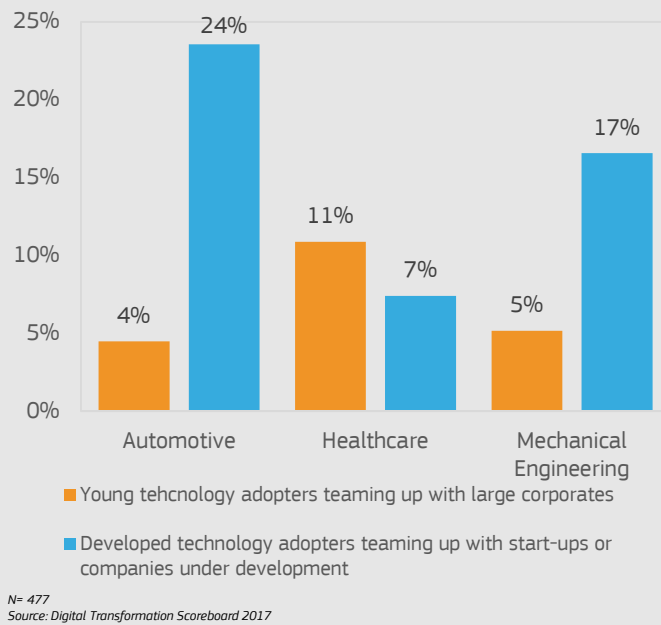
Collaboration is an essential enabler of digital transformation, in particular for young businesses, either through means of internal sourcing of ideas or external collaboration. Yet, results from the survey indicate that **young businesses prefer internal collaborative processes to harness the implementation of digital transformation** rather than relying on external ventures with third parties.

Indeed, only a small share of businesses across industries (below 23% in the case of developed companies teaming up with young ones, and below 10% of young companies teaming up with developed ones) declare to have teamed up with a third company to accomplish new ideas over the last three years. It is important to note that specificities inherent to each industry may play an important role on the extent and direction of teaming up strategies.

Harnessing the benefits from B2B collaboration

Survey results indicate that 23% of businesses in the automotive industry and 16% in the mechanical engineering industry that have adopted a digital technology are pursuing a teaming up strategy with a smaller young company under development; on the other hand, the reverse behaviour is observed in the healthcare industry where 10% of businesses that have adopted a digital technology are adopting teaming up strategies with a more developed company.

Figure 24: Collaboration between companies of different size by industry



Digital platforms: a threat or an opportunity?

Digital platforms are nowadays essential to every business value chain; they offer new value proposition and create new business opportunities. However, these platforms are controversial since they are often perceived as dominant players at risk of abusing from their preferential position in B2B relationships. They often raise critics due to the increasing shares of value they capture and the lack of transparency on the way they collect and exploit data.

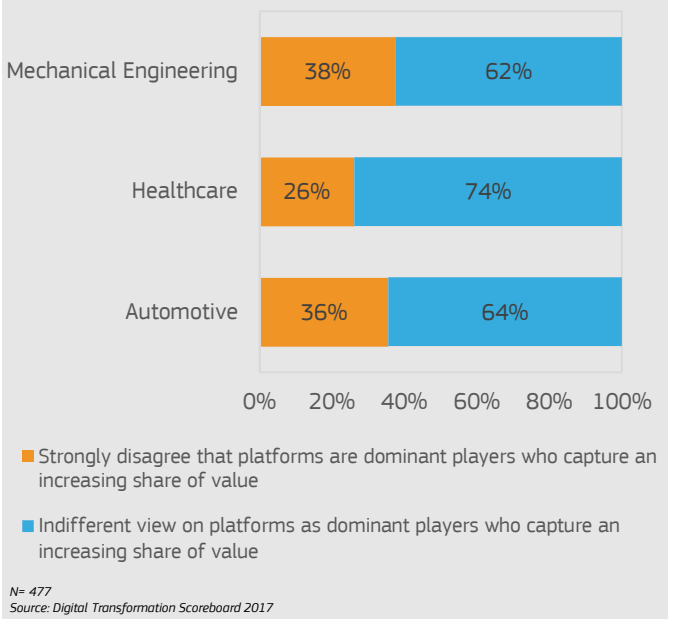
European businesses mostly positively disposed towards digital platforms

DTM survey results show that digital platforms are not considered as a threat by the respondents. Indeed, a large share of businesses who have adopted digital technologies indicate that they are indifferent (neither agree nor disagree, from 62% in mechanical engineering to 74% in healthcare) to any views on the dominant and non-transparent character of digital platforms. A smaller share of companies disagree with this notion (26% percent in healthcare to 38% in mechanical engineering).

This observation points out to the fact that businesses across the three industries do not mainly have negative views on the way digital platforms operate. They mostly consider that these platforms seem to be essential and useful in the digital economy through their role of digital infrastructures facilitating business operations. Concerns about dominance and lack of transparency do not represent a top priority from an individual business perspective today, as its indifferent views dominate the survey.

38% of businesses in mechanical engineering strongly disagree with negative views on digital platforms regarding alleged dominant position or lack of transparency

Figure 25: Views on platform by industry

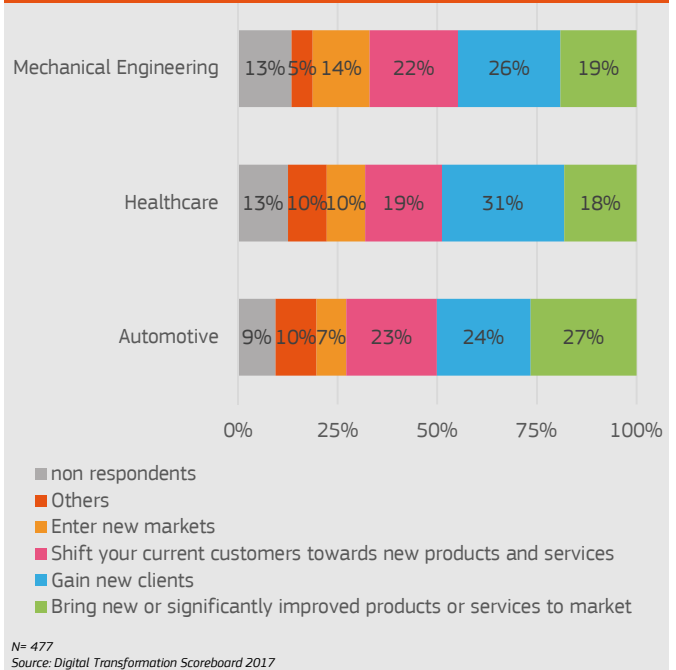


Strategic impact of digital adoption

Overall, the adoption of digital technologies has enabled businesses to reach strategic impact in terms of growth through the development and commercialisation of new or improved products and services, the conquest of new clients and markets, and the conversion of existing clients towards new products and services with higher added value.

The survey results show that a little over **80% of businesses across all industries declared to have benefitted from strategic impact in terms of growth.** In detail, healthcare represents the largest share of technology adopting business that gained new clients (31% of survey respondents) closely followed by mechanical engineering (26%). The automotive sector declared for 27% of its respondents having bring new or improved products and services to the market.

Figure 26: Impact of digital adoption by industry



4.5 Impact on company performance



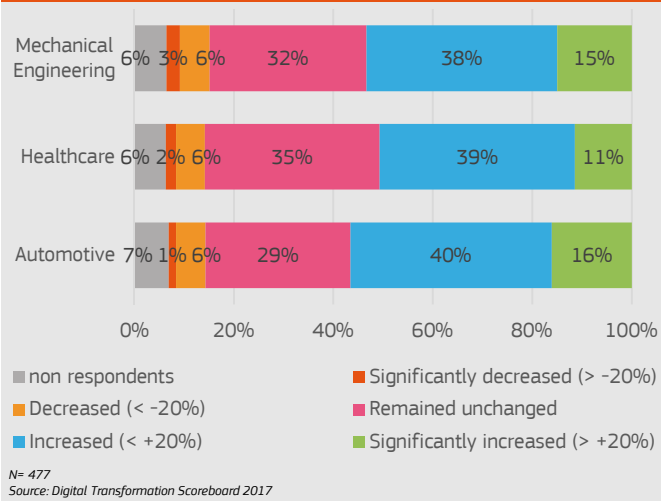
56% of technology adopting businesses in the automotive sector have experienced up to 20% increases in productivity gains over the last three years

The adoption of digital technologies and the consequent digital transformation of businesses has a direct effect on companies, employees, customers and to a large extent society, mainly in terms of business performance. Improvements in business performance following the adoption of digital technologies can be measured through changes in annual turnover, productivity and operational costs. These changes reflect concrete benefits that businesses who adopt novel digital technologies can achieve and provide insight on the extent to which the digital transformation of the European industry has advanced and the direct effects on business finances and resource efficiency.

Positive results of digital transformation on annual turnover

Survey results indicate that a large share of businesses having adopted digital technologies declare positive changes on their annual turnover. Most of these technology adopting businesses (38% in mechanical engineering, 39% in healthcare, and 40% in automotive) highlight that their annual turnover grew by up to 20% during the last three years, while a smaller share ranging from 29 to 35% of these businesses indicate that their annual turnover during the last three years remained unchanged.

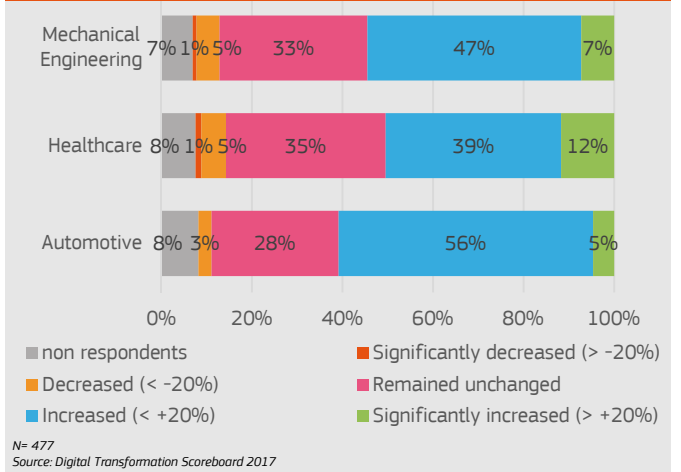
Figure 27: Results of digital transformation on annual turnover by industry



Positive results of digital transformation on productivity

Regarding changes in resource efficiency measured by productivity gains, a large share of businesses adopting technologies ranging from 39% in healthcare to 56% in automotive also **declare to have experienced higher efficiency by up to 20% of productivity gains** throughout the last three years, while a smaller share of these businesses ranging from 28 to 35% (automotive and mechanical engineering respectively) achieved unchanged productivity gains during the last three years.

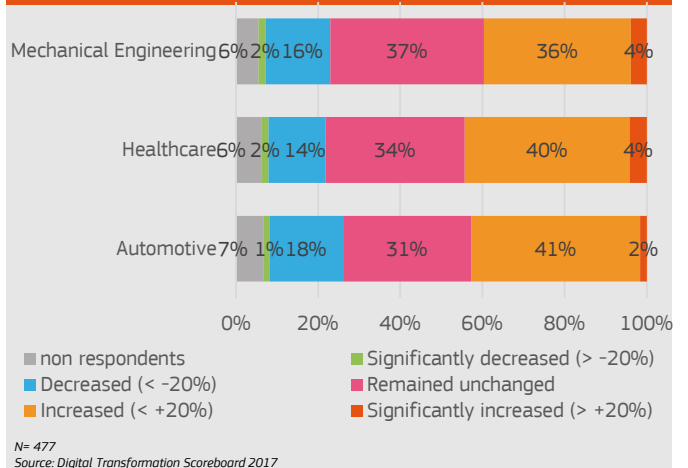
Figure 28: Results of digital transformation on productivity by industry



Higher operational costs as a result of technology adoption

Changes in operational costs of technology adopting businesses reflect the costs these companies incur in not only by adopting novel digital technologies, but also by ensuring their organisation, infrastructure, and operational processes are aligned with the organisational requirements that underpin digital transformation. Results from the survey also indicate that **operational costs** of technology adopters across the three industries (40% in mechanical engineering, 44% in healthcare, and 43% in automotive) **increased by up to 20%**. It remained unchanged for a smaller yet important share of businesses (37% in mechanical engineering, 34% in healthcare, and 31% in automotive). Though increasing operational costs may be perceived as negative effects, these effects are expected as businesses are adopting new digital technologies. They need to adjust the way they operate **to meet the requirement of these technologies, which increase costs**.

Figure 29: Results of digital transformation on operational costs by industry



Technology focus

Technology landscape in Europe



Digital technologies can fundamentally reshape European industries and spur companies to still greater success in the coming decades. The adoption of diverse technological solutions is increasingly regarded as a means to positively affect industry performance and to thrive in the global competition to offer the best products and services on the market. The survey of the Digital Transformation Monitor investigates how companies across 3 industries are using 7 key digital technologies (social media, mobile services, cloud technology, Internet of Things, cybersecurity solutions, robotic and automated machinery, big data and data analytics). Survey findings focus on the impact of the adoption of these technologies and related developments on the growth, productivity and competitiveness of selected sectors of business operations. The technology profiles provide an accurate portrait of the impact of each of these 7 technologies on business performance and therefore provide the foundation for developing strategic recommendations to make technology adoption swifter and more efficient.

5.1 Overview of technologies under adoption



66% of micro businesses have adopted at least one key specific digital technology while 93% of large businesses have adopted one of these technologies

Key technology adoption

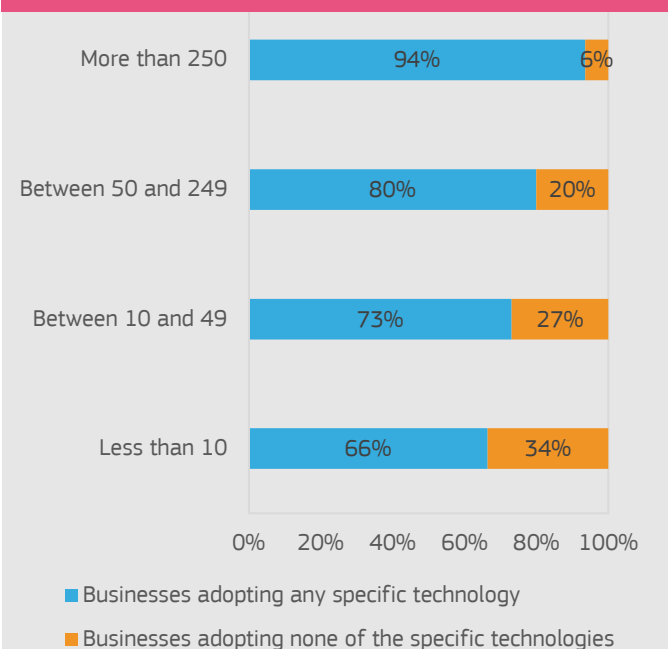
Across business size classes

From a general perspective, the industry survey investigated the **adoption of key specific technologies**, namely social media, mobile services, cloud technology, Internet of Things, cybersecurity solutions, robotic and automated machinery, and big data / data analytics. These specific technologies were chosen because they represent the **current most prominent new digital technologies** enabling the rapid transformation of industries and the way businesses operate in the digital paradigm.

At the company level, these technologies have often been adopted by large companies of more than 250 employees (94% adopting at least one of the specific technologies), while small businesses of less than 10 employees have adopted these specific technologies to a lower extent (66% adopting at least one specific technology).

As shown in the graphic aside, as businesses increase in size, the set of specific digital technologies is adopted at an increasing share. This observation allows to assume that rapid adoption and deployment of digital technologies requires not only the will of businesses to engage in their digital transformation, but also the availability of technical and financial means to ensure the success of the process. The adoption process of these technologies indicates that large businesses are leading the process, while smaller businesses follow.

Figure 30: Technology adoption by business size class



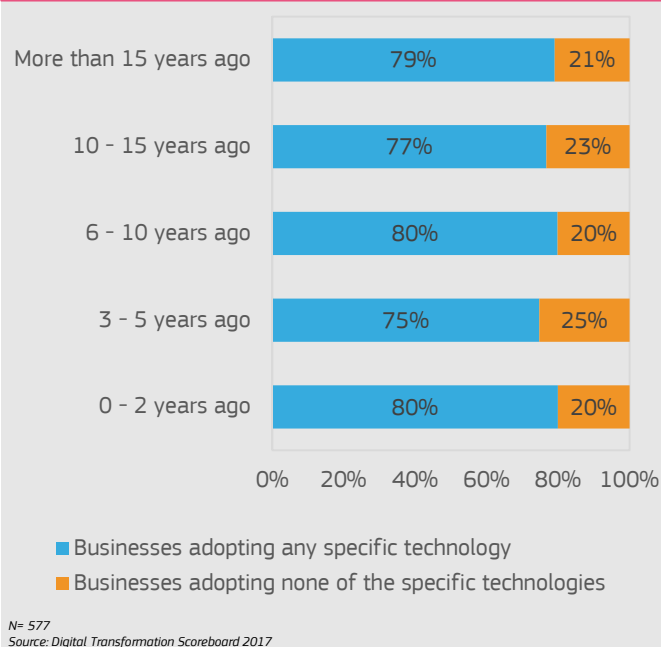
N= 633
Source: Digital Transformation Scoreboard 2017

Across business age classes

As previously described, the analysis of adoption of key digital technologies by business size class indicates that large businesses tend to adopt key digital technologies to a large extent when compared to smaller businesses. Furthermore into the analysis of business characteristics of technology adopters, we look for differences in key digital technology adoption by businesses of different age to understand whether or not the age of a business has any influence on the likelihood of adopting such technologies.

Results from the survey indicate that such differences do not exist (or are at least marginal) since young business aged between 6 and 10 years old are as likely to adopt key digital technologies as new businesses aged up to 2 years old. Indeed, 80% of all these business age classes indicate they have adopted at least one of the key technologies mentioned above.

Figure 31: Technology adoption by company age

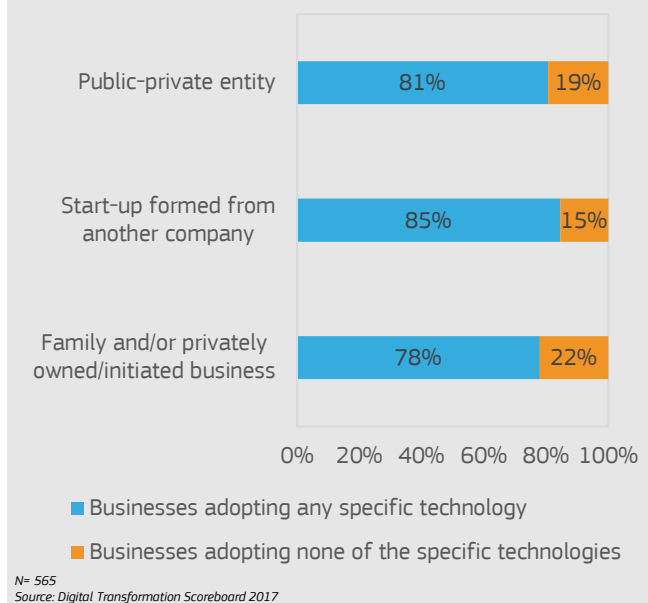


Across business types

The analysis of key technology adoption across businesses presenting different characteristics indicates so far that only the size class seems to have an effect on the extent to which these technologies are adopted within the business population. To finalise this analysis, we investigate whether differences exist across the nature of European businesses in the automotive, healthcare and mechanical engineering industries in terms of their type and their stage of development.

In terms of differences between key technology adoption by businesses of different type, results from the survey indicate that all businesses spawned off from university or research institutes have adopted at least one key technology. These businesses are followed by start-up businesses derived from other companies (84% of their population have adopted key technologies) and the remaining business types (nearly 80% indicate adoption).

Figure 32: Technology adoption by organization type



Across stage of development

Furthermore, when investigating the role of different stages of development in the adoption of key digital technologies by businesses, survey results show that potential differences may be marginal, as about 85% of those businesses that are under growth phase, or developed in the European market have adopted at least one key technology.

Figure 33: Technology adoption by company development stage

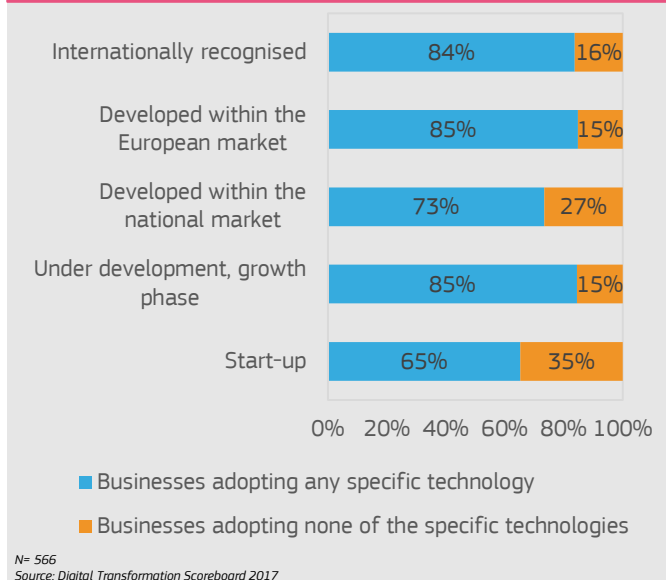


Figure 34: Couples of simultaneously adopted key digital technologies

	Social Media	Big Data / Data Analytics	Cloud technology	Mobile services	Cybersecurity solutions	Internet of Things	Robotic and automated machinery
Technology adoption rate among technology adopters	35%	28%	35%	37%	24%	28%	33%
Social Media							
Big Data / Data Analytics	8%						
Cloud technology	15%	10%					
Mobile services	16%	10%	14%				
Cybersecurity solutions	9%	7%	10%	11%			
Internet of Things	12%	10%	11%	11%	6%		
Robotic and automated machinery	4%	9%	8%	7%	7%	8%	

N= 477
Source: Digital Transformation Scoreboard 2017

Multiple technology adoption

The analysis of the business characteristics and key technology adoption has focused so far on the adoption of at least one technology. Further analysis of several technologies seem to go hand in hand as **businesses adopt them simultaneously**.

This is the case of **mobile services and social media** which come at the top of most adopted couples of key digital technologies (16% of the technology adopters among the business population), followed by cloud technology and social media (15% of the technology adopting business population) and mobile services and cloud technology (14% of the technology adopters among the business population). These top three couples of simultaneously adopted key digital technologies reflect the path digital transformation is currently engaged on, as these technologies (mobile services, social media and cloud technology) are mainly utilised **for large scale application deployment and diffusion of services**.

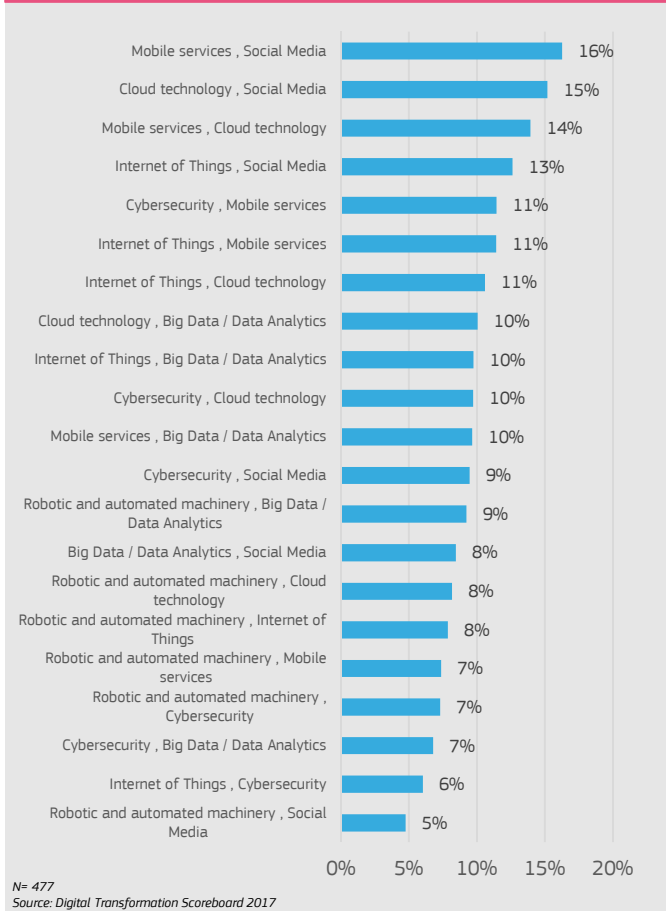
A technological push of services

Interestingly, the technological push of services suggested by the survey results does not seem to be matched by an informational pull from customer data and analysis, as the first time big data and data analytics appears in the distribution is in the 8th and 9th position coupled with cloud technology and Internet of Things.

Indeed, cybersecurity solutions come for the first times in the distribution at the 5th and 10th position coupled with mobile services and cloud technology. This observation indicates that companies currently prioritise scaling new services and reaching large customer bases over ensuring the protection of information as an input to new production processes and over optimising the exploitation of acquired information.

Most important, the evidence stresses the fact that cybersecurity is not currently a top priority for businesses in the current digital paradigm where access to and protection of information, characterised as non-depletable and non-excludable good, is critical to ensure competitiveness and value creation.

Figure 35: Couples of simultaneously adopted key digital technologies



N= 477
Source: Digital Transformation Scoreboard 2017

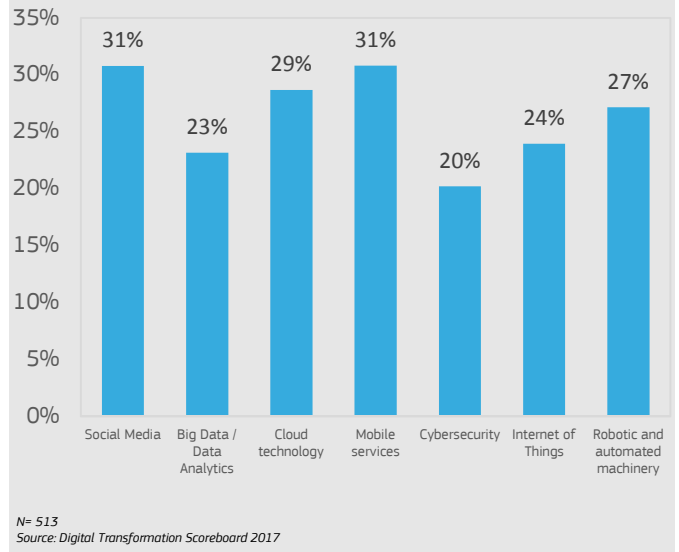
General impact of key technology adoption

Having described the characteristics of businesses adopting key technologies and the way these technologies are usually combined, our analysis turns to understand the extent to which these key technologies have had an impact on businesses and the way they operate.

Not surprisingly, the top two technologies adopted by businesses who declare that digital technologies have already had a positive impact are mobile services and social media (31% of the business population declaring positive outcomes), followed by cloud technology and robotic and automated machinery (29 and 27% of the business population declaring positive outcomes).

This observation confirms previous analyses reflecting the importance given by businesses to social media and mobile technologies, and stresses the assumption that in the current digital paradigm, businesses do prioritise rapidly deployable and scalable technologies as the first step to ensure their digital transformation. Once a critical mass of products, services and customers is reached, attention will have to turn to analysis and protection of large volumes of data.

Figure 36: Technologies adopted by survey respondents, who claim that technologies had a positive impact



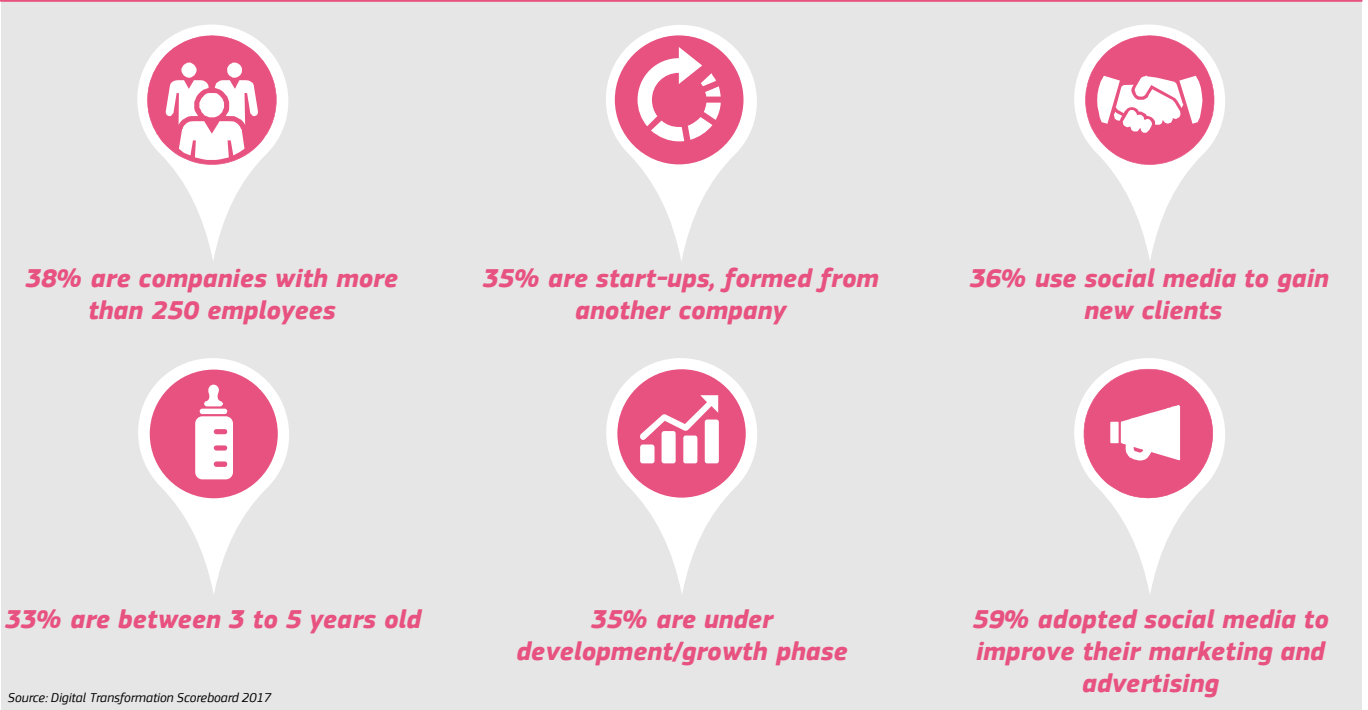
5.2 Social media



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86% of respondents who adopted social media considered digital technologies have generated positive outcomes

Figure 37: Profile of survey respondents which have adopted social media

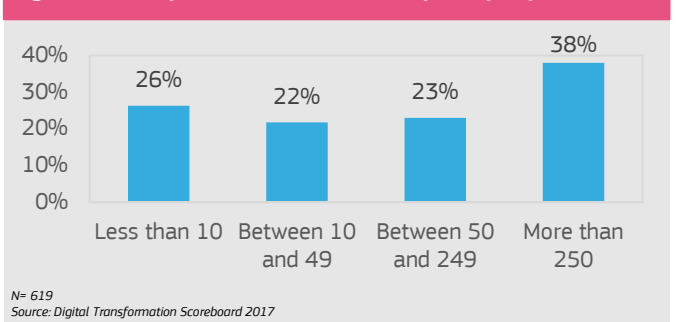


Social media have a wide-ranging impact on digital entrepreneurs such as better insight into customer behaviour and improved office productivity with internal networks. Recent trends include social media going company-wide beyond marketing and community building functions and a decline of email use as instant messaging are becoming office fixtures, allowing for real-time communication and information sharing.

Business characteristics

According to Eurostat⁷, social media is used by 45% of all European businesses, excluding the financial sector. This trend is similar to the one identified in the three industries of the DTS. The survey respondents indicate that the technology is adopted by about 38% of large businesses of more than 250 employees. The distribution of social media adopters by business size class is characterised by shares between 22 and 26% of SMEs adopting social media technology.

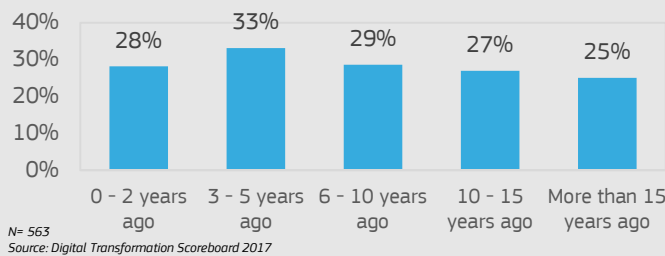
Figure 38: Adoption of social media by company size



Social media adoption is also characterised by a concentration of young businesses aged between 3 and 5 years old (33% adoption rate amongst key technology adopters), closely followed by new businesses aged up to 2 years old and by businesses between 6 and 10 years old (28% and 29% respectively).

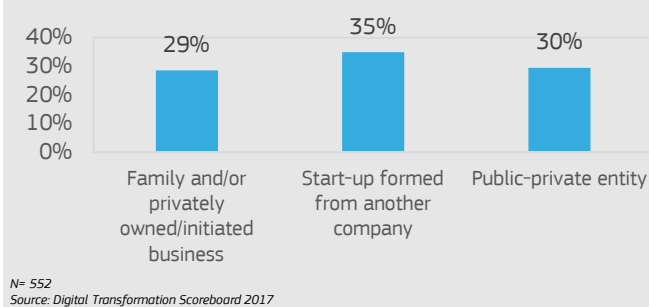
In general, this technology is utilised by more than a quarter of businesses in each age band and is highly used to engage with customers, improve marketing strategies and enhance competitiveness. These observations provide insight on a general purpose to capitalise on brands and build reputation in the digital economy.

Figure 39: Adoption of social media by company age



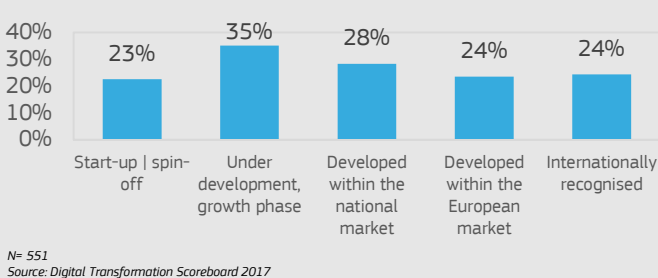
Furthermore, the analysis of social media adoption shows that mainly start-up businesses are the most representative type of companies adopting this technology with 35% adoption rate amongst key technology adopters. This category of businesses are closely followed by all other types of businesses.

Figure 40: Adoption of social media by organisation type



Finally, survey results indicate that social media adoption primarily takes place in businesses under development or in a growth phase and in businesses developed at a national level.

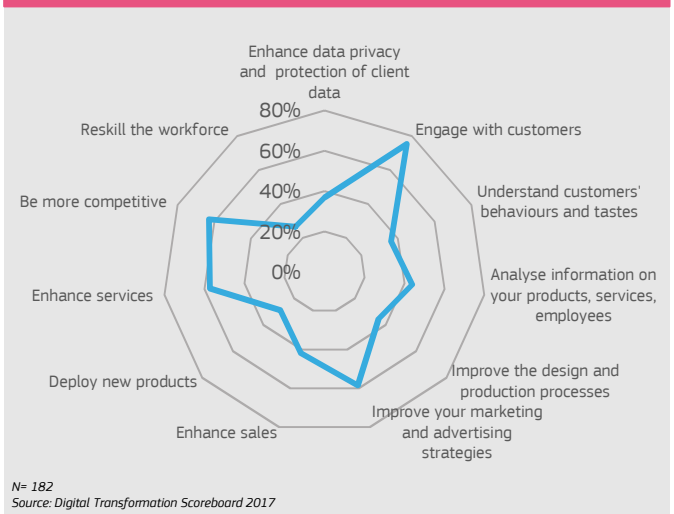
Figure 41: Adoption of social media by development stage



Purpose

As mentioned before, survey results indicate that businesses adopting social media also declare adopting key digital technologies with the purpose of engaging with customers; in the digital economy, reputation and brands can be strengthened through the proper use of social media technology which helps reach a critical mass of customers and can convey numerous messages. Indeed, businesses adopting this technology also declare the improvement of marketing and advertising strategies and the enhancement of competitiveness and services as additional main purposes for adopting key digital technologies.

Figure 42: Purpose of social media adoption

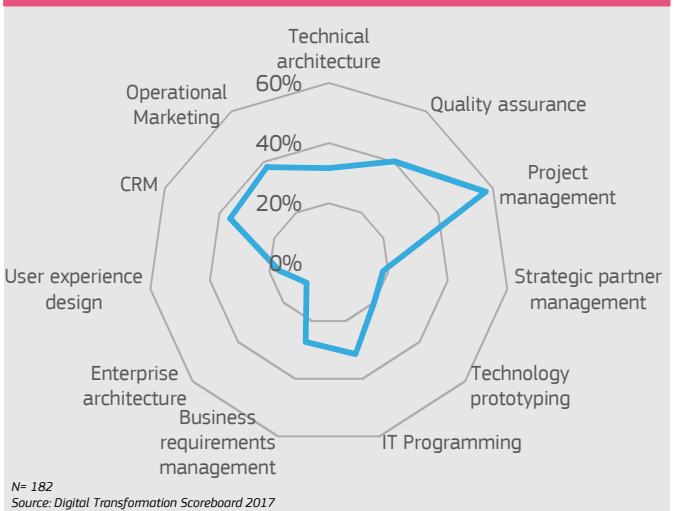


Impact

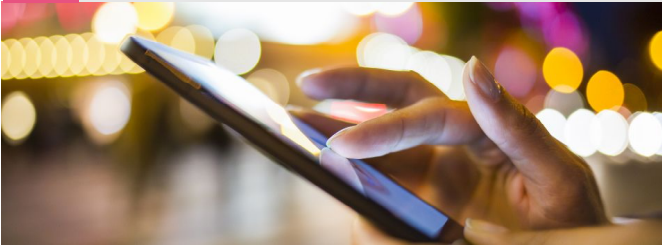
In general, positive impacts from digital technology adoption are reported by most of the businesses adopting social media (86% declare having experienced positive outcomes). These specific impacts have also taken place, with 33% of these businesses declaring having gained new clients and nearly 20% having been able to shift existing clients towards new products and services.

Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting social media technology also declare that key digital technologies are modifying mainly their project management function (57%), closely followed by quality assurance (40%), operational marketing (38%) and CRM (37%) functions. These observations confirm changes undergone by businesses adopting key digital technologies.

Figure 43: Business function impacted by social media adoption

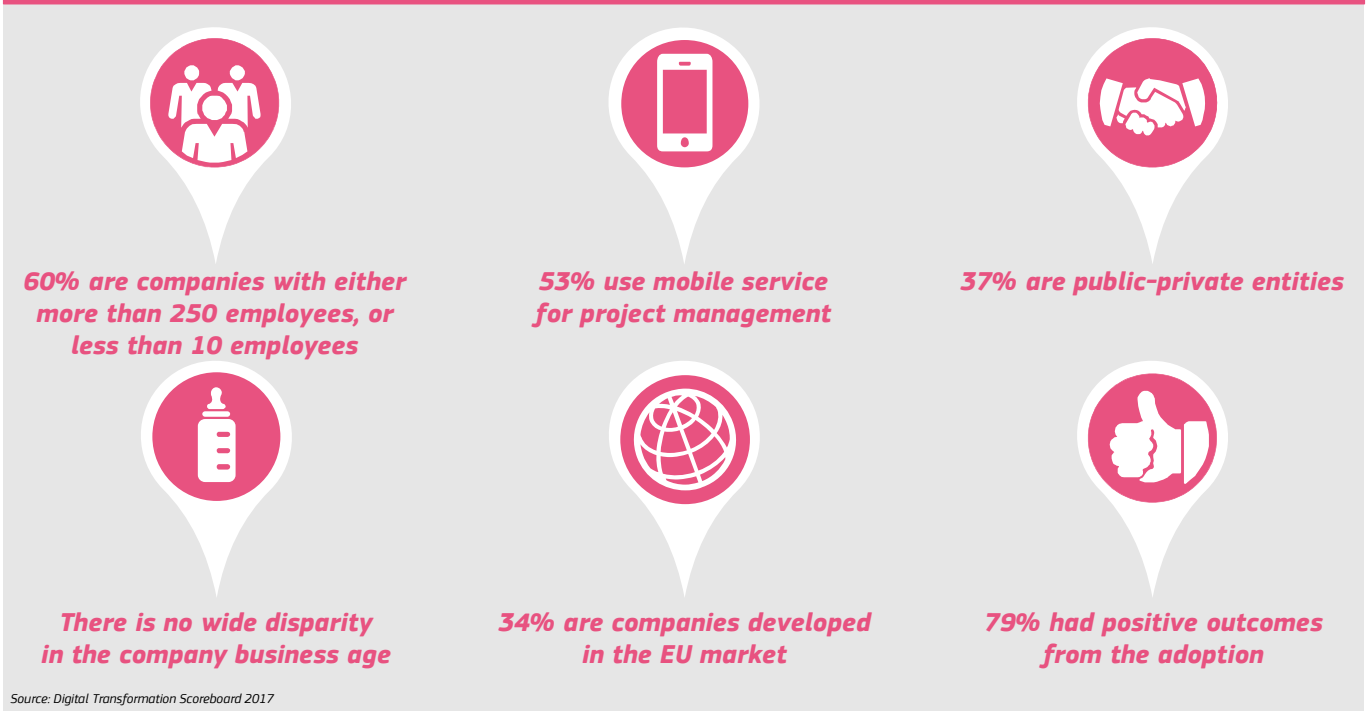


5.3 Mobile services



24% of respondents who adopted mobile services used the technology to gain new clients

Figure 44: Profile of survey respondents which have adopted mobile services

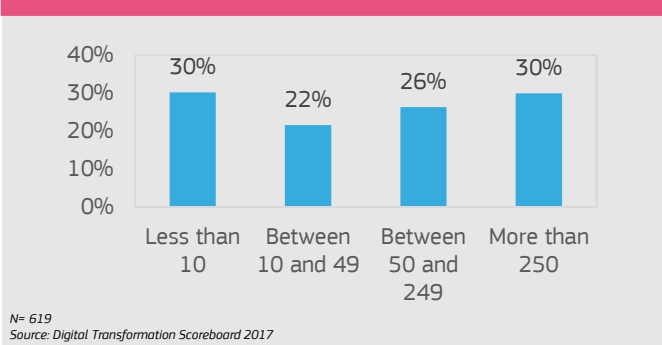


Source: Digital Transformation Scoreboard 2017

Business characteristics

In the case adoption of mobile services technology the characteristics of adopting businesses slightly differ; indeed, the business population adopting mobile services is mainly characterised by both a large share of micro businesses (less than 10 employees) adding up to 30% of adopting businesses, and a large share of large businesses (more than 250 employees) adding up to 30%. These businesses are followed by small companies (between 10 and 50 employees) and medium-sized companies (between 50 and 250 employees) adding up to 22% and 26% respectively.

Figure 45: Adoption of mobile services by company size



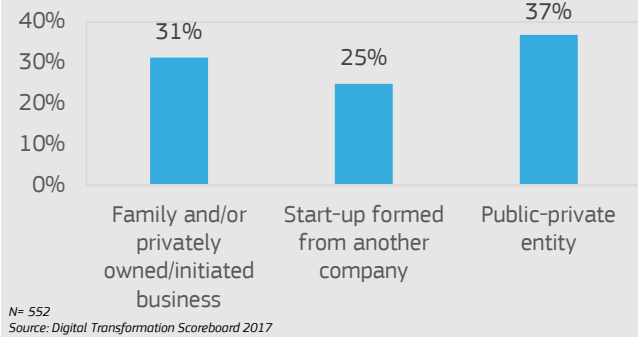
The age bands of those businesses adopting mobile services technology is mainly represented by businesses aged between 6 and 10 years old (32%), closely followed by young businesses aged between 3 and 5 years old (31%), by older businesses aged between 10 and 15 years old (31%), and by new businesses aged up to 2 years old (30%). Mature businesses aging more than 15 years old come last accounting for 28% of businesses adopting key digital technologies.

Figure 46: Adoption of mobile services by business age



Furthermore, this technology is heavily adopted by public-private entities (37% of adopting businesses), while all other types of companies only range between 25 and 31% adoption rates.

Figure 47: Adoption of mobile services by organization type



Finally, the adoption of mobile services technology takes place in businesses under development or in a growth phase and in businesses developed in the European market (accounting for 35% and 34% respectively), closely followed by businesses developed at a national level and by internationally recognised businesses (both at 28% adoption rate). Start-up businesses do not seem to adopt mobile services technologies (7% adoption rate) perhaps due to minimum utility during product development processes.

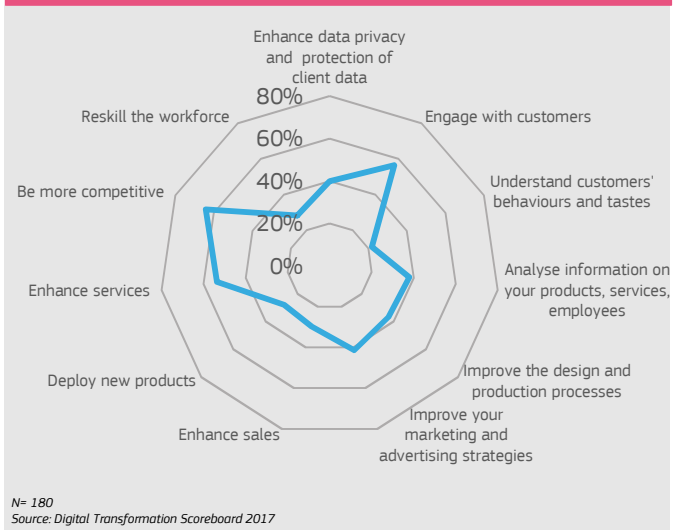
Figure 48: Adoption of mobile services by development stage



Purpose

Survey results indicate that businesses adopting mobile services also declare adopting key digital technologies with the purpose of enhancing competitiveness, engaging with customers, and enhancing services; in the digital economy, services can be provided and improved through the proper use of mobile services technologies which help reach a customer base and can deliver enhanced services. Furthermore, businesses adopting this technology also declare the improvement of marketing and advertising strategies and the analysis of information on products services and employees as additional main purposes for adopting key digital technologies.

Figure 49: Purpose of mobile services adoption

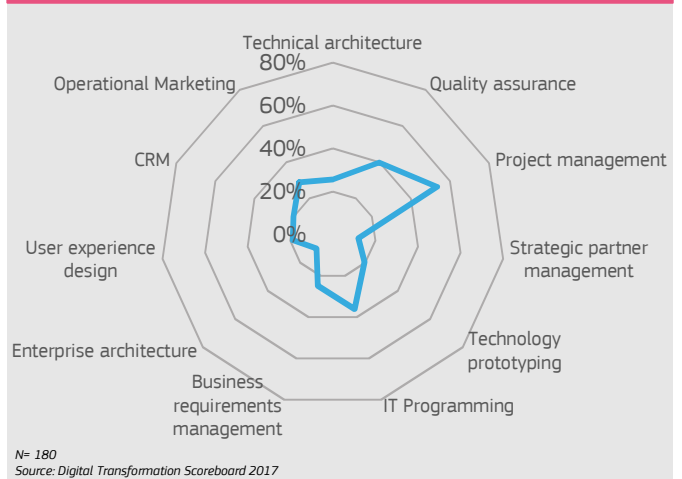


Impact

In general, positive impacts from digital technology adoption are reported by most of the businesses adopting mobile services, as More specific impacts have also taken place, with 23% of these businesses declaring having gained new clients, 21% having introduced new or improved products and services to the market, and 20% having been able to shift existing clients towards new products and services.

Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting mobile services technology also declare that key digital technologies are modifying mainly their project management function (53%), closely followed by their IT programming (36%) function.

Figure 50: Business function impacted by mobile services adoption

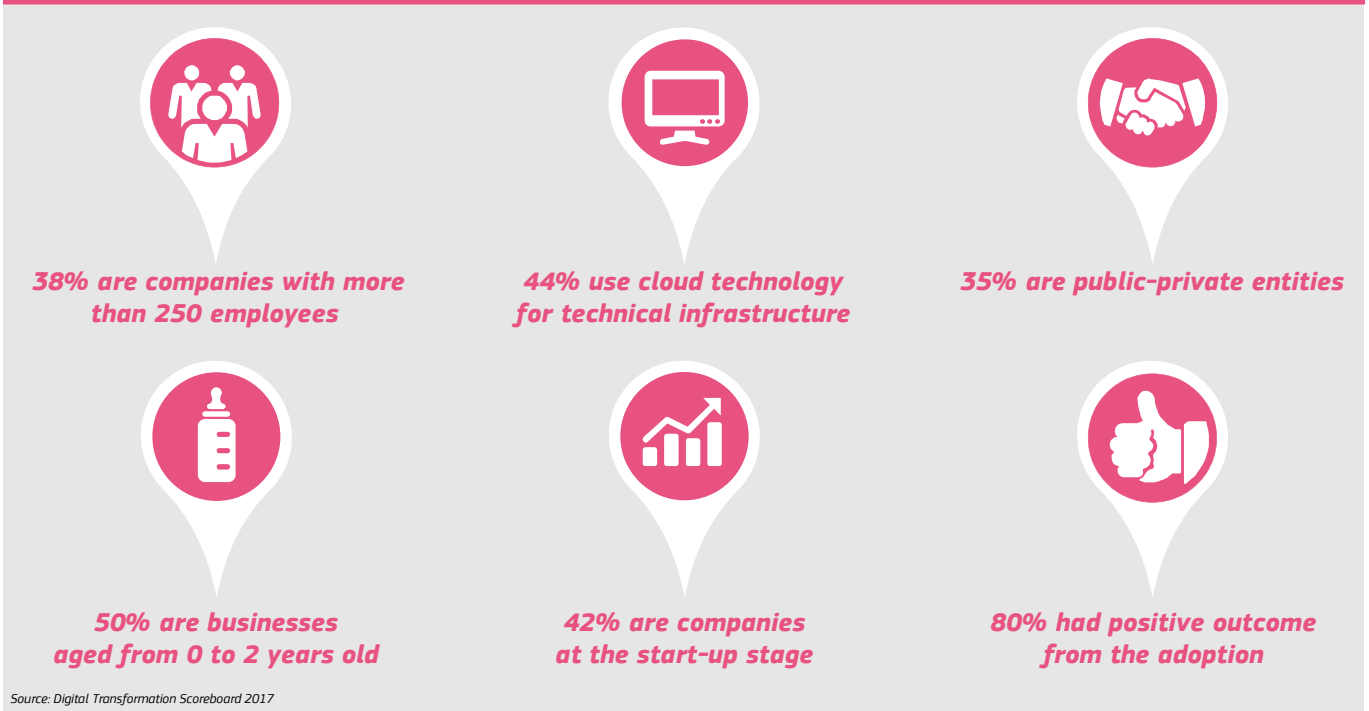


5.4 Cloud technology



27% of respondents who adopted cloud technology used the technology to bring new or significantly improved products or services to market

Figure 51: Profile of survey respondents which have adopted cloud technology



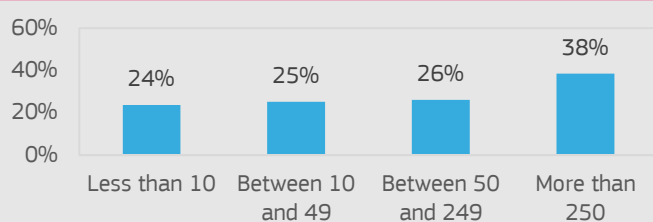
Source: Digital Transformation Scoreboard 2017

Business characteristics

Cloud technology is bought by 21% of all EU businesses. Important business data, forms and other documents can now be accessed from virtually anywhere and cloud computing is making it easier to do business, creating a more dynamic entrepreneurial culture.

Following the behaviour of previous technologies, the adoption of cloud technology is characterised by large businesses (more than 250 employees), in this case this share adds up to 38% of large businesses adopting key digital technologies; these are followed by an important share of medium-sized businesses (between 50 and 250 employees) with a share of 26% adopting this specific technologies. Medium-sized firms are are closely followed by small companies (between 10 and 50 employees) and micro firms (less than 10 employees) with a share of 25% and 24% respectively.

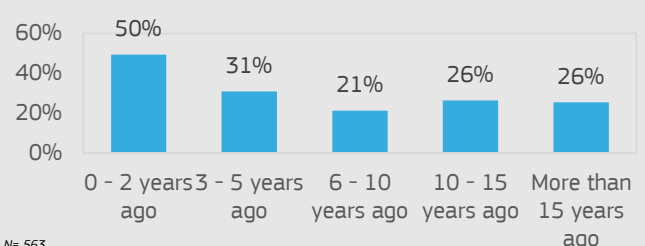
Figure 52: Adoption of cloud technology by company size



N= 619
Source: Digital Transformation Scoreboard 2017

Cloud technology adoption is also characterised by a concentration of new businesses aged between up to 2 years old (50% of new businesses who adopt key technologies), followed by young businesses aged between 3 and 5 years older businesses aged between 10 and 15 years old (31% and 26% respectively). In general, this technology is utilised by more than 21% of businesses in each age band and is also highly used to engage with customers and enhance competitiveness. These observations provide insight on a general purpose to capitalise on computing and distributive capabilities offered by cloud services developed internally or most likely sourced externally from cloud services B2B providers.

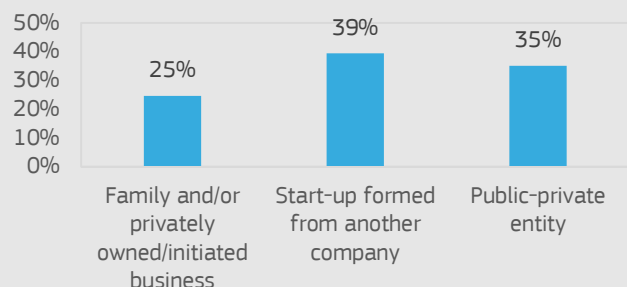
Figure 53: Adoption of cloud technology by business age



N= 563
Source: Digital Transformation Scoreboard 2017

When investigating the nature of businesses adopting cloud technology, survey results indicates start-up businesses formed from other companies (39%) and public-private entities (35%). Family and/or privately owned/initiated businesses are the type of business which adopt the least cloud technology.

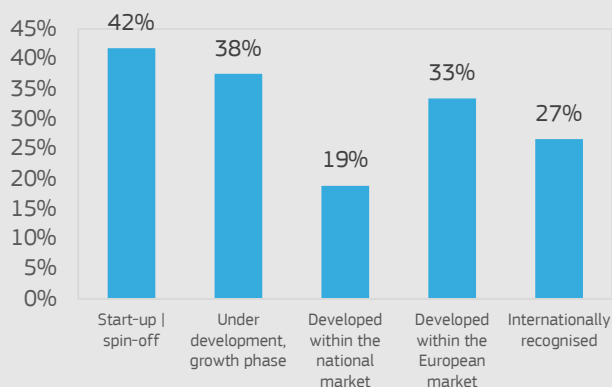
Figure 54: Adoption of cloud technology by business type



N= 552
Source: Digital Transformation Scoreboard 2017

Regarding the stage of development of businesses adopting this technology, the results indicate that businesses starting up and under development businesses represent the largest shares of adoption (42% and 38% respectively), followed by developed businesses. Businesses developed within the national market are those who adopt cloud technologies the least.

Figure 55: Adoption of cloud technology by company development stage

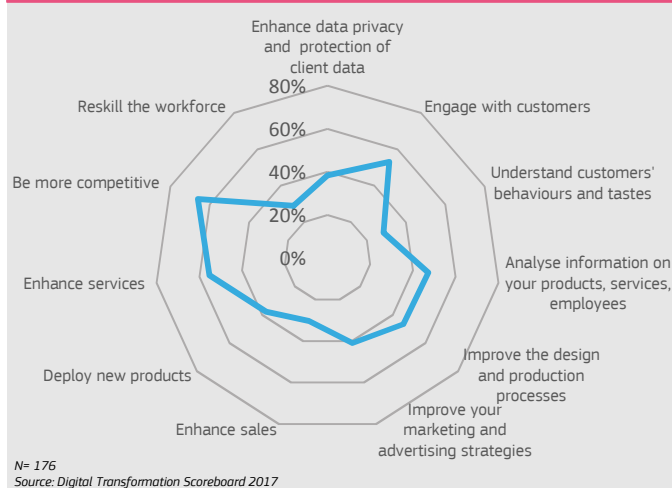


N= 551
Source: Digital Transformation Scoreboard 2017

Purpose

As mentioned before, survey results indicate that businesses adopting cloud technology also declare adopting key digital technologies with the purpose of enhancing competitiveness, services and engaging with customers. To a lower extent, these businesses also declare the analysis of information on products, services and employees, and the improvement of design production processes as additional main purposes for adopting key digital technologies.

Figure 56: Purpose of cloud technology adoption



N= 176
Source: Digital Transformation Scoreboard 2017

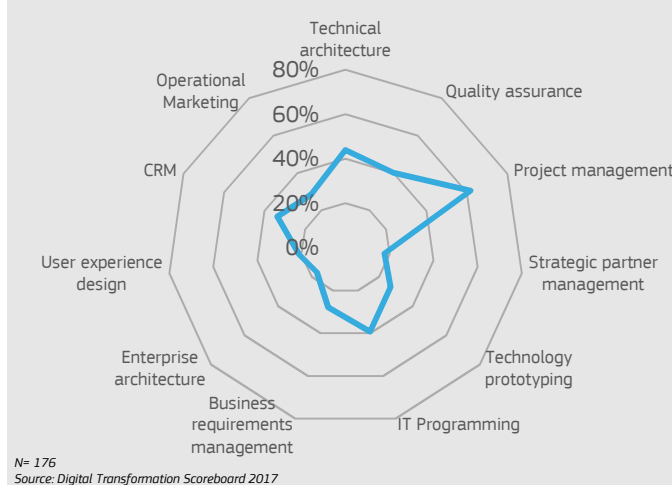
Impact

Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting cloud technology also declare that key digital technologies are modifying mainly their project management function (61%), distantly followed by their technical architecture (43%) and their IT programming (39%) functions. These observations confirm changes undergone by businesses adopting key digital technologies.

In the case of cloud technology adoption, digital transformation is not only changing the way projects are managed, but also the way key business functions are organised.

In general, positive impacts from digital technology adoption are reported by most of the businesses adopting cloud technology (80% declare having experienced positive outcomes). More specific impacts have also taken place, with 26% of these businesses declaring having introduced significantly improved products and services to the market.

Figure 57: Business function impacted by cloud technology adoption



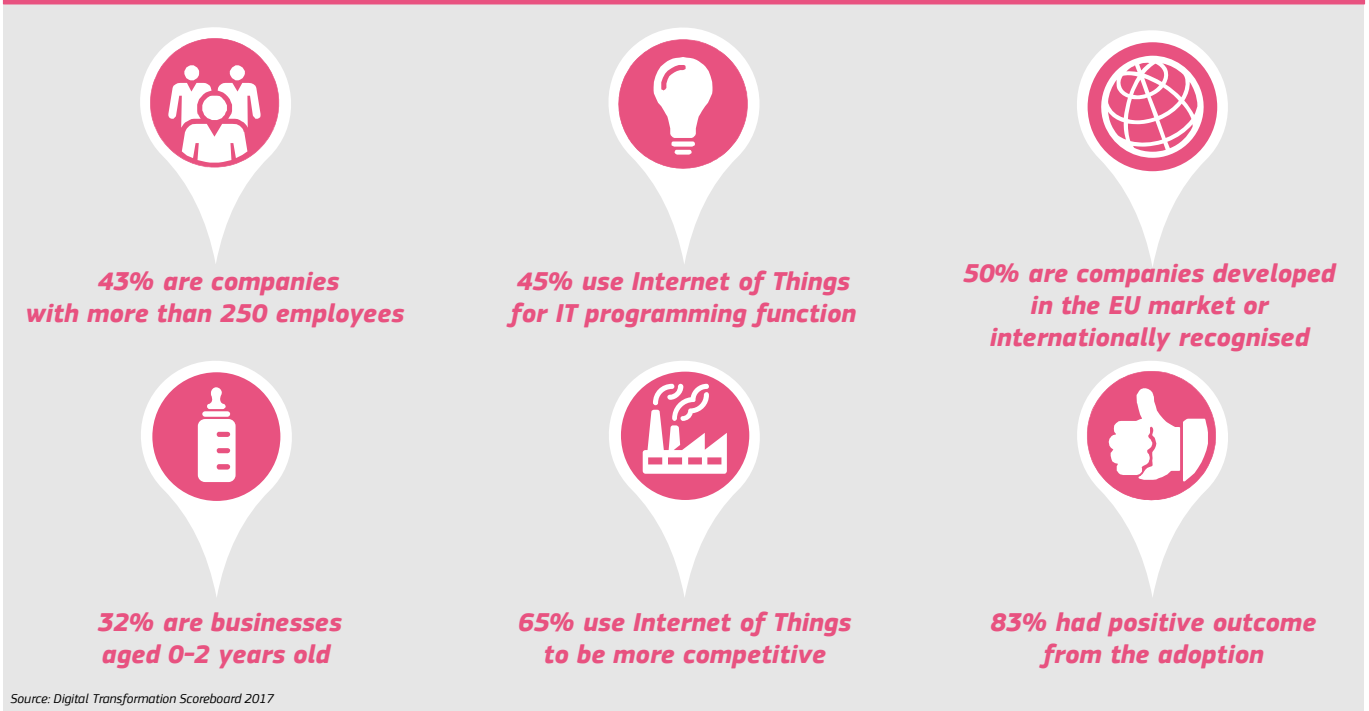
N= 176
Source: Digital Transformation Scoreboard 2017

5.5 Internet of Things



27% of respondents who adopted Internet of Things used the technology to gain new clients

Figure 58: Profile of survey respondents which have adopted Internet of Things



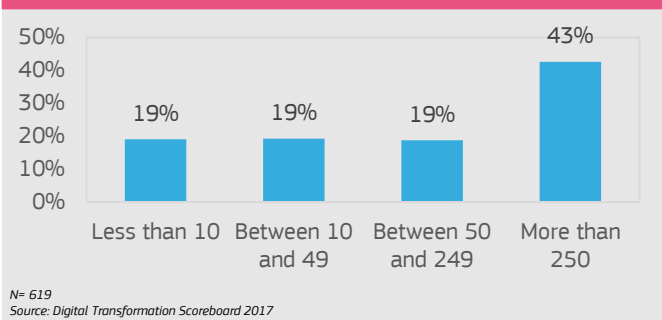
Source: Digital Transformation Scoreboard 2017

Business characteristics

As mobile devices proliferate, serving the needs of the mobile user in diverse contexts and environments is becoming of paramount importance. Phones and wearable devices are now part of an expanded computing environment including such things as consumer electronics and connected screens in the workplace, which will raise management challenges for IT organisations as they lose control of user endpoint devices.

The adoption of Internet of Things is also characterised by a large share of large businesses (more than 250 employees) having adopted the technology, in this case this share adds up to 43%. All other business size categories distantly follow all ranging at 19% of adoption rate.

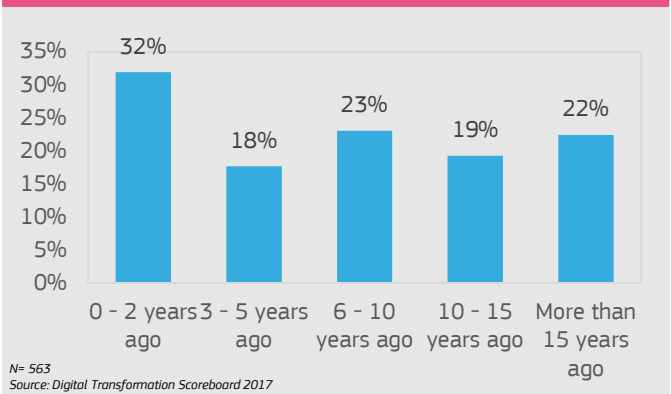
Figure 59: Adoption of IoT by company size



N= 619
Source: Digital Transformation Scoreboard 2017

In addition, the adoption of Internet of Things is also mainly represented by new businesses of up to two years old (32% adoption rate), distantly followed by young businesses aging between 6 and 10 years old (23%) and by mature businesses of more than 15 years old (22% of businesses adopting this specific technology).

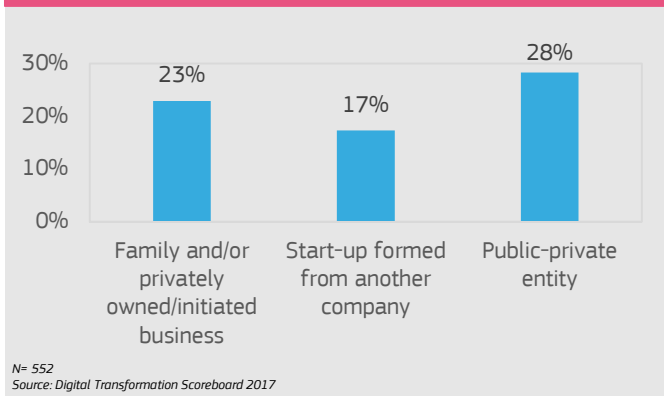
Figure 60: Adoption of IoT by business age



N= 563
Source: Digital Transformation Scoreboard 2017

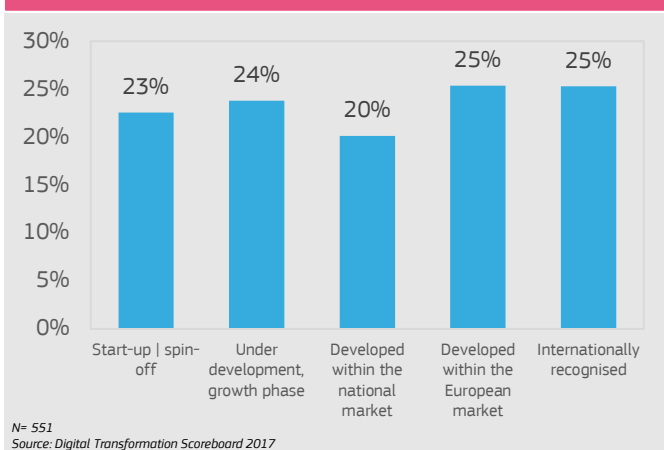
Furthermore, Internet of Things technology is largely adopted by public-private entities (28% of adopting businesses) which reflects the need for crowding in effects for the development of the technology which is today at the beginning of its adoption cycle.

Figure 61: Adoption of IoT by organisation type



Finally, survey results indicate that the adoption of Internet of Things mainly takes place at equal adoption rates across businesses in all development stages indicating that this key technology is regarded with the same level of priority by businesses each development stage.

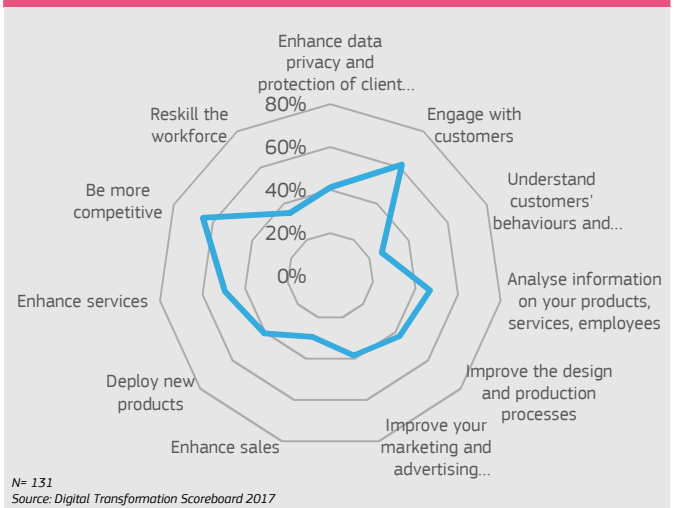
Figure 62: Adoption of IoT by company development stage



Purpose

As mentioned before, survey results indicate that businesses adopting Internet of Things technology also declare adopting key digital technologies with the purpose of enhancing competitiveness and engaging with customers. Furthermore, businesses adopting this technology also declare the analysis of information on products, services and employees and the enhancement of services as additional main purposes for adopting key digital technologies.

Figure 63: Purpose of IoT adoption

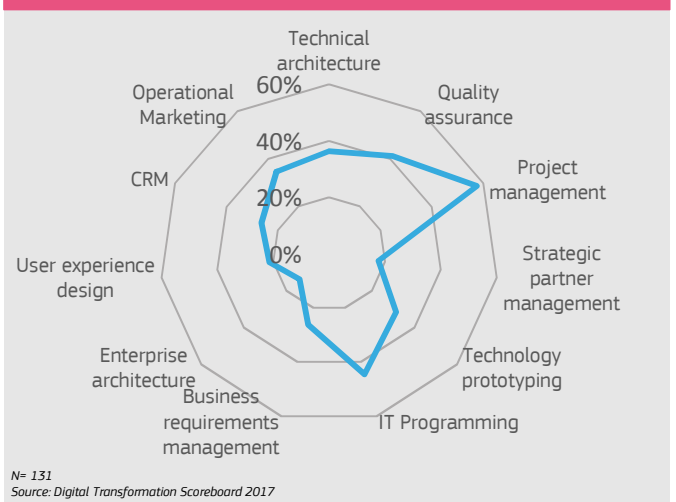


Impact

Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting Internet of Things technology also declare that key digital technologies are modifying mainly their project management function (58%), closely followed by their IT programming function (45%).

In general, positive impacts from digital technology adoption are reported by most of the businesses adopting Internet of Things technology (83% declare having experienced positive outcomes). More specific impacts have also taken place, with 27% of these businesses declaring having gained new clients and 25% having been able to shift existing clients towards new products and services.

Figure 64: Business function impacted by IoT adoption



5.6 Cybersecurity



23% of respondents who adopted cybersecurity used the technology to shift their current customers towards new products and services

Figure 65: Profile of survey respondents which have adopted cybersecurity



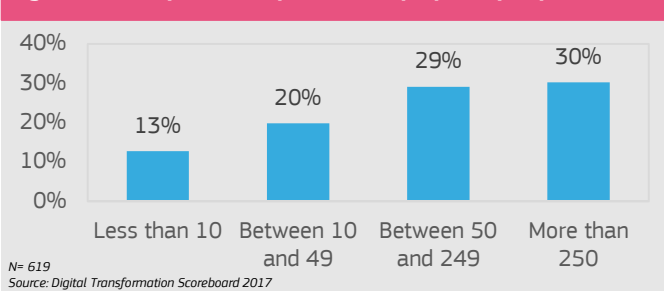
Source: Digital Transformation Scoreboard 2017

Business characteristics

Cybersecurity has never been more essential, as companies have more digital assets than before and these assets are worth more than they were before. The increasingly used hybrid cloud architectures requires a more sophisticated approach to cybersecurity. The pervasive use of mobile devices by staff means that corporate IT now has to manage the security of many more devices.

Cybersecurity solutions are also largely adopted by a large share of large businesses (more than 250 employees), which in this case adds up to 30% of adopting rate. Large businesses are closely followed by medium sized companies (29% between 50 and 250 employees) and by small companies (19% between 10 and 50 employees).

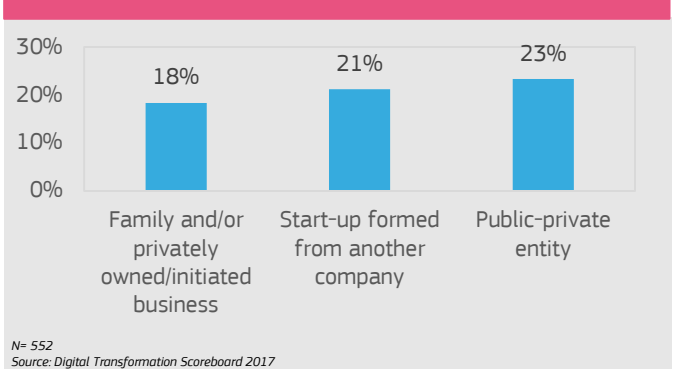
Figure 66: Adoption of Cybersecurity by company size



Micro firms (less than 10 employees) only represent 12% of businesses adopting this technology.

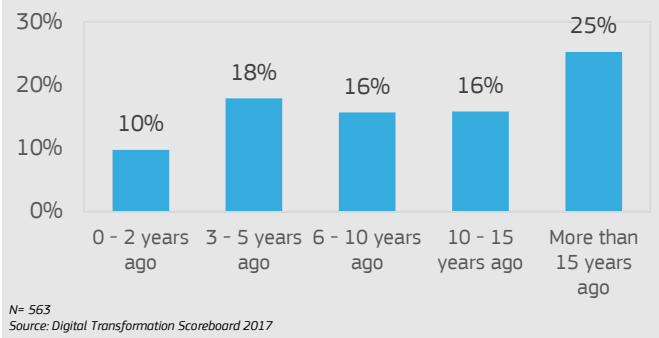
Cybersecurity is mainly adopted by public-private entities with 23% adoption rate closely followed by start-up and other business in a range between 18% and 23% adoption rate.

Figure 67: Adoption of Cybersecurity by organisation type



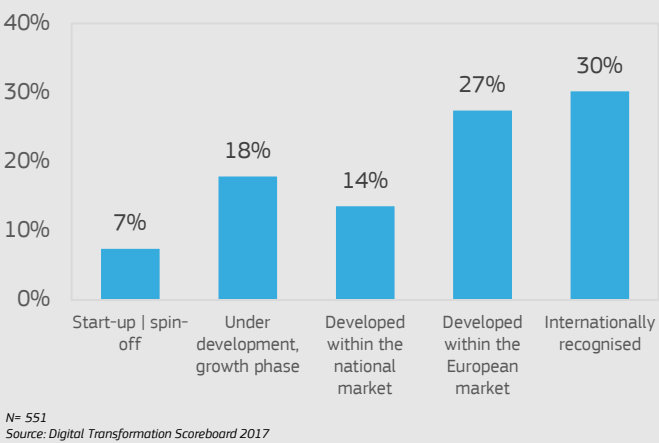
Cybersecurity is mainly adopted by mature businesses aged more than 15 years old (25% adoption rate), which are distantly followed by young businesses aging between 3 and 5 years old (18%), and older businesses between 6 and 10 years old and between 10 and 15 years old (16% adoption rate each). Interestingly, cybersecurity adopting businesses present low adoption rates when analysed across age bands, which seems counter intuitive as one would believe that businesses in the digital economy would place particular attention to information security matters regardless of whether they are mature or new.

Figure 68: Adoption of Cybersecurity by business age



Finally, and in contrast to most of the other specific technologies, cybersecurity is mainly adopted by internationally recognised businesses (30%), closely followed by businesses developed at the European level (27%), and by businesses under development or growth phase (18%).

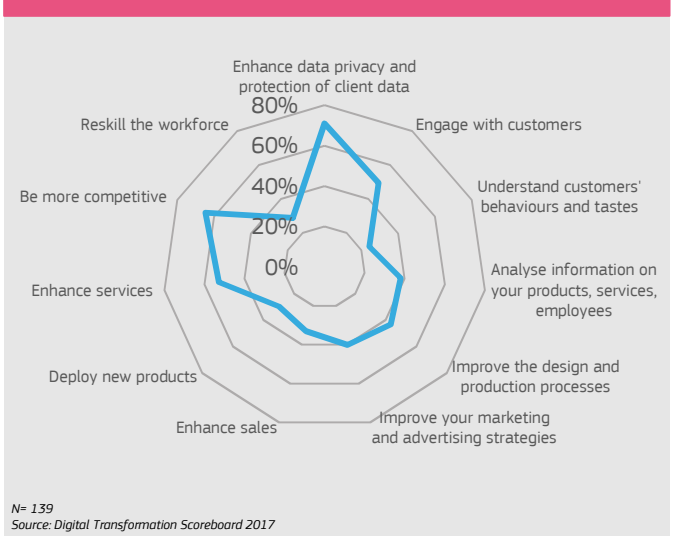
Figure 69: Adoption of Cybersecurity by company development stage



Purpose

As mentioned before, survey results indicate that businesses adopting cybersecurity also declare adopting key digital technologies with the purpose of enhancing data privacy and protection of client data, and enhancing their competitiveness and service offer. In the digital economy, data protection is a key factor of success, helping increase the reputation of businesses and enabling them to enhance their product and service offers. Furthermore, businesses adopting this technology also declare engaging with customers and the improvement of design and production processes as additional main purposes for adopting key digital technologies.

Figure 70: Purpose of Cybersecurity adoption

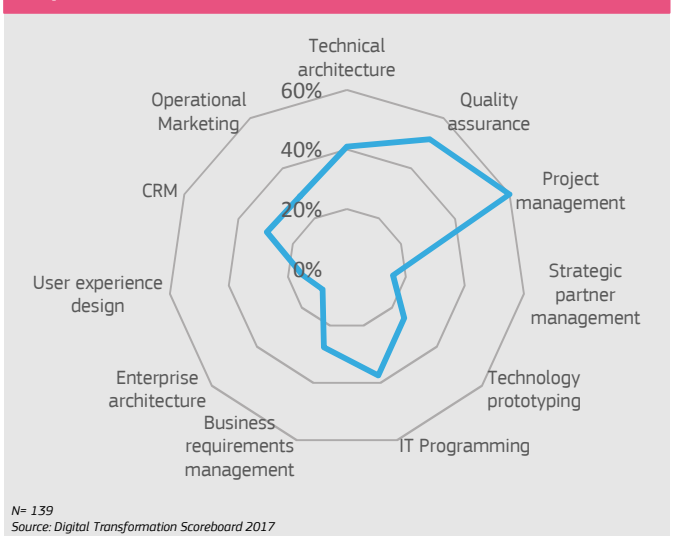


Impact

In general, positive impacts from digital technology adoption are reported by most of the businesses adopting cybersecurity solutions (80% declare having experienced positive outcomes). More specific impacts have also taken place, with 26% of these businesses declaring having gained new clients and nearly 23% having been able to shift existing clients towards new products and services.

Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting cybersecurity technology also declare that key digital technologies are modifying mainly their project management function (59%), closely followed by their quality assurance (52%) and their IT programming (37%) functions. These observations confirm changes undergone by businesses adopting key digital technologies, in particular in the case of cybersecurity adoption, digital transformation is not only changing the way data privacy and protection of client data is managed, but also the way quality assurance is ensured.

Figure 71: Business function impacted by cybersecurity adoption



5.7 Robotic and automated machinery

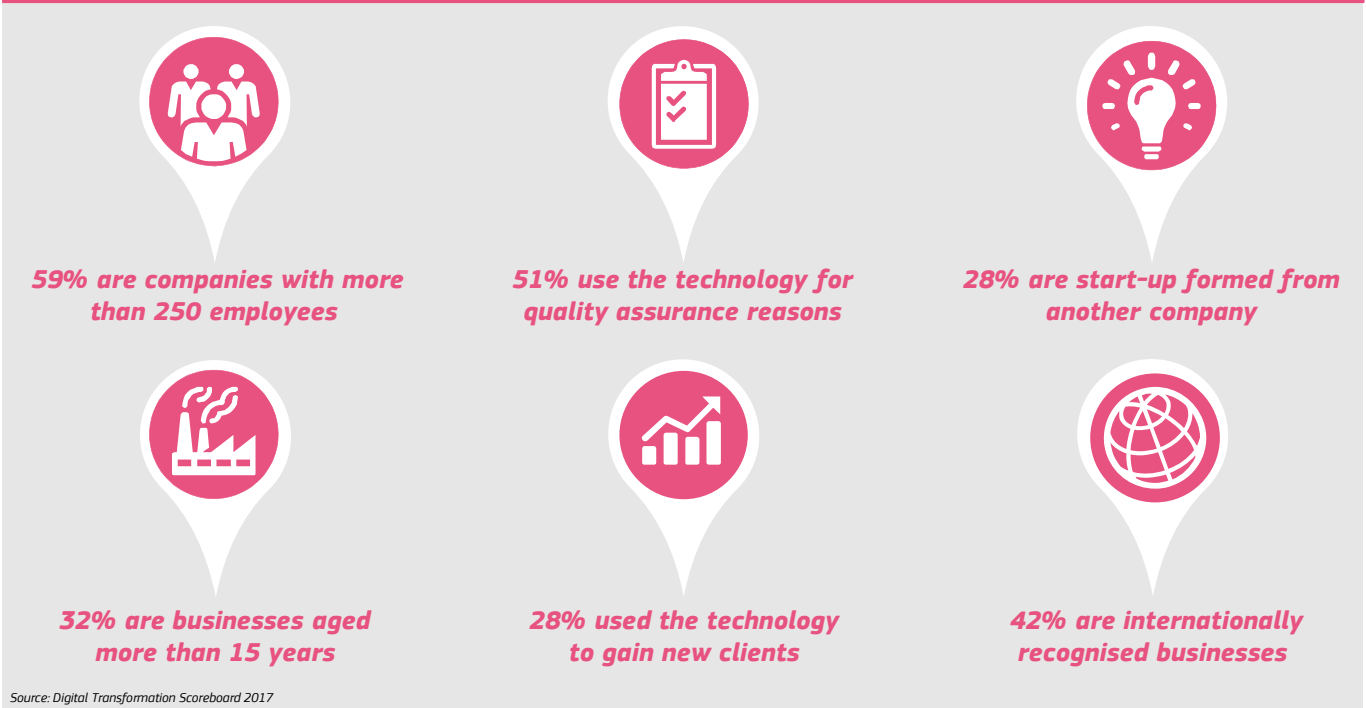


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24%

of respondents who adopted robotic and automated machinery used the technology to bring new or significantly improved products or services to market

Figure 72: Profile of survey respondents which have adopted robotic and automated machinery

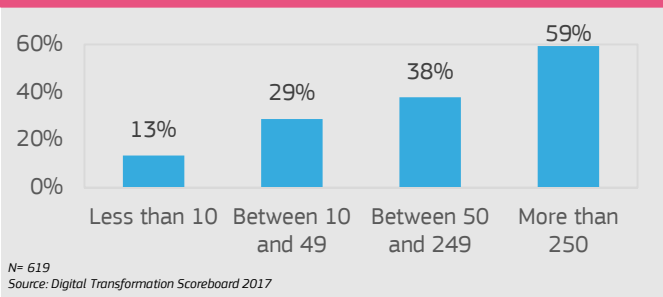


Source: Digital Transformation Scoreboard 2017

Business characteristics

Robotics can disrupt business models and shift the labour/capital mix while managing societal expectations. End-user industries are rapidly adopting robots for industrial purposes to improve the quality of products and reduce the cost of manufacturing. In terms of business size class characteristics, the adoption of robotic and automated machinery is mainly represented by an important share of large businesses (more than 250 employees), which in this case adds up to 59% of adopting rate. Large businesses are closely followed by medium sized companies (38% adoption rate of businesses between 50 and 250 employees) and by small companies (between 10 and 50 employees) with an adoption rate of 29%.

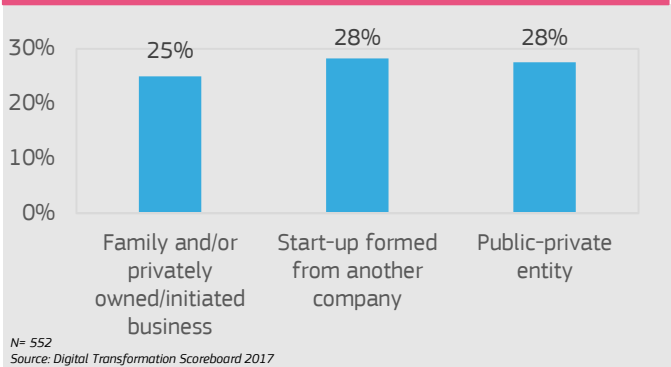
Figure 73: Adoption of Robotic and automated machinery by company size



Micro-companies are only represented by a 13% adoption rate amongst businesses adopting key technologies.

All other types of business are represented in a range between 25 and 28% adoption rate. Beyond the fact that this specific technology serves the improvement of production processes, this observation highlights the importance knowledge capital and advanced skills has on the development and adoption of robotic and automated machines as they draw on fundamental and applied knowledge directly streaming from research facilities.

Figure 74 Adoption of Robotic and automated machinery by organisation type



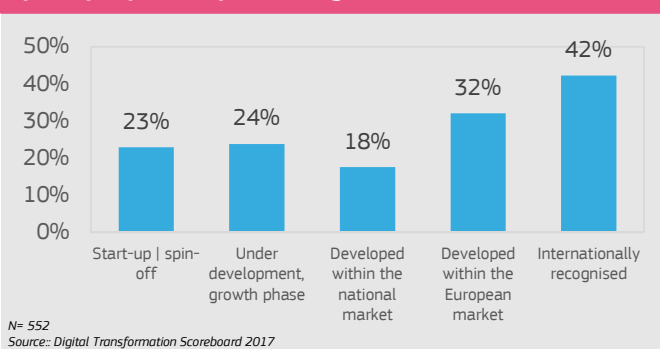
Robotic and automated machinery adoption is also characterised by mature businesses aged more than 15 years old (32% adoption rate amongst businesses using key digital technologies), which are closely followed by newly born businesses and older businesses (26% for those aged up to 2 years old, and 28% for those aged between 10 and 15 years old).

Figure 75: Adoption of Robotic and automated machinery by business age



Finally, and in contrast to most of the other specific technologies (with the exception of cybersecurity solutions), robotic and automated machinery is mainly adopted by internationally recognised businesses (42% adoption rate), distantly followed by businesses under developed at the European level. Businesses under development or in a growth phase and start-up businesses present both about 24% adoption rates. This observation shows there are differences between adoption rates of robotic and automated machinery across different development stages of a business, which in contrast to most other key digital technologies in the present study, which may require lower investment efforts, suggests that large internationally recognised groups are those with the capacity to lead the adoption process of this specific technology.

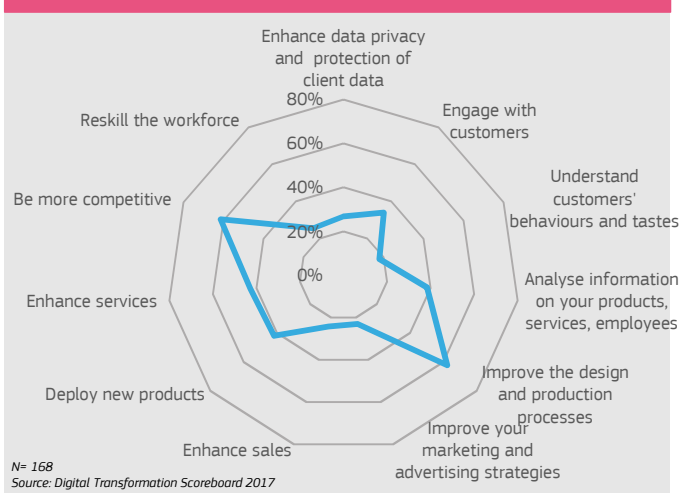
Figure 76: Adoption of Robotic and automated machinery by company development stage



Purpose

In the digital economy, where scalability goods and improved quality are enhanced efficiency gains, this technology plays a critical role for businesses looking forward to transform their processes and benefit from productivity gains therefore increasing their degree of competitiveness.

Figure 77: Purpose of Robotic and automated machinery adoption



Impact

Furthermore, businesses adopting this technology also declare the enhancements of services and the deployment of new products as additional main purposes for adopting key digital technologies. Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting robotic and automated machinery also declare that key digital technologies are modifying mainly their project management function (60%), followed by their quality assurance (42%), technology prototyping (42%), and IT programming (42%) functions. These observations confirm changes undergone by businesses adopting key digital technologies, in particular in the case of robotic and automated machinery adoption.

In general, positive impacts from digital technology adoption are reported by most of the businesses adopting robotic and automated machinery (81% declare having experienced positive outcomes). More specific impacts have also taken place, with 28% of these businesses declaring having gained new clients and 24% having been able to bring new or significantly improved products or services to market.

Figure 78: Business function impacted by Robotic and automated machinery adoption



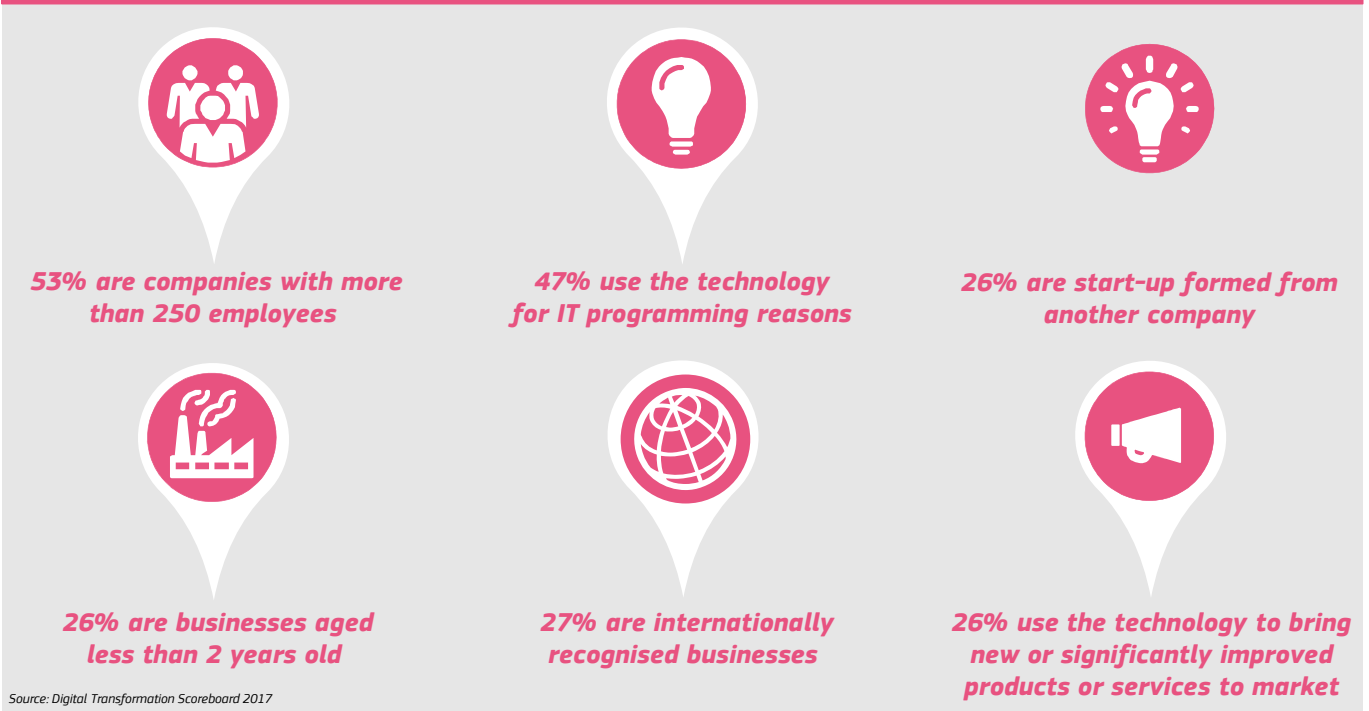
5.8 Big data and data analytics



81%

of respondents who adopted big data and data analytics considered digital technologies have generated positive outcomes

Figure 79: Profile of survey respondents which have adopted big data



Source: Digital Transformation Scoreboard 2017

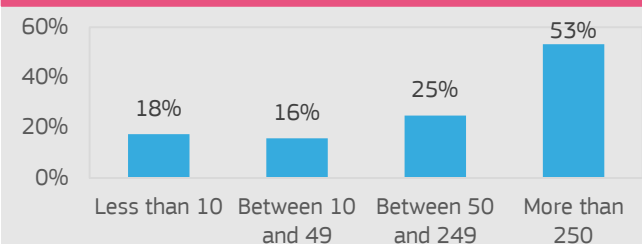
Business characteristics

Companies are beginning to utilise big data analytics to gain business insights. As analytic technologies mature, they will leverage on what computers do best, while freeing decision-makers from complex data analysis to deliver “intelligence at the moment”. This “information advantage” will speed the transition of data to insight and drive better business decisions and actions generating superior business results. The adoption of big data and data analytics is mainly characterised by important share of large businesses of more than 250 employees, in this case this share adds up to 53% of large businesses adopting key digital technologies, which is the most represented business size category in terms of adoption of big data and data analytics.

Small businesses and medium sized companies adopt this technology with shares ranging between 15% for businesses between 10 and 50 employees and 24% for very small businesses of less than 10 employees.

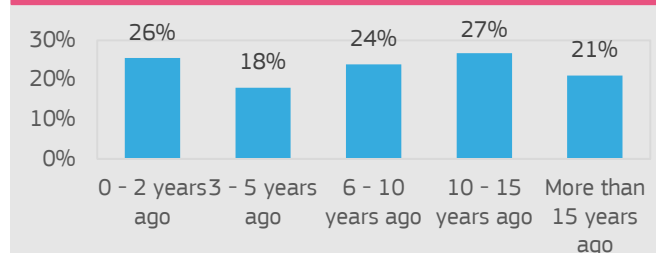
Big data and data and analytics is characterised by an adoption by both, new businesses aged up to 2 years old and older businesses aged between 10 and 15 years old (both about 25% adoption rate). These businesses are closely followed by young businesses aging between 6 and 10 years old (23% of young businesses adopting key digital technologies). Overall, the adoption of big data and data analytics capabilities mainly takes place in young businesses, which may indicate their ease of adopting complex analytical technologies.

Figure 80: Adoption of big data and data analytics by company size



N= 619
Source: Digital Transformation Scoreboard 2017

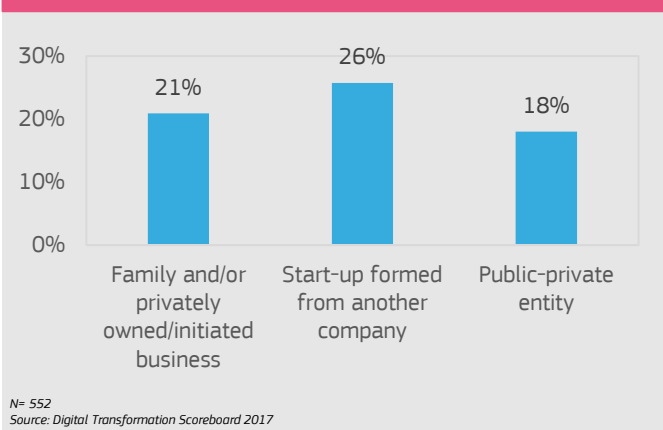
Figure 81: Adoption of big data and data analytics by company age



N= 563
Source: Digital Transformation Scoreboard 2017

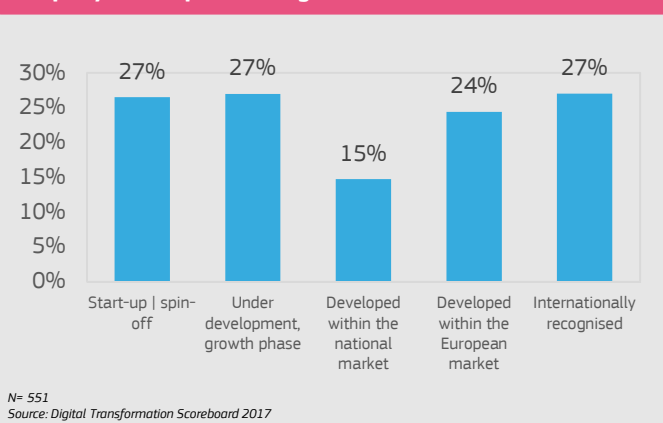
In addition, the adoption rate by organisation type shows that start-up companies are leading with 26%. Family and private businesses are closely following with 21%, while public-private entity ranks third with 18%.

Figure 82: Adoption of big data and data analytics by organization type



These observations indicate that young businesses starting up and under a growth phase are more likely to adopt analytic tools enabling them to treat large volumes of data mainly to enhance their competitive advantage.

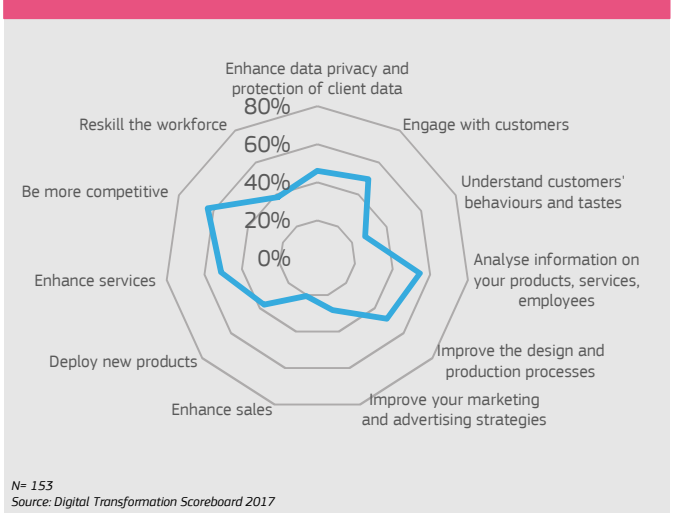
Figure 83: Adoption of big data and data analytics by company development stage



Purpose

As mentioned before, survey results indicate that businesses adopting big data and data analytic technologies also declare adopting key digital technologies with the purpose of enhancing competitiveness and analysing information on products services and employees. Analytic tools are particularly useful in the digital economy, where the understanding of information embedded in large streams of data can provide advantages in the market.

Figure 84: Purpose of big data and data analytics adoption

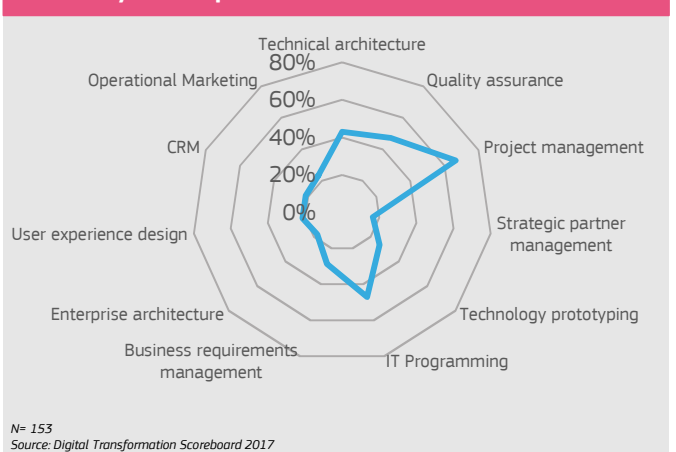


Impact

In general, positive impacts from digital technology adoption are reported by most of the businesses adopting big data and data analytic technologies (81% declare having experienced positive outcomes). More specific impacts have also taken place, with 26% of these businesses declaring having introduced significantly improved products and services to the market.

Additional insight on the utility of the technology is provided by the analysis of business functions under transformation. In fact, businesses adopting big data and data analytics technology also declare that key digital technologies are modifying mainly their project management function (66%), closely followed by their IT programming (47%) function, which can be interpreted as an internal utilisation of the technology rather than its use as an outsourced service provided by a third party. These observations confirm changes undergone by businesses adopting key digital technologies, in particular in the case of big data and data analytics.

Figure 85: Business function impacted by big data and data analytics adoption



Geographic focus



Beyond the analysis of digital transformation by businesses across the automotive, healthcare and mechanical engineering industries from a micro perspective, this study adopted national indicators to monitor digital transformation in Europe with a geographic focus and from a macro perspective.

Country comparisons were performed with the purpose of highlighting the diversity of countries in terms of digital transformation and enabling conditions. Analyses of these conditions were based on the national indicators gathered from external sources, namely the European Commission, Eurostat, and the World Economic Forum. In particular, this analysis uses a number of national indicators grouped across seven “pillars” reflecting enabling conditions and outcomes within the context of digital transformation; and establishes a global index for each pillar which provides a rank and benchmark for countries against selected aggregates such as the EU28 mean to illustrate their individual situation with respect to the EU average.

6.1 Building an index for enabling conditions and outcomes



Enabling conditions and outcomes of digital transformation

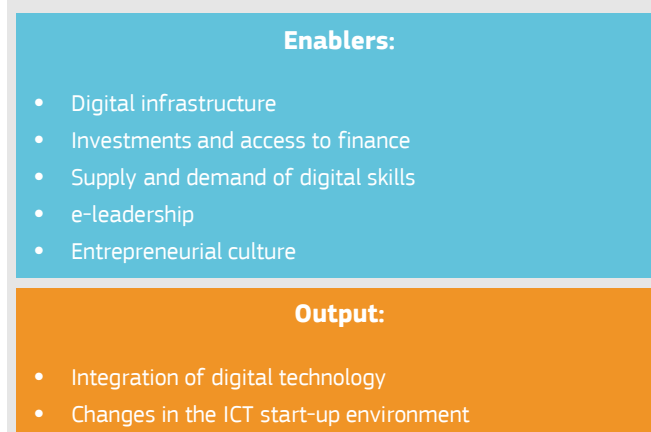
Information on enabling conditions for digital transformation is presented using a **five-category typology or ‘pillars’ that capture the principal aspects of the transformation across the 28 EU Member States** to allow countries to be positioned and ranked. The effects of digital transformation are assumed to have an impact on the integration of digital technology and on changes to the ICT start-up environment. These effects are captured through indicators **in two ‘output’ categories**, and an overview of the indicators and their classification across the five categories. Figure 86 opposite provides an overview of the enablers and output categories investigated under the geographic focus of the Scoreboard.

This revised list of national indicators integrates suitable outcome indicators that have become available such as the adoption of cloud computing services, the usage of social media, or the use of mobile solutions within the enterprise.

Within the scope of the five enablers, skills and e-leadership can be measured by the development of the ICT skills of all employees, which is central to the digital transformation of traditional companies. As an illustration, the percentage of enterprises which provide employees with training to help them develop their ICT skills therefore constitutes a relevant indicator to be captured. Furthermore, cloud computing, social media and mobile devices are technological advances transforming traditional businesses. Indicators focusing on these categories enable us **to obtain insights into the degree of transformation** of European businesses. Monitoring the use of these technologies is also a prime indicator of the influence of digital technologies on the way businesses work.

Figure 87 overleaf provides a detailed summary of the individual indicators comprised in each category of enablers and outcomes.

Figure 86: Summary of framework conditions for digital transformation



Source: Digital Transformation Scoreboard 2017

Figure 87: Composition of framework condition dimensions (individual indicators)

Dimensions	Digital Transformation Monitor Indicators	Source	Last update	Last year available	
Digital infrastructure	Enterprises using DSL or other fixed broadband connection	Eurostat	17/10/2016	2015	Enablers
	Internet bandwidth	Global Competitiveness Index	Ed. 2016	2016	
	Percentage of enterprises who use an ERP software package to share information between different functional areas	Eurostat	17/05/2016	2015	
	Percentage of enterprises using Customer Relationship Management to analyse information about clients for marketing purposes	Eurostat	17/05/2016	2015	
Investments and access to finance	Business enterprise R&D expenditure in all NACE activities from high-tech sectors	Eurostat	31/03/2016	2015	
	Direct investment in the reporting economy (inward) in the Information and communication sector (sector J) (NACE Rev. 2)	Eurostat	16/03/2016	2014	
	Total tax rate (percentage of Commercial Profits)	Global Competitiveness Index	Ed. 2016	2015	
	Venture capital availability	Global Competitiveness Index	Ed. 2016	2015	
	Ease of raising money through local equity markets	Global Competitiveness Index	Ed. 2016	2015	
Supply and demand of digital skills	Ease of access to loans	Global Competitiveness Index	Ed. 2016	2015	
	European high-technology patents per million inhabitants	Eurostat	07/07/2016	2013	
	Percentage of total persons employed that have ICT specialist skills	Eurostat	16/06/2014	2007	
	Enterprises that employ ICT specialists and had hard-to-fill vacancies for ICT specialists	Eurostat	17/05/2016	2015	
e-leadership	Persons employed, who were provided with a portable device that allows a mobile connection to the internet for business use	Eurostat	17/05/2016	2015	
	Percentage of enterprises that provided ICT/IT specialists with training to develop/upgrade their ICT skills	Eurostat	17/05/2016	2015	
	Percentage of individuals who have obtained IT skills through formalised educational institution (school, college, university, etc.)	Eurostat	01/07/2016	2011	
Entrepreneurial culture	Enterprises giving their employees portable devices for a mobile connection to the internet	Eurostat	17/05/2016	2015	
	Percentage of respondents that would prefer to be self-employed if they could choose between different kinds of jobs (employee, self-employed, none or don't know).	FlashEurobarometer (Entrepreneurship in the EU and beyond)	08/08/2012	2012	
	Percentage of respondents that would set up a new business or take over an existing one if they had the means to start their own business, including sufficient funding.	FlashEurobarometer (Entrepreneurship in the EU and beyond)	08/08/2012	2012	
ICT start-ups	Percentage of respondents that have a broadly favourable overall opinion about entrepreneurs (self-employed, business owners)	FlashEurobarometer (Entrepreneurship in the EU and beyond)	08/08/2012	2012	
	Information and communication technology birth rate (NACE Rev. 2)	Eurostat	24/10/2016	2014	Outcomes
	Employment share of information and communication technology enterprises (NACE Rev. 2)	Eurostat	14/10/2016	2014	
	Change over time of share of ICT SMEs in total number of SMEs	Eurostat	25/10/2016	2014	
Change over time of share of ICT sector (NACE Rev. 2) value added as a percentage of GDP	Eurostat	14/10/2016	2014		
Integration of digital technology	Enterprises who use an ERP software package to share information between different functional areas	Eurostat	14/12/2016	2015	
	Enterprises using radio frequency identification (RFID) technologies for after-sales product identification or as part of the production and service delivery	Eurostat	14/12/2016	2014	
	Enterprises that use two or more types of social media	Eurostat	14/12/2016	2016	
	Enterprises sending e-invoices suitable for automatic processing	Eurostat	14/12/2016	2016	
	Firms that buy cloud computing services of medium-high sophistication delivered from shared servers and from servers of service providers exclusively reserved for the enterprise	Eurostat	14/12/2016	2016	
	Enterprises selling at least 1% of turnover online	Eurostat	14/12/2016	2016	
	Enterprises' total turnover from e-commerce	Eurostat	14/12/2016	2016	
Enterprises that did electronic sales to other EU countries	Eurostat	14/12/2016	2016		

Building up indices for enablers and outcomes of digital transformation

The synthesis of selected national indicators reflecting enablers and outcomes of digital transformation in Europe was carried out through the **development of a series of rank indices**; these indices focus on the geographic scope of digital transformation and provide depth to the analysis of enabling conditions for digital transformation at EU-level and for individual Member States.

The resulting indices are used to **perform an EU-level analysis and monitoring of digital transformation**; in addition, this set of indices is also used to support the comparative analysis of individual Member States' enabling conditions and outcomes which are provided in the country profiles in section 7 of this report.

A Digital Transformation Enablers' Index (DTEI) and a Digital Technology Integration Index (DTII) are provided in pages 48 and 49 respectively. These indices make it possible to **identify the performance of Member States in terms of enabling conditions and transformation experienced** by means of a positioning score comprised between 0 and 100. These scores allow the analysis of the way countries are distributed in terms of enabling and outcome conditions with respect to each other and with respect to the EU 28 average score.

Methodology used for the construction of the indices

The construction of an index per enabling condition and outcome dimension was based on the analysis of data availability and coverage for each Member State. As shown in figure 87, many indicators across enabling conditions are available until 2015, with a few exceptions mainly in the dimensions of e-leadership, entrepreneurial culture, and supply and demand of digital skills. Furthermore, the availability of data for outcome indicators varies mostly between 2010 and 2015.

The construction of the indices followed rules **on data imputation and transformation to overcome availability issues and ensure comparability** across countries. In addition, following the application of the imputation procedure, two other steps were carried out in the construction of all rank indices (one per each enabling and output dimension): a data transformation process to limit the effects of extreme or outlying values, and a min-max normalisation process to define the rank index within a common scale for each Member State.

Homonymous Digital Economy and Society Index dimension

The Digital Economy and Society Index (DESI) of the European Commission (DG CONNECT) provides key insights into Europe's digital performance and serves to track developments in EU Member States, across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services.

The DESI dimension "Integration of Digital Technology" and the DTS output dimension on digital transformation intend to capture the same effects. The **usage of a common composite index to analyse the digitisation of Europe's industry** helps to highlight the links and the complementarity between the two tools. The methodology for the creation of the Digital Technology Integration Index is therefore that of the homonymous DESI-2016 dimension.

Analysis of data availability and coverage and imputation on missing values

This first step highlighted the fact that several of the national indicators present limitations regarding data coverage. In order to overcome such limitations, **a strategy of data imputation was adopted**; this strategy allowed the construction of the set of indices based on the following rules:

- Limitations regarding missing information for individual indicators across Member States (where no information was available) were overcome by imputing the EU average of the indicator calculated using the set of available values for the specific indicator.
- Limitations regarding data availability for a single year for a given Member State were overcome by imputing the data of its closest year available, and whenever data was available for both adjacent years the average between the two available years was retained.

Data transformation to limit the influence of extreme values and standardisation to ensure comparability

The second step following analysis and imputation involved a **process of data transformation to control for outlying values** present in the different groups of indicators.

A **min-max normalisation procedure** was selected and performed in order to allow country comparisons by means of a common range between 0 and 1. The implementation of this procedure requires careful attention to the treatment of extreme or outlying values which can induce a distortion to the resulting rank index.

Within this context, the effects of extreme or outlying values were addressed by transforming the dataset of indicators through the application of a **Winsorisation method** which limits and reduces the impact of outlying data (OECD, 2008).

Following this transformation, the **normalisation process** was engaged to ensure comparability of scales in the construction of the indices. As described above, the selected method implemented to normalise the information is a min-max standardisation procedure, which measures the distance from the value of a given Member State to the minimum value in EU28, in the context of a specific indicator.

In essence, the min-max normalisation process provides a ratio of the distance between a given observation and the minimum, with respect to the overall distance between the minimum and maximum observed indicator values in EU28. This **ratio is observed as a percentage and ensures comparability providing the rank of the Member States** within EU28 in the context of the specific indicator. As a result, rank index per framework condition was computed.

Figure 88 overleaf provides the indices and detailed ranking of Member States across the five enabling dimensions and the two output dimensions previously described. These indices reflect a **general dominant position of Western and Scandinavian economies across most of the enabling conditions**, indicating that they have led the way through the transformation of industries.

This leading position of Western and Scandinavian economies is observed for most of the enabling dimensions (infrastructures, investment and access to finance, skills, and e-leadership), with the exception of the entrepreneurial culture dimension.

Figure 88: Index scores by framework conditions

Country	Digital infrastructure	Investments and access to finance	Supply and demand of digital skills	e-leadership	Entrepreneurial culture	Changes in the ICT start-up environment	Integration of digital technology
Austria	56	63	63	77	32	42	41
Belgium	76	74	80	71	33	37	50
Bulgaria	22	30	26	6	52	62	24
Croatia	18	12	32	59	62	40	36
Cyprus	65	2	31	63	48	56	35
Czech Republic	44	47	22	43	10	51	39
Denmark	81	45	90	88	39	60	53
Estonia	45	48	27	56	42	72	28
Finland	75	72	70	100	60	60	47
France	53	63	63	57	65	50	34
Germany	66	78	67	63	32	51	44
Greece	22	39	17	39	56	31	23
Hungary	10	41	31	40	57	37	23
Ireland	59	47	74	64	73	42	56
Italy	41	45	19	43	55	31	31
Latvia	13	20	20	42	58	61	22
Lithuania	62	32	16	42	53	90	44
Luxembourg	79	72	55	87	47	43	28
Malta	69	41	39	71	26	79	37
Netherlands	84	65	76	66	44	41	48
Poland	19	43	12	44	67	60	23
Portugal	63	26	14	47	71	43	43
Romania	15	15	0	0	80	40	20
Slovakia	31	41	24	78	51	73	32
Slovenia	46	21	37	70	6	65	41
Spain	60	46	27	39	68	37	37
Sweden	80	83	85	88	32	23	51
United Kingdom	48	70	45	70	83	62	36
EU28	49	44	40	55	47	48	36
EU28 Median	55	45	32	61	52	50	37

Source: Digital Transformation Scoreboard 2017

6.2 The Digital Transformation Enablers' Index (DTEI)



The more powerful the enablers, the better the digital transformation!

The procedure described in the previous section made it possible to establish a rank index for each enabling condition and outcome of digital transformation. In addition to each of the seven indices, a Digital Transformation Enablers' Index was developed through a linear combination of each one of the enabling conditions indices.

This Digital Transformation Enablers' Index (DTEI) provides a ranking for Member States based on the **assumption that infrastructure, access to finance, and the demand and supply of skills are the most important factors driving digital transformation** (with a respective weight of 20%, 30%, and 30% of the DTEI), whilst the indices on the environmental enabling conditions (e-leadership and entrepreneurial culture) are assumed to integrate the DTEI with lower weight (10% each).

Key findings

According to the resulting index on digital transformation enabling conditions, two countries (Sweden and Finland) present the highest scores in terms of digital capital, labour and business environment, followed by western European economies.

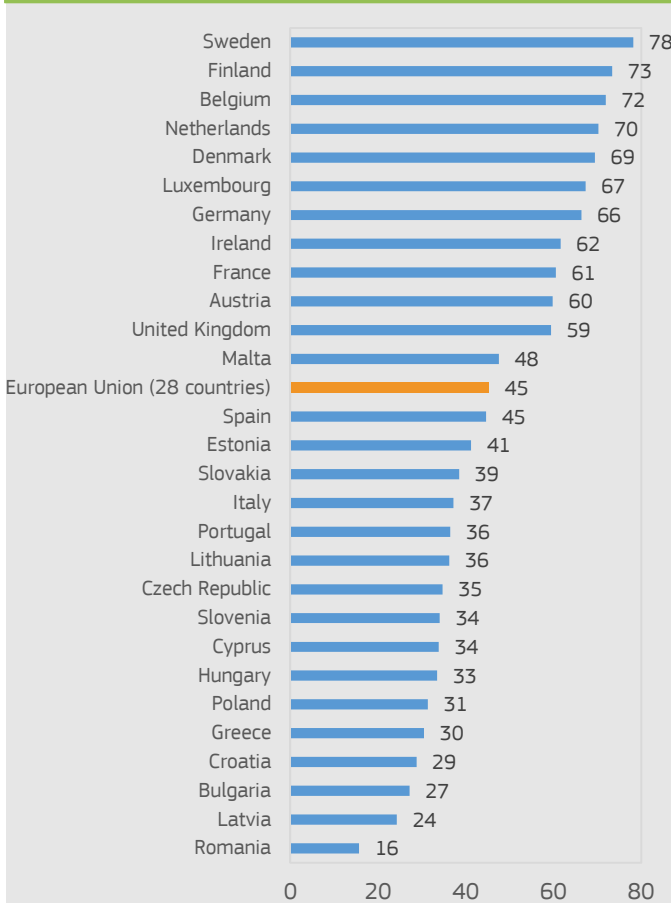
The index does not point to any major underdispersion or overdispersion in the distribution (or strong disparities measured by its degree of skewness). However, it is important to note that most of the countries below the EU28 average rank are mainly southern and eastern economies.

Overall EU performance on enabling conditions for digital transformation

Figure 90 (below) provides an illustration of the average and median EU 28 performance across each individual dimension of the digital transformation enablers' index. This illustration provides evidence about its negative skewness (where the median is greater than the mean) within each enabling dimension at the EU 28 aggregate level, with exception of the skills dimension.

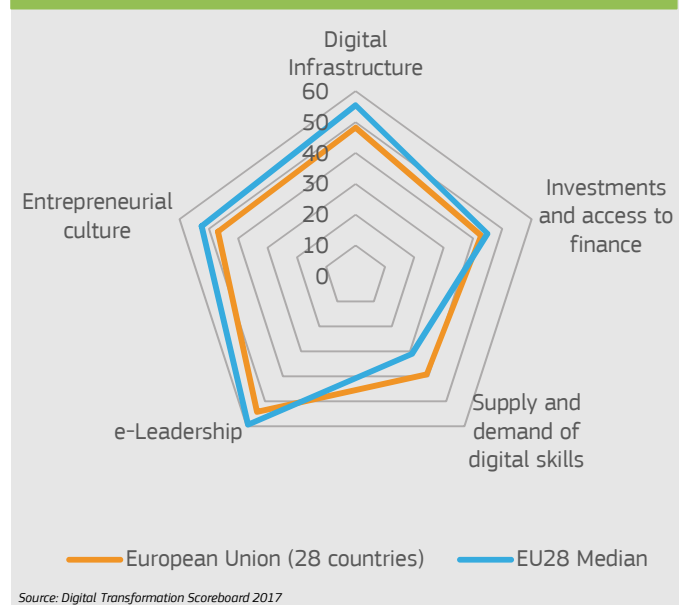
This observation indicates that low scores in the digital transformation enablers' index are concentrated across several Member States, while only a few concentrate high scores in most enabling dimensions. In this respect, we can assume that Member States prioritise efforts in different enabling conditions although the supply and demand of digital skills is a factor that many countries consider important.

Figure 89: EU Digital Transformation Enablers' Index



Source: Digital Transformation Scoreboard 2017

Figure 90: EU Digital Transformation Enablers' Index (EU28 average and median)



Source: Digital Transformation Scoreboard 2017

6.3 The Digital Technology Integration Index (DTII)



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The DTII adopted for the comparative analysis against enabling conditions only takes into account the eight individual indicators measured at national level and assumed **to reflect changes in the digital transformation of European businesses**. The resulting indicator shows that the three principal economies presenting the highest scores are Ireland, Denmark and Sweden. The index also shows that a considerable number of Member States perform above the EU28 average rank in integration of digital technology which therefore reflects an overdispersion across the rank index (where the median is greater than the average). This result demonstrates that the **integration of digital technology is indeed taking place in a majority of EU economies**, although improvements are yet to be made in the case of central and eastern economies who are lagging behind.

Key findings

According to the resulting index on digital transformation, **Northern countries** (i.e. Ireland, Denmark, and Sweden) present the highest scores in terms of digital transformation.

Integration of digital technology is advancing in a majority of EU MS but a few countries are still lagging behind

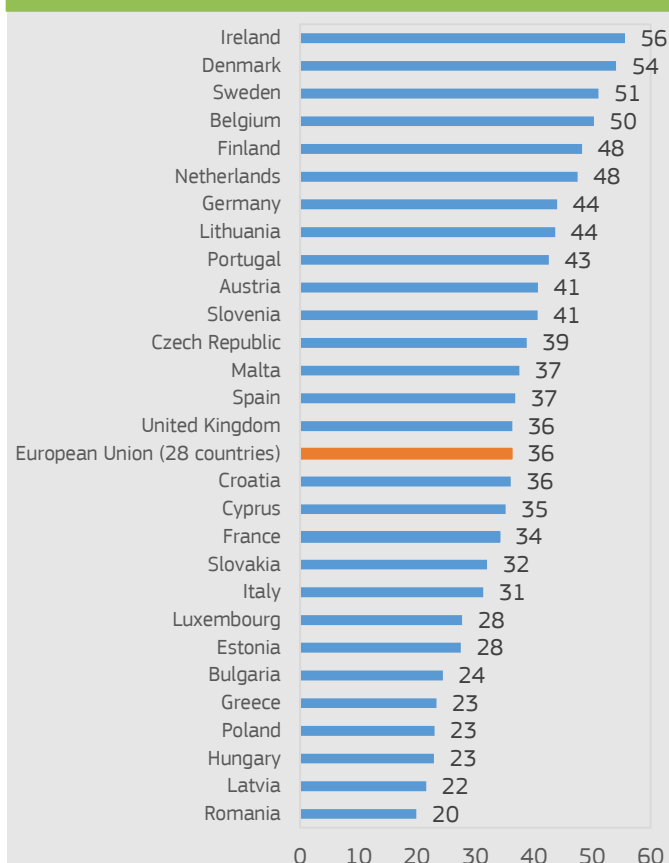
These countries are followed by **Western European economies** (Belgium, the Netherlands, Finland and Germany) with the exception of Lithuania which appears in the top tier of the index. The distribution of the index does point to some degree of overdispersion (or strong disparities measured by its degree of skewness).

Overall EU performance on digital technology integration

Figure 92 below provides an illustration of the average and median EU 28 performance across each individual dimension of the digital technology integration index. This illustration provides evidence about its positive skewness (where the mean is greater than the median) within most of the individual digital technology integration indicators at the EU 28 aggregate level, with a few exceptions, such as the automated exchange for receiving customer orders, the use of RFID technologies and the use of two or more social media.

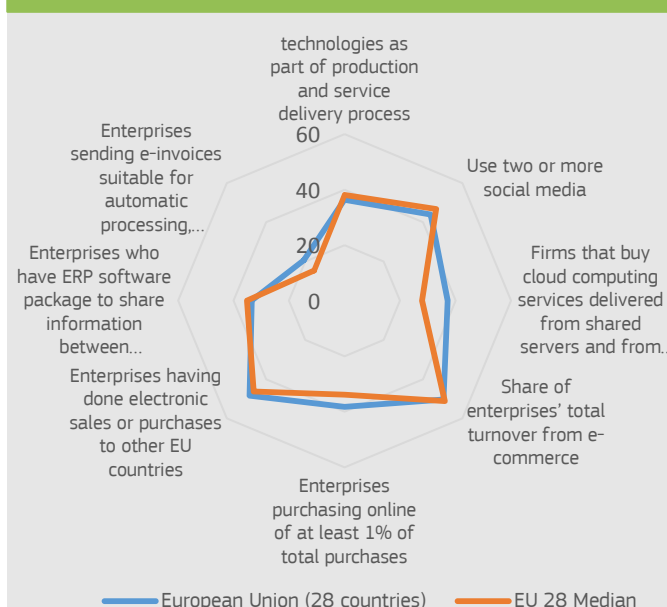
This observation indicates that a large number of Member States benefits from high scores in most of the individual indicators comprised in the index; this leads to the assumption that the tendency for digital technology integration in the European industry is widely spread across countries. This result provides **evidence about the transformation dynamics of the European industry** as a whole, regardless of differences between Member States. However, as one should never rest on one's laurels, Member States should neither neglect future support for digital technology integration in their policies when digital transformation seems to be engaged, nor should they dismiss the need to carry out structural and regulatory adjustments when it doesn't.

Figure 91: EU Digital Technology Integration Index



Source: Digital Transformation Scoreboard 2017

Figure 92: EU Digital Technology Integration Index (EU28 average and median)



Source: Digital Transformation Scoreboard 2017

Digital skills for digital transformation

The relationship between digital technology integration and the supply and demand of digital skills was analysed using a rank index described in the previous section. Correlation analyses help understand the **extent to which digital transformation relates to the supply and demand of digital skills**.

Five countries providing the best digital skills for digital technology integration

Denmark is the best performing country in the “supply and demand of digital skills” dimension, closely followed by Sweden. Belgium, the Netherlands and Finland are also leaders in the dimension with a performance well above that of the EU average. Ireland, Germany, France, Austria, Luxembourg and the UK are also performing above the EU average.

Five countries lagging behind for digital technology integration

Romania, Poland, Portugal, Greece, Latvia, Italy, Lithuania and Slovakia are lagging behind with a performance level well below that of the EU average. The weak performance of Romania and (to a lesser extent) of Poland are particularly worrying given the significant gap compared to all other EU countries.

Positive impact of digital skills on digital technology integration

Figure 94 (below) demonstrates the positive correlation between the level of supply and demand of digital skills and performance in terms of digital technology integration. The highest-performing countries in terms of digital skills are also the best performers in terms of digital technology integration and the same holds true for low performing countries.

Figure 93: Supply and demand of digital skills

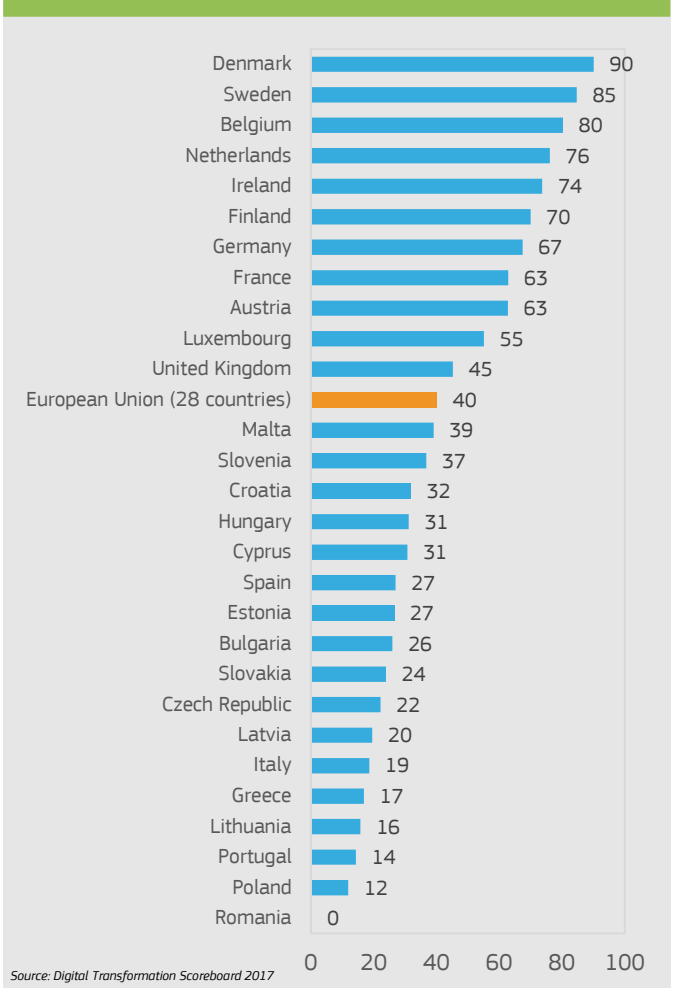
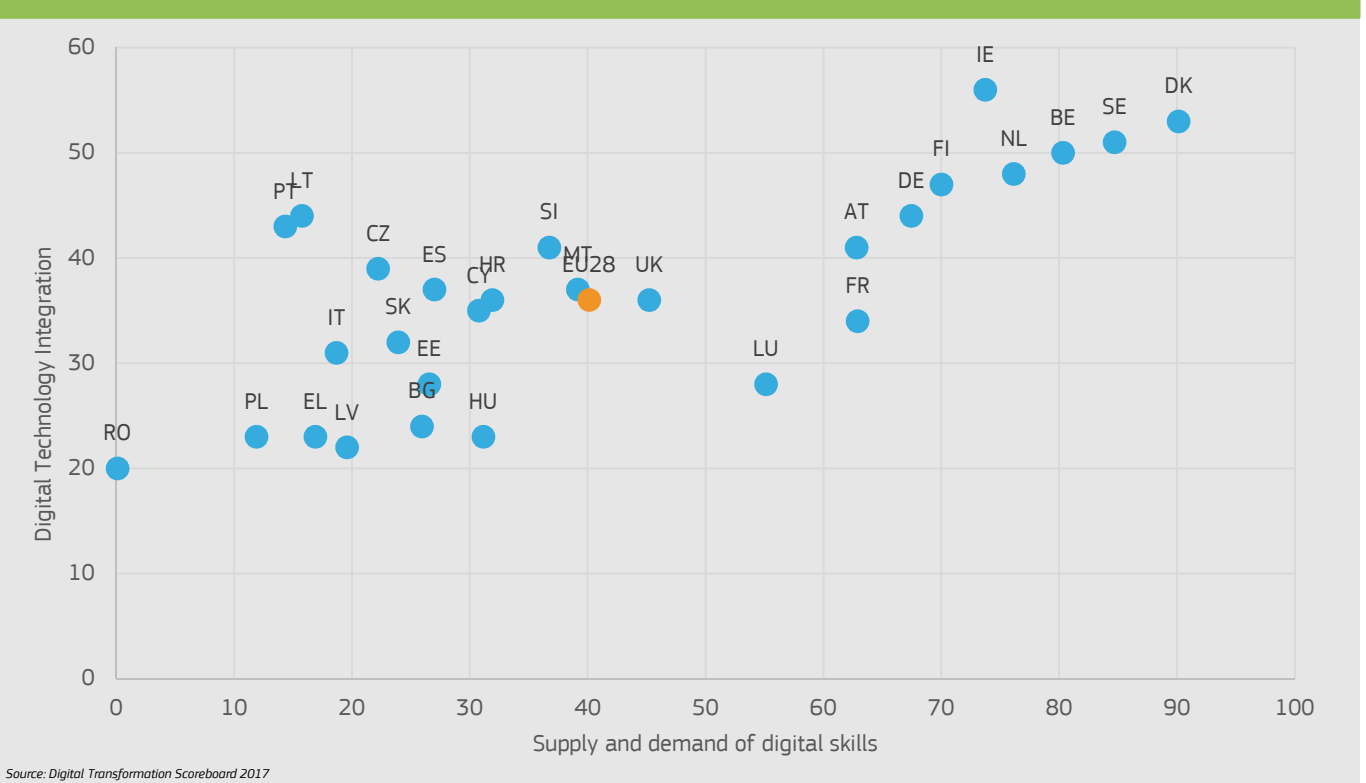


Figure 94: Supply and demand of digital skills



Entrepreneurial culture and digital transformation

The relationship between digital technology integration and entrepreneurial culture was analysed using the rank index described in the previous section. Correlation analyses help understand **the extent to which digital transformation relates to the entrepreneurial culture.**

Wide disparities in “entrepreneurial culture” between EU Member States

The EU average in the “entrepreneurial culture” dimension conceals huge discrepancies between the Member States: while the performance score for the UK (best-performing country) is above 80, that of Slovenia (worst-performing country) is below 6.

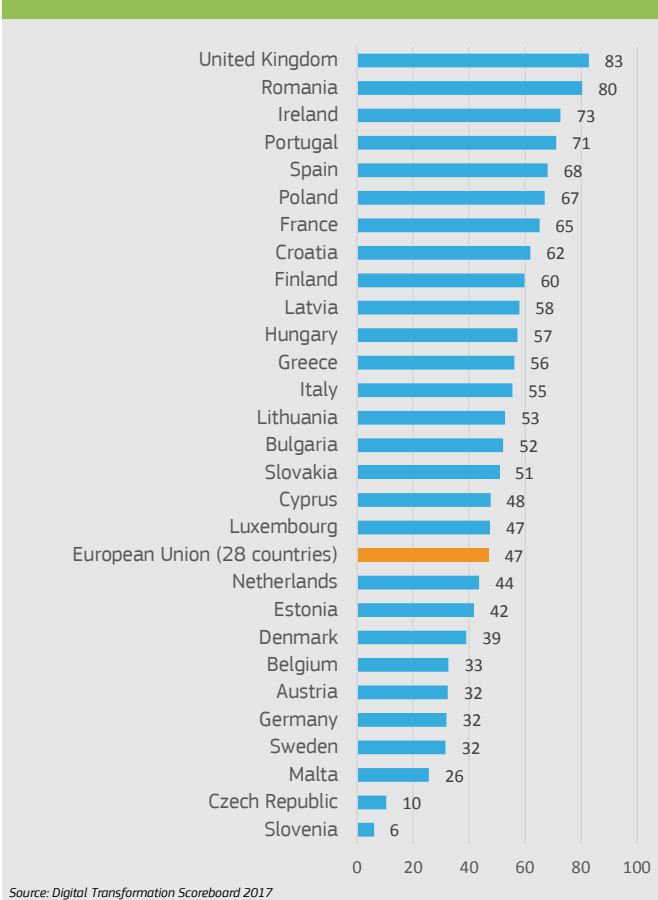
An entrepreneurial culture widely spread across a majority of EU countries

The UK is the best-performing country in the “entrepreneurial culture” dimension, closely followed by Romania. Ireland, Portugal, Spain, Poland and France are also leaders in the dimension with a performance well above that of the EU average. The UK and Ireland have recently implemented a wide range of measures to support entrepreneurs, start-ups and SMEs in order to reinforce their competitive position in entrepreneurship conditions. The high performance of Romania reflects the success of the recent active implementation of policies conducive to the creation of a business-friendly environment. Consequently, “entrepreneurial intentions and entrepreneurship as a desirable career choice in Romania are among the highest compared to other EU countries”⁸. In Portugal, considerable policy efforts were carried out recently to promote entrepreneurship in order to reduce the unemployment rate. This active promotion may explain why Portugal continues to perform well above the EU average in this area⁹.

Opportunity vs necessity-driven entrepreneurial activity

The motivation behind the start of a business may influence the propensity of business leaders to adopt digital technologies. High-performing countries in entrepreneurial culture with a high share of **opportunity-driven entrepreneurs** would be more likely to adopt digital technologies than business-friendly countries with a higher share of **necessity-driven entrepreneurs**. This assumption could explain why some countries (Romania, Poland) with a low rate of opportunity-driven entrepreneurial activity¹⁰ but high performance in terms of entrepreneurial culture, could have a low performance in terms of digital technology integration.

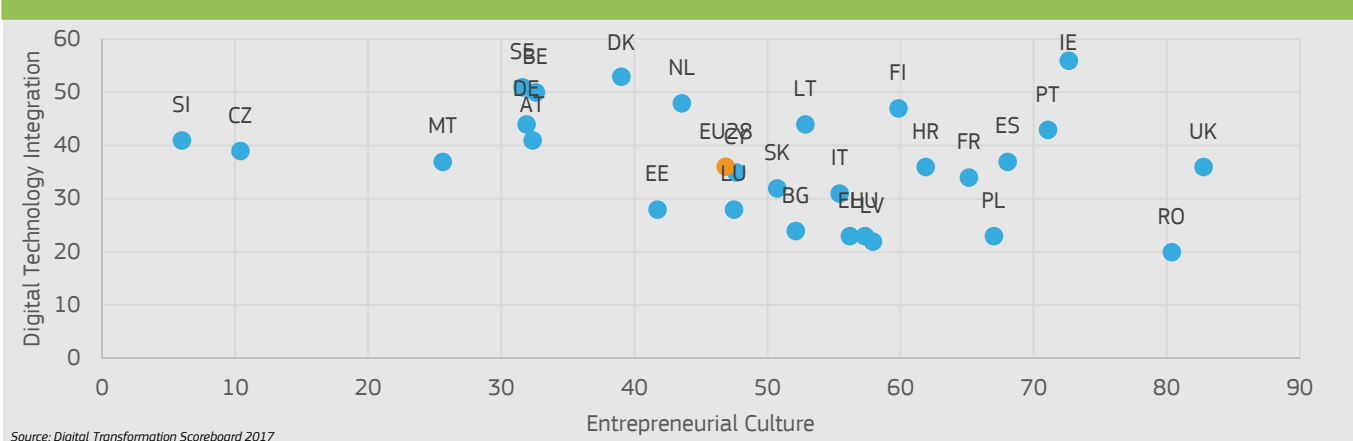
Figure 95: Entrepreneurial culture



A few EU countries are lagging a considerable way behind in terms of entrepreneurial culture

At the bottom of the scale, the weak performance of Slovenia and (to a slightly lesser extent) of the Czech Republic are particularly worrying given the significant gap compared to all other EU countries. The low performance of Slovenia could be the result of the “unsystematic approach to integration of entrepreneurship into the education curricula, and the lack of cooperation between entrepreneurs and higher education institutions”. Similarly, the Czech Republic’s low performance could be explained by the mainly negative “public perception of entrepreneurs, particularly those running small businesses and handicraft businesses”. Malta, Sweden, Germany, Austria and Belgium are also lagging behind with a performance well below that of the EU average.

Figure 96: Entrepreneurial culture



Investments and access to finance for digital transformation

The relationship between digital transformation and investments and access to finance was analysed using the rank index built as described in the previous section. Correlation analyses help understand **the extent to which digital transformation relates to investments and access to finance.**

Vast disparities in “investments and access to finance” between EU Member States

The EU average in the “investments and access to finance” dimension conceals huge discrepancies between the Member States: while the performance score for Sweden (best-performing country) is above 80, that of Cyprus (worst-performing country) is below 5.

A favourable investment environment in a majority of EU countries

Sweden is the best-performing country in the “investments and access to finance” dimension, followed by Finland, Germany and Luxembourg. Belgium, the UK, France and the Netherlands are also leaders in the dimension, with a performance well above that of the EU average.

A few EU countries are lagging a considerable way behind in terms of investments and access to finance

At the bottom of the scale, the weak performance of Cyprus and (to a slightly lesser extent) of Croatia and Slovenia are particularly worrying given the significant gap compared to all other EU countries. Latvia, Portugal, Romania, Bulgaria and Hungary are also lagging behind with a performance well below that of the EU average.

Figure 96: Investments and access to finance

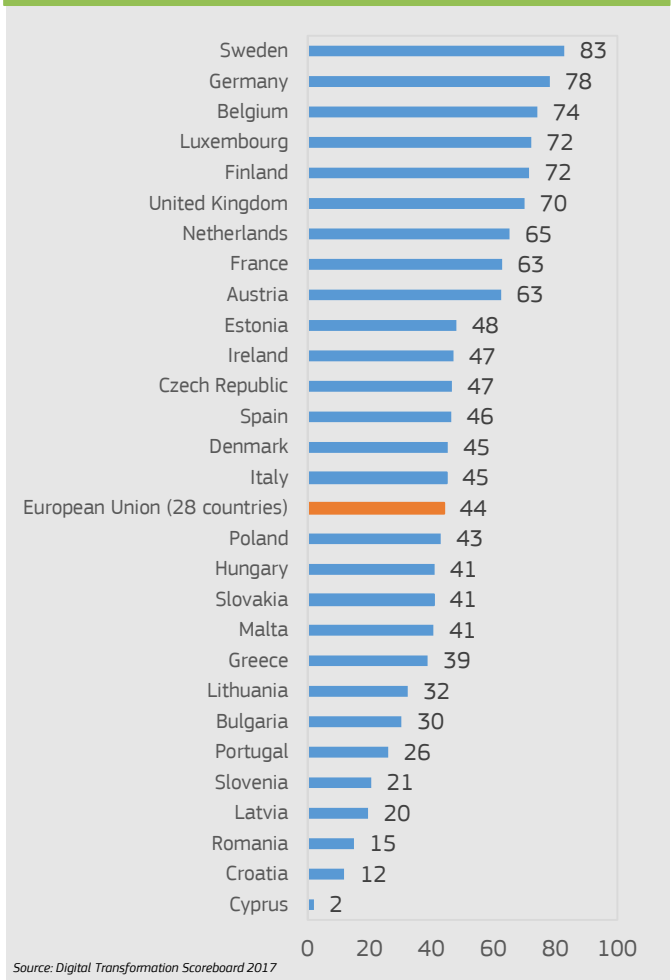
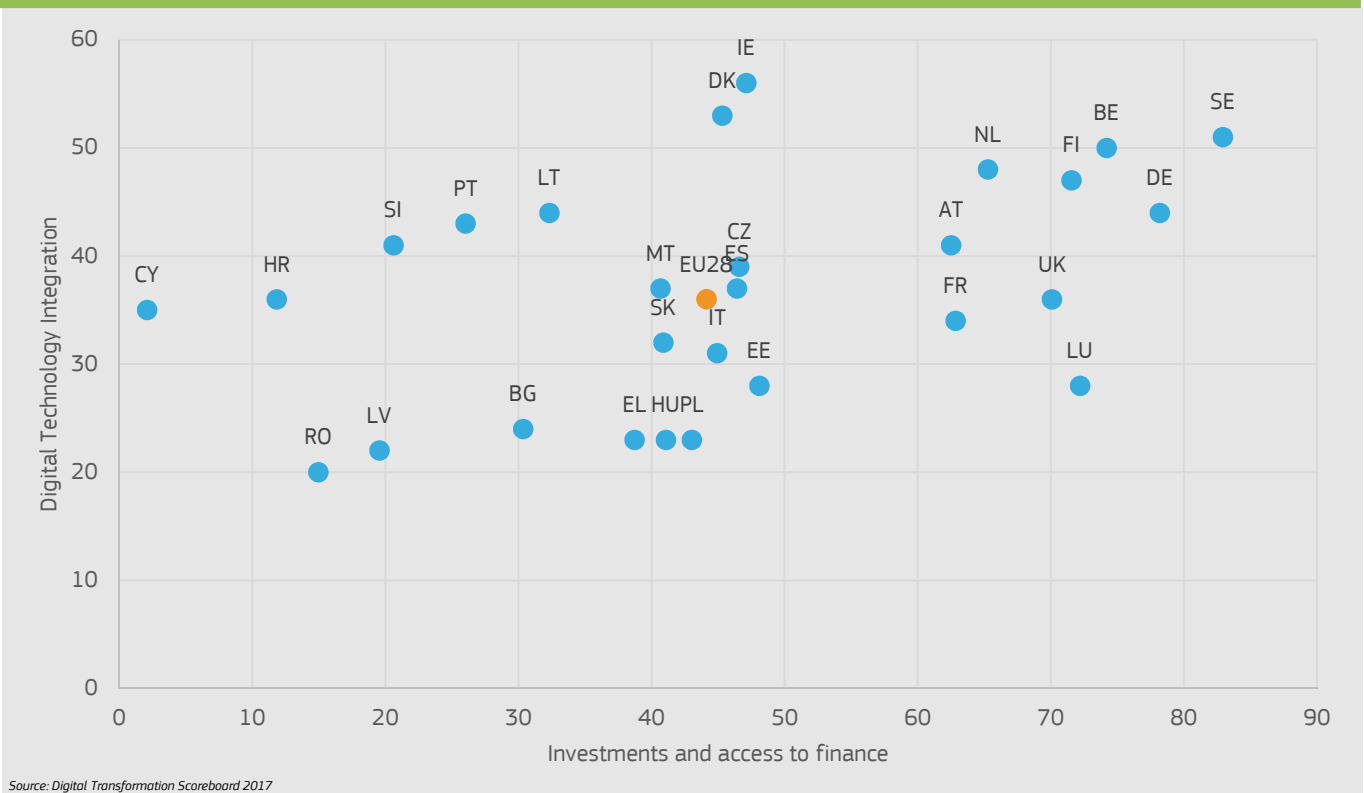


Figure 97: Investments and access to finance



E-leadership for digital transformation

E-leadership is described as the capacity to offer training and/or digital devices to the staff. The relationship between digital technology integration and e-leadership was analysed using the rank index (Figure 99) built as described in the previous section. Correlation analyses were carried out to help understand **the extent to which digital transformation relates to e-leadership**.

Vast disparities in “e-leadership” between EU Member States

The EU average in the “investments and access to finance” dimension conceals huge discrepancies between the Member States: while the performance score for Finland (best-performing country) is 100, that of Bulgaria (worst-performing country) is 6.

Scandinavian countries leading the way in terms of e-leadership

Finland is the best-performing country in the “e-leadership” dimension, followed by Denmark and Sweden. Following Scandinavian countries, Slovakia, Luxembourg, Austria, Belgium, the UK and Slovenia are also leaders in the dimension with a performance well above that of the EU average.

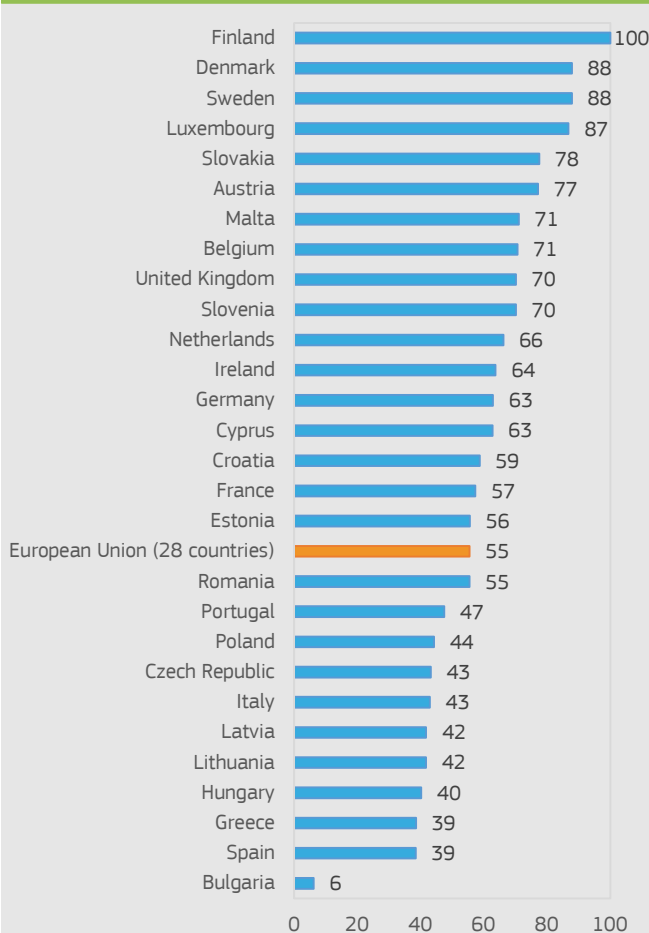
A few EU countries are lagging a considerable way behind in terms of e-leadership

At the bottom of the scale, the weak performance of Romania and (to a slightly lesser extent) of Bulgaria are particularly worrying given the significant gap compared to all other EU countries. Greece, Latvia, Spain and Hungary are also lagging behind with a performance well below that of the EU average.

A clear positive impact of e-leadership on digital technology integration performance

Figure 99 demonstrates the positive correlation between e-leadership performance and digital technology integration.

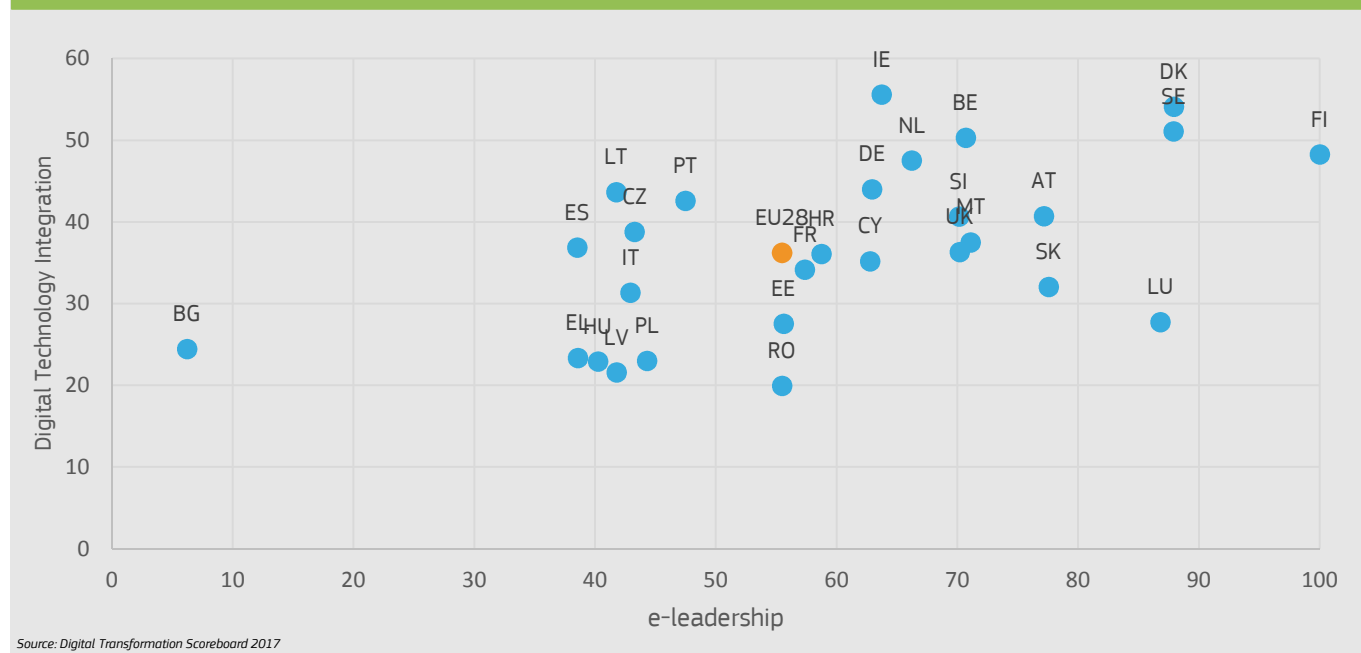
Figure 98: e-leadership



Source: Digital Transformation Scoreboard 2017

Countries performing well above the EU average in terms of e-leadership are also the best performers in terms of digital technology integration. This correlation is further explained in section 6.4 (p.55) of this report.

Figure 99: e-leadership



Source: Digital Transformation Scoreboard 2017

Digital infrastructure for digital transformation

The relationship between digital technology integration and digital infrastructure was analysed using the rank index built as described in the previous section. Correlation analyses were carried out to help understand **the extent to which digital transformation relates to the existence of digital infrastructure.**

Vast disparities in the existence of digital infrastructure between EU Member States

The EU average in the “digital infrastructure” dimension conceals huge discrepancies between the Member States: while the performance score for Sweden (best-performing country) is above 80, that of Hungary (worst performing country) is below 5.

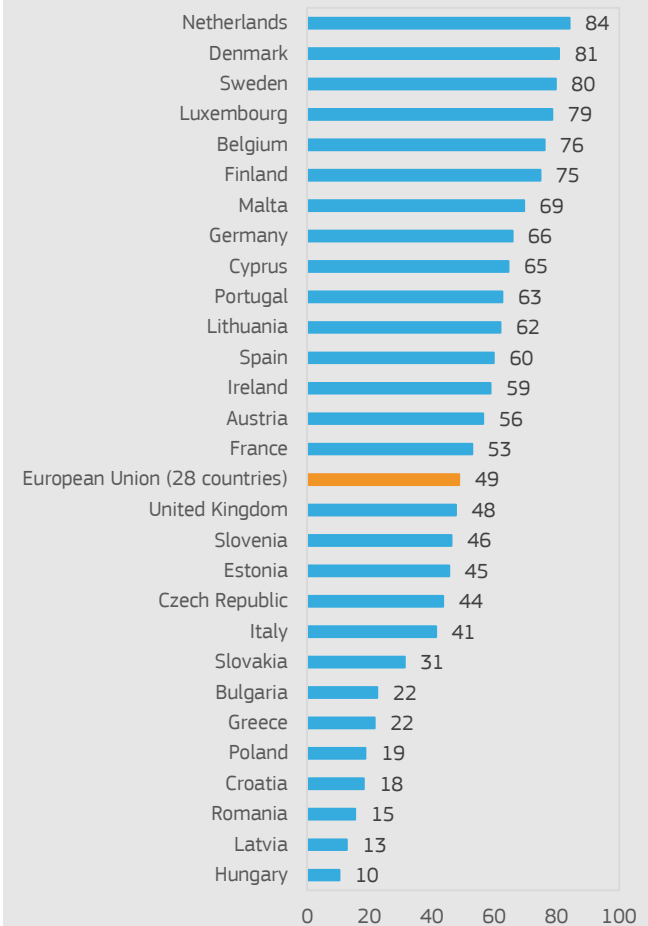
Digital infrastructure available in a majority of EU countries

Sweden is the best-performing country in the “digital infrastructure” dimension, followed by Luxembourg, the Netherlands, Denmark and Finland. Belgium, Malta and Spain are also leaders in the dimension with a performance well above that of the EU average.

A few EU countries are lagging a considerable way behind in terms of digital infrastructure

At the bottom of the scale, Hungary’s weak performance is particularly worrying given the significant gap compared to all other EU countries. Poland, Romania, Latvia and Bulgaria are also lagging behind with a performance well below that of the EU average.

Figure 95: Digital infrastructure



Source: Digital Transformation Scoreboard 2017

Figure 96: Digital infrastructure



Source: Digital Transformation Scoreboard 2017

6.4 Enabling digital transformation



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Investigating the relationship between digital transformation and five enabling conditions

Methodology

The relationship between digital technology integration and principal enabling conditions was analysed using the rank indices described in the previous sections. Correlation analyses were carried out to understand **the extent to which digital transformation relates to the enabling conditions**.

To implement these analyses a set of three models was designed **to understand how digital transformation as an outcome is related to capital, labour and entrepreneurial factors**. The three models examined are as follows:

- Model 1 provides the correlations amongst the pillar indices on transformation, ICT start-ups, e-leadership, and entrepreneurship,
- Model 2 provides the correlations amongst the pillar indices on transformation, ICT start-ups, infrastructure and skills,
- Model 3 provides the correlations amongst the pillar indices on transformation, ICT start-ups, investments and skills.

Differences in the models

The differences in the design of these models aim to highlight the relationships between outcome indicators (digital technology integration and ICT start-ups) and enabling conditions. Enabling conditions were separated into the two following groups:

- **business environment factors** (e-leadership and entrepreneurial culture), and
- **production factors** (infrastructure, investment, and labour).

It is important to notice that the difference between model 2 and 3 intends to overcome an overlap between infrastructure and investment which can be both considered as capital factors. In this respect, they present overlapping effects in the clustering analysis described in the following section.

Testing the statistical significance of the results

For each model, a hypothesis test was carried out to determine if the results of the correlation analyses were statistically significant. The hypothesis test therefore makes it possible to establish whether there is a relationship between digital transformation and the enabling conditions analysed.

E-leadership and entrepreneurial culture are key drivers of digital transformation

Correlation results and discussion

Positive impact of e-leadership and entrepreneurial culture on digital transformation

Results from model 1 indicate that the DTII presents positive correlation (above 50%) with the e-leadership index (51%). It is important to note that in the case of this model the analysis of critical values associated to a hypothesis test indicates the rejection of the null hypothesis for the DTII and entrepreneurial culture. As regards the relationship between the ICT start-ups index and both e-leadership and entrepreneurial culture, the result of the hypothesis test is the same.

Under these conditions, **the correlation analyses confirm the existence of a positive and significant relationship between outcome indices and business environment indices (e-leadership and entrepreneurial culture)**.

No clear-cut link between digital transformation and the level of digital infrastructure and skills

In the case of model 2, results from the analysis of enabling conditions indicate that the digital technology integration index (DTII) presents positive correlations (above 50%) with the infrastructure and skills rank indices (65% and 59% respectively) at EU28 level. This result indicates that any positive unit change in the levels of infrastructure and skills indices would be related to an increase in the digital technology integration index.

However, further investigation of these correlation values through a hypothesis test shows that the associated critical values are not sufficient to reject the null hypothesis which assumes no correlation between the variables. Consequently, under these conditions **it is impossible to confirm or invalidate the existence of the relationship**.

No clear-cut link between digital transformation and the level of investments and skills

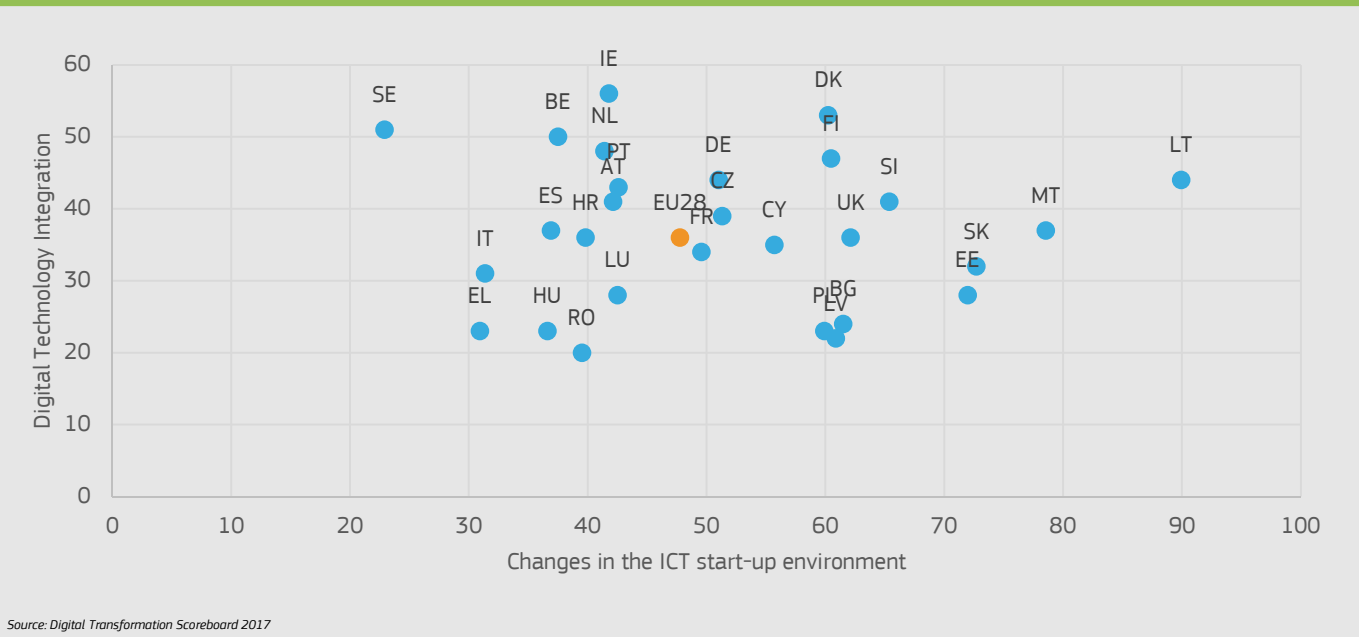
In the case of model 3, the relationship between investment and skills indices also provides positive correlations above 50% with the DTII and ICT start-ups indices (55% and 59% respectively) at EU28 level. However, the critical values associated to the hypothesis test were still not sufficient to reject the null hypothesis.

Under these conditions, **it is impossible to confirm or invalidate the existence of a positive relationship between outcome indices and production factors (investments and skills)**.

Conclusion

In conclusion, it is worth noting that only the business environment factors (e-leadership and entrepreneurial culture) present a statistically confirmed positive correlation with the output.

Figure 98: Changes in ICT Start-ups



Source: Digital Transformation Scoreboard 2017



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6.6 Cluster analysis at the national level



A clustering analysis of enabling conditions and outcomes of digital transformation was performed with the objective of **grouping countries based on their similarities in terms of enabling conditions leading to digital transformation.**

This analysis helped define four principal groups of countries based on their enabling conditions.

- Best enabling environment;
- Good enabling environment;
- Moderate enabling environment;
- Modest enabling environment.

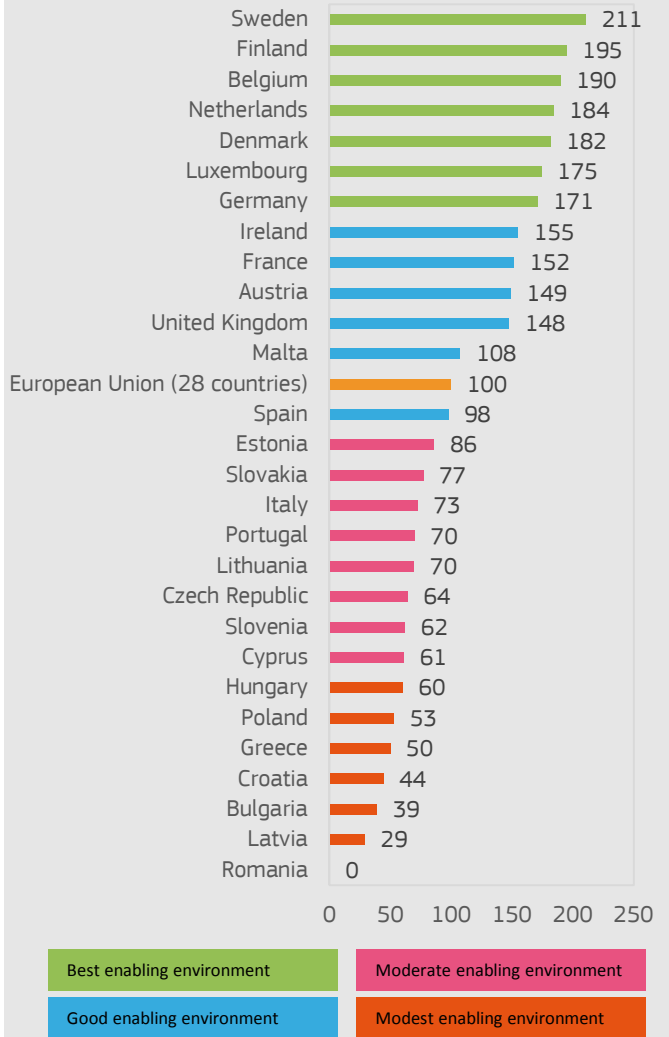
Aggregating enabling conditions into a summary index

The clustering analysis relies on the **aggregation of the enabling framework conditions indices** into a single Digital Transformation Enablers' Index (DTEI). This index comprises a linear combination of the scores associated to each country for each of the five enabling conditions described earlier in this section.

Grouping countries across four enabling environments

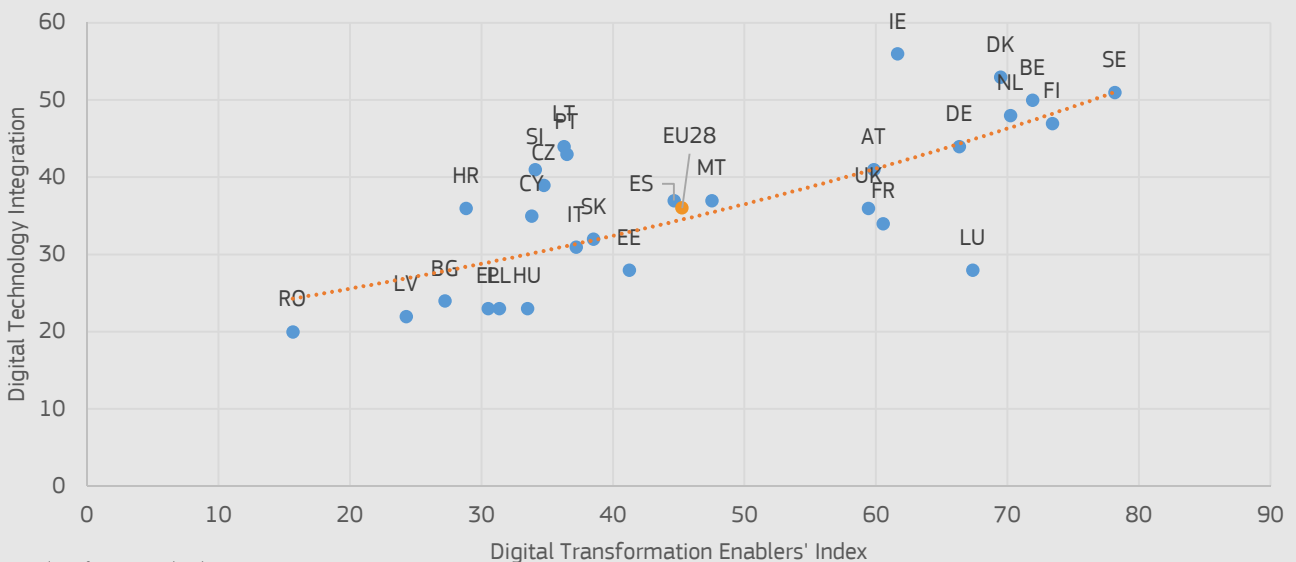
The methodology used to group the countries within the four categories involves a phase of normalisation of the DTEI scores prior to the calculation of each Member State's relative performance in terms of enabling conditions with respect to the EU 28 index average. Member States were **grouped according to the distribution of the enabling conditions' performance**; these groups were delimited using the quartiles of the distribution. The figure below provides an illustration of the principal groups of countries based on their enabling conditions.

Figure 99: Digital Transformation Enablers' Index and country clustering across enabling environments



Source: Digital Transformation Scoreboard 2017

Figure 100: Digital transformation scores as a function of enabling conditions cores



Source: Digital Transformation Scoreboard 2017

Results and discussion

Comparative analysis

A comparative analysis of Member States according to their digital transformation rank as a function of DTEI rank indicates that in general, as the DTEI is higher, it is likely that the digital technology integration index will also be higher, providing insight into a positive relationship between digital transformation and the set of enabling conditions. In summary, **the more powerful the enablers, the better a Member State's digital transformation.**

In essence, the clustering analysis of countries based on the performance of their enabling conditions with respect to the EU 28 index average indicates that **mostly Scandinavian and north-western countries benefit from the best allocation of framework conditions in terms of infrastructure, investments, skills, e-leadership and entrepreneurial culture.** This group is followed by western economies, which are located in the 3rd quartile of the distribution, while mainly eastern and southern countries account for those groups where enabling conditions can be improved.

Following the development of the Digital Transformation Enablers' Index and the geographic clustering of countries, an analysis of the impact of enabling conditions on digital transformation at country level was performed by comparing both indices (DTEI and DTII).

Best enabling environment

Member States comprised in the best enabling environment group are **strong economies which have led the way into the digital paradigm.** Many of these countries account for a number of big caps in high-technology industries and are examples of how the spreading of technology across other sectors of the economy ensures its transformation and creates value. As an illustration, big telecom companies in Scandinavian economies helped change and shape the way services have been provided in these countries over the past 20 years, allowing the emergence of unicorns such as Spotify.

Good enabling environment

Member States comprised in the good enabling environment group are characterised by **a mix of large and small economies whose fiscal and industrial policies differ in several ways.** This creates diverse effects on the adoption of digital technologies by their industry, which may slow down the impact these technologies should have on economic growth. As an example, fiscal instability and complex fiscal systems observed in some Member States may have pervasive effects on the fast adoption of digital technologies and the transformation of the industry, as is the case in France. France presents good enabling conditions but does not seem to fully convert them into its digital transformation.

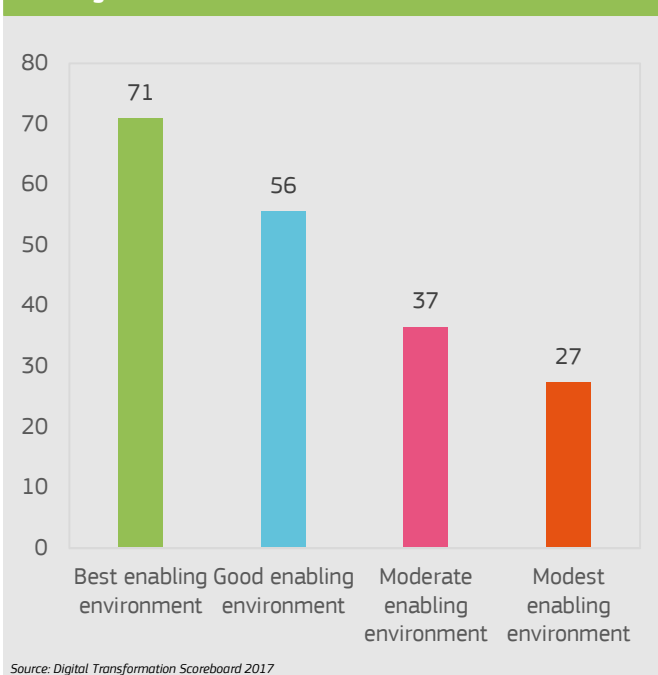
Moderate enabling environment

Member States comprised in the moderate enabling group are **in a position of catch-up and convergence.** It is their decision making in terms of industrial policy that will determine whether or not they will succeed in transforming their industries.

Modest enabling environment

Member States in the modest enabling environment are currently **at risk of missing the trajectory of digital transformation** that should enable their industry to converge towards the EU average and enable their economies to be competitive within the digital economic paradigm.

Figure 101: Average digital enabling performance by enabling environment



Conclusions

According to the results of the analysis, and contrary to what is expected, the group of the Nordic and Western European **countries, which lead the Digital Transformation Enablers' Index, do not present the highest performance in terms of digital transformation.** It is the group of countries comprising the UK, Luxembourg, and Ireland which present the highest performance in digital transformation.

This analysis leads to a final observation on the existence of differences between countries belonging to different enabling environments, which **are able to outperform in digital transformation given their initial enabling conditions.**

This observation may be explained by several factors such as:

- **barriers to adoption:** they are not measured in this research;
- **adoption dynamics** which may increase at decreasing rates past an inflexion point.

These factors could affect how well Member States can perform in digital transformation given their enabling conditions and how fast their digitisation process has taken place – and how advanced this process is.

It is important to note that **most countries below the trend line (see Figure 100) are those whose digital transformation is relatively lower with respect to their performance in enabling conditions.** These countries comprise both western and eastern economies, which may indicate that their digitisation process may be either suffering from adoption barriers, which slow down its dynamics, or simply lagging behind.

In contrast, the group of countries above the trend line comprises mainly northern and eastern economies, and indicates that **their digitisation process is outperforming their enabling conditions.** These countries can be characterised as outperforming or converging fast in digital transformation.

National focus

Country profile reports



The Country Profile Reports (CPRs) serve as a basis for EU 28 Member States (MS) to measure progress, account for results and identify areas for improvement in their efforts towards the digital transformation of their industries and enterprises. The CPRs can be seen as a "snapshot" of the digital transformation performance of an EU Member State at a specific time. It offers a summary of each MS digital transformation performance illustrated through a radar chart depicting the performance of EU MS along the seven key dimensions of Scoreboard. Including sections on relative strengths, areas for improvement, best practices and comparisons at EU level, the CPRs allow for trend analysis, fair comparisons and effective benchmarking in order to point out to solutions best adapted to accelerate the digital transformation journey of each EU Member State.

7.1 Aim of country profile reports

Objectives

The main objective of the present section is to provide key insights into the digital transformation performance of each EU Member State through qualitative and quantitative data.

General approach

The CPRs are based on the results of the following two main tools of the Scoreboard:

- The survey-based monitoring approach (qualitative part)
- The indicator-based monitoring approach (quantitative part)

Content

The CPRs are divided into the following 5 main sections:

1. "Introduction":

This section presents key country specific characteristics.

2. "in a nutshell"

This section provides a brief analysis of the country performance along 7 key dimensions of the Scoreboard and highlights major trends as regards digital transformation.

3. "Strengths and areas for improvement"

This section outlines the country's digital assets and areas dimensions requiring further actions.

4. "Comparison with the other EU Member States"

This section offers a better understanding of the country's position in terms of digital transformation compared to other EU MS.

5. "Interesting policy practices"

This section focuses on key national or local policies implemented to accelerate the digital transformation of industries and enterprises.



7.2 Table of content of the country profile reports





A

Austria



The Austrian record on digital transformation shows significant variation featuring high and low performing fields. Austria scores relatively high in relation to digital skills, e-leadership and digital infrastructure; yet challenges remain in the field of entrepreneurial culture and ICT start-ups. Austria performs above the European average in the majority of digital transformation dimensions. A look at recent national policy efforts reveals that the Austrian focus is on Industry 4.0 providing strategic as well as more operational policy approaches.

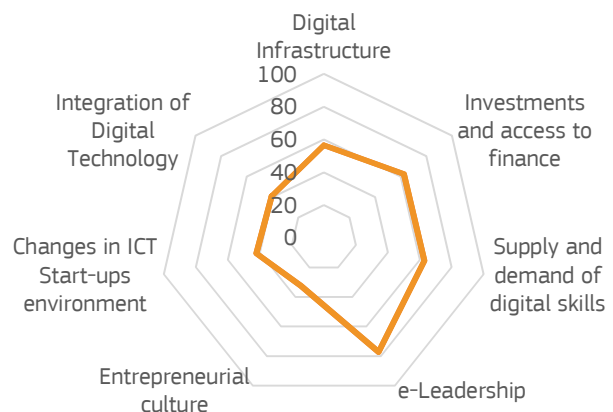
A Austria in a nutshell

Austria is a strong performer in e-leadership with a good supply and demand of digital skills.

Austrian enterprises also have access to a high-quality digital infrastructure, while investment levels and access to finance is somewhat weaker. Despite its rather favourable investment climate, Austria’s performance in relation to ICT start-ups is by far weaker.

On average, businesses in Austria show a rather low performance concerning digital transformation. The dimension where Austria proves to perform the lowest is in entrepreneurial culture.

In summary, Austria displays a mixed performance with relatively high scores in two areas, average marks in three fields and two low performing fields.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Austria’s strong performance in e-leadership relies on companies’ wide distribution of portable internet devices to employees. In addition, companies regularly provide trainings to ICT specialists to improve their skills.

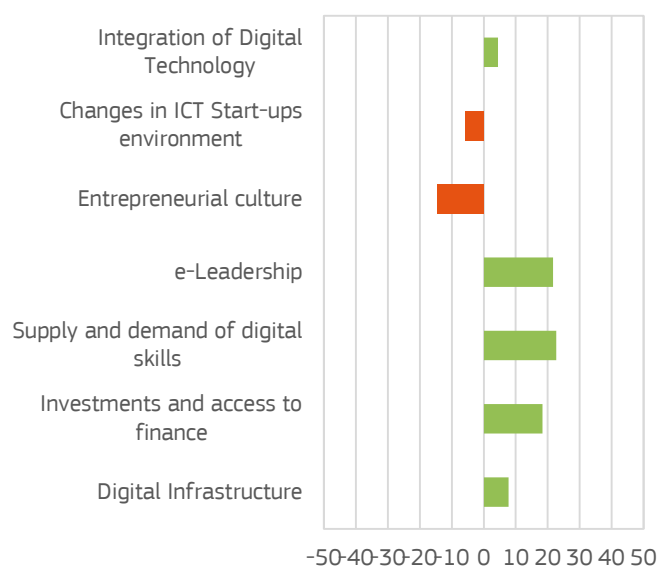
Austria’s solid digital infrastructure is rather due to the heavy use of ICT software in enterprises than its average internet speed. ERP and CRM tools are used extensively by Austrian businesses allowing for effective information sharing and clients’ analysis.

- Areas for improvement

Austria’s performance in entrepreneurial culture provides significant room for improvement. Recent data shows that the majority of the population would prefer to be employed rather than self-employed. In addition, Austrians tend to have a rather negative image of entrepreneurs in general.

Given the rather negative perception of entrepreneurs in Austrian society, it is not surprising that Austria’s second challenge concerns creating more ICT start-ups.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Austria performs above the average in five out of seven dimensions.

Austria's strongest asset is the supply and demand of digital skills, followed closely by e-leadership. In these two dimensions the country scores more than 20% higher than the EU average.

Furthermore, Austria provides a relatively high level of digital infrastructure and investments and access to finance. The dimensions where Austria scores below the EU average are entrepreneurial culture and ICT start-ups.

Meanwhile, Austria's performance with regard to the integration of digital technology of its industry and enterprises is broadly in line with the EU average.

D Interesting policy practices

Industry 4.0 Austria

Launched in 2015, "Industry 4.0 Austria – the Platform for intelligent production¹¹" is a registered association composed of stakeholders from industry, government, science and society. The main goal is to make the most of the new technological developments and innovations of digitisation (industry 4.0) for enterprises and employees and to make the change socially compatible for society.

Industry 4.0 acts in the form of an observatory, network and strategic advisory body creating working groups, strategies, focus areas as well as case studies on industry 4.0 topics. The work of Industry 4.0 also seeks to contribute to the creation of synergies between national, regional and international R&D activities.

Currently, there are 6 working groups in the fields of pilot factory, norms and standards, R&D and innovation, humans in the digital factory, qualifications and competences and regional strategies. The platform has equally created a profile for each of the 9 federal states including key facts and focus areas.

aws Industrie 4.0

The Federal Ministry of Science, Research and Economy and Austria Wirtschaftsservice Gesellschaft mbH (aws) introduced "aws Industrie 4.0¹²" in 2015. The main purpose is to provide an incentive to implement methods related to industry 4.0 and to strengthen the innovative performance for Austrian Small and Medium Size Enterprises (SME).

The measure provides grants for projects in the area of Industry 4.0, referring to future forms of industrial production of customised products, produced by highly flexible production conditions, and involvement of costumers and stakeholders into the processes.

The measure supports, among other, horizontal integration over the value creation process, data-integration, vertical integration, connection of production-systems, new business models and cyber physical production systems (CPPS). Targeting SMEs and large enterprises active in the production, grants of up to 500,000 can be used for network infrastructure, sensors, robotics, etc.





B

Belgium



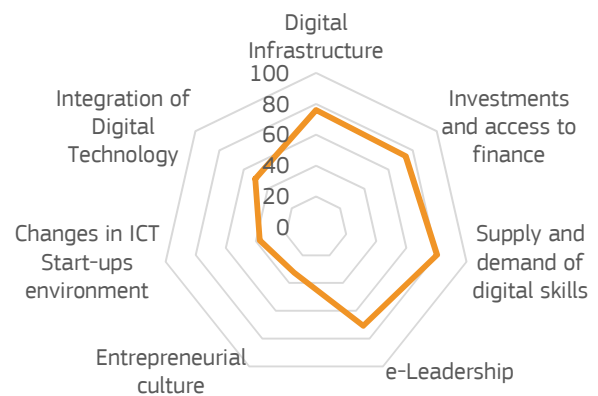
The Belgian entrepreneurial environment possesses all necessary components to successfully undergo a digital transformation. A well-developed digital infrastructure goes hand-in-hand with strong e-Leadership and the adaptation of digital software in companies together with regular trainings to improve ICT/IT skills among the employees are widely used practices. Furthermore, steadily increasing investments and access to finance are likely to positively influence the entrepreneurial culture and increase currently low numbers of ICT start-ups in the near future.

A Belgium in a nutshell

Digital transformation in Belgium does not unfold equally along the different pillars. On the one hand, the country performs as one of the EU frontrunners in digital infrastructure and e-Leadership. It also shows strong results in the fields of investments and access to finance and the supply and demand of digital skills.

On the other hand, Belgium scores low in ICT start-ups and entrepreneurial culture. The low activity in entrepreneurship has a direct impact and keeps the number of ICT start-ups low in comparison to the EU average.

In summary, while ICT and digital technologies are successfully embedded and used in the companies, Belgium's start-up mentality is still in the early stages in need of a further support measures.



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

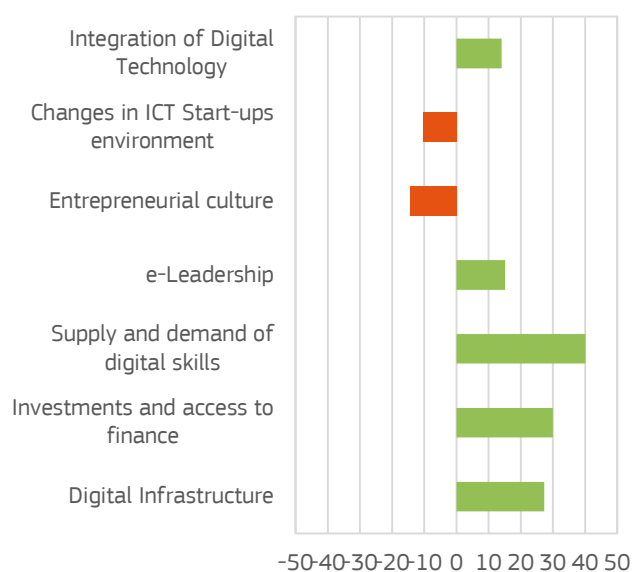
The overwhelming majority of companies in Belgium are equipped with fixed broadband connection. In addition, the enterprises make wide use of software solutions aimed at sharing information and/or analysing information for marketing purposes.

Furthermore, Belgium secures its strong position in e-Leadership thanks to few factors. First of all, the percentage of enterprises offering ICT training to their employees is steadily growing. The employees can additionally practice the acquired skills and secure access to the internet through the portable devices that are provided by the companies.

- Areas for improvement

The number of newly-created ICT start-ups shows a decreasing trend in the last 5 years; yet, signs of recovery are visible. Despite an increase, Belgium performs below the EU average with regard to the creation of ICT start-ups combined with low activity in entrepreneurial culture. While there is an overall positive perception of entrepreneurs, Belgians appear to be hesitant to become self-employed. However, the willingness to become independent increases considerably when sufficient funding and incentives are provided by the government.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

The digital transformation in Belgium is unfolding. The country scores well above the EU average in five pillars out of seven. Digital transformation is indeed impeded by the low number of new ICT start-ups and rather reserved attitude towards the setup of new businesses.

Nevertheless, the growing investments and access to finance can positively influence this trend in the future, as the likelihood to start up own business is greatly correlated with the access to funding and provision of tools.

That being said, digital transformation is being pulled forward by the well-embedded digital infrastructure. With the provision of trainings to develop and further improve the ICT skills and supply of portable devices, the employees can correctly and efficiently make use of Belgium's well developed digital infrastructure.

D Interesting policy practices

Made different

Aiming at modernising the Flemish manufacturing industry and strengthening its position in the world, the Flemish government, together with technology federations Agoria and its joint research centre Sirris, have developed a made-to-measure Action Plan.

The initiative –called 'Made Different'¹³ – recognises the importance of the manufacturing industry for the prosperity of the region and Europe and is designed to provide Flemish manufacturers with a future in the rapidly changing landscape.

Made Different provides the necessary information, organises awareness raising activities and offers specific guidance in the format of seven paths. Each of the paths explains the exact steps, needed to be undertaken, for the factory to turn into the factory of the future.

Few companies have already been included in the process of transformation and more are following the example. By 2018, Made Different expects to involve about 500 business in the initiative and to have at least 50 companies fully ready to transform into the factories of the future.



Plan Marshall 4.0

With the Plan Marshall 4.0¹⁴, the Walloon government aims at presenting a detailed scheme for an effective industrial policy. Based on the lessons learnt from the two previous plans, Marshall 4.0 will support and reinforce actions to promote a context for greater job opportunities, trainings and research.

With the ambition to place Wallonia at the forefront of the Fourth Industrial revolution, various actions will be undertaken under the framework of Plan Marshall 4.0.

For example, the Walloon government is developing measures to strengthen the links and ease the transition between education and training. It will also support the development of industry by involving SMEs in the digitalisation processes. In addition, there are plans to integrate digital innovation into social and industrial practices.

The Walloon government allocated €2.4 billion and plans to inject an additional 468 million coming from alternative funding.





B

Bulgaria



Bulgaria's profile shows different levels of digital transformation in several dimensions. The country's strength lies in ICT Start-ups and overall entrepreneurial culture. In these fields, the country performs well on the national level and also stands out in comparison to the EU partners. However, in other dimensions the country faces several challenges, especially in the fields of e-leadership, digital infrastructure, supply and demand of digital skills. Implemented measures and initiatives focus on addressing some of the issues, particularly in terms of increasing investment and access to finance and the promotion of entrepreneurship, innovation, and skills.

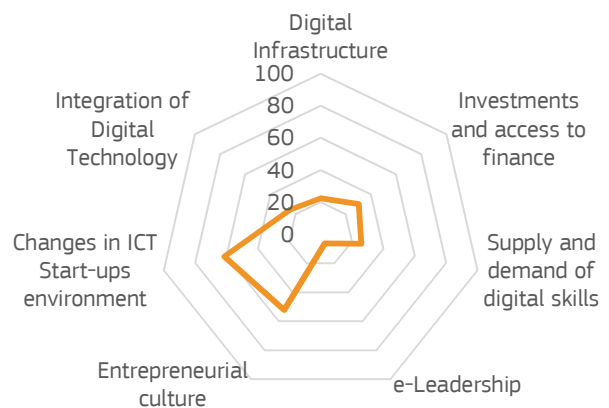
A Bulgaria in a nutshell

Bulgarian businesses benefit from a well developed entrepreneurial culture, which has a positive effect on Bulgaria's performance in the field of ICT Start-ups.

On the other hand, there are some opportunities for further improvement in regards to investment and access to finance, in which the country only achieves a relatively low score.

E-leadership represents the dimension where the country scores the lowest, followed by the supply and demand of digital skills.

Overall, Bulgaria's profile indicates two areas with a rather high score and relatively moderate to low performance in the remaining five fields.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Bulgaria excels in the field of ICT start-ups thanks to the growing contribution of the ICT sector to GDP and the high birth rate of communication and technology enterprises. Recent data shows a gradually increasing employment of ICT personnel and growing number of ICT SMEs operating on the Bulgarian market.

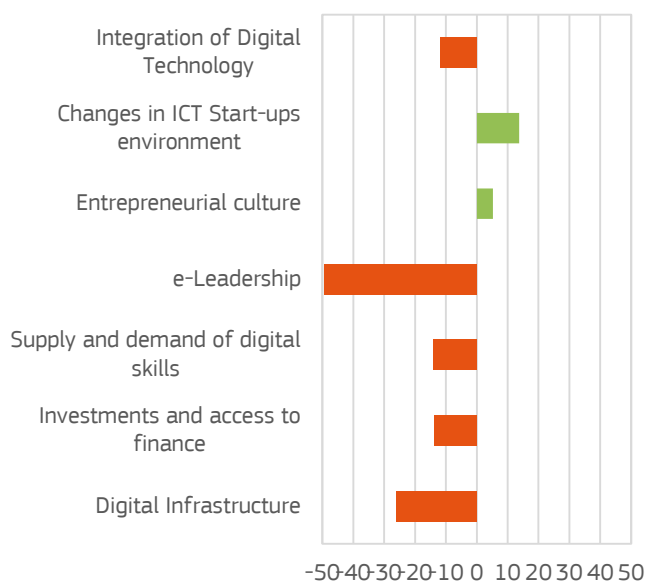
Moreover, there is a generally positive image of entrepreneurship in Bulgaria. The majority of the population would prefer to be self-employed rather than employed with a relatively high interest in the possibility to set-up or take over a business.

- Areas for improvement

Bulgaria faces significant drawbacks in the field of e-leadership and the supply and demand of digital skills. Data shows a low number of individuals with IT skills obtained through education, limited opportunities for ICT training and insufficient availability of modern technology provided to employees by enterprises. Consequently, the majority of employees do not possess a sufficient level of digital skills.

Furthermore, the integration of internal processes as a part of digital infrastructure also provides areas for further development.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison to the EU Member States, Bulgaria performs above the EU average in two dimensions while scoring below the average in five dimensions.

The country scores high in terms of ICT Start-ups, exceeding the EU average by 15%. Bulgaria also benefits from a strong entrepreneurial culture, with the results slightly above the EU average.

E-leadership represents the dimension with the lowest score, and one of the lowest results among the EU Member States. Major challenges remain in the fields of digital infrastructure and the supply and demand of digital skills. Bulgaria's performance is below the EU average also in terms of investment and access to finance and integration of digital technology.

Overall, the digital transformation of Bulgarian industry and enterprises shows good efforts regarding entrepreneurship and ICT start-ups; however, challenges persist in five different dimensions.

D Interesting policy practices

Action Plan 'Entrepreneurship 2020 – Bulgaria'

The Action Plan 'Entrepreneurship 2020'¹⁵ was launched by Council of Ministers in 2015. It consists of 31 concrete measures in line with recommendations adopted by the European Commission in Action Plan 'Entrepreneurship 2020 - Revival of the entrepreneurial spirit in Europe'.

The main objective is promotion and creation of new businesses by reducing the administrative and legislative burden on businesses. The measure includes comprehensive efforts to introduce entrepreneurship programmes in schools, vocational education, universities and secondary schools, supporting under-represented groups among entrepreneurs and providing better conditions in terms of access to funding and investment.

Part of the plan is to foster the use of R&D services, the recruitment of skilled personnel, opportunities for training, knowledge transfer, and promotion related to the creation of innovative clusters and incubators.

Targeted beneficiaries are young entrepreneurs, students at all levels of education and unemployed, in order to stimulate the innovative mind-set among the young generation and foster an entrepreneurial spirit.

'Initiative for SMEs'¹⁶ 2014-2020 (OP ISME)

The operational programme introduced by the Ministry of the Economy was approved by the European Commission with a total budget of €102 million. The budget is secured by the EFRD with expected funding to be provided by EIF & EIB.

The Programme aims to improve the access to finance for SMEs in Bulgaria, increase the competitiveness of SMEs, promote investment in the private sector and foster development and innovation.

The measure includes the development of financing programmes with instruments combining features of debt and equity while respecting State Aid rules, improvement in the availability and level of utilisation of EU-funded programmes and instruments in support of SMEs.

Together with the programme 'New approach towards investment barriers' launched by the Ministry of Finance, Bulgaria is determined to improve its business environment, reduce the administrative burden, improve the business environment and increase investments for the benefit of SMEs.



Croatia



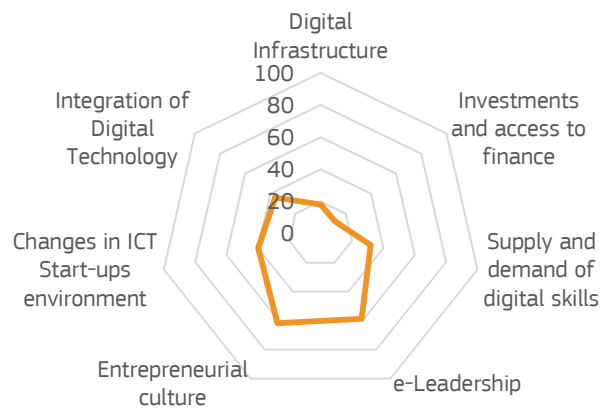
Croatia's digital transformation performance displays wide variations. A relatively strong performance can be observed in less capital intensive fields – entrepreneurial culture – whereas challenges exist in capital intensive fields such as investments and access to finance and digital infrastructure. Next to entrepreneurial culture, Croatia performs above the EU average in ICT, while significant challenges exist with regard to access to finance and digital skills. In the light of these challenges, recent policies adopted by the government focus on investments and access to finance and innovation.

A Croatia in a nutshell

Croatia performs the strongest in the field of entrepreneurial culture. Given this performance, it is not surprising that the country receives good scores in ICT Start-ups. Further relative strengths include e-leadership.

Meanwhile, Croatia displays a rather low to average performance in the field of supply and demand of digital skills. Furthermore, despite Croatia's good performance in e-leadership, the country scores much lower in digital infrastructure.

Where Croatia scores the lowest is on investments and access to finance. Overall, Croatia's performance is relatively good in less capital intensive fields, e.g. entrepreneurial culture, whereas capital intensive fields such as investments and access to finance and digital infrastructure remain challenging.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Croatia displays a high score in the field of entrepreneurial culture. Next to preferring self-employment over other employment types, recent data shows that more than 60% of the population would run a business of their own, if they had the financial means.

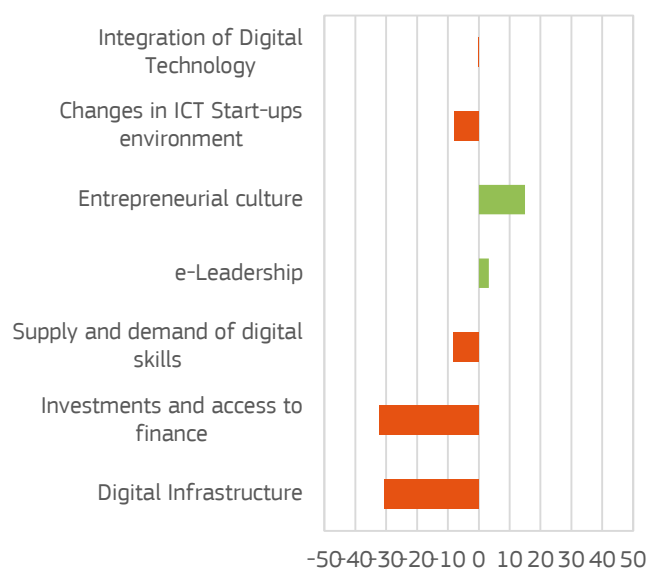
Moreover, Croatia's solid performance in e-leadership relies more heavily on the engagement of enterprises' than on its formal education system. Businesses in Croatia provide regular trainings to ICT specialists as well as portable devices for mobile internet connection.

- Areas for improvement

Despite an average development in e-leadership, Croatia's performance in the supply and demand of digital skills has room for improvement. One aspect in particular need of improvement concerns the low share of high-patent applications among EU Member States.

Meanwhile, Croatia's low performance in investments and access to finance is linked to the difficulty of enterprises to access venture capital. A second explanation is the relatively low development of the local equity market.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

Compared to other EU Member States, Croatia scores above the EU average in two out of seven dimensions. With a lead of 15% compared to the EU average, the field where Croatia performs best is Entrepreneurial Culture.

In the fields of digital transformation and e-leadership Croatia's performance is in line with the EU average.

Finally, Croatia faces challenges in the dimensions investment and access to finance, digital infrastructure performance, ICT Start-ups environment and the supply and demand of digital skills. While the investment climate for enterprises performs more than 30% below EU average, digital infrastructure and the supply and demand of digital skills score approximately 20% below EU average.

D Interesting policy practices

Innovation Grants for entrepreneurs

In 2015 HAMAG-INVEST¹⁷, the Croatian Agency for SMEs, Innovations and Investments, announced innovation grants targeting SMEs and entrepreneurs. The grants refer to two main measures, the so-called Programme II (RAZUM) for the development of knowledge-based enterprises and Programme III (IRCRO) centred on collaborative research and development.

The grants aim to support the development knowledge-based SMEs, to foster commercialisation of research results, to ensure the competitiveness of domestic enterprises and products and facilitate knowledge transfer.

The grants are made available through calls for proposals focusing on R&D activities with the potential of new, innovative and ready for market products or services, deployment of SMEs' infrastructures and knowledge and strengthen the link between business and science.

Overall, €4.9 million are provided through the programme. Out of a total of 191 applications, 131 for program II - RAZUM and 60 for program III - IRCRO, 34 projects were awarded.

Microloans to foster entrepreneurship

The loan programme¹⁸ for new micro economic entities (Micro enterprises) tackles the difficulties many Croatian enterprises have in accessing even smaller amounts of finance. The programme was established in 2015 by a decision of the government with the intention to increase investments in fixed and working assets of micro companies in Croatia. It is run by the HAMAG-INVEST, the Croatian Agency for SMEs, Innovations and Investments.

The goal of this programme is the provision of micro credits to new companies, crafts and other small businesses legally established up to 24 months before the application. The programme provides micro credits ranging from €1.400 to €16.000. Further conditions include a low interest rate of 0.99% and a repayment period of 5 years, including a grace period.

Altogether, 670 000 of funding is provided throughout 2015 and 2016. In 2015, 34 micro loans were granted for a total value of €50,000.





Cyprus



Cyprus performance on digital transformation shows a significant disparity featuring high and low performing fields. Cyprus has strengths in Digital Infrastructure and e-Leadership pillars, in which it performs above the European average. Challenges for Cyprus concern investments and access to finance in particular. A look at recent national policy practices and initiatives unveils Cyprus' efforts to tackle the challenges encountered, for example by implementing instruments that will facilitate SMEs access to finance and nurture the innovation and entrepreneurship environments.

A Cyprus in a nutshell

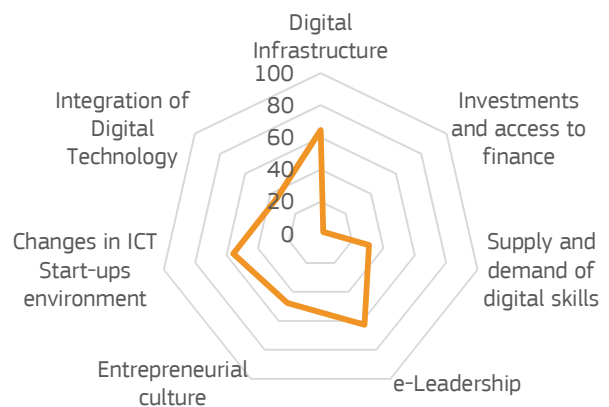
Cyprus has a solid performance in digital infrastructure and records a satisfactory indicator in the e-Leadership pillar.

Overall, Cyprus proves to have a consolidated entrepreneurial culture and, in line with that, its performance in ICT start-ups is relatively good.

However, the country is faced with a weak supply and demand of digital skills, despite its good performance in e-Leadership.

In spite of the high-quality access to digital infrastructure and a supportive environment for entrepreneurship, Cyprus's performance in integration of digital technology is relatively low.

Moreover, the area of investments and access to finance presents another challenge for Cyprus.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

The strong performance of Cyprus in digital infrastructure is based on companies' solid uptake of ICT software solutions. However, the overall good performance in digital infrastructure is to some extent hindered by a rather low average internet speed.

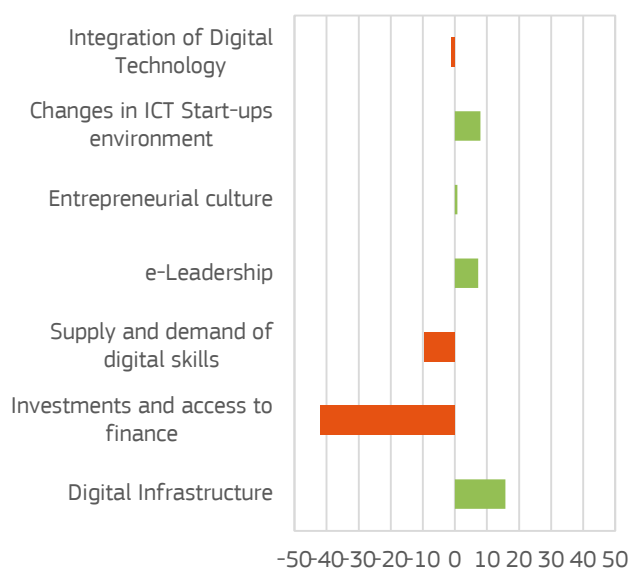
Cyprus' strength in e-Leadership is built on a high-level of ICT skills, which are promoted through both formal education as well as in-work training provided by companies. However, the distribution of portable internet devices to employees is rather low.

- Areas for improvement

A key challenge for Cyprus is the need to boost investments and access to finance. As recent data shows, Cyprus has a rather weak performance in private R&D investment, commercial profits, availability of venture capital and the facility to obtain loans.

Efforts to promote the integration of digital technology could also be enhanced. Although, most Cypriot companies carry out online commercial transactions with other EU or non-EU countries, efforts to develop and integrate ICT technologies, including for example cloud computing services, could be improved.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to the EU-average, Cyprus stands out in three out of seven pillars, e-Leadership, ICT Start-ups and Digital infrastructure.

In addition to those dimensions, Cyprus's performance matches the EU average regarding entrepreneurial culture and integration of digital technology.

The data indicates that Cyprus' weakest point is the investments and access to finance. These area is significantly below EU level. Relative to the EU average, it scores nearly 40% lower in investments and access to finance.

Similarly, Cyprus also ranks below the EU average regarding the supply and demand of digital skills.

Overall, there is some room for improvements. Its strongest assets being digital infrastructure, improvements are needed in the areas of investments and access to finance, and the supply and demand of digital skills.

D Interesting policy practices

Cyprus Entrepreneurship Fund

Cyprus set up the Cyprus Entrepreneurship Fund¹⁹ (CYPEF) as a mechanism to bolster and reinforce entrepreneurship by promoting the access to finance.

Established in March 2015, this financial instrument is monitored by the European Investment Fund, which is in charge of selecting the local banks that will grant the loans to the country's SMEs.

The scheme involves the co-financing of loans. An initial EUR 200 million capital was made available, of which EUR 100 million came from direct contribution of the Cypriot Government and the rest from EIF's selected banks in Cyprus. It is foreseen to increase the available budget, depending on the fund's success.

The CYPEF offers favourable loans terms, particularly in relation to the repayment period (minimum 24 months), the required collateral and the grace period amongst others. The maximum loan available per project is 1.5 million Euros.

By the end of 2015 over 27 entrepreneurship SMEs had taken advantage of CYPEF, while it expected that around 150 SMEs will have benefiting from it by 2017.

'Industrial Design and Innovation' subject

The Ministry of Education and Culture of Cyprus aims to develop ICT skills and to overall foster entrepreneurship culture. On this background, it set up a pilot project in the second quarter of 2014 to introduce Industrial Research and Innovation²⁰ as a compulsory subject in the curriculum of all public secondary vocational schools in the country.

The pilot was implemented in eleven Technical Schools. In cooperation with the private sector, it searched to develop skills and competences in the area of product development through the knowledge triangle (education-research-innovation).

Ten innovative products were developed, and their 3D printed models were displayed at several national exhibitions.

The new field of study "Industrial Design" is currently implemented in the Technical School "Makarios III" Nicosia and at the First Technical School of Limassol. The Ministry intends to offer it also in the rest of the VET networks in the near future.



Czech Republic



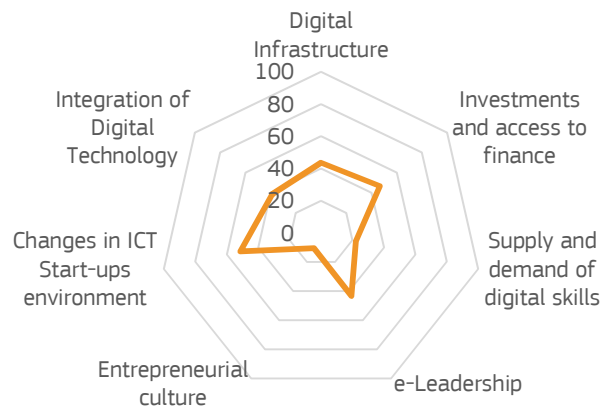
The record of the Czech Republic displays a moderate level of digital transformation with a strong position in the area of ICT Start-ups. The Czech Republic's performance is slightly under the average's line of the EU Member States in most of the dimensions. The fields of entrepreneurial culture, e-leadership and supply and demand of digital skills provide room for improvement. The Czech government launched several programmes seeking to further support digital transformation. The measures aim to promote entrepreneurship, support new business ideas, provide assistance in obtaining new technology and enhance cooperation and knowledge transfer.

A Czech Republic in a nutshell

The Czech Republic achieves the highest score in the area of ICT Start-ups, although the country's performance regarding the supply and demand of digital skills is fairly weak.

Meanwhile, entrepreneurial culture is the dimension where the country receives the lowest score. It might be explained by a rather negative image of entrepreneurship.

To sum up, four out of seven dimensions show similar tendencies, including digital Infrastructure, integration of digital technology, investments and access to finance and ICT start-ups. On the other hand, Czech Republic faces challenges in terms of entrepreneurial culture and the supply and demand of digital skills.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

The Czech Republic performs well in the dimension of ICT start-ups. The success lies in the country's wide access to IT skills obtained through formal educational or offered by in-work ICT skills training.

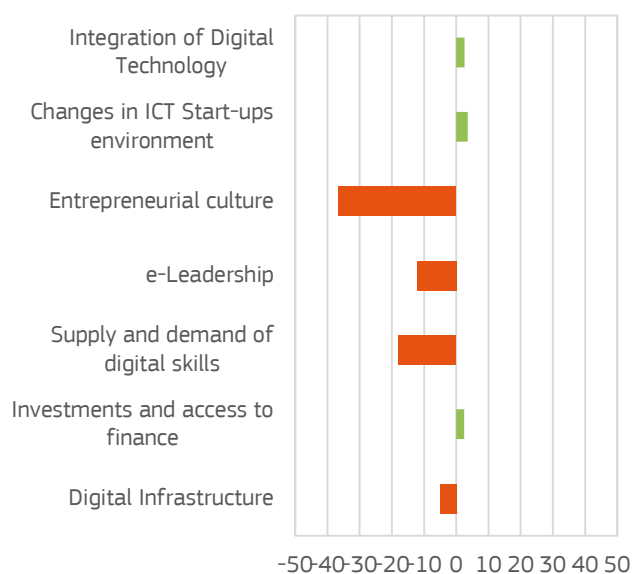
Czech businesses benefit from an active participation in online trade. Moreover, a large share of enterprises' total turnover derives from e-commerce, contributing to a strong position of the Czech Republic in the area of e-commerce among the EU Member States.

- Areas for improvement

The low performance in the area of entrepreneurial culture derives from a negative image of entrepreneurship in the Czech Republic. Recent data shows a preference towards employment rather than self-employment. In addition, the majority of the population has a low interest in setting up a business or taking over an existing one. Overall, the country tends to have a negative perception of entrepreneurship.

The demand for digital skills also provides an opportunity for further enhancement, particularly in terms of the demand for ICT skilled personnel.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

The Czech Republic performs in line with the EU Member States average in three out of seven dimensions. Despite high marks in e-leadership at national level, in comparison to the EU partners the country is still slightly below the EU average.

In the dimension entrepreneurial culture the country scores significantly below the average of EU Member States, to be precise 36% lower. Similarly, there is a shortfall in terms of supply and demand of digital skills, country's performance is around 18% below the EU average.

The Czech Republic scores slightly above the average of the EU Member States in regard to investment and access to finance.

Overall, the country performs broadly in line with the EU average, however, there is room for improvement in entrepreneurial culture and supply and demand of digital skills.

D Interesting policy practices

Průmysl 4.0

The long-term goal of the initiative 'Industry 4.0'²¹ is to maintain and enhance the competitiveness of the Czech Republic at the onset of the fourth industrial revolution. The measure was introduced by the Ministry of Industry and Trade and approved by the Czech government in 2016.

The initiative aims to indicate possible trends and outline measures that would not only boost the economy and industrial base but also help prepare the entire society to absorb this technological change. The document contains mapping and measures to promote investments, applied research, standardization, and deals with issues related to cyber security, logistics, and legislation.

The measure serves as a regulatory framework providing information on the need for urgent changes related to the fourth industrial revolution for the government, ministries, and social partners in order to promptly apply specific measures. The initiative Industry 4.0 simultaneously aims to mobilise the business community and the stakeholders to become actively involved in the implementation process.



Technologie

The main objective of the programme 'Technologie'²² is to provide support to increase the number of new business projects implemented by start-ups and micro-enterprises. 'Technologie' falls under the SME support programmes for the period of 2015 - 2020, implemented by Ministry of Industry and Trade of the Czech Republic with a cooperation of Czechinvest (Investment and Business Development Agency).

Targeting beneficiaries such as start-ups, micro-enterprises and SMEs, the programme focuses on the acquisition of new machinery and/or technological equipment. In terms of the territorial dimension, the programme focuses on the economically troubled regions and areas with high unemployment rate and urban areas with presumed participation in the integrated territorial investments.

The total budget available for the purposes of the programme is 220,795,917 EUR. The subsidy for each project may vary from 3,700 EUR (microenterprises) and 37,000 EUR (SMEs) up to 740,000 EUR. The maximum aid intensity is equal to 35% (medium enterprises) or 45% (small and micro-enterprises) of the eligible costs. Technologie is a support programme within the OPEIC (Operational Programme Entrepreneurship and Innovations for Competitiveness).



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Denmark



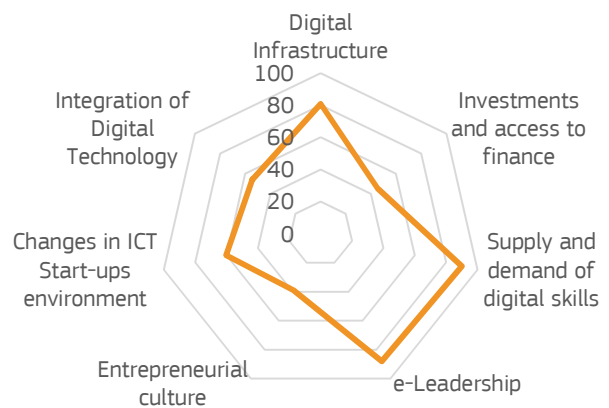
Denmark has a strong performance in most aspects. The country has strengths in such areas as the level of digital skills, e-Leadership and digital infrastructure. However, Denmark has a relatively low performance in dimensions related to entrepreneurial culture and the broader investment and access to finance climate. Recent policy initiatives cover a wide range of initiatives seeking to promote competitiveness of the manufacturing sector, including efforts to promote the uptake of digital technologies in production.

A Denmark in a nutshell

Denmark performs strongly in e-Leadership and has a high level of supply of and demand for digital skills. This is further supported by a solid performance in digital infrastructure. On average, Denmark also has a good performance in the conditions for the integration of digital technology, while the performance of ICT start-ups are weaker.

There is a potential for improvements in the area of investments and access to finance: Denmark's broader investment and finance climate achieves a modest performance. However, the dimension where Denmark provides to perform the lowest is entrepreneurial culture.

Overall, Denmark's sound performance is based on strong scores for e-leadership and the supply and demand of digital skills as well as digital infrastructure. This is complemented by relatively good scores for integration of digital technology and ICT start-ups. However, the country's performance in the areas of investments and access to finance and entrepreneurial culture is weaker.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

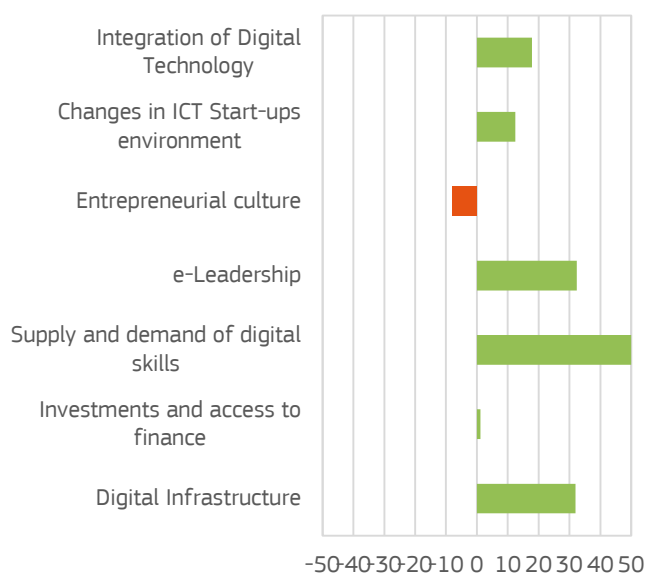
+ Strengths

Denmark's strong performance in the supply and demand of digital skills relates, among other, to a high level of respectively high-tech patent applications, recruitment of ICT specialists and provision of portable devices with mobile connections for employees. Taken together, performances for these indicators help to give Denmark strengths in digital skill-sets, which is relevant for the use and integration of digital technologies. The well-rounded performance in e-Leadership is supported, in particular, by enterprises' efforts to offer training on ICT skills. This is complemented by an educational system that emphasizes the use of and training in IT.

- Areas for improvement

With a relatively weak performance in entrepreneurial culture and ICT start-ups, these area provides opportunities for improvements in Denmark. According to recent data, only a limited percentage of the population prefers to work independently or to be self-employed compared to being employed. The data also displays that only a low percentage of the population is interested in setting up a new business or taking over an existing businesses. However, while there is little interest in working as self-employed or independently, there is a broadly favourable overall opinion towards entrepreneurs.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison with the EU average, Denmark's performance is above the average in five out of seven dimensions.

The best relative performance is recorded for the supply and demand of digital skills. Denmark scores significantly above the average in this dimension.

This is followed by a strong relative performance in e-leadership and digital infrastructure where Denmark also provides a high level compared to the EU average.

In addition, Denmark's performance with regard to integration of digital technology and ICT start-ups is well above the average.

However, its performance in the area of investments and access to finance is in line with the EU average.

Entrepreneurial culture makes up the weakest dimension for Denmark, highlighting that there is a potential for improvements in this area.

D Interesting policy practices

Manufacturing Academy of Denmark

The Manufacturing Academy of Denmark²³ (MADE), a nation-wide initiative for the digitisation of industry, seeks to promote the development of high technology solutions through collaboration and partnerships. MADE was created in 2014 to strengthen manufacturing in Denmark by improving the link between research, innovation and education. The overall objective is to improve the competitiveness in the Danish manufacturing sector and to maintain its position as a leader of innovation.

MADE covers a wide range of target groups, including larger and smaller companies, academia and universities, research organisations and advanced technology groups, and helps them in the development of new solutions in such areas as digitization, automation and 3D printing.

Core components and activities include a platform for dialogue and collaboration on state-of-the technologies and solutions, demonstration projects, open labs etc. in support of businesses and in particular SMEs, research on production technology, knowledge sharing and networking as well as education activities through its PhD network.

MADE is financed widely by companies, associations, foundations and participating universities.

InnoBooster

The Innovation Fund Denmark²⁴ invests in strategic research projects that creates growth and employment in Denmark. Overall, the fund provides programmes targeting projects at different scales, including high-tech platforms and smaller grants targeting the development innovative solutions.

The Innovation Fund Denmark offers the InnoBooster programme, which is an instrument for the promotion of innovative ideas. It is targeted towards small enterprises and enterprises with defined development plans, often at early-stages and with relatively high-level of risk. InnoBooster can for example be used to further automation and digitalisation.

The programme provides grants with an objective to improve the innovation capacity of SME. The grants can be up to approx. €0.7 million. The larger the amount applied for, the higher the requirements are for substantiated the commercial and innovation potential of the project. The grants are typically used to invest in consultancy services, knowledge, equipment and cooperation with research institutes.





E

Estonia



Estonia's record on digital transformation shows significant polarisation. Estonia's performance is relatively good in relation to ICT start-ups, e-leadership and investments and access to finance; yet challenges are noticeable in the field of digital transformation, digital infrastructure and supply and demand of digital skills. Estonia performs above the EU average in two out of seven dimensions. A look at recent national policy efforts reveals that Estonia is focusing in the enhancement of professional skills, as well as, in the development of innovative products and the penetration of new foreign markets.

A Estonia in a nutshell

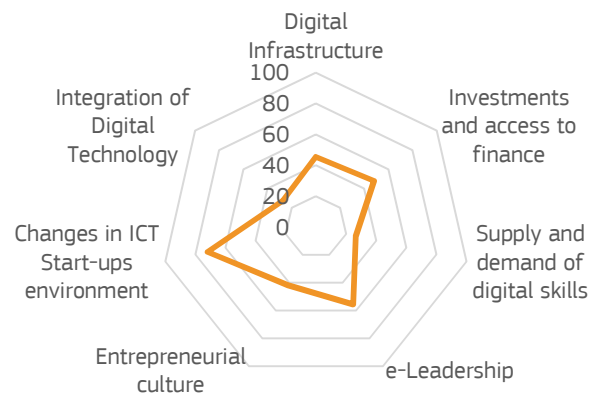
Estonia has a noteworthy performance in the ICT Start-ups pillar. In addition, it is a strong performer in e-leadership and investment and access to finance.

Given its strong record in ICT start-ups, it is not surprising that Estonia's entrepreneurial culture is well developed.

However, the country faces challenges in the dimensions of digital infrastructure and integration of digital technology.

Moreover, in spite of Estonia's solid performance in e-leadership, its score in supply and demand of digital skills is relatively low. In fact, this is where Estonia receives the lowest marks.

Overall, Estonia's performance shows significant division. Although, it scores relatively good in 5 out of 7 pillars the room for improvement in the other 2 pillars is quite significant.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Estonia's strong performance in ICT start-ups relies mainly on the full employment of its ICT workforce. In addition, the share of its ICT sector in the total GDP underscores the high result of this dimension.

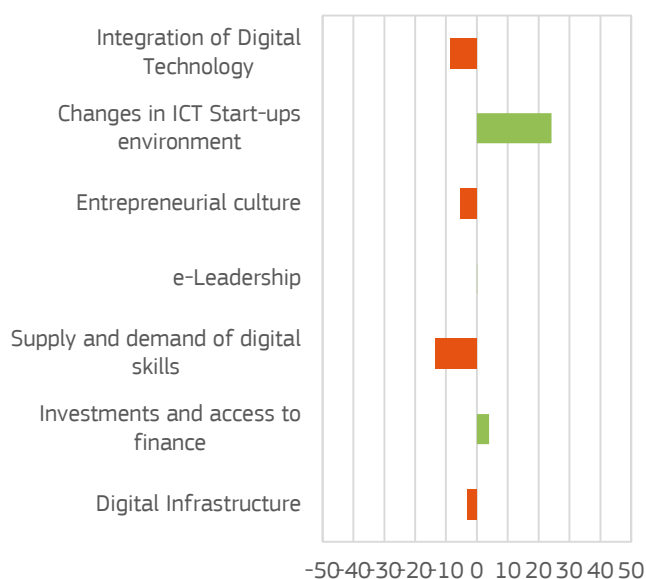
Estonia's solid e-leadership score is rather due to the skills obtained through academic education, than through in-work training provided by companies. Nonetheless, the distribution of portable devices to employees is rather high and contributes to the good performance in this field.

- Areas for improvement

Estonia's performance in the supply and demand of digital skills shows significant room for improvement. The data available also indicates that the percentage of high-tech patent applications is rather low. Moreover, a substantial number of companies encounter problems when hiring ICT specialist.

Another key challenge for Estonia is the need to improve its digital infrastructure. Although most companies have access to a broadband connection, the use of integrated management software solutions could be enhanced.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Estonia performs above the average in two out of seven dimensions. In particular, Estonia stands out in ICT starts-ups scoring 24% higher than the EU average.

Furthermore, Estonia's performance in investments and access to finance is also above the EU Member States average. Its e-leadership stays in line with the EU average.

In spite of the high performance in ICT start-ups, Estonia's entrepreneurial culture is below the EU average.

The data indicates that Estonia's weakest point is the supply and demand of digital skills, where it scores 14 % below EU average.

Similarly, its performance in integration of digital technology and digital infrastructure is also lower than the average record of EU Member States.

D Interesting policy practices

Enterprise Development Programme

The instrument was launched in 2015 to encourage the market entry of disruptive and more profitable goods by supporting companies in the field of smart specialisation. The programme also seeks to foster the penetration of new markets.

Implemented by Enterprise Estonia²⁵ (EAS), the programme is not conceived as a mere financial instrument. The instrument assists the companies during the three phases of product development. This includes the identification of the company's willingness to change as well as the preparation of a development plan and its implementation.

The instrument provides grants of up to €500.000, of which up to €200.000 can be used to invest in modern technology. The grants are subject to different degrees of co-financing: For small companies required co-financing amounts to 55% of costs, whereas for medium-sized and large enterprises 65% and 75% of own capital is needed.

The programme's targets to support 150 companies to commercialise 100 new products, of which at least 20 should be unique in the world, by 2020.



OSKA System

Estonia set up the Coordination System of surveillance and forecasting of the labour market and the development of skills in 2015, as part of the Estonian competitiveness strategy "Eesti 2020". The system seeks to ensure the match between the labour market needs and the education curricula.

The Estonian Qualification Authority, under the control of the Minister of Education and Research is in charge of the implementation. With an overall budget of €4.400.000 until 2020, OSKA system²⁶ is supported by financing from the European Social Fund.

The system is based on a comprehensive monitoring mechanism. This mechanism involves regular cooperation with the private sector, in-depth analysis of the labour market, economic trends analysis and forecasts to map the skills needs in each sector.

Five economic sectors are analysed each year with a view to present a state of play and recommendations for training for the next 10 years. Each economic sector is analysed once every 5 or 6 years, and the implementation of recommendations monitored during the intervention period.

In 2016 the sectors under analysis are: Accounting, Forestry and Timber Industry, Information and Communication Technology, Manufacturing of metal products, machinery and equipment, and Social Work.



F

Finland



Finland's digital development can be seen as one of the best examples in the European Union. A strong e-leadership in combination with advanced digital infrastructure ensures that the digitisation is well embedded in the overall entrepreneurial environment. Moreover, steadily growing access to finance and investment tends to positively impact the number of start-ups and influence the rather weak entrepreneurial culture. Finland has launched various effective programmes – such as Start Guarantee and Industrial internet – aimed at further stimulating digital entrepreneurship.

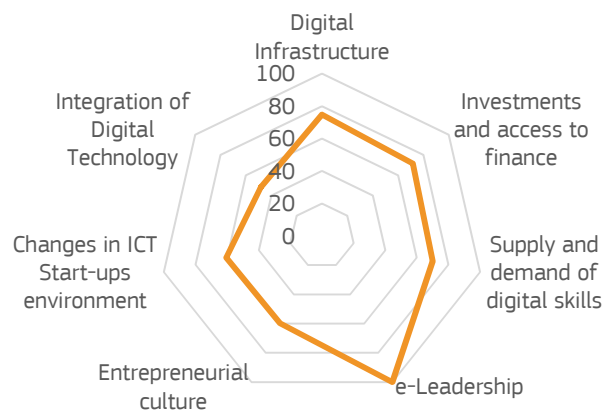
A Finland in a nutshell

Overall, Finland shows strong results in digital development. Finland performs well above the European average in all dimensions.

The Integration of Digital Technology currently appears to be the weakest dimension being still in the process of development.

On the other hand, e-leadership is the most advanced among the EU countries with the overwhelming majority of ICT skilled and equipped workers.

Finland also performs well in digital infrastructure. It additionally ensures good access to finance and availability of investments together with high supply and demand of digital skills to push digitisation forward.



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

B Strengths and areas of improvements

+ Strengths

Finland performs outstandingly in e-Leadership. It is the country with the highest share of enterprises providing trainings to IT experts to further develop ICT skills in the EU. Finland has been the EU's number one for four years now. The country also tops the chart of the individuals that are IT/ICT educated in the formalised educational institutions.

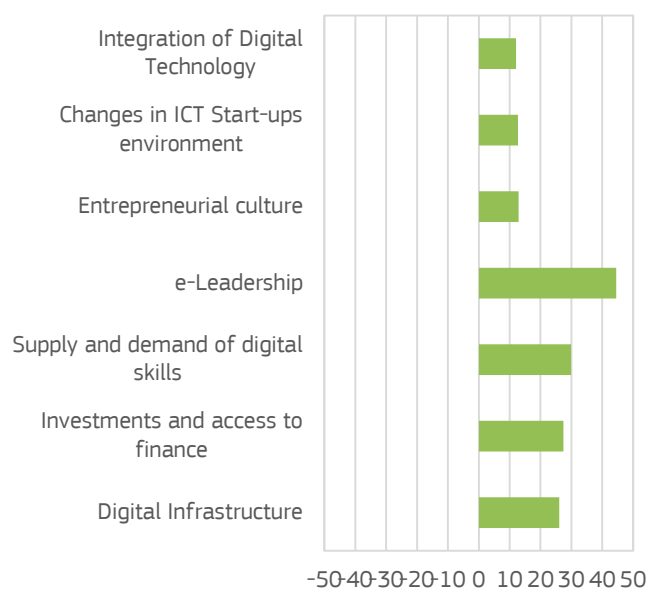
At last, the overwhelming majority of enterprises equip their staff with portable devices ensuring employee access to a mobile connection for business purposes.

- Areas of improvements

Finland is a rather modest performer with regard to the entrepreneurial culture. The number of employees that would opt for being self-employed is considerably low in Finland in comparison to the EU average.

However, the willingness to become an entrepreneur doubles when additional support, including sufficient funding is offered. As a result, the preferences are likely to change as the opportunities of access to loans are increasing after the recession of the previous years.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

The digitisation process in Finland has been unfolding for several years and today the country can be seen as one of the pioneers in embracing IT/ICT in the entrepreneurial environment.

E-Leadership in Finland is well above the EU average and tops the list of EU Member states in terms of trainings to improve the ICT/IT skills of their employees and the provision of necessary tools and devices. This is strongly linked to a high performance in the supply and demand of digital skills with very few enterprises facing difficulties to fill the jobs requiring ICT specialist skills.

All enterprises based in Finland use DSL or other broadband fixed connections. They also widely make use of the necessary software packages to plan and manage work accordingly.

Investments and access to finance is showing a slight increase in the last year and the number of ICT Start-ups is growing again.

D Interesting policy practices

Industrial Internet – Tekes

Tekes²⁷, the Finnish Funding Agency for Innovation operating most of Finland's public innovation programmes, has launched a programme called 'Industrial Internet'.

This five-year programme, with a total budget of 100 million euros, targets businesses by offering them services to renew their business operations. It also encourages companies from different sectors to engage in cross-sectoral cooperation. Besides targeting companies, the 'Industrial Internet' initiative supports research and development of new technological solutions required when doing digital business.

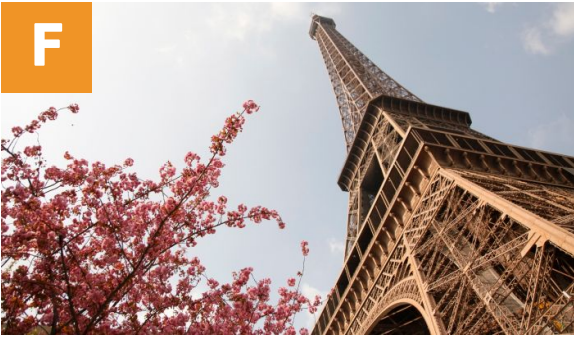
Target areas include the refinement of big data masses to support business, business based on machine-to-machine communication and real-time service and production processes.

Start Guarantee - Finnvera

Finnvera²⁸ – a specialised financing company owned by the State of Finland – is responsible in supporting and providing finances for the start, growth and the internationalisation of enterprises.

With the programme 'Start Guarantee', Finnvera intends to provide a solution for securing financing to newly launched SMEs. In the case SMEs cannot offer an adequate security, Finnvera performs as a guarantor for the company and the bank can apply for Finnvera's Start Guarantee as partial security for the loan.

Finnvera's Start Guarantee operates in almost every sector and has agreements with over fourteen different banks.



France



France displays a rather average performance in digital transformation. France scores well and stands out from its European partners in the fields of entrepreneurial culture, supply and demand of digital skills and investments and access to finance. However, efforts could be stepped up to support the development of ICT start-ups as well as to improve digital infrastructures and integration of digital technology of industry and businesses. Taking stock of these challenges, the French government recently launched strategic and tailored policies, notably based on industry involvement and collaboration, to further push forward digital transformation.

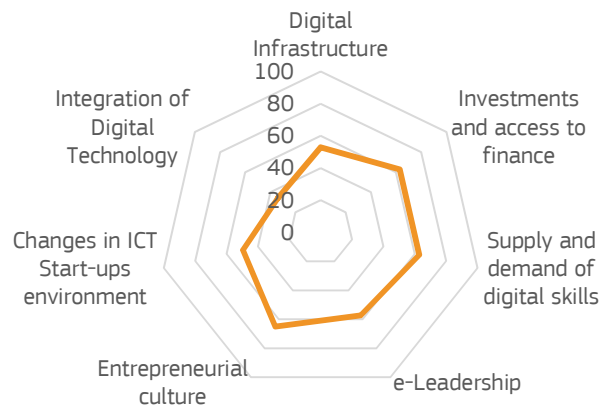
A France in a nutshell

France's key strengths lie in its entrepreneurial culture as well as in its high level of investment and good access to finance. French companies also benefit from solid supply and demand of digital skills, helping them to take advantage of the opportunities offered by digital technologies.

Despite this favourable context, the country's results in e-Leadership, ICT Start-ups and digital infrastructure prove to be somehow weaker.

Integration of digital technology is the dimension where France performs the lowest.

Overall, France's profile seems relatively homogeneous across all dimensions. Indeed, the country does neither highly outperform nor significantly lag behind in any sector.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

France performs well in terms of supply and demand of digital skills, mainly thanks to French companies' significant efforts to submit high-tech patent applications, and to hire employees qualified in digital technologies.

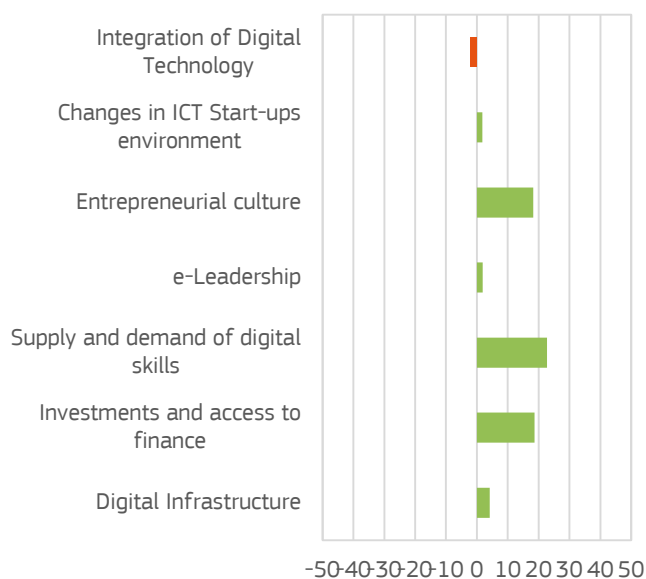
France also benefits from a financial framework that positively incentivises private investments in ICTs. Indeed, French companies prove to have easy access to private funding in local equity markets and dedicate relatively high levels of R&D investment in digital technologies.

- Areas for improvement

France's performance in digital transformation could be further improved. In particular, French companies need to increase their efforts in integrating digital technologies into their production processes and in adapting their business models accordingly (i.e. use of cloud computing, social media, e-commerce...).

France would also significantly benefit from the further development of ICT companies, and in particular SMEs, which could act as a key driving force towards the digital transformation of its industry.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison to the EU average, France performs particularly well in three out of seven dimensions. The supply and demand of digital skills is France's biggest strength as the country exceeds the EU average by 23%.

France also benefits from solid entrepreneurial culture and investments and access to finance. Both exceeds by more than 18% in comparison to other EU Member States.

On the contrary, France does not stand out from its European partners in the four remaining dimensions. The country is broadly in line with the EU average in ICT start-ups, digital infrastructure, e-leadership and scores slightly below in integration of digital technology.

However, overall, France scores well in investments and access to finance, supply and demand of digital skills as well as in entrepreneurial culture and does not significantly lag behind EU Member States in any of the seven dimensions.

D Interesting policy practices

Industrie du Futur

Launched by the French government in April 2015, the "Industrie du Futur"²⁹ (IdF) programme aims to support companies in accelerating their uptake of digital technologies, transforming business models as well as in modernising production practices. IdF's overall objective is also to address the significant underinvestment adversely affecting industry, in particular SMEs and mid-tier firms.

The programme relies on the important participation and financial contribution of the private sector. A platform bringing together public and private industry and digital technology stakeholders, the "Alliance Industrie du Future", was created to design and monitor its implementation as well as to ensure constant cooperation and dialogue. Also, the €10 billion of public funds made available in the form of subsidies and loans is expected to attract five times more funding from private investors.

IdF has so far supported around 3,400 companies in getting a diagnosis for the modernisation of their production tools, provided 800 loans to companies.

For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



La French Tech

On 27 November 2013, the French government launched a new certification scheme called "French Tech"³⁰ that identifies cities providing proactive support to ICT start-ups. The label aims to foster and streamline the development of local digital innovation ecosystems- mainly those outside of the Paris area which concentrates today 50% of France's potential- and to promote them at the international level.

So far, 13 cities have been awarded the label. The programme led to the establishment of a 200 M€ fund, managed by the Banque Publique d'Investissements (French Public Investment Bank), which directly supports private start-ups through a grant allocation process.

The "French Tech" programme has an important international dimension, notably with the creation of the "French Tech hub" label which identifies existing and active networks of French start-ups, entrepreneurs and investors based abroad. The French government also launched a 15 M€ campaign to promote its digital innovation start-ups at the international level (e.g. by facilitating their participation in international technology and innovation conferences).





Germany



Germany shows a strong overall performance with some deviations. Germany is a high performer in the field of investments and access to finance and the supply and demand of digital skills; however, the country receives very low scores with regard to entrepreneurial culture. Notwithstanding this challenge, Germany performs above the European average in all other fields. Recent examples from policy show a focus on Industry 4.0 initiatives. Next to high-level, strategic initiatives such as the platform Industrie 4.0, also smaller policy initiatives targeting SMEs have been adopted by the German authorities.

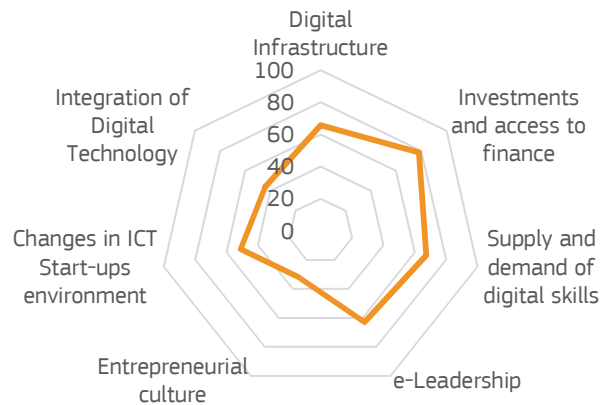
A Germany in a nutshell

Germany is a high performer in investments and access to finance. Moreover, Germany's labour market can benefit from a relatively high supply and demand of digital skills as well as high levels of e-leadership.

Although German enterprises can rely on a high-quality digital infrastructure, the score for the digitisation of Germany's industry and enterprises is somewhat lower.

Compared to other digital transformation dimensions, Germany's performance in ICT start-ups is rather low. Meanwhile, entrepreneurial culture is the dimension where Germany scores by far the lowest.

In summary, Germany provides of a more pronounced, overall performance composed of three core strengths, a series of average performance fields and one significant outlier.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Germany's strong performance in the field of investments and access to finance derives in particular from a strong German equity market. Companies in Germany can count on high availability of venture capital as well as on relatively easy access to financial loans.

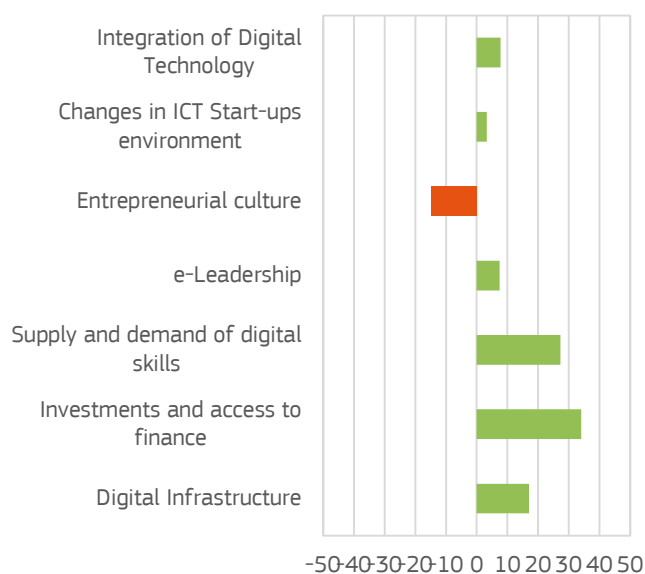
Furthermore, Germany's high score in the supply and demand of digital skills is supported by an elevated number of patent applications in high tech sectors and a large share of ICT specialists employed by enterprises.

- Areas for improvement

Germany's performance in entrepreneurial culture provides significant room for improvement. Recent data shows that around half of the German population would prefer to be self-employed rather than employed. Meanwhile, a significantly lower share would set up their own business, if they had the means to do so.

Despite an average performance in the field of ICT start-ups, one field where Germany could improve in particular is in the share of ICT companies out of the total of company birth rates.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

Compared to other EU Member States, Germany achieves scores above the EU average in six out of seven dimensions. Outperforming the EU average by respectively 27% and 34%, Germany is among the EU's leaders in the supply and demand of digital skills and investments and access to finance.

Moreover, Germany performs above the EU average in digital infrastructure, e-leadership and integration of digital technology. On the contrary, in the field of ICT start-ups Germany only ranks slightly above the EU average.

Finally, the dimension where Germany performs significantly below EU average is entrepreneurial culture. In this field, Germany's performance is 15% below the EU average.

D Interesting policy practices

Plattform Industrie 4.0

"Industrie 4.0"³¹ (I40) is a strategic initiative from the Federal Ministries of Education & Research (BMBF) and Economic Affairs and Energy (BMWi). It aims to drive digital manufacturing forward by increasing digitisation and the interconnection of products, value chains and business models. It also seeks to support research, industry partner networking and standardisation.

Launched in 2011 by BMBF in the form of the High-Tech Strategy 2020 Action Plan, I40 has become institutionalised by creating the Plattform Industrie 4.0. BMBF and BMWi have jointly allocated €200 million in funding.

Stakeholders consider I40 as a strategic measure to consolidate German technological leadership in mechanical engineering. I40 has managed to limit segregation among industry sectors, to swiftly move research into mainstream practice in a fairly short period, and to scale-up nationally to become one of the largest industry networks of its kind. For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



Trusted Cloud

With the Trusted Cloud project³², the Federal Ministry of Economics and Energy (BMWi) is promoting an enabling technology on the road to industry 4.0. Given SMEs' uncertainties on the value added, concerns about legal conformity, safety and data loss, the Federal Government wants to help companies build confidence in cloud services.

The BMWi commissioned the creation of uniform and transparent assessment criteria for the use of cloud services by setting up a cloud portal and awarding a trusted cloud label. The portal and label were created as the result of the technology programme implemented from 2010 to 2015.

The Trusted Cloud platform equally seeks to push forward privacy certification for cloud applications. At present, the data protection-compliant storage and processing of data is a major obstacle to practical application. The certificate enables a data-compliant and economical processing of data in and for the cloud.





Greece



The Greek performance on digital transformation shows significant room for improvement. Greece scores relatively high in relation to entrepreneurial culture; yet challenges remain in integration of digital technology, e-leadership and the supply and demand of digital skills. Greece performs above the EU average only in the entrepreneurial culture dimension. A look at recent national policy initiatives unveils Greece's approach to tackle the challenges encountered, focusing on support measures that will facilitate the creation of ICT start-ups and equip the unemployed with the right skill set to reintegrate into the labour market.

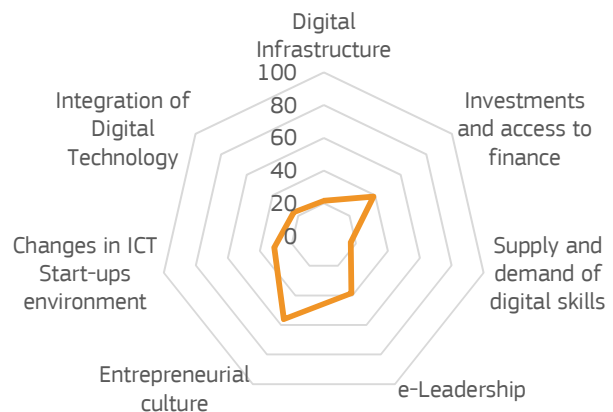
A Greece in a nutshell

Greece is a strong performer in entrepreneurial culture, while its performance in digital infrastructure is somewhat weaker.

In spite of its rather favourable entrepreneurial climate, Greece's performance in ICT start-ups is relatively low.

The country has a low integration of digital technology. Moreover, the areas of e-leadership, investments and access to finance also present challenges for Greece. The dimension where Greece proves to perform the lowest is the supply and demand of digital skills.

Overall, there is some room for improvement in most of the pillars. Its strongest asset being entrepreneurial culture, improvements are needed in the areas of e-leadership, ICT start-ups and supply and access to finance.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

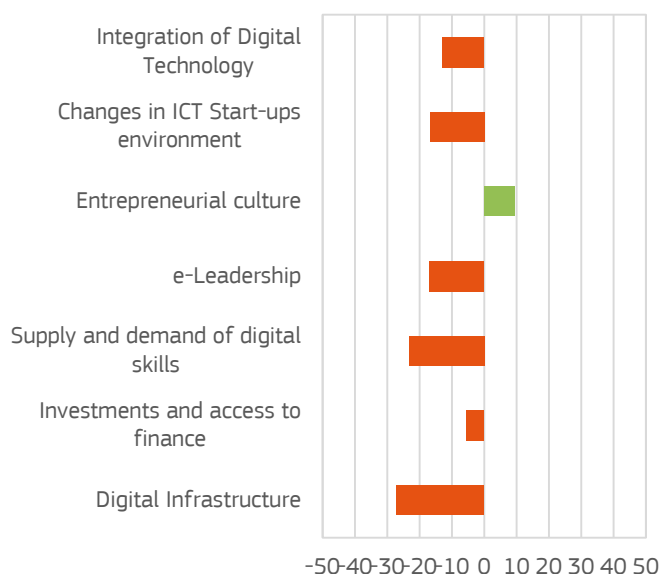
Greece's strong performance in entrepreneurial culture relies on the overall good image of entrepreneurs in general. Recent data shows that the majority of the population would set up their own company if they had the means to do so. In addition, a vast majority would prefer to be self-employed rather than employed.

- Areas for improvement

Greece's performance in digital transformation provides significant room for improvement. Although the use of social media amongst Greek companies is rather high, efforts to enhance the use of cloud computing services and e-commerce are needed.

Another key challenge for Greece is the need to improve the supply and demand of digital skills. Meanwhile, the provision of portable devices for mobile internet connection to employees as well as high-tech patent applications should be increased.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Greece performs above the average in one out of seven dimensions.

Greece's strongest asset is its entrepreneurial culture. In this dimension the country scores nearly 10% higher than the EU average.

Despite Greece's high performance in entrepreneurial culture, its score in ICT Start-ups is below the EU average.

The data indicates that Greece's greatest challenges are digital infrastructure and supply and demand of digital skills where it scores 27% and 23% below EU average, respectively.

Similarly, Greece also ranks below the EU average regarding e-leadership and ICT start-ups.

In summary, there is room for improvement in six out of seven dimensions.

D Interesting policy practices

Start-up entrepreneurship

Launched in 2015, "Start-up entrepreneurship" is a programme under the "Competitiveness, Entrepreneurship and Innovation 2014-2020" (EPAnEK)³³ Operational Programme.

The programme aims to assist the set up of innovative start-up, which would lead to the creation of new jobs.

The priority areas supported by this mechanism are: Agrifood, Energy, Cultural and Creative Industries, Supply Chain, Environment, ICT, Health - Drugs, Materials - Construction.

The programme is co-financed by the European Social Fund (ESF). The overall budget of €120 million is split into two cycles, during the two semesters of 2016 (60% and 40% respectively), and will be allocated in the different regions of Greece.

The programme's project funding ranges from 15.000 € to 60.000€ with a duration of 24 months after the approval of the business plan. The approved projects will have a funding rate of 100% of the total project budget.

The measure is expected to contribute to the establishment of 2,500 new businesses and the creation of 4500 new jobs.

Training and Validation of skills

The Training and Validation (of skills) opportunities for unemployed 18-24 year old youths in private, priority enterprises was launched in 2015. It is part of the Operational Plan "Human Resources Development, Education and Lifelong Learning"³⁴.

The project objective is to equip 15000 unemployed and economically inactive young people with the appropriate knowledge and skills to smoothly and seamlessly integrate into the Greek labour market in the coming years.

The programme focuses on developing and certifying new innovative skills in 4 different sectors: Supply chain (logistics), Retailing, International commerce/exports, and Information and communication technologies (ICT).

The duration of the mentoring and training activities is 380 hours, of which 120 hours will be theoretical and 260 hours will be practical training through internships.

The overall budget is €39.75 million, co-financed by the European Social Fund (ESF) and the European Initiative for Youth Employment (PAN).



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Hungary



Hungary is today a modest performer in digital transformation. In comparison to other European Member States, the country's main weaknesses lie in its digital infrastructure and in a limited e-leadership. However, Hungary's performance remains encouraging thanks to a good entrepreneurial culture, rather dynamic ICT sector and an attractive investment environment. Taking stock of existing challenges, the government recently implemented both strategic and operational policies to support the development of the ICT sector as well as to improve Hungarians' digital skills and infrastructure.

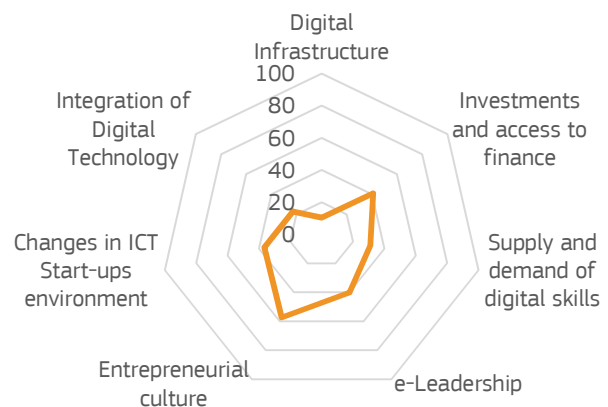
A Hungary in a nutshell

Hungary appears to be a modest performer in digital transformation.

There is in particular a need to further strengthen the country's digital infrastructure. Hungarian companies also face limited supply and demand of digital skills.

Nevertheless, Hungary's performance is encouraging in four out of seven dimensions. The country's digital potential is, amongst others, well supported by a relatively good level of investments and easy access to finance as well as a rather dynamic ICT sector.

In summary, Hungary displays an overall low performance, in particular due to the weakness of its digital infrastructure. Regardless of these limitations, Hungary's profile proves to be rather balanced across the remaining dimensions.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

The Hungarian ICT sector is dynamic and displays a rather high level of employment in comparison to other sectors of the economy. National companies also prove to be attracted by the opportunities offered in digital businesses, in particular those related to e-commerce activities.

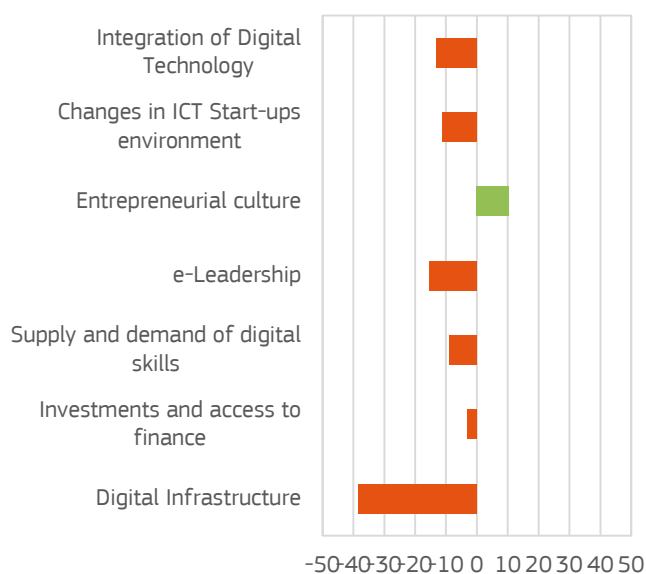
Hungary provides a favourable investment environment that is notably attractive to European investors. Hungary's digital transformation benefits from the high level of inward foreign direct investment into its ICT sector.

- Areas for improvement

Hungary's greatest weakness lies in its digital infrastructure. A particular effort should be made to improving the quality of Internet bandwidth and companies' access to high-speed broadband connection.

Hungary would also greatly benefit from improving the qualifications of its workforce in digital business and technologies. Although the country's ICT sector is expanding, Hungarian companies face difficulties in hiring employees with adequate ICT skills.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Hungary performs below the average in 6 dimensions. Entrepreneurial culture is the only field that stays above the EU average.

The digital infrastructure is the biggest challenge to overcome with 38% disparity compared to the EU average.

On the contrary, the country proves to be relatively in line with EU Member States in two out of seven dimensions. Hungary scores less than 10% below the EU average in investments and access to finance, and supply and demand of digital skills.

Hungary's achievements are slightly weaker but not completely far-off the EU average in the remaining dimensions: ICT start-ups, integration of digital technology, and e-leadership.

Overall, Hungary's performance remains below the EU average across 6 dimensions. However, although Hungary scores low on digital infrastructure, the gap between the country and its European partners is marginal in many cases, such as investments and access to finance.

D Interesting policy practices

National Info-communication Strategy

In 2014, the Hungarian government launched a comprehensive strategy aiming to support the development of the ICT sector in the country. The strategy sets out a series of key objectives to achieve by 2020 and of tailored policy measures in majority financed by the EU Economic Development and Innovation Operational Programme³⁵.

The government aims in priority to significantly improve the state of Hungary's digital infrastructure and notably of its broadband connection. Amongst others, Hungarian authorities committed to ensure that every household would have internet access of at least 30 Mbps and at least half of them of 100 Mbps or faster by 2018.

Developing digital skills and the digital economy are also two key pillars of this strategy. The government will step up efforts to increase the digital skills of Hungary's workforce and support SMEs specialised in digital technologies. The objective is notably to double the number of workers attending ICT trainings as well as to increase the value of Hungarian software and services exports by 2020.

Hipersuli Education Programme

Hipersuli³⁶ is a pilot educational programme that aimed to promote digital education through the use of mobile apps and the mobile internet in selected primary and secondary schools throughout the country.

Between 2015 and 2016, children were provided with digital devices in classrooms to support their daily lessons and activities and received trainings on the safe use of the Internet. Teachers also received a tailored training as well as a dedicated technical and academic support.

The objective of the programme was to improve students' digital skills and use of digital tools for learning purposes. Academic researchers specialised in pedagogy and psychology were also involved to evaluate the potential benefits of these new educational techniques and the possibility to replicate them at a larger scale.

The programme was the result of a public-private cooperation involving Telenor, one of Hungary's biggest operators in mobile and broadband services, Microsoft Hungary and the Hungarian Institute for Educational Research and Development (OFI).



Ireland



Ireland's digital transformation shows a strong overall performance. Ireland receives high scores in the supply and demand of digital skills and the integration of digital technology of its industry and businesses. Given its strong performance in entrepreneurial culture and digital infrastructure, the low performance in ICT Start-ups stands out. Recent examples from policy show that the Irish government provides a wide range of measures providing finances as well as skills training for start-ups and entrepreneurs across different sectors.

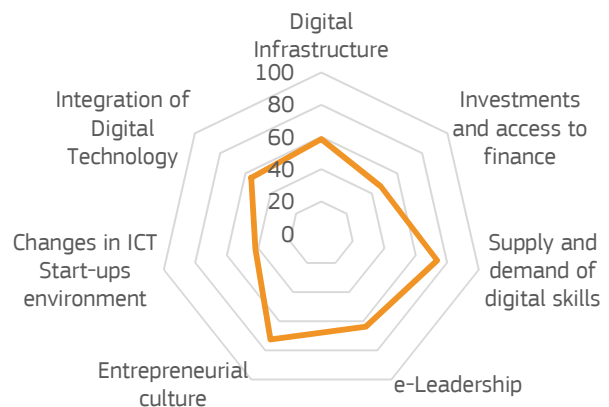
A Ireland in a nutshell

Ireland performs particularly well in the supply and demand of digital skills, entrepreneurial culture and integration of digital technology.

Meanwhile, Ireland's performance in the dimensions e-leadership, investments and access to finance and digital infrastructure is solid.

Despite a highly developed entrepreneurial culture, a firm level of digital skills of its workforce and a solid digital infrastructure and investment climate, Ireland receives a very low score in ICT Start-ups.

Overall, Ireland receives high to relatively very high scores in six out of seven dimensions. The only field where the country shows a very low performance is in relation to ICT Start-ups.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Ireland's strong performance in the field of the supply and demand of digital skills derives from its high activity in high-tech patents and the high share of enterprises providing employees with portable devices to access the internet.

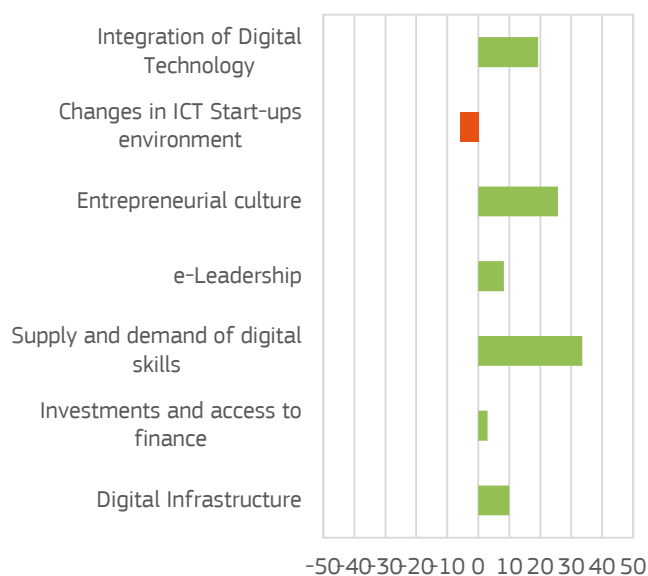
In addition, enterprises in Ireland score very high in e-commerce, an important asset for the high performance in integration of digital technology. It accounts indeed for a large share of total exports.

- Areas for improvement

In sharp contrast to the other dimensions, Ireland achieves only a low performance in ICT Start-ups. One area to be improved concerns the relatively low share of ICT company birth rates in Ireland.

Despite a solid performance in investments and access to finance, Ireland's scores in the access to loans and venture capital of enterprises provides room for improvement. The rather average score in these fields contrasts with the vast amounts of EU direct investment income obtained by Ireland.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

Compared to other EU Member States, Ireland achieves scores above the EU average in six out of seven dimensions.

With a lead of 19% to 34%, Ireland is among the EU's top performers in the supply and demand of digital skills, entrepreneurial culture and integration of digital technology.

Meanwhile, Ireland displays a rather average to narrow lead performance in digital infrastructure, e-leadership and investments and access to finance.

Finally, the one field where Ireland performs below the EU average is ICT Start-ups. In this field Ireland performs close to 6% lower than the EU average.

D Interesting policy practices

Competitive Start Fund for Graduates

The Ministry for Jobs, Enterprise and Innovation, launched the Enterprise Ireland Competitive Start Fund³⁷ in May 2014. Its main goal is to stimulate new start-up business activity for graduates by providing access to early stage financing to help young entrepreneurs turn their ideas into new products and services in the international marketplace.

In total, start-up financing of €500,000 is distributed with maximum funding amounts of up to €50,000 per start-up. The priority of the programme is to provide graduates with the critical early stage funding for the key commercial and technical milestones that will ensure delivery of their product or service.

Supported start-ups applications are welcome from Manufacturing & Internationally Traded Services sector to start up businesses involved in activities such as Internet, Games, Apps, Mobile, SaaS, Cloud Computing, Enterprise Software, Lifesciences, Food, Cleantech and Industrial Products.

Following the success of the programme, start funds for additional areas were launched by the Irish government in 2015. These areas include female entrepreneurship, manufacturing and agriculture and mobile entrepreneurs.

Strategy for Higher Education-Enterprise Engagement 2015-2020

Set up in 2015 by the Higher Education Authority (HEA), the strategy³⁸ is delivering national measures through nine action lines. Each action line is a project with clearly assigned leadership and partners as well as deliverables according to a timeline.

The strategy aims to make dynamic, high impact partnerships and engagement with enterprise a core feature of higher education in Ireland. Enterprise partners include public and private sector companies and employers.

The provisions laid out in the strategy include a communications plan and developing accessible mechanisms for employers to access the full range of skills and research development opportunities in higher education. It is putting in place funding to incentivise education-enterprise partnerships. It is developing innovative targeted skills and research initiatives to enhance their impact for participants, and for employment and job creation regionally and nationally, as well as establishing a new apprenticeship model as a core element of Ireland's education and training system.





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Italy



Italy's digital transformation performance displays wide variations. Compared to the EU Member States, a relatively strong performance can be observed in the field of entrepreneurial culture. The country's challenges are multiple with 5 fields below the EU average, the main ones being digital skills, ICT start-ups and e-leadership. A look at recent policy shows that the Italian authorities seek to further improve the digitisation of industry through Industry 4.0 initiatives; yet also programmes to improve the digital skills for the labour market are developed by the Italian government.

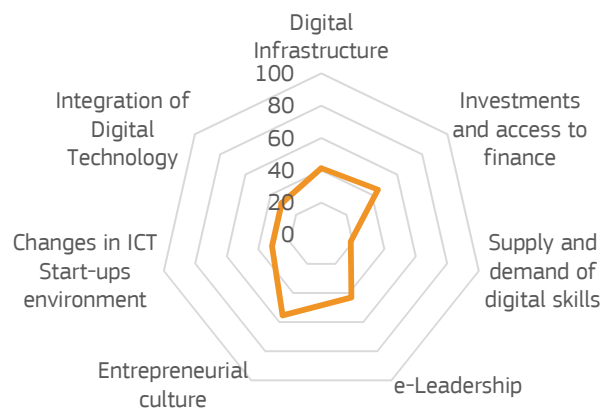
A Italy in a nutshell

Italy is a strong performer in the field of Entrepreneurial Culture. Italy matches the EU average in the field of investment and access to finance.

Overall, Italy's profile is more pronounced featuring moderate to strong performances in the financial, technological and entrepreneurial field. Meanwhile, shortcomings are mainly digital skills related.

Meanwhile, Italy displays room for improvement in the field of e-leadership and supply and demand of digital skills. In these areas the country receives very low scores.

Given these rather unfavourable framework conditions, it appears that the country's performance in ICT Start-ups is relatively low.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

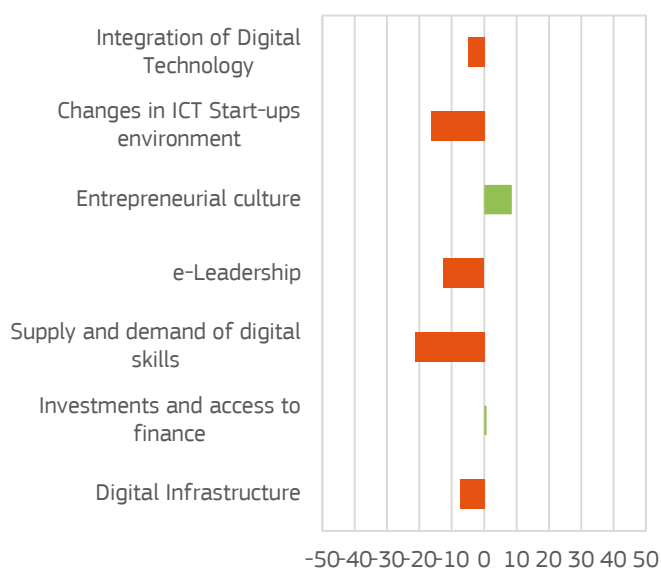
Italy displays a high score in the field of entrepreneurial culture. Next to preferring self-employment over conventional employment, recent data shows that 61% of the population would run a business of their own, if they had the financial means.

- Areas for improvement

In the field of supply and demand of digital skills Italy has room for improvement. Italian businesses rarely provide employees with devices for mobile internet connection for business. Given the size of the country, Italy could also improve in terms of high-tech patents.

Meanwhile, Italy's low performance in e-leadership is primarily due to the low share of businesses providing ICT training to ICT specialists. The share of personnel who have acquired their skills through formal education is only a little higher.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

Compared to other EU Member States, Italy scores above the EU average in only one out of seven dimensions with a 9 % gap for entrepreneurial culture.

Regarding the financial and infrastructural framework conditions, Italy's performance is more or less weaker than the EU average. This fact is confirmed by the relatively low performance in terms of ICT Start-ups.

Italy's core challenge lies in the field of e-leadership and supply and demand of digital skills. While the country performs more than 13% below EU average in e-leadership, the score for the supply and demand of digital skills is approximately 21% below EU average.

D Interesting policy practices

Intelligent Factory Cluster (CFI)

The Italian Ministry of Education, University and Research created the National Technological Intelligent Factories Cluster³⁹ (CFI) in 2012 aiming to increase productivity and develop new strategic industries. CFI is an organised aggregation of companies, universities and other public or private research institutions. Its mission is to propose, develop and implement a strategy based on research and innovation, able to direct the transformation of the Italian manufacturing sector towards new products, services, processes and technologies.

Next to establishing priority research projects in four research lines – sustainable manufacturing, adaptive manufacturing, smart manufacturing and high performance manufacturing – the CFI focuses on activities linked to technology transfer, knowledge and infrastructure sharing as well as skills development.

The IFC has achieved to centralise the dispersed actors of the Italian manufacturing industry, both regionally and nationally in an effort to create a manufacturing community and common roadmap. Overall, €45 million of public and private funding have been invested in priority research projects.

For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



Designs+3

Launched by the Ministry of Economic Development and the Italian Patent and Trademark Office (UIBM) in 2015, Designs+3⁴⁰ seek to support micro and SMEs in better exploiting skills in the area of designs/models through specialised external services for new product creation or IPR commercialisation.

The measure finances projects aimed at enhancing and further promoting registered designs/models. Each project has a maximum duration of 9 months. The incentive in capital account covers 80% of project eligible costs – maximum €65,000 for production costs and maximum €15,000 for commercialisation costs.

The measure was launched through a call for applications. The programme is implemented through the support of Unioncamere, the national Union of Chambers of Commerce, with which the Ministry of Economic Development has signed an agreement in July 2015.

Targeting micro enterprises and SMEs officially registered and operating in Italy, the programme's overall budget amounts to €4.7 million



Latvia



Latvia displays a mixed performance in digital transformation. Out of a total of seven dimensions, Latvia scores above the EU average in ICT start-ups and entrepreneurial culture. There is however room for improvements in every other areas especially digital infrastructure and investments and access to finance. Latvia has over the last years implemented various measures to support digital start-ups, including financial support programmes and through competence centres.

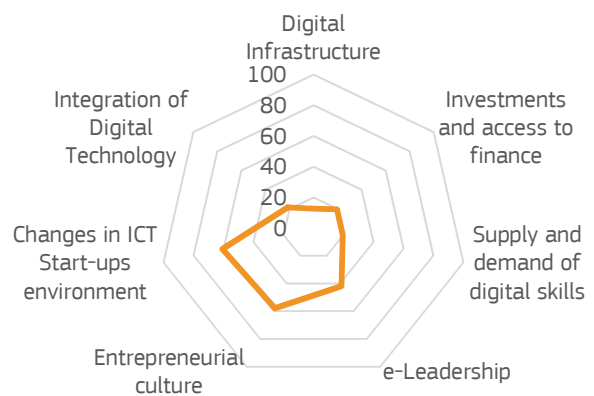
A Latvia in a nutshell

Latvia performs well in the dimensions ICT start-ups and entrepreneurial culture.

Latvia however has a relatively weak performance in access to finance and regarding the level of supply and demand of digital skills and competences.

In addition, Latvia has its lowest score in digital infrastructure, which is relevant for providing connectivity to Latvian industries and businesses.

Overall, Latvia provides a mixed performance with relatively good performances in ICT start-ups and entrepreneurial culture, and low and very low performances in the other five fields.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Latvia achieves a relatively good performance in ICT start-ups. This is linked to a rather high birth rate of new enterprises in the ICT sector. According to recent data, the percentage of ICT personnel in total employment is also well above the EU average.

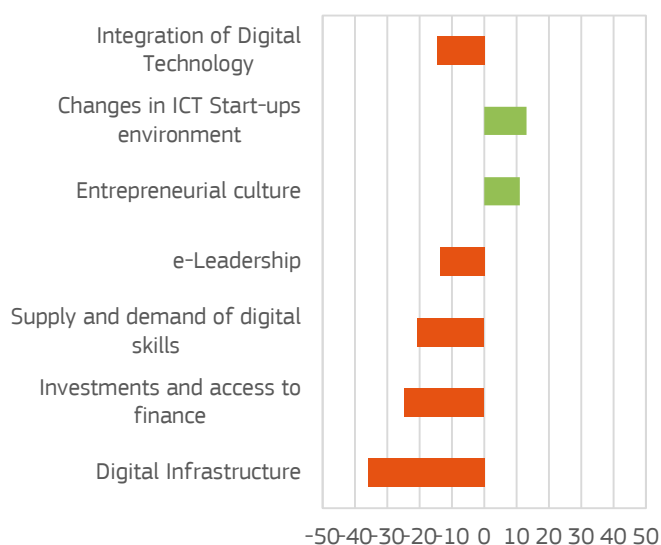
Latvia also performs well in entrepreneurial culture. Flash Eurobarometer data displays that Latvians have a rather positive opinion on self-employment and working independently. The responses for example displayed significant interest in being self-employed compared to working as an employee.

- Areas for improvement

Latvia's relatively weak performance in e-Leadership provides a potential for improvements. In particular, recent data shows that enterprises are only providing limited training to develop and upgrade ICT skills of employees. Latvia's performance concerning the provision of portable devices to employees for business use is however in line with the EU average.

Moreover, the country's performance in digital infrastructure is linked, among other things, to limited internet bandwidth at the work place.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison with other EU Member States, Latvia's performance is above the average in two out of seven dimensions.

Latvia provides a relatively strong performance regarding ICT start-ups, which is significantly above EU average.

The solid performance in the conditions for ICT start-ups is followed by a relatively high score in entrepreneurial culture.

Latvia scores below the EU average in dimensions such as e-Leadership, integration of digital technology and supply and demand of digital skills, highlighting a potential for improvements in these areas.

Meanwhile, the weakest relative performance concerns digital infrastructure and the investments and access to finance.

D Interesting policy practices

ALTUM support programmes

The state-owned development finance body ALTUM⁴¹ provides financing support through loans, credit guarantees and investments in venture capital funds. ALTUM's objective is to compensate for existing market shortcomings, to help facilitate business growth and to ensure economical development. Among several support programmes, ALTUM offers:

- Business Start-up Programme: loan for businesses or start-ups established within a period of the previous 3 years;
- Loans for Business Angels Co-financed Projects: loans for new projects and enterprises with growth potential;
- SME Growth Loans: loans for investment and working capital.

The areas of operation cover support for business start-ups and self-employment, improvement of competitiveness and implementation of technologies and innovation and export facilitation. ALTUM also offers non-financial support through education, mentoring and consultations etc.

ALTUM's shareholders include the Republic of Latvia's Ministry of Finance, the Ministry of Agriculture and the Ministry of Economics.



IT Competence Centre

The IT Competence Centre⁴² was created in 2010 based on a signed contract with the Latvian Investment and Development Agency.

It aims to promote long-term collaboration between industry and research institutions. On this background, it seeks to create innovative technologies and prototypes of IT products that are competitive at the international level.

The IT Competence Centre was established to better implement existing knowledge and technology findings as well as to use the Latvian research potential to improve new technologies and enter new markets.

The public-private initiative, which has a national coverage, provides funding for collaborative research projects. The IT Competence Centre's main research directions are business process analysis technologies and natural language technologies.

The Centre is organised by leading Latvian IT companies and universities and co-financed by the European Regional Development Fund.





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Lithuania



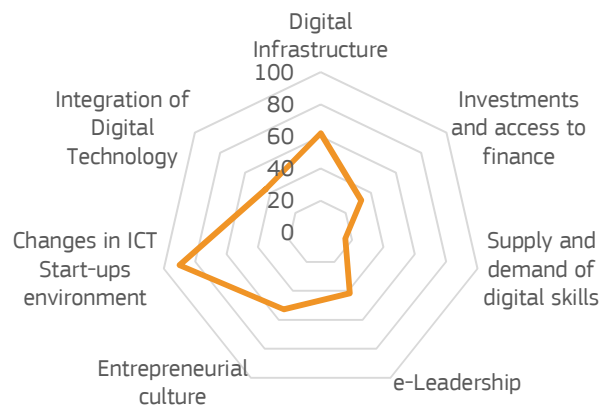
Being one of the best in the European Union, Lithuania is exemplary for the high number of ICT Start-ups. ICT Start-ups in Lithuania create more and more jobs and consequently play a greater role in the employment share. Compared to other EU countries, Lithuania exceeds the EU average in four out of seven digital transformation areas. Furthermore, the government foresees different initiatives and programmes such as innovation vouchers to innovate and stimulate the uptake of digital technologies in the entrepreneurial environment. These initiatives also aim at tackling the lower supply and demand of digital skills and boosting e-Leadership, two of the core challenges of the country.

A Lithuania in a nutshell

Overall, Lithuania is performing well in fields related to digital development. It provides of a fairly advanced digital infrastructure, developed entrepreneurial culture and a high number of ICT Start-ups.

Meanwhile, Lithuania's challenges are in the fields of supply and demand of digital skills and e-leadership. However, given Lithuania's relatively strong digital infrastructure, spill-over effects on the country's performance in e-Leadership and digital skills may occur.

In the field of investments and access to finance Lithuania shows a low performance. Despite the lack of finance and investments, Lithuania performs strongly in ICT start-ups. Given the country's dynamic and uprising entrepreneurial culture, an improved finance and investment framework would have the potential to boost Lithuania's digital transformation.



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas of improvements

+ Strengths

After a deep dive caused by the global financial crisis, the Lithuanian entrepreneurial scene is recovering fairly quickly. An indicator reflecting this trend is that the number of newly-established start-ups has tripled in the last five years. The share of ICT companies in employment is equally on the rise.

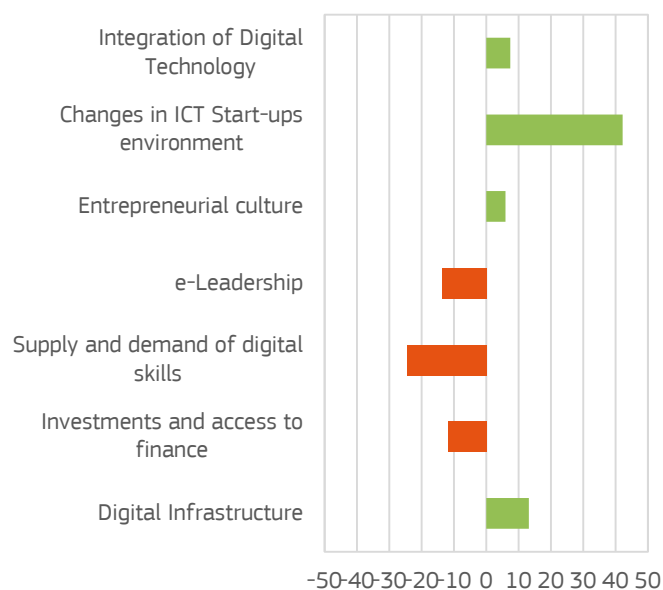
Lithuania performs also strong in digital infrastructure with the overwhelming majority of enterprises using broadband internet and various software solutions to improve business processes.

- Areas of improvements

Lithuania's low performance in the supply and demand of digital skills can be seen as the main point of improvement in Lithuania. To a large extent, this performance is caused by the low results of employees' ICT or IT skills. In addition, the amount of enterprises that employ ICT-specialists is also relatively small.

Moreover, only a low share of Lithuanian employees have portable devices to connect to the internet for business purposes.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

In comparison with other EU Member States, Lithuania is performing above the EU average in four out of seven indicators.

Integration of digital technology is taking off with the increasing number of enterprises purchasing online in the last two years. Moreover, share of enterprises' total turnover from e-commerce is also steadily growing.

Entrepreneurial culture is showing better results than the EU average as over half of the employees are willing to be self-employed with or without governmental support. The entrepreneurial culture is also reflected in the high number of the newly-created ICT Start-ups.

Lithuania performs moderately in e-Leadership in comparison to the EU average. Similarly, the supply and demand of digital skills along with the investments and demand of digital skills are subject for the improvement.

D Interesting policy practices

Lithuanian Innovation Development Programme 2014-2020

The programme⁴³ was initiated with the aim to gather and mobilise resources at the state level for the enhancement of the innovativeness in the country. Through the programme, the Lithuanian government seeks to foster a more competitive economy based on a digitally and technically qualified labour force in line with its smart specialisation strategy.

The overarching goal is to embed innovation across all sectors and in different aspects such as business models, branding and services, industrial design and creative solutions.

The programme addresses all relevant stakeholders that can benefit from innovation policies. Next to SMEs, Start-ups, business and public associations, also major companies are defined as target groups.

With the Innovation Development Programme, the Lithuanian government intends to further improve the country's capacities and skills related to human resources.

Innovation vouchers

Aiming at boosting innovation and further uptake of digital technologies in SMEs, the Lithuanian Ministry of Economy has introduced 'innovation vouchers⁴⁴'.

The innovation voucher system is a system of small credits that SMEs can use to purchase R&D expertise from co-operation, technology and knowledge holders such as research institutions and competence centres.

By using the vouchers, SMEs engage in business and scientific cooperation, accelerate transfer of knowledge, research and technologies, create innovative business models and facilitate the uptake/commercialisation processes of research results.

Supported activities include industrial or applied research, technological development and feasibility studies.

Innovation vouchers are known for its low administrative burden and have a fairly simple application procedure.





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Luxembourg



Luxembourg is today one of the EU leaders in digital transformation. The country’s high quality digital infrastructure represents the main driving force behind its strong performance. Luxembourg offers overall an advantageous environment that incentivises companies to engage in digital business and technology. Despite these excellent achievements, further efforts should be made to tap the full potential of ICT start-ups in the country. Taking stock of these limitations, the government of Luxembourg recently launched policies to support the development of ICT companies and improve digital skills among students.

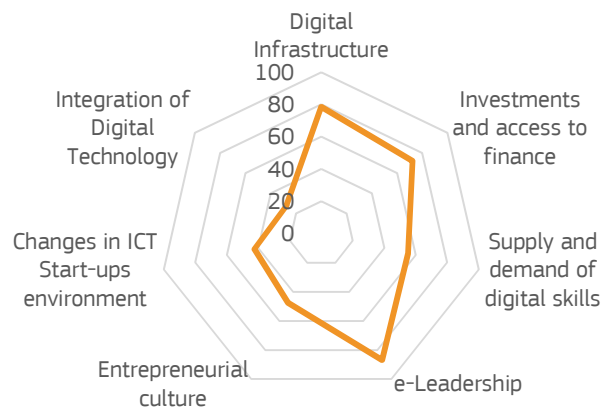
A Luxembourg in a nutshell

The country displays excellent results in three key dimensions. Luxembourg not only provides high quality digital infrastructure, but is also well-advanced in investments and access to finance and e-Leadership.

Companies in Luxembourg also benefit from a very favorable investment environment, with a positive supply and demand of digital skills. Entrepreneurial culture is rather supportive as it stays with the EU average.

However, the country’s main weakness lies in its low level of integration of digital technology and ICT start-ups.

Overall, Luxembourg displays a strong performance across almost all dimensions. The country’s robust digital infrastructure is the key driving force behind its digital transformation. Such achievement could be further improved with greater support to the development of ICT start-ups.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

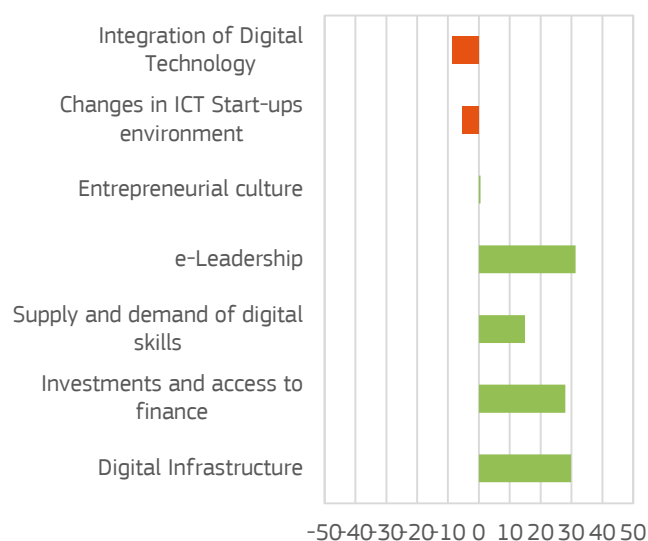
The country’s main strength lies in its digital infrastructure. Companies benefit from an excellent access to high-speed broadband connection. There is indeed a high proactivity in digital business; in particular, in e-commerce activities.

Luxembourg’s favourable investment environment also explains its strong performance. Low tax rates and easy access to private funding are great incentives for domestic and international ICT companies to invest in the country.

- Areas for improvement

Despite its strong performance, Luxembourg’s record in integration of digital technology could be further improved. A particular effort is needed to supporting the development of the digital sector and of ICT companies, and in particular innovative start-ups.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison to other EU Member States, Luxembourg's performance is strong in four out of seven dimensions. It is an EU leader in e-leadership, digital infrastructure and investments and access to finance with respectively 31%, 30% and 28% scores above the EU average.

Also, the country is significantly more advanced than its European partners in supply and demand of digital skills.

However, despite these positive achievements, Luxembourg is not in line with other European Member States in integration of digital technology and ICT start-ups where the country stays below the EU average by respectively 5% and 8%.

Overall, Luxembourg undeniably ranks as one of the EU leaders in digital transformation, in particular thanks to its top three fields.

Nevertheless, the support to ICT start-ups should be stepped up in order to confirm Luxembourg's status as a driver of digital transformation in Europe.

D Interesting policy practices

Digital4Education Strategy

In 2015, the government of Luxembourg launched the Digital4Education strategy⁴⁵ which aims to foster the development of IT skills among students and to ensure that they are well-equipped to take full advantage of the ongoing digital transformation of society in everyday life and at work.

This comprehensive strategy sets out several key operational initiatives. For instance, the "Bee Creative" programme aims to improve students' digital skills by developing their digital literacy and promoting entrepreneurship. It consists in the creation of several FabLab in secondary schools where students are trained to use high-tech digital devices and able to develop their own digital tools in fields such as coding, 3D printing, robotics, etc.

Other flagship initiatives include inter alia the large-scale development of digital tools for teachers and students, the distribution of tablets in classrooms and the creation of one secondary school, le Lycée de Clervaux, with tailored programmes dedicated to digital technology.



The Digital Tech Fund

In 2016, the government of Luxembourg established the Digital Tech Fund⁴⁶, together with five private investors to support the funding and development of ICT start-ups in the country. The creation of this new fund was set out in the comprehensive "Digital Lëtzebuerg" Strategy, published in 2014 by the government, which aims to strengthen Luxembourg's leading position in digital technology and economy.

The fund is expected to support ICT start-ups by taking equity stakes in promising innovative enterprises created less than 7 years ago, and which are already developing functional prototypes. The fund has a particular focus on venture capital investments in areas such as cybersecurity, FinTech, Big Data, the 'Internet of Things', etc.

The Digital Tech Fund is the result of a strong public-private partnership in which the State's participation amounts to 5 M€ and is complemented with a 15.33 M€ financial contribution from private investors and other public actors such as the National Credit and Investment Company (SNCI) and the University of Luxembourg.





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Malta



Malta shows a rather positive level of digital transformation in the majority of dimensions. The country is a strong performer in digital infrastructure, e-leadership and ICT Start-ups, whereas major challenges remain in the entrepreneurial culture at the national and European level. Malta shows a higher performance than its EU partners in three fields, while the other two are broadly in line with the EU average. In order to further enhance the digital transformation, the government has launched several programmes to ease the access to finance and to address the skills shortage of workers.

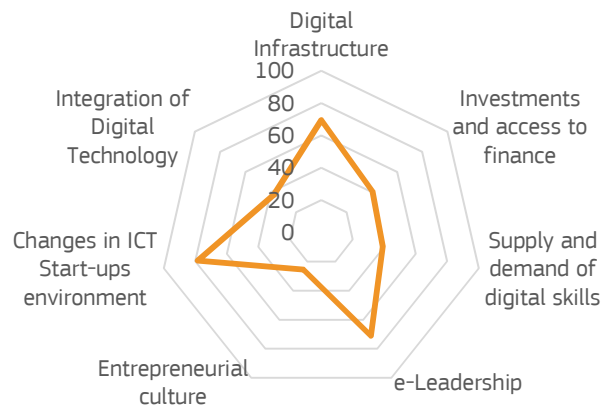
A Malta in a nutshell

Malta's strengths lie in its well-developed digital infrastructure and proactive approach to e-leadership. In both dimensions, the country achieves high results.

Although the entrepreneurial culture is the weakest dimension, Malta is a strong performer in ICT Start-ups, as one of most successful dimensions of digital transformation.

In the field of investment and access to finance, integration of digital technology, supply and demand of digital skills, the country displays fairly moderate values.

To sum up, Malta performs well in most of the dimensions, whereas the entrepreneurial culture shows room for further improvement.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

The strongest asset of Malta is a solid digital infrastructure. Businesses benefit from a high-speed internet connection, well-integrated internal processes and high usage of Customer Relationship Management. Moreover, the country scored well in the Global Competitiveness Index.

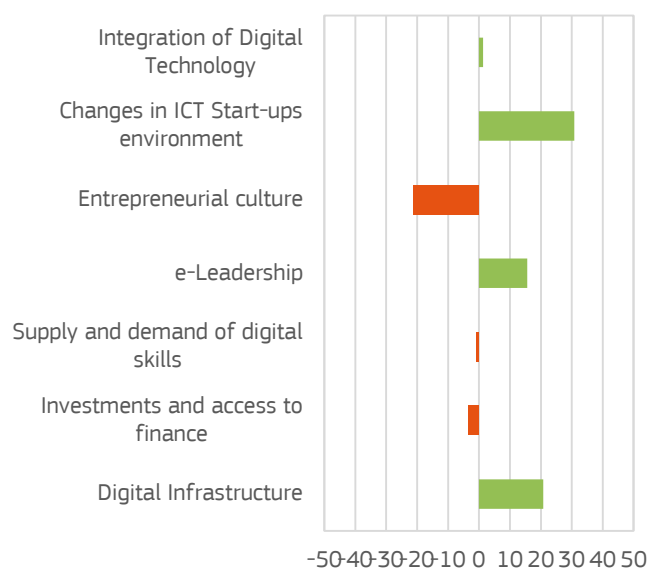
ICT Start-ups and e-leadership are also high-performing areas in Malta. The share of ICT sector on GDP is growing, as well as the number of SMEs operating in the ICT sector. The evidence shows growing efforts from the employers in providing training focused on obtaining the ICT/IT skills.

- Areas for improvement

The country's profile illustrates a room for improvement in terms of the entrepreneurial culture. Recent data shows that overall opinion about the entrepreneurship is rather negative in Malta. Similarly, the majority of the population prefers to be employed rather than self-employed, with a low interest in setting-up or overtaking a business.

Regarding the supply and demand of digital skills, and access to finance, there are still opportunities for further enhancement, however, Maltese government has implemented several policies to tackle these issues.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison to its EU partners, Malta shows a good level of digital transformation with scores well above the EU average in three dimensions. The only exception is entrepreneurial culture where the country performs much lower than most other Member States.

The country scores high in terms of digital infrastructure and e-leadership also at the European level, exceeding the average by approximately 20%.

Furthermore, Malta achieves its best results in the dimensions of ICT Start-ups with values above the EU average by respectively 21% and 16%.

Malta's integration of digital technology, supply and demand of digital skills, and investment and access to finance are broadly in line with the EU average. However, there are incentives from the Maltese government on improving the access to finance and skills development in order to further enhance the conditions of SMEs and start-ups.

D Interesting policy practices

JAIME - Joint Assistance Initiative for Maltese Enterprise

The programme⁴⁷ is administrated by the Bank of Valetta with funding by the European Union under ERDF allocated to the Government of Malta and Horizon 2020 and by the European Investment Bank.

The main goal is to provide SME's with financing for capital investment and related working capital by assuring advantageous interest rates and reduced collateral obligations. The current interest rate is 3.5%, with bank requests to secure amounting to only 25% of such facility. The overall assistance ranges between €25,000 and €500,000 with a total budget of €60 million.

In order to ease the access to finance, Malta launched several complementary programmes. Business Plan is a scheme assisting start-ups with seed funding, grants up to €25,000 for a period of one year. Similarly, Start-up finance provides financial assistance in form of loans of up to €200,000/€500,000 (purchase of machinery), targeting start-ups.

Knowledge transfer

The programme "knowledge transfer"⁴⁸ was set up in 2016 for a period of 4 years, administered by Malta Enterprise Corporation. The measure supports applicants of enterprises employing at least five full-time employees for the last two fiscal years.

The main objective is to address the skill shortage, to support knowledge transfer and to develop skills matching the needs of industry. The initiative shall support development and implementation of the training programmes, up-skilling and re-skilling personnel. The training can be delivered from related enterprises, by qualified external trainers, or in-house.

Financial support for the purposes of this measure will be granted in form of tax credits. The maximum aid is capped at 1 million. The intensity is established according to the size of the applicant, granting up to 70% of eligible costs for small businesses, 60% for medium enterprises, and 50% for large companies. Overall, €10 million are allocated over four years (2016-2020).



The Netherlands



Digitisation processes in the Netherlands are unfolding at a quick pace with the country being one of the best performers in the European Union thanks to the country's high supply and demand of digital skills along with high scores in e-Leadership and digital infrastructure. The Dutch government is aware of the strong assets of its country, such as the strong digital skills of its population and very good internet connection. Nevertheless, building on these assets further efforts are made by including the entire society in digitisation processes.

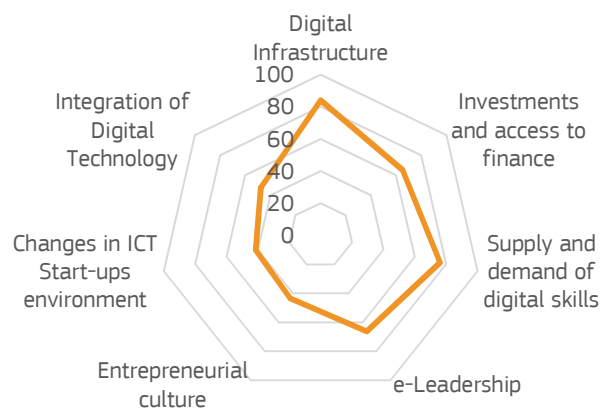
A The Netherlands in a nutshell

Overall, the Dutch digital development shows very good results. However, the process does not unfold equally along all the different pillars.

The Netherlands is a rather moderate performer in the number of ICT Start-ups. Additionally, the country's entrepreneurial culture shows a relatively low activity.

On the other hand, the country has developed a high supply and demand of digital skills as many employees possess ICT/IT skills and employers do not experience excessive difficulties to fill ICT/IT positions.

Companies in the Netherlands are well equipped with internet and different software solutions. Moreover, companies widely provide portable devices to their employees. These effective actions result in strong e-Leadership and digital infrastructure.



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas of improvements

+ Strengths

The staggering majority of enterprises in the Netherlands are equipped with fixed broadband connection. Employees of the companies cannot only draw upon a high-quality internet connection but also on software solutions intended for sharing information and/or evaluate information for marketing purposes.

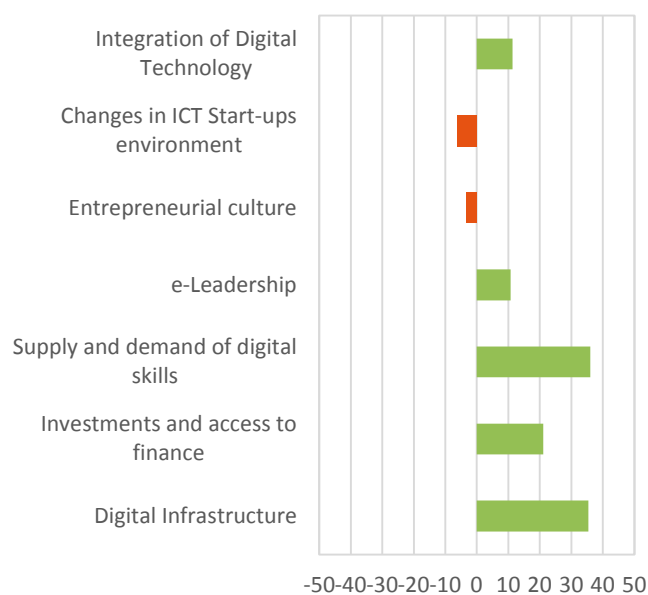
Moreover, the Netherlands has high supply and demand of digital skills with just a small percentage of enterprises that found it hard to fill jobs requiring ICT specialist skills.

- Areas of improvements

The number of newly-established start-ups shows a decreasing trend in the Netherlands and the overall performance in this pillar is rather moderate.

In addition, the country's entrepreneurial culture shows low activity with relatively small number of employees wishing to become self-employed. However, the readiness to do so would most likely increase substantially in case the government will foresee sufficient funding and incentives.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

Overall, the Netherlands is one of the best performers in comparison to other EU Member States as digital uptake is taking place. It is very significant in the supply and demand of digital skills and digital infrastructure where the country performs respectively at 36% and 35% above the EU average.

The country scores above the EU average in five out of seven dimensions. However, the low number of ICT start-ups and the related low activity in entrepreneurial culture impede the country's full digital uptake. However, positive developments in investments and access to finance can possibly upsurge the numbers in ICT Start-ups and entrepreneurial culture in the near future.

The Netherlands can draw upon a highly developed digital infrastructure and on the high demand and supply of digital skills. Additionally, more and more employees are provided with portable devices ensuring that the skills can be further developed and access to internet granted for business purposes when needed.

D Interesting policy practices

Smart Industry

The Ministry of Economic Affairs, the Chamber of Commerce along with the industry and research representatives produced 'the Smart Industry Report⁴⁹' that examines Smart Industry in the Dutch context.

In 2014, this report was translated and formalised into an Action Agenda. The Action Agenda presents improvements in the current policy and the existing Technology Pact. The documents aim primarily at increasing competitiveness through a more efficient and quicker use of the opportunities that ICT has to offer.

The document outlines the world-class industrial base in the Netherlands, that possesses all the necessary conditions including highly-developed ICT infrastructure, wide internet penetration and strong tradition in collaboration through networks and clusters. The Action agenda explains how to build the Smart Industry based on these conditions and presents three points of action: (1) capitalising on existing knowledge, (2) accelerating in Field Labs and (3) strengthening the foundation.

For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



Digitaal 2017

'Digitaal 2017⁵⁰' is the initiative of the Dutch government that aims to offer all governmental services online by 2017.

The goal is to develop an integral service and to operate from one central website regardless of the particular service being offered. With this new programme, the Dutch government aims at improving, simplifying and accelerating public services. Additionally, the government hopes to ensure a quicker exchange of information and to increase the trust of their services by operating at a faster and more efficient pace.

The programme foresees not only a written submission of requests, but also offers online meetings where citizens and companies can communicate to officials by using an app.

Additionally, the government app will display both demand and supply of services offered at local level. This includes contacting volunteers for the help to elderly people or people with disabilities.





Poland



The Polish record shows a moderate level of digital transformation. The country's asset is its well developed entrepreneurial culture and ICT start-ups, while its performance in investment and access to finance displays average results. Challenges remain in the 4 other dimensions, particularly in digital infrastructure and supply and demand of digital skills. This trend can also be observed when benchmarking Poland's performance at European level. The Polish government's recent policy efforts seem to focus on providing better access to finance and on enhancing technology and innovation development.

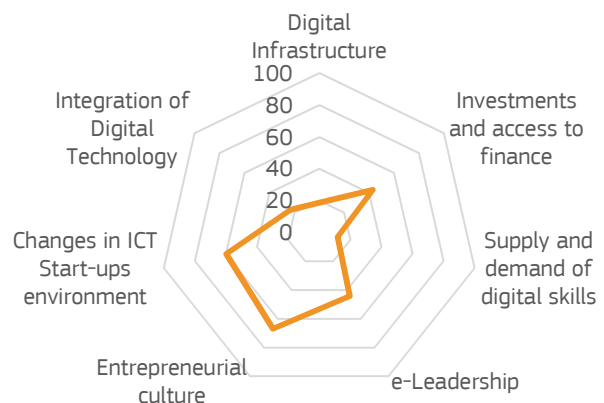
A Poland in a nutshell

Poland performs well in the dimension of entrepreneurial culture and ICT start-ups.

Somewhat weaker results are obtained in terms of investment and access to finance.

However, challenges remain in several dimensions. There is a significant shortfall in Poland's supply and demand of digital skills. Similarly, Poland's results in the area of digital infrastructure are significantly low, followed by e-leadership and integration of digital technology.

To sum up, Poland benefits from strong entrepreneurial culture and ICT start-ups, while scoring average results in one further field. However, a rather low performance in several dimensions indicates that further policy efforts are needed in order to advance with the country's digital transformation.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Poland shows a strong performance in entrepreneurial culture. The majority of the population prefers self-employment over being an employee. In addition, people are highly interested in setting up a business or take over an existing one.

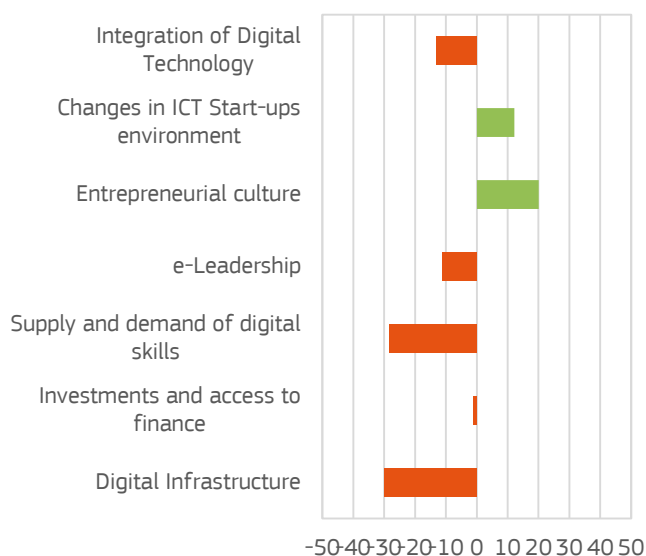
The positive trend related to ICT start-ups is illustrated by a growing number of new businesses operating in the ICT sector. Concerning the access to finance dimension, Polish enterprises benefit from a relatively easy access to loans and EU direct investment.

- Areas for improvement

Poland's fairly weak performance in the supply and demand of digital skills is due to the low number of ICT personnel in enterprises as well as the low number of in-work ICT/IT skills trainings.

Moreover, Polish businesses only make occasional use of software solutions to improve business processes. Alongside the low use of e-commerce and cloud computing solutions, relatively weak internet bandwidth is another chapter in Poland's challenge to achieve a solid digital infrastructure.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

In comparison to the EU partners, Poland's profile shows two strong dimensions, one slightly below the EU average and four dimensions with rather low performance.

The country scores high in terms of entrepreneurial culture and ICT Start-ups, exceeding the EU average by respectively 20% and 12%.

Investment and access to finance is the dimension where Poland performs slightly below the EU average.

Poland's key challenges concern the areas of digital infrastructure and supply and demand of digital skills. Compared to the EU Member States, further areas for improvement concern the dimensions of e-leadership and integration of digital technology.

D Interesting policy practices

Program Inteligentny Rozwój 2014-2020

The Operational Programme Intelligent Development 2014-2020⁵¹ is administrated by the Ministry of Infrastructure and Development. The total budget for the purposes of this programme is approximately €10 billion, funded in cooperation with the European Regional Development Fund.

The programme aims to improve the competitiveness and boost the innovation development in Poland by increasing the expenditures of research and development activities of enterprises. An additional goal is to foster knowledge transfer and strengthen the cooperation between businesses and research centres at the national and regional level.

The provision of financial instruments, such as guarantees and equity investments, and investments in R&D in the private and public sector will enhance the number and quality of applied research, and production of high-technology products. The goal is to stimulate the transition to an innovation-based economy and to increase the global competitiveness of Polish businesses.



**INTELIĞENTNY
ROZWÓJ**

Fundusz Pożyczkowy Innowacji

The "Innovation Loan Fund⁵²" was designed as a source of debt financing in the early stages of development of innovative businesses. The measure is administrated by the Polish Agency for Enterprise Development and co-financed by the European Regional Development Fund.

The main objective is to improve the access to finance for micro and small enterprises which face difficulties in obtaining sufficient capital from 'traditional' financial institutions. Above all, this applies to the financing of innovative projects at the early stages of development, often associated with high risk.

The financial instrument grants preferential interest-free loans involving private capital in form of signed investment agreements by business angels or venture capital funds. The loans range in size between €46,500 and €446,500. The programme is implemented from 2017 to 2023.

PARP ◀



Portugal



The Portuguese performance in digital transformation shows significant variation featuring high and low performing fields. Portugal scores relatively high in relation to entrepreneurial culture; yet challenges remain in investments and access to finance as well as in the supply and demand of digital skills. Portugal performs above the EU average in three out of seven dimensions. A look at recent national policy initiatives reveals that Portugal recently adopted policy measures to support the development of ICT start-ups, notably through the establishment of a more favourable investment and entrepreneurial environment.

A Portugal in a nutshell

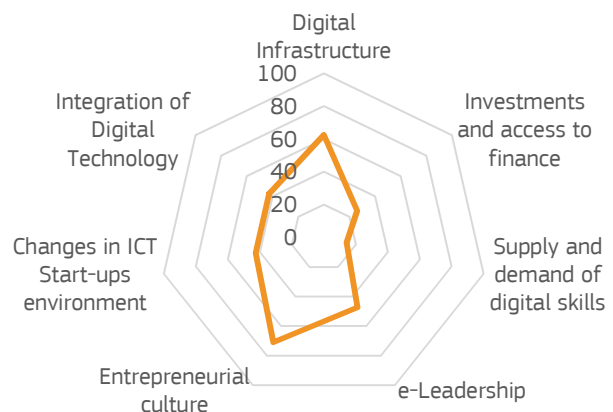
Portugal is a strong performer in entrepreneurial culture and in digital infrastructure.

The country also shows a consolidated performance in integration of digital technology and e-leadership.

In spite of its rather favourable entrepreneurial climate, Portugal's performance in ICT start-ups is quite weak.

The areas of investments and access to finance and supply and demand of digital skills present challenges for Portugal. Indeed, the area in which the country performs the lowest is the supply and demand of digital skills.

Overall, there is some room for improvement in three out of seven dimensions. The country's main strengths lie in its entrepreneurial culture and digital infrastructure. However, further efforts are needed in investments and access to finance as well as in supply and demand of digital skills.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Portugal's strong performance in entrepreneurial culture relies on Portuguese's great interest in being self-employed and in setting up their own company if they had the means to do so. However, entrepreneurs tend to have in general a rather negative image among the population.

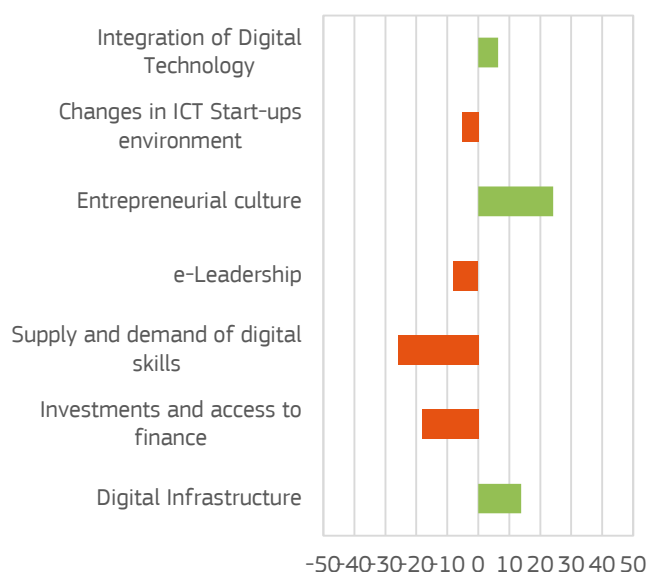
Portugal's solid digital infrastructure is based on companies' solid uptake of ICT software solutions and extensive use of fixed broadband connection. However, this overall good performance could be even further consolidated with a faster internet connection speed.

- Areas for improvement

Portugal's performance in supply and demand of digital skills could be significantly improved. The data shows that a substantial number of companies encounter problems when hiring ICT specialists. Moreover, efforts should be stepped up in increasing high-tech patent applications.

Another key challenge for Portugal is the need to boost investments and access to finance. The country shows a rather weak performance in private R&D investment. Companies have difficulties in raising money through local equity markets.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Portugal performs above the average in three out of seven dimensions. In particular, Portugal stands out in entrepreneurial culture scoring nearly 25% higher than the EU average.

Furthermore, the country performs well in digital infrastructure and integration of digital technology in comparison to its European partners.

Despite Portugal's high performance in entrepreneurial culture, its score in ICT Start-ups and e-leadership are below the EU average.

Similarly, the country's performance is significantly weak in investments and access to finance.

The data indicates that Portugal's greatest challenges lie in supply and demand of digital skills, where it scores 26% below the EU average.

D Interesting policy practices

StartUP Portugal

In 2016, Portugal launched "StartUP Portugal"⁵³ a new plan to boost entrepreneurship. Developed as a four-year strategy, it aims to assist the setting-up and sustainability of innovative start-ups. Additionally, its objective is also to attract international start-ups and ensure that they set-up in Portugal in the long run.

The programme is formed of 15 measures divided in three pillars: ecosystem, funding and internationalisation. The objective of the "ecosystem" pillar is to identify and overcome sectoral and regional flaws in the entrepreneurial environment.

Regarding funding policies, the programme focuses on promoting new methods of financing. Measures will aim to attract private investors by matching public funds with business angels or venture capital. Moreover, a budget of 10 million euros for vouchers will be released to the benefit of incubators and accelerators. Portugal will also emphasise crowdfunding and peer-to-peer investments and plans to launch a more favourable tax system for investors in start-ups. Finally, employment incentives to support the hiring of young professionals are envisaged.

As for the last pillar, measures are geared towards strengthening Portugal's attractiveness to international start-ups. The plan will notably support the presence of start-ups in global tech events and fairs.



Call Indústria 4.0

Indústria 4.0 call⁵⁴ is Portugal's venture capital investment programme. The objective of the mechanism is to modernise Portugal's industrial companies by supporting the creation of new companies within the Industry 4.0 domains.

The initiative aims to foster the development of projects within the following areas of knowledge: Cyber-physical Systems; Communication Networks; Visualisation, Modelling and Simulation; Digitalisation; Support Technologies; Energy; Artificial Intelligence and Smart and New Materials.

Eligible projects should be promoted by start-ups (i.e. businesses up to 3-year-old or about to be set up), providing innovative technologies, products, solutions with a strong marketing potential and the ability to grow in the face of international competition. Selected projects must also be based on proprietary technology and knowledge.

This initiative is the continuation of the "+Innovation + Industry" programme which supported over 150 new projects during its seven years of operation. Call Indústria 4.0 is set to go beyond what has previously been achieved in "+Innovation + Industry".

Selected projects under Call Indústria 4.0 will benefit from direct equity investments up to 500,000 €.



Romania



Romania faces significant challenges in the field of digital transformation. In comparison to other European Member States, Romania's performance is notably hampered by a lack of high-quality digital infrastructure, limited digital skills among professionals and a rather weak investment climate. However, the country benefits from a solid entrepreneurial culture as well as a dynamic ICT start-up ecosystem. The Romanian government recently adopted several measures to address the country's enduring challenges in digital transformation, with a particular focus on improving digital infrastructure and facilitating SMEs' access to finance.

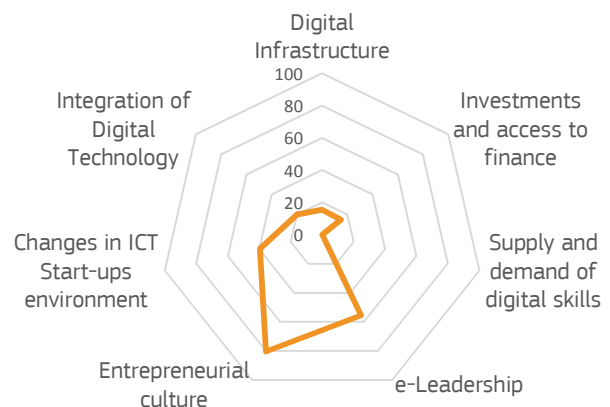
A Romania in a nutshell

Romania performs low in five out of seven dimensions. The country's limited achievements are notably explained by the lack of high-quality digital infrastructure. Also, professionals display a rather low level of digital skills.

Despite higher results, the investment environment in the country remains unfavourable and companies would need to increase their efforts in digital transformation.

Encouraging achievements are however noteworthy as Romania benefits from the dynamic development of ICT start-ups and a strong entrepreneurial culture.

Overall, Romania is a low performer in digital transformation and further efforts are needed in almost all dimensions. However, the country displays promising results in entrepreneurial culture and ICT start-ups.



Note: Based on the average of the latest imputed for 2015. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Romania's main strength lies in its solid entrepreneurial culture. Polls show that Romanians support entrepreneurship and would be highly interested in setting up their own business provided that regulatory and financial conditions are adequate.

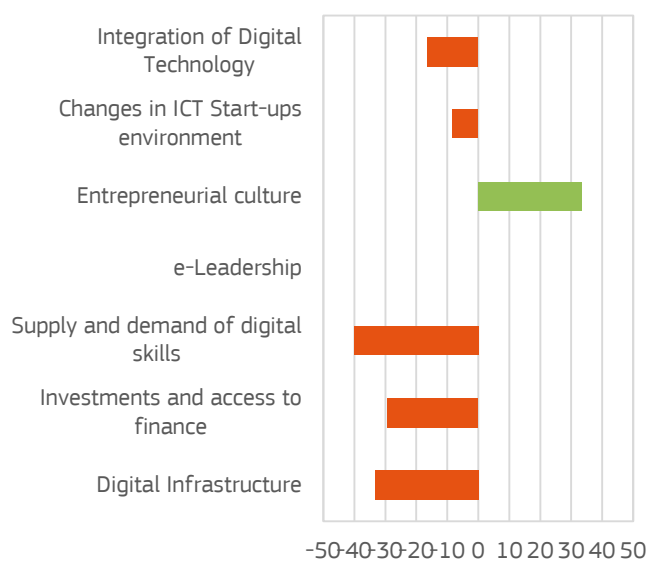
Despite an unfavourable context, the ICT start-up ecosystem in Romania is today expanding. Indeed, companies specialised in digital business or technology represent a good share of the companies recently created in the country.

- Areas for improvement

Further efforts are needed in many areas. However, the country's digital infrastructure and the level of digital skills need to be improved in priority. In particular, strengthening companies' access to a fast and reliable broadband connection would certainly foster their digital transformation.

Also, Romanian companies should take action to increase digital skills among professionals. Businesses could fill the shortage of ICT skills among their employees by providing them tailored and more regular trainings.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest values for 2015.

In comparison to other European Member States, Romania scores low in five out of seven dimensions. The gap between Romania and its European partners is the widest in access to finance, supply and demand of digital skills as well as in digital infrastructure with scores more than 30% below the EU average. Also, the development of ICT start-ups in the country is slightly below the EU average.

Despite more positive results, the country's performance is also not in line with other European Member States regarding companies' level of digital transformation.

However, Romania benefits from a strong entrepreneurship culture in comparison to other European Member States.

Overall, Romania is one of EU's low performers in digital transformation. Nevertheless, the country's displays encouraging results in ICT start-ups and in entrepreneurial culture.

D Interesting policy practices

National Strategy on Digital Agenda for Romania

In 2015, the Romanian government adopted a comprehensive strategy⁵⁵ aiming to support the development of the ICT sector in the country. The strategy sets out a series of ambitious objectives to be achieved by 2020 and of tailored policy measures in majority financed by European structural funds.

The strategy notably aims to significantly improve the state of the country's digital infrastructure and broadband coverage. The government committed to ensure that by 2020, at least 80% of Romanian households would have a decent access to internet of at least 30 Mbps, and that 45% of them would have subscriptions over 100 Mbps.

The government's action in digital infrastructure focuses primarily on connecting rural and disadvantaged areas. It launched the "Ro-NET" initiative which is expected to provide broadband infrastructure to 783 localities hitherto lacking access to electronic communication networks. The project's total investment amounts to 69 M€, mainly funded by the European Regional Development Fund (i.e. around 57M€).



MINISTRY FOR
INFORMATION SOCIETY

**The National Strategy
for the Digital Agenda
for Romania**

Business Angel Law

In July 2015, the Romanian government introduced new tax incentives⁵⁶ to stimulate private investments from "business angels" into innovative SMEs.

By definition, a business angel is a private individual who directly invests part of his personal assets in new and growing private businesses such as ICT start-ups. Angel investors also usually provide business management experience, skills and contacts for the entrepreneur.

According to the law, the business angel cannot be associated with the SME prior to the investment and cannot hold more than a 49% share of the company. In return, private investors will then be exempt from paying a dividend tax for a period of three years after becoming shareholder.

The measure does not specifically target the ICT sector. However, it has the potential to significantly support the already growing start-up ecosystem in Romania. By facilitating access to finance for SMEs with riskier projects, the Business Angel Law addresses one of the key barriers to the further development of innovative IT start-ups in the country.



Slovakia



Slovakia shows a moderate level of digital transformation revealing strengths and areas for further improvement. The country is a strong performer in e-leadership and ICT Start-ups, whereas major challenges remain in the digital infrastructure, supply and demand of digital skills. In order to address remaining challenges, the Slovak government has launched several programmes aiming at enhancing the country's entrepreneurial culture and improve the digital skills and innovation capacities of its workforce and enterprises.

A Slovakia in a nutshell

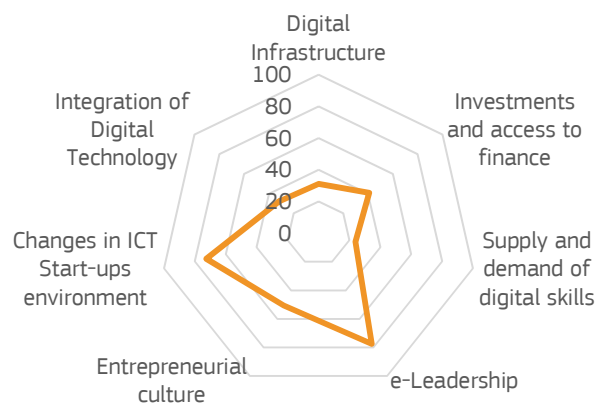
Slovakia is a strong performer in the dimension of e-leadership.

Furthermore, the country achieves good results in terms of ICT Start-ups, even though the entrepreneurial culture is one of the weakest dimensions.

Meanwhile, Slovakia faces challenges in the supply and demand of digital skills and digital infrastructure. Similarly, the dimension investment and access to finance provides room for improvement.

In the field of integration of digital technology, Slovakian businesses display moderate values.

To sum up, Slovakia performs well in two dimensions, whereas the other dimensions are in need of further enhancement.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Slovakia's strongest asset is e-leadership. Its established position in this field is due to the high number of people obtaining ICT skills through formalised education. On the other hand, more and more businesses offer IT/ICT skills training courses to their employees.

Furthermore, the number of ICT enterprises operating on the Slovak market is increasing. Next to a growing ICT workforce, Slovakia also provides of a high birth rate of ICT enterprises

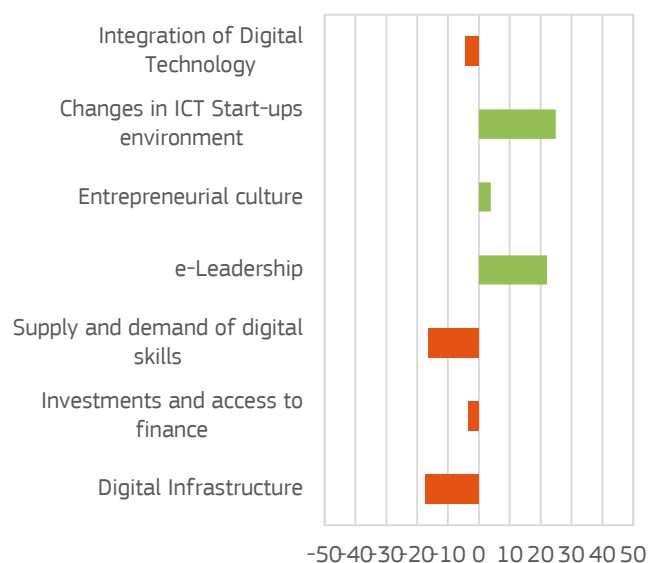
- Areas for improvement

Slovakia's low performance in digital infrastructure is linked to the low integration of CRM and ERP software by Slovak businesses as well as low internet bandwidth.

One of Slovakia's greatest challenges is the supply and demand of digital skills. One of the factors explaining Slovakia's performance in this field is the fairly low number of hi-tech patent applications.

Although Slovakia shows good results in the dimension of ICT Start-ups, the country's entrepreneurial culture is rather average providing significant room for further improvement.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Slovakia is performing well in two dimensions, while three dimensions are broadly in line with the performance of EU partners. Meanwhile, two dimensions have room for further improvement.

Furthermore, the country achieves a high score in ICT Start-ups and e-leadership at national but also at European level. In these dimensions Slovakia exceeds the EU average by more than 20%.

With a performance around 17% below the EU average, digital infrastructure is Slovakia's greatest challenge. Similarly, the supply and demand of digital skills belongs to Slovakia's low performance areas.

In terms of entrepreneurial culture, Slovakia is broadly in line with the EU average and slightly below in regards to integration of digital technology and investments and access to finance.

D Interesting policy practices

Finančné kupóny na právne, technologické a obchodného poradenstva

The Programme "Financial vouchers for legal, technological or business partnerships"⁵⁷ was introduced by the Ministry of Finance in 2015. The total budget is €50 million is mostly earmarked from Slovakia's EU funds.

The main goal is to support start-ups by issuing financial vouchers for legal, technological and business consulting services. The measure also aims to protect intellectual property by funding the process of patenting products. In a wider context, the programme seeks to improve the conditions for young innovative entrepreneurs, enhance knowledge transfer and together with other initiatives to ease the access to finance, reduce the administrative burden and boost the entrepreneurial spirit.

The vouchers are issued every three months ranging from €3,000 to €8,000. Start-ups can apply for a voucher in particular areas only once. The voucher is valid for six months. However, it is possible to apply for another voucher in a different area each quarter. The vouchers can also be used for a purchase of software, market research, marketing or PR purposes.

Operačný Program Výskum a Inovácie

The "Operational Programme for Research and Innovation"⁵⁸ aims to create the stable and favourable conditions for further development of innovations and research, to increase effectiveness and efficiency of R&D activities, competitiveness, sustainable economic growth, and employment.

With a total budget of €2,23 million, the programme combines EU funds and financial resources earmarked from the national budget. The financial resources will be allocated mostly for technological development and innovation, technological transfer to overall strengthen the research and innovation activities in Slovakia.

As a part of the project, several centres will be established, operating in different areas such as research and education, innovation and entrepreneurship support. Funds are also allocated to help increase the competitiveness of the SMEs.

As a joint programme of the Ministry of Education, Science, Research and Sport and the Ministry of Economy, the programme also makes use of European structural and investment funds as a part of the 2014 – 2020 strategy.





S

Slovenia



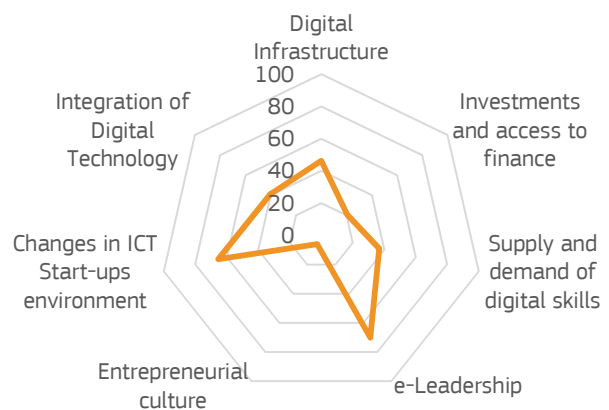
Slovenia's digital transformation performance displays wide variations featuring strong points and significant challenges. Slovenia is a strong performer in e-leadership and ICT Start-ups; yet, the unfavourable investment climate and low entrepreneurial culture remain key challenges for the country. Compared to other EU Member States, Slovenia scores above the EU average in three out of seven dimensions. Notwithstanding existing challenges, the Slovenian government is implementing measures at strategic as well as operational levels to drive forward its digital transformation.

A Slovenia in a nutshell

Slovenia is a strong performer in the field of e-leadership and ICT Start-ups. Its high performance in e-leadership is matched with a rather average score in the supply and demand of digital skills indicating that companies provide good training opportunities to a rather low number of ICT specialists.

An additional field where Slovenia shows a good performance is digital infrastructure. Judging on the basis of the rather low performance of the country in integration of digital technology, it appears as if Slovenian enterprises did not make good use of the good digital infrastructure.

Despite its good performance in ICT start-ups, Slovenia performs the lowest in the field of entrepreneurial culture. Furthermore, Slovenia scores low in investments and access to finance.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Slovenia's high score in the field of ICT start-ups can largely be explained by the high birth rate of ICT companies; yet, ICT companies are also well established in terms of the population of active businesses.

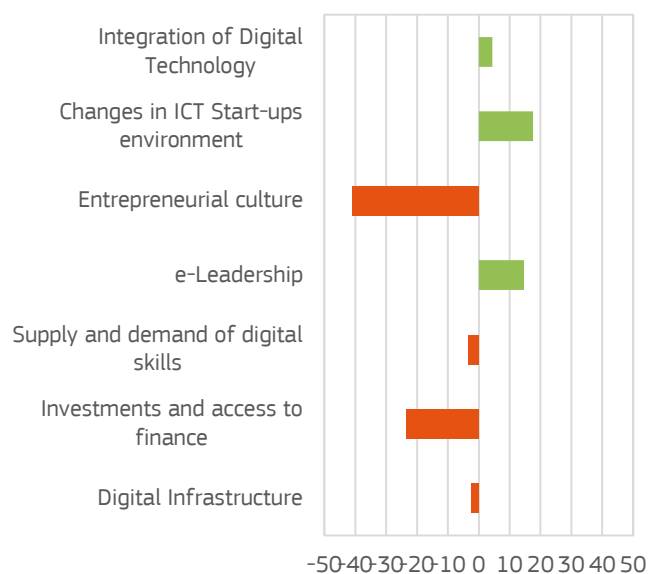
On the contrary, Slovenia's high score in e-leadership relies to equal terms on the engagement of enterprises' and its formal education system. Businesses in Slovenia provide regular trainings to ICT specialists as well as portable devices for mobile internet connection.

- Areas for improvement

Investments and access to finance are a major challenge in Slovenia. To large extents, this is linked to the local business environment. Slovenian enterprises face difficulties accessing loans and the probability of local equity market financing is very low.

The second challenge concerns entrepreneurial culture. While recent data shows that the Slovene population fears self-employment mostly for financial reasons, improving the negative image that a large part of the population has of entrepreneurs would be an impactful first step.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used

Compared to other EU Member States, Slovenia scores above the EU average in three out of seven dimensions. The country shows significantly high results in the field of e-leadership performing almost 15% better than the EU average.

Despite apparent weaknesses in the fields investments and access to finance and entrepreneurial culture, ICT Start-ups is the Slovenian strongest asset compared to other member states.

Contrarily, Slovenia's performances in the digital infrastructure and supply and demand of digital skills are slightly below EU average. This also applies to the field of integration of digital technology. Improving its low performance in business finances and entrepreneurial culture, the country may become a top performer in ICT start-ups.

D Interesting policy practices

Slovenia 5.0 - Industrial Policy Manifesto

In May 2015, the Chamber of Commerce and Industry of Slovenia (GZS) adopted Slovenia 5.0⁵⁹, the country's wider industrial policy strategy. The main objective of Slovenia 5.0 is to raise the value added in Slovenia's strongest industrial branches to 80% of EU average by 2020, implying an actual increase of 2 percentage points per year.

The Strategy is divided into 5 key thematic areas: Smart State (Business environment); Smart Taxes (tax policy); Smart HR Management (HR policy); Smart development (development policy) and Smart Industrialisation (Promotion of Industry on Foreign Markets). Each thematic area provides key action points as well as statistical information on Slovenia's current performance.

Slovenia 5.0 was developed by the Slovenia 5.0 Strategy Group, composed of representatives from the leading industry enterprises of Slovenia. The mission of the CCIS Slovenia 5.0 Strategy Group is to raise awareness in different public spheres on the importance of industry and the necessity of its advancement based on development programmes with the best chance of succeeding on the market.

"E-Education project"

The national E-Education Project⁶⁰ (2009-2014) in Slovenia was conducted in accordance with the needs of today's society and aiming to build a path for schools to get ready for 21st century technologies and become an e-competent school. The E-education project was designed by the Ministry of Education, Science and Sports to be a national model for the training of teachers, development of e-competence standards for teachers and schools, and facilitating learning content and online services, including new communication platforms.

One of the main goals of the project is to create a standard for 'e-competence' that is applicable to teachers, school heads and IT experts. The establishment of this standard allows for the implementation of a national strategy to develop an efficient educational model for all education professionals, bringing Slovenia up to speed in terms of 21st century teaching and leadership.

The project involved the participation of 20.296 teachers in seminars, with some of the participants who participated to more than one seminar (in total there were 36.574 participations). Also, 99% of educational institutions participated in the project.



Spain



The Spanish record on digital transformation shows a mixed performance featuring high and low performing fields. Spain's score stands out in entrepreneurial culture and digital infrastructure; yet challenges remain in the field of supply and demand of digital skills and e-leadership. Spain performs above the European average in two of the digital transformation dimensions. A look at recent national policy efforts reveals that the Spanish focus is on Industry 4.0 and on boosting the development of ICT Start-ups.

A Spain in a nutshell

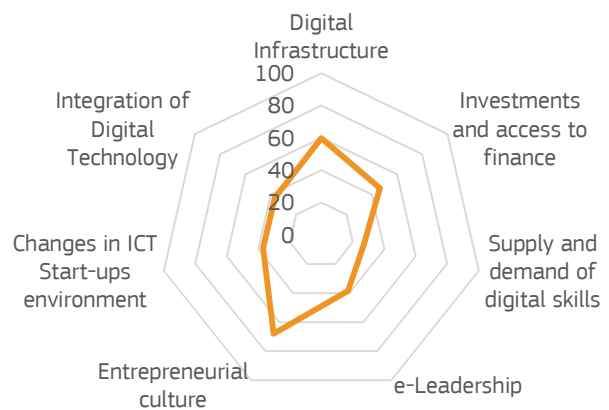
Spain is a strong performer in entrepreneurial culture and in digital infrastructure.

Overall, Spain shows a consolidated performance in digital transformation as well as in investments and access to finance.

Despite its favourable entrepreneurial culture, Spain's performance in relation to ICT start-ups is rather weak.

Spain also faces challenges in the areas of supply and demand of digital skills and e-leadership. The dimension where Spain proves to perform the lowest is in supply and demand of digital skills.

In summary, Spain displays a mixed performance with relatively high scores in two areas, average results in three fields and two low performing fields.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Spain's strong performance in entrepreneurial culture relies on Spaniards' great interest in setting up their own company if they had the means to do so. In addition, they tend to have a rather positive image of entrepreneurs in general.

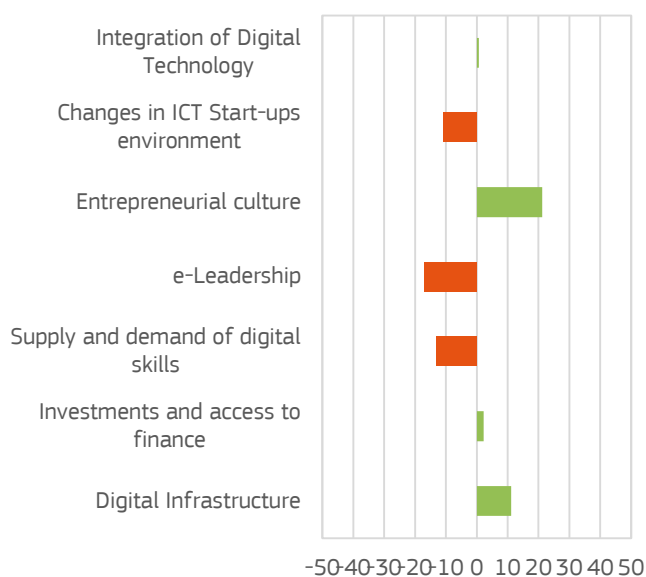
Spain's solid digital infrastructure is rather due to the heavy use of ICT software in enterprises than its average internet speed. Moreover, most companies have access to a DLS or other fixed broadband connection.

- Areas for improvement

Spain's performance in supply and demand of digital skills shows some room for improvement. Recent data indicates that the number of high-technology patents applications is rather low. In addition, the number of ICT specialists employed by Spanish companies could be improved.

Another challenge for Spain is the need to strengthen its e-leadership dimension. Although Spanish companies tend to provide in-work training to develop ICT skills, further efforts should be made to improve educational programmes in ICT business and technologies.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, Spain performs above the average in two out of seven dimensions.

Spain's strongest asset is its entrepreneurial culture, followed closely by digital infrastructure. In these two dimensions the country scores respectively more than 21% and 11% higher than the EU average.

Spain's performance in integration of digital technology as well as in investments and access to finance is just above the EU average.

Although the country stands out in the entrepreneurial culture dimension, its performance in ICT start-ups is rather weak in comparison to its European partners.

Spain's main weaknesses lie in the supply and demand of digital skills and e-leadership, where it scores respectively 17% and 13% lower than the EU average.

Overall, Spain stands out in two pillars and shows some room for improvement in three out of seven dimensions.

D Interesting policy practices

Industria Conectada 4.0

"Industria Conectada 4.0"⁶¹ is a joint coordinated initiative between the public and private sector. It is aligned within the Spanish Digital Agenda 2013 and falls under the Agenda for the Strengthening of the Spanish Industrial Sector (2014).

The main goals of the initiative are to increase the country's industrial added-value and skilled employment in the industry sector. The development of local supply of digital solutions is also targeted. Furthermore, this initiative aims to develop differential competitive levers to support industrial activities and boost exports.

The initiative steers digital transformation along four action lines: awareness and training; creation of cooperative environments and platforms; promotion of digital enablers; and support for digital developments.

As a public-private initiative, the management model includes the participation of private companies, education and research institutions, as well as social partners.

The initial budget for 2016 amounts to €97m, and is being financed by the General Secretariat of Industry and SMEs.

For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



Iniciativa Emprendedora en la Universidad

The Entrepreneurship Initiative⁶² is a programme launched in 2013 by the Spanish Government.

The aim is to promote entrepreneurial activity and alternative business way-outs as future career opportunities.

Within the programme, free courses are offered to students to provide them with the necessary tools to assess the viability of a business idea.

In 2014, 360 business projects were presented, out of which 87% were considered as viable. Moreover, 73% of the projects could be implemented in the short or medium term, eventually leading to the creation of more than 1,300 jobs.

During the third edition of the initiative up to 70 courses will be held to coach more than 2,500 students across business schools in Spain.

One of the key assets of the programme is that students' participation is free of charge.

**iniciativa emprendedora
en la universidad**
proceso de creación de empresas





Sweden



Sweden achieves a solid overall performance. The country performs particularly well in e-Leadership, access to finance, supply of digital skills and digital infrastructure. Sweden however has a more modest performance in integration of digital technology and a relatively weak performance in providing favourable conditions for ICT start-ups and entrepreneurial culture to prosper. Different policy initiatives have been launched to foster public-private collaboration and project financing in relation to digital technologies in industry. Efforts have similarly been taken at the national level to promote Industry 4.0 solutions among Swedish companies.

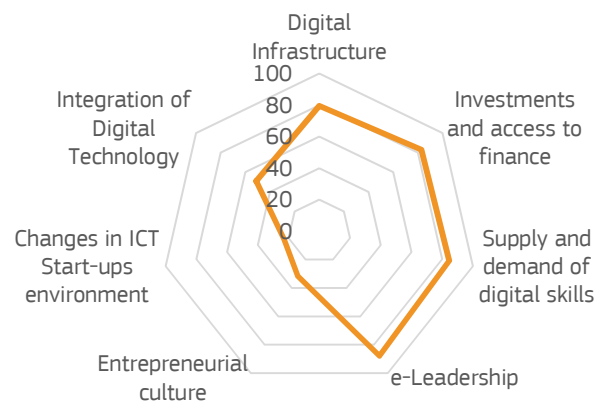
A Sweden in a nutshell

Sweden provides a strong performance in investments and access to finance. It also performs strongly in e-Leadership and has a high level of supply and demand of digital skills.

In addition, Sweden achieves a strong performance in digital infrastructure. However, Sweden’s performance in integration of digital technology is more modest.

The areas where Sweden performs the weakest are entrepreneurial culture and ICT start-ups; there is a potential for improvements in both of these areas.

To sum up, Sweden’s solid performance is backed by strong scores in access to finance, e-Leadership, the supply and demand of digital skills and digital infrastructure. On the contrary, the country’s performance in integration of digital technology is more modest, while it achieves the weakest performance in entrepreneurial culture and ICT start-ups.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

Sweden’s solid investment climate and conditions for accessing finance is backed by, among other things, venture capital availability. It is further supported by a sound environment for financing through the local equity market and ease of access to loans.

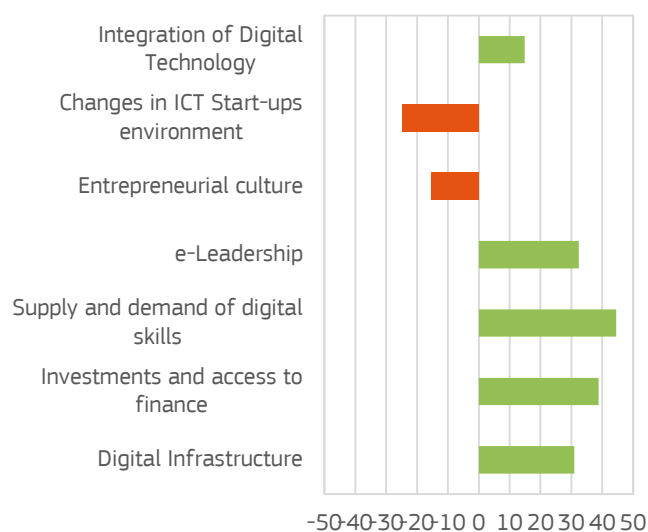
The high level of supply and demand of digital skills is for example linked to enterprises’ recruitment of ICT specialists, a high number of high-tech applications and a widespread use of portable devices at the workplace, which provides employees with a mobile connection.

- Areas for improvement

Sweden has a weak performance in entrepreneurial culture. As shown by recent data, this can for example be explained by a rather low interest in setting up a new business and to become self-employed. Yet, the perception of entrepreneurs is largely positive.

Integration of digital technology in Sweden is supported by the integration of cloud computing services and the sharing of electronic information relevant for automatic processing with external business partners.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Overall, Sweden's performance is significantly above the EU average in five out of seven dimensions. Sweden has the best relative performance in the supply and demand of digital skills.

It also achieves a relatively strong performance in investments and access to finance. This is supported by a solid performance in both e-Leadership and digital infrastructure.

However, Sweden's performances in entrepreneurial culture is significantly below the EU average.

Yet, the lowest performance for Sweden is recorded for ICT start-ups, highlighting that there is a room for improvements of both the conditions for ICT start-ups and entrepreneurial culture.

D Interesting policy practices

Produktion2030

The strategic research and innovation programme Produktion 2030⁶³ was launched in 2013 by the Swedish innovation agency VINNOVA. The aim of the initiative is through long-term efforts to provide Sweden with a leading competitive position in sustainable production and to improve conditions for future investments in digital and sustainable manufacturing.

Produktion2030 is based on a public-private collaboration platform and it addresses the needs of large companies, research institutes and in particular SMEs. It is carried out through five inter-linked instruments that targets six identified areas of strength. Project financing makes up the largest instrument and seeks to promote the development of concepts, methods and prototypes with market potential. This tool is supported by instruments that supports knowledge transfer to SMEs, staff mobility within funded projects, education in production and internationalisation.

The measure has a basis in the research agenda Made in Sweden 2030. Produktion2030 is funded by approx. €25 million from VINNOVA for the 2013-2018 period, which is supported by around €25 million from industry.

For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



Smart industry – a strategy for new industrialisation for Sweden

The Swedish government launched in January 2016 a strategy for 'new industrialisation'⁶⁴ that sets out action at the national level to strengthen the development of Swedish industry, the integration of Industry 4.0 solutions and the capacity of companies to change.

Overall, the strategy is based on four focus areas that are considered to have the greatest potential to improve the competitiveness of Swedish industry sectors. First, it promotes Industry 4.0 to help Swedish companies to exploit the potential of digitisation and to make them leaders in digital transformation. Second, it seeks to support sustainable production through increased resource efficiency and circular business models. Third, it aims to give a boost to industrial skills by better linking the system for supplying skills at local, regional and national levels with industry sector needs. Fourth, the initiative targets testbeds and research and innovation investments that contribute to a new industrialisation.

The tools range from laws, regulations and public procurement, to investments in innovation, enterprises and education as well as the promotion of testbeds and open data.



U

United Kingdom



The United Kingdom is a strong performer in digital transformation. The country scores high in relation to entrepreneurial culture, e-leadership as well as in investments and access to finance; yet challenges remain in the field of digital infrastructure. The United Kingdom performs above the European average in the majority of digital transformation dimensions. A look at recent national policy efforts reveals that operational measures have been implemented to support the development of innovative SMEs and improve digital skills among professionals.

A United Kingdom in a nutshell

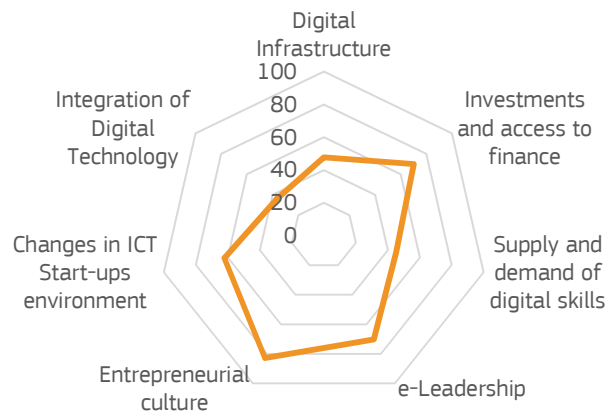
The main strength of the United Kingdom lies in its strong entrepreneurial culture. In addition, the country stands out in e-leadership and investments and access to finance.

Considering its favourable entrepreneurial culture, it is not surprising that the United Kingdom displays a consolidated performance in ICT start-up.

Companies also show a rather good performance in integration of digital technology, while supply and demand of digital skills is somewhat weaker.

The dimension where the United Kingdom proves to perform the lowest is in digital infrastructure.

In summary, the United Kingdom displays a good performance with relatively high scores in three areas, good results in two fields and two weaker fields.



Note: Based on the average of the latest imputed values. Where no data available, the EU average was used.

B Strengths and areas for improvement

+ Strengths

The United Kingdom's strong performance in entrepreneurial culture relies on the positive image that people tend to have of entrepreneurs. In addition, recent data shows that the majority of the population would set up a new business or take over an existing one if they had the means to do so.

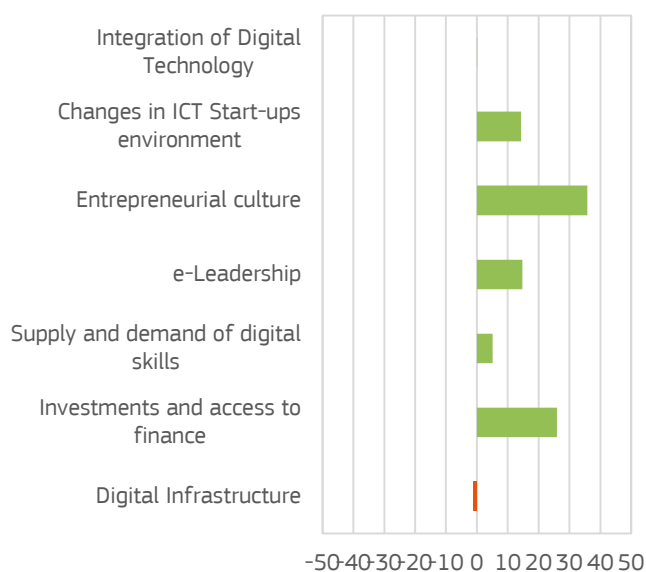
The United Kingdom's solid e-leadership dimension is mainly explained by the high-level of digital skills that professionals developed through academic education, rather than through in-work training provided by companies.

- Areas for improvement

Further efforts should be made in improving the country's digital infrastructure. Although internet bandwidth is of rather high-quality, the use of integrated management software solutions could be enhanced.

The United Kingdom should also improve its performance in supply and demand of digital skills. In particular, available data indicated that the percentage of high-tech patent applications is rather low.

C Comparison with other EU Member States



Note: Based on the average of the difference of the latest imputed values. Where no data available, the EU average was used.

Compared to other EU Member States, the United Kingdom performs above the average in six out of seven dimensions.

The United Kingdom's strongest asset lies in its entrepreneurial culture, followed by the level of investments and access to finance. In these two dimensions the country scores respectively more than 36% and 26% above the EU average.

Furthermore, the United Kingdom scores relatively high in the e-leadership and ICT start-ups dimensions.

Meanwhile, the country's performance in integration of digital technology and supply and demand of digital skills is also above EU average.

The United Kingdom does not stand out from its European partners in digital infrastructure with a score slightly below the EU average.

Overall, the United Kingdom is a strong performer scoring around 10% or more above the EU average in most of the dimensions.

D Interesting policy practices

Interaction between people and machines

The High Value Manufacturing Catapult (HVMC)⁶⁵ is the UK's national initiative to increase the competitiveness and value added of its manufacturing industry. As the first and largest of eleven national catapults under the programme, the HVMC is composed of seven technology centres. Through the centres UK businesses have access to industrial scale technology to accelerate and de-risk new concepts to commercial reality.

Set up in 2011 as a public-private partnership, the HVMC is overseen by Innovate UK. A total of over €164 million is invested by the government over the period of 2012 – 2018 to stimulate manufacturing, reduce the risk of innovation for new and established manufacturing businesses and attract international business.

As a remarkable strength, the government has been responsive to the needs of the HVMC by scaling up funds progressively. Recognising the importance and unique challenges posed, additional ring fenced funding has been allocated to help increase SME engagement from 1500 per year in 2013 to 2250 by 2020.

For further details on this initiative, please refer to the related policy report produced under the Digital Transformation Monitor.



Skills funding for SME engineering firms

Launched in December 2014, the aim of this fund⁶⁶ was to help SME engineering companies to grow and become more productive through investing in the skills of its current and future engineers.

The United Kingdom government contributed to 50% of eligible costs of companies who had projects to provide extra training to employees to support: career progression and conversion training. Companies could include staff wage costs as part of their project costs.

The fund was open to any small or medium sized company which directly employed people in engineering occupations. The funding was intended to be more accessible to smaller firms and featured a minimum funding threshold of £10,000 (c. 12,000 EUR) (compared with £40,000 – c.48,000 EUR- for previous funds that were not SME specific).

The overall budget for this programme was of £10 m (c. €12 m). The fund was part of a £30 million initiative (c. €36 m) that saw government and employers join together to invest in engineering skills. The first 2 tranches of funding were targeted at improving engineering careers and developing women engineers. 1

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