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The state of digital transformation at regional level and COVID-19 induced changes to economy and business models, and their consequences for regions

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List of acronyms

AR	Augmented Reality
AI	Artificial Intelligence
B2B	Business-to-Business
COVID-19	Coronavirus Disease 2019
CRM	Customer Relationship Management
DESI	Digital Economy and Society Index
DIH	Digital Innovation Hub
DIaaS	Digital Innovation as a Service
DPR	Digital Preparedness in Regions
EC	European Commission
EDIH	European Digital Innovation Hubs
EIB	European Investment Bank
ERDF	European Regional Development Fund
ERNACT	European Regions Network for the Application of Communications Technologies
ERP	Enterprise Resource Planning
ESF	European Social Fund
ESPON	European Spatial Planning Observation Network
EU	European Union
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GVA	Gross Value Added
HRST	Human Resources in Science & Technology
I&C	Information and Communication
ICT	Information and Communication Technologies
IoT	Internet of Things
LAGs	Local Action Groups
LORDI	Local and Regional Digital Indicators
LRAs	Local and Regional Authorities
Mbps	Megabits per second
MFF	Multiannual Financial Framework
MSMEs	Micro-, Small and Medium-sized Enterprises

NACE	*Nomenclature statistique des activités économiques dans la Communauté européenne*
NGA	Next Generation Access
NUTS	*Nomenclature des Unités territoriales statistiques*
p.p.	percentage points
PPP	Public-Private Partnership
R&D	Research and Development
R&D&I	Research and Development and Innovation
RIS3	Regional Smart Specialisation Strategy
SMEs	Small and medium-sized enterprises
S&T	Science and Technology
TED	Tenders Electronic Daily
VR	Virtual Reality
WLAN	Wireless Local Area Network
5G	5th Generation

Executive summary

The COVID-19 pandemic has raised awareness among individuals and across business sectors on the importance of digital connectivity, technologies, services and solutions. The digital transformation of society and economy had begun well before the occurrence of the pandemic but the health crisis initiated in January 2020 made, out of necessity, the digital transformation movement a more universal one.

This study focuses on understanding the state of digitalisation of small and medium-sized enterprises (SMEs) in European regions, and of the level of territories' readiness in supporting their digital transformation. The overall scope of the study is to highlight which policy actions regional authorities should prioritise in order to successfully support and accelerate the digital transformation of business.

In the **introductory part**, digital transformation is defined and its state of play at the regional level is analysed against the four main components of digital infrastructure, digital skills, digitalisation of public services, and digitalisation of businesses. These components are set in the EC Communication on 'Shaping Europe's digital future' and will be used in the next years to measure progress in Europe's digital transformation. A first evidence drawn from the analysis is that most of the indicators proposed by the EC to monitor this progress are not available at the regional level. Data availability failure at the subnational level is a recurrent constraint faced in the development of this study. Whereas the territorial dimension of digital transformation is evident (for example, consider broadband infrastructure deployment which is so closely linked to territorial features), European official statistics fail in properly informing policymakers at this level.

There is a divide between rural and urban areas in terms of fast and ultrafast coverage of digital infrastructures. Even though broadband connectivity was already almost universally achieved in 2019 (99.9%), fast or ultrafast connectivity coverage, which nowadays is actually a prerequisite for using the latest available technologies and services, is uneven. This limits the competitive advantage that may be generated by digital transformation. There are also important differences across European regions, and a rural-urban divide, in terms of users' digital skills. On the other hand, the last eGovernment report (Van der Linden *et al.*, 2020) highlights that in some countries e-services made available to citizens at the regional and local level are few and unlikely to create a pull effect in promoting digital competencies. Still on eGovernment services, statistics show that even in this area there is a rural-urban divide and that the COVID-19 pandemic did not

help in closing the gap. Actually, in some countries differences between individuals living in urban and rural areas widened in 2020.

The fourth and last component of the digital transformation envisioned by the EC relates to businesses, whose digital transformation is at the core of this study. Digital transformation of business is defined in several ways and serves different purposes, but, overall, its definition always implies a change in the way work and business are done. The change relates to business operations, organisation and culture, and implies the structural use and integration of digital technologies, processes and competencies in order to create value, new services and products as well as innovation.

A 2020 global survey (McKinsey, 2020) has found that acceleration of digitalisation in business caused by the COVID-19 pandemic is significant and often quantifiable into 'years'. The way of doing business has been affected, for example by the increase of customer demand for online services and online sales/purchases, by the adoption of remote working, and by the migration of business assets to the cloud. Business models have changed accordingly.

Whether these changes are permanent or not is unclear but public authorities at all levels have a role to play in building on the surge in digital transformation of business triggered by the pandemic. Are regional authorities ready to do it? In **Part 1** we propose a framework to measure digital preparedness in regions (DPR) with respect to SMEs' digital transformation. Our approach in designing this framework includes the conceptualisation of its components and of the corresponding indicators; an indicators' data gap analysis; and the proposal of a set of ten measurable indicators at the regional level which are intended to reflect the level of DPR. This exercise was highly constrained by the lack of data. The gap analysis highlights that many key areas cannot be properly measured and monitored at the regional level. Examples of areas suffering a lack of data include the provision of eGovernment services to business, the quality of the connection (download speed, upload speed, latency) used by business, availability of ICT human resources, ICT usage and e-commerce in enterprises, and cybersecurity. The Digital Economy and Society Index (DESI), which has a national scope, has no equivalent at the regional level and the majority of the data collection processes the DESI relies upon do not collect data in regions.

In **Part 2**, we provide eight examples of successful initiatives undertaken by regional authorities with the aim of accelerating the digital transformation of business in their regions. This evidence clearly demonstrates that although some interventions were initiated as a result of the pandemic, others started well before January 2020 and sometimes experienced adaptation, or further development, in order to support businesses during the COVID-19 crisis.

Comprehensive region-wide approaches covering both the supply and the demand side of the digitalisation of SMEs are found in Niederösterreich (Austria) and Bayern (Germany). Four other cases focus on actions of regional authorities stimulating the supply side of digitalisation: in Galicia (Spain), digitalisation of SMEs is pursued through a multi-pronged approach which has its core in the establishment of sectoral digital innovation hubs. In the Northern and Western region of Ireland, the digitalisation of traditional indigenous SMEs is targeted using the pulling effect of technology and digital services providers (I&C companies). A similar approach is found in Nord-Vest Romania, where a digital innovation hub is used to create a digital innovation ecosystem; and in Oost-Nederland where SMEs' digital transformation needs are matched with approaches/technologies of other SMEs. Lastly, two additional cases, in Grand Est (France) and Lombardia (Italy), focus on the demand side of digitalisation with SMEs applying for support principally provided in the form of grants/vouchers.

With a view towards widening the understanding of how LRAs favour the digital transformation of SMEs, and on the type of support they may provide in the short- and medium-term, we designed a questionnaire for an online consultation. The consultation was jointly carried out by the European Committee of the Regions and EUROCHAMBRES, the Association of European Chambers of Commerce and Industry, and was distributed to their respective stakeholders, covering European local and regional authorities, chambers of commerce and industry, and other informed stakeholders. It was open from 30 April 2021 to 4 June 2021. Over this period, a total of 87 contributions were received from 21 EU Member States. **Part 3** illustrates and analyses the answers to the survey which focuses on four areas: digital preparedness in regions, changes in business models driven by the digital transformation, impact of the COVID-19 outbreak on the digital transformation process, and actions undertaken/expected to support SMEs' digital transformation.

When broadband started being introduced in the early 2000s, the focus for policymakers was primarily on its deployment. Currently, the focus in the digital domain is equally divided between the deployment of fast and ultrafast broadband and its uptake by society and the economy. Some pioneers, as in the case of the Bayern Region with its Digital Bayern I initiative, already started capitalising on the investments made on digital infrastructure in the mid-2000s. But the COVID-19 crisis comes as a call for everybody as it has made the unused potential of digital technologies evident. Building on the evidence collected through desk research, including the case studies and the findings of the survey, this study concludes (**Part 4)** that specific contextual conditions are needed to favour the digital transformation of SMEs. In particular:

- The digitalisation of the interaction between public authorities and business is still inadequate in some countries. As e-services require the use of information and communication technologies by businesses and citizens, this inadequacy does not produce the necessary pull effect on the whole society. There is a need for public authorities to **create synergies and shared milestones at the planning stage between the transformation process of the public and the private sectors** (R1).

- Digital transformation provides an opportunity to improve cohesion across the EU and within countries and should not generate further divide and differences between high performing and low performing territories. It is necessary to **reduce the rural-urban digital divide in businesses' operational conditions** (R2); **achieve digital cohesion by reaching out to as many SMEs as possible** (R3); and **avoid the negative externalities** that digital transformation may have **on jobs and on exclusion from the labour market** (R4).

Still drawing on the experiences illustrated in the case studies and the evidence gathered through the consultation, Part 4 also includes suggestions on how LRAs may prepare to support the digital transformation of SMEs. In particular:

- Since one of the most important barriers to the digitalisation of SMEs is the cost of its implementation, it is necessary to facilitate access by SMEs to external capital in order to support the implementation of a digital transformation path (R5). LRAs are in the position of **designing the appropriate financing instruments for digital transformation and define ad-hoc access rules for SMEs**.

- Making digital maturity assessment tools available to SMEs is a way to raise their awareness on the competitive advantages implied by a digital transformation and also to create an entry point for these SMEs into a digital transformation path. Entities with a Europe-wide presence across territories, such as the chambers of commerce, may take the lead in involving SMEs in **massive digital maturity assessment campaigns** (R6).

- ICT companies, their aggregations (e.g. ICT clusters), or intermediaries for digital innovation such as DIHs which are offering digital products and solutions to the market shall be used as a **leverage to initiate the digital transformation of SMEs** (R7). LRAs should contribute to facilitating the creation of **physical and virtual tech marketplaces that use digital innovation as a service** (DIaaS).

- Besides the technical push by ICT companies/aggregates/innovators, SMEs also need organisational and business expertise for the transition of their business models towards new paradigms. Intermediaries such as the **chambers of commerce** may facilitate this transition by **framing it into territorial policies for competitiveness and economic growth** (R8).

- **Regional authorities shall identify the actors in their territory who are potential providers as well as beneficiaries of knowledge, technologies and innovation** to create collaborative integrated **digital innovation ecosystems** that can become a stable reference system for the digital transformation of SMEs in the region. Strategies for competitiveness, innovation and economic growth should be coupled with those for digital transition (R9).

As a last point, this study has demonstrated the presence of several and important **data gaps** to properly inform policymakers on the state of play of digital transformation of business at the regional level. This constrains progress monitoring and benchmarking at the subnational level. If the Commission's vision is for 'A Europe fit for the digital age', it has to widen the geographical scope of existing data collection processes and regularly collect information for at least some basic indicators at the regional level (R10). This may possibly be supported by further modernising or (digitally) transforming the current EU data collection processes.

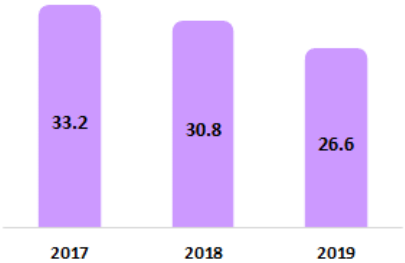
Introduction

There is no standard definition of **digital transformation**. Still, in its 2020 communication on 'Shaping Europe's digital future', the European Commission (EC) underlines that '*connectivity is the most fundamental building block of the digital transformation*' and that '*improving education and skills is a key part of the overall vision for digital transformation*' (EC, 2020). Digital transformation **is therefore defined by means of its components**, such as connectivity and competencies. The outline of these components is further detailed by the EC in its recent communication on '2030 Digital Compass: the European way for the Digital Decade'. Here, Europe's digital transformation is described as encompassing **secure and sustainable digital infrastructures** (including connectivity), **skills** (from basic digital skills to ICT specialists), **digitalisation of public services**, and **digital transformation of businesses** (EC, 2021). The territorial dimension of digital transformation is evident throughout these components.

This introduction provides an overview of the state of play of digital transformation in **European regions**. Notably, most of the indicators proposed by the EC to measure the above components of digital transformation are not available at the regional level. Thus, the use of proxies and complementing information is necessary to pursue the scope of this introductory part as well as of the entire study.

When referring to **digital infrastructures**, connectivity is the key aspect to be considered. Actually, nowadays, fast or ultrafast connectivity is the necessary condition for using the latest available technologies and services. Lack of adequate connectivity generates a digital divide and, in turn, potentially less competitive areas. Benchmarking of connectivity status is therefore done against the availability of next generation access (NGA) which allows download speed over 30 Mbps. Latest NGA coverage data refer to mid-2019 and are mapped as part of a study carried out on behalf of DG CONNECT (HIS Markit, Omdia & Point Topic, 2020).

Figure 1. Digital divide between total and rural NGA coverage of households, in percentage points

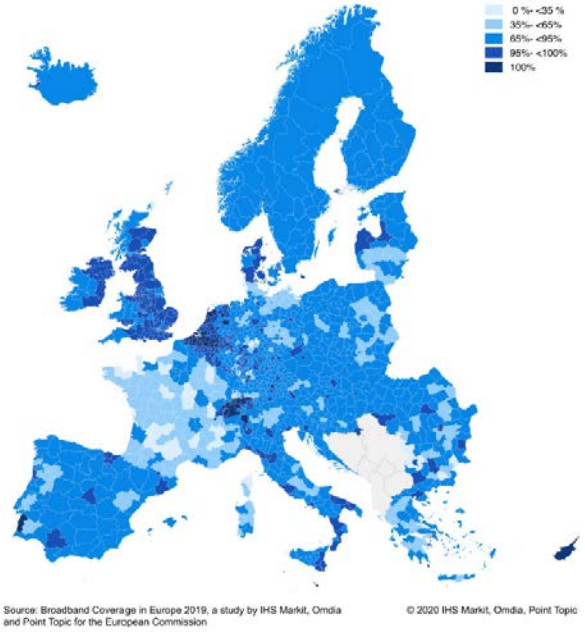


Source: data are from HIS Markit, Omdia & Point Topic, 2020.

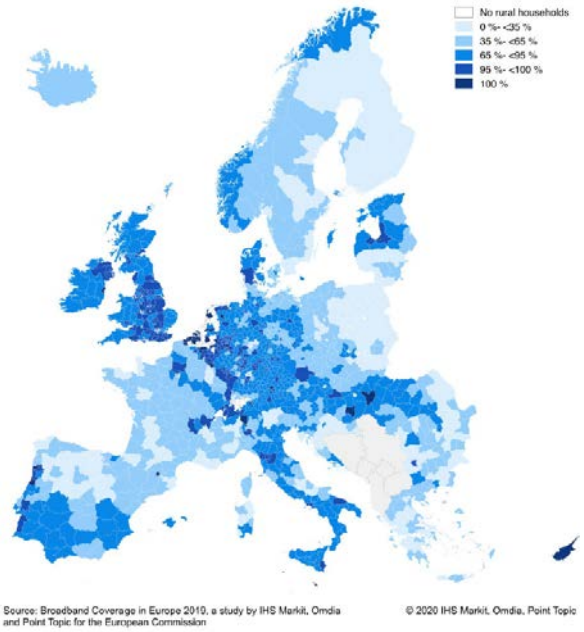
The study reports that the digital divide has progressively closed over the period 2017-2019. In 2017, the difference between the total and the rural NGA coverage of households, or gap, was of 33.2 percentage points (p.p.). It decreased to 26.6 p.p. in 2019 (Figure 1). Notwithstanding the

narrowing of the gap, Map 1 and Map 2 clearly indicate that rural areas lag behind in terms of NGA coverage. This is particularly evident for French rural areas, a large part of Spanish rural areas and rural areas in Sweden, in Finland, in the eastern part of Poland and Romania, in Bulgaria, and in Greece.

Map 1. NGA coverage, total, 2019



Map 2. NGA coverage, rural areas, 2019

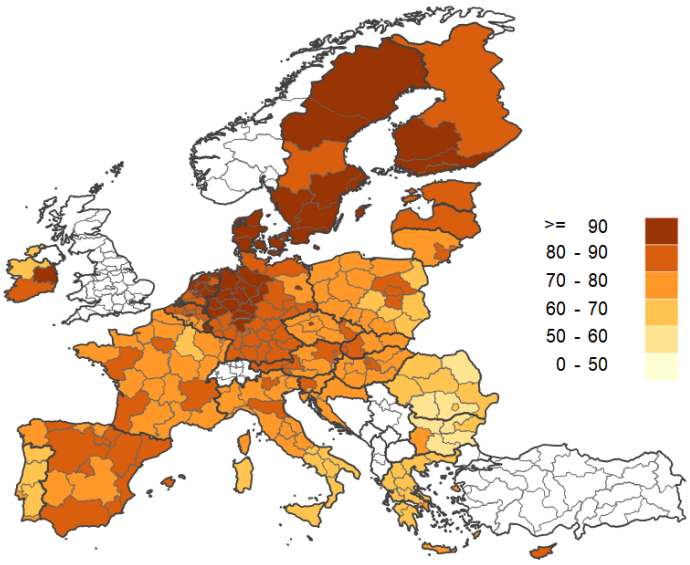


Source: maps are extracted from HIS Markit, Omdia & Point Topic, 2020, a report prepared for DG CONNECT.

When it comes to ultrafast connectivity, which allows Gigabit speeds, the gap is comparable to the NGA gap. In fact, in 2019, the total coverage of households with very high-capacity networks was 44% versus a coverage of 20.1% of households in rural areas.

Digital transformation in terms of **digital competencies** cannot be measured by the level of basic digital skills as these data are not available at the regional level, but we consider individuals' ability to use the internet daily an appropriate proxy (Map 3). This indicator shows high variability across countries and even across regions within the same country. In the eastern regions of Poland and Romania, and in Bulgaria, low rates of use seem to coincide with low NGA coverage in rural areas. However, this is not the case in Finland and Sweden, where low NGA coverage in rural areas apparently does not prevent daily internet use by high shares of individuals. This means that users in these regions take full advantage of other technologies such as satellite broadband, which was available to 99.9% of European households in 2019 (HIS Markit, Omdia & Point Topic, 2020).

Map 3. Individuals who use the internet daily, %, 2020

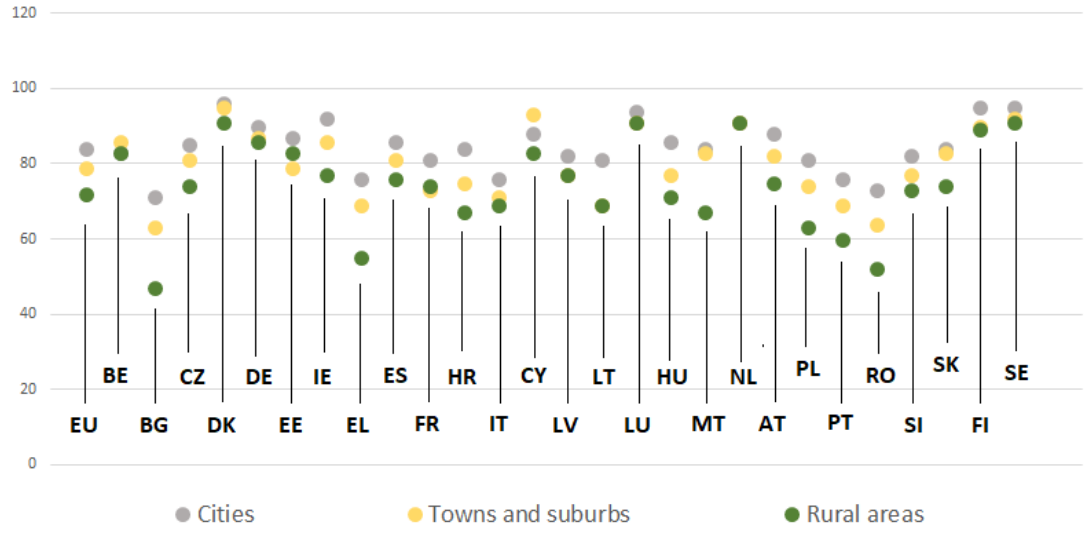


Map created by the authors on the basis of Eurostat data online, table isoc_r_iuse_i, accessed in March 2021.

Notes: 2019 data for France and Italy. No data for Åland, Finland.

In order to better understand the digital divide between rural and urban areas, Figure 2 reports daily internet use in terms of degree of urbanisation (i.e. in cities, towns and suburbs, and rural areas), by country. The figure shows that the divide between urban and rural areas is contained in countries such as Germany and Sweden, and is nil in Belgium and the Netherlands (where only a minimum share of the territory is classified as rural), but in all other countries the divide is important.

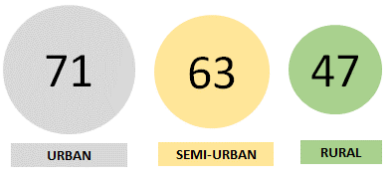
Figure 2. Individuals who use the internet daily: rural-urban divide, 2020, by country



Source: Eurostat data online, table isoc_ci_ifp_fu, accessed in March 2021.
Notes: 2019 data for France and Italy.

The largest divide is found in Bulgaria. Romania, Greece, Poland, Malta and Croatia follow. In Bulgaria, there are 24 p.p. of difference when it comes to daily internet use in cities and in rural areas (Figure 3).

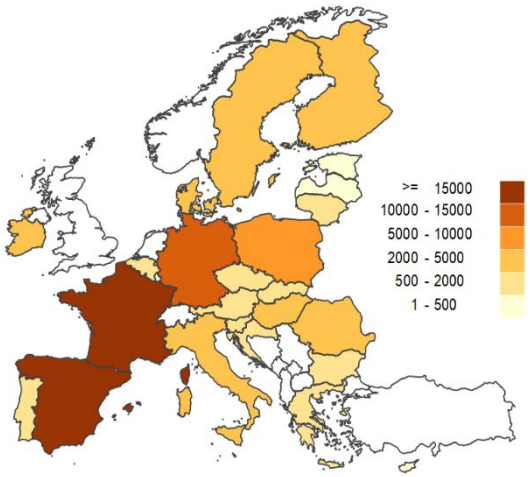
Figure 3. Rural-urban divide for the daily use of the internet in Bulgaria, p.p.



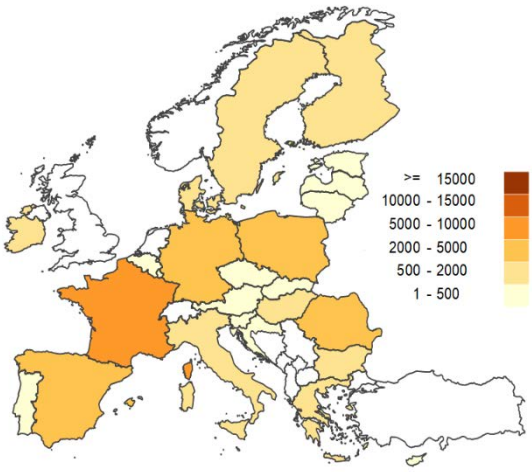
Source: Eurostat data table isoc_ci_ifp_fu.

Still regarding digital competencies, statistics on the number of ICT graduates are not available at the regional level. Data at the national level are shown in Maps 4 and 5 to get an idea of the countries where these types of competencies are found. The gender distinction clearly indicates that ICT is a male-dominated area at the tertiary education level.

Map 4. Tertiary education in ICT, number of graduates, males, 2019



Map 5. Tertiary education in ICT, number of graduates, females, 2019



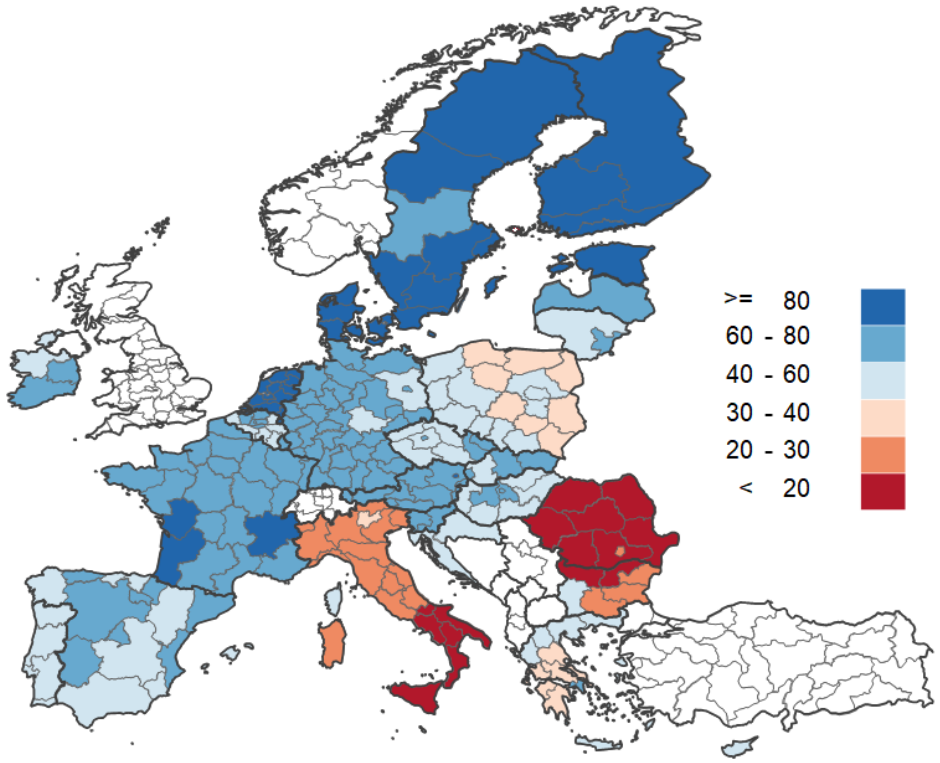
Source: Eurostat online data code EDUC_UOE_GRAD02.
Notes: no data for NL. Maps created by the authors.

The key source of data to measure the **digitalisation of public services** is the eGovernment benchmark report which nevertheless only analyses the availability and characteristics of digital public services at the national level. At the regional level, a proxy of availability of eGovernment services is considered to be the number of individuals who use the internet for interaction with public authorities (Map 6).

Variability for this indicator is evident across countries but is limited among regions of the same country. In particular, the use of digital public services appears to lag behind in Italy, Romania and Bulgaria. This may be due to the fact that digital public services are not actually available in these countries, or are not easily accessible. The highest access characterises countries such as Finland,

Sweden, Estonia, Denmark, and the Netherlands. These data are in line with the findings of the latest eGovernment benchmarking report which highlights underperformance in penetration for Italy, Greece and, to a lesser extent, Bulgaria and Poland. Instead, in Romania the most evident underperformance area relates to digitisation (Van der Linden *et al.*, 2020).

Map 6. Individuals who used the internet for interaction with public authorities, 2020, by region



Map created by the authors on the basis of Eurostat data online, table isoc_r_gov_i accessed in March 2021.

Notes: 2019 data for France and Italy. No data for Åland, Finland.

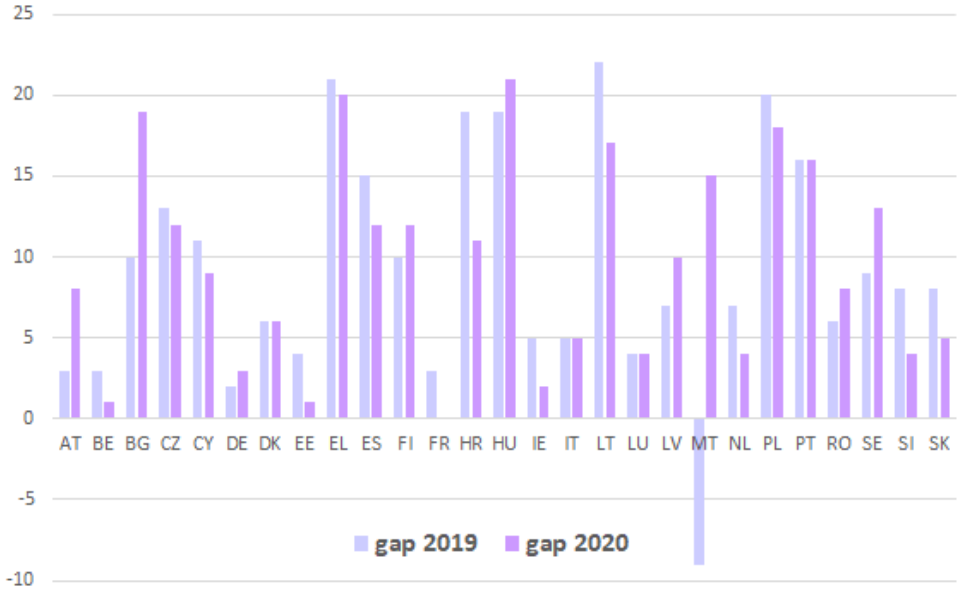
According to the 2020 eGovernment benchmarking report, **the services made available online by regional and local public authorities are lower but comparable, on average, to those made available by national authorities**. The 'online availability' indicator scores 89% for national services, 84% for regional services and 77% for local services. **These EU averages hide wide differences across countries.** For example, online services made available by regional public authorities in Italy score less than 30%. This is the lowest level across the EU and is very far from the second EU lowest score of Germany which is around 70%. Instead, in some EU countries, services made available online by regional authorities score better than national ones: this is the case, for example, of Denmark, Slovenia, Bulgaria and Croatia (Van der Linden *et al.*, 2020). These are online information and services made available to citizens and businesses. The subnational characterisation of services made available to businesses only is not provided in the eGovernment benchmarking report.

Figure 4. Scores for the indicator 'online availability of public services', by administrative level, 2019 biennial average per country

Source: this figure is extracted from Van der Linden *et al.*, 2020 (p.24).
Notes: among the EU27 countries, Malta, Cyprus and Sweden do not have services provided on a regional level.

Statistics show **that there is an urban/rural divide in terms of use of eGovernment services and that the COVID-19 pandemic did not help in closing the gap**. Actually, in some countries differences between individuals living in urban areas and individuals living in rural areas widened in 2020. Figure 5 highlights in which countries the rural-urban divide increased from 2019 to 2020 with regard to the eGovernment indicator 'submitting complete forms'.

Figure 5. Divide between individuals living in cities and in urban areas for the eGovernment activity 'submitting complete forms', 2019-2020, in p.p.



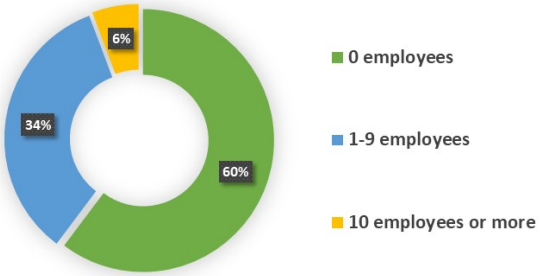
Source: Eurostat data online, table isoc_ciegi_ac accessed in March 2021.

Notes: no 2020 data available for France.

In Bulgaria, the divide increased by nine percentage points (p.p.) and in Austria by five p.p. But the divide also increased in Germany, in Finland, in Hungary, in Latvia, in Romania and in Sweden.

The fourth and last component of the digital transformation envisioned by the EC relates to businesses. The **digital transformation of business** is very much relevant to the scope of this study which is actually focused on SMEs. In fact, in Part 1 we propose a framework to measure digital preparedness in regions with respect to SMEs' digital transformation, and in Part 3 we discuss and present the results of a survey investigating SMEs' digital transformation. At the EU level, microenterprises (i.e. up to 9 persons employed) represent the highest share of European businesses (94%) (Figure 6). Their distribution is shown in Maps 7 and 8.

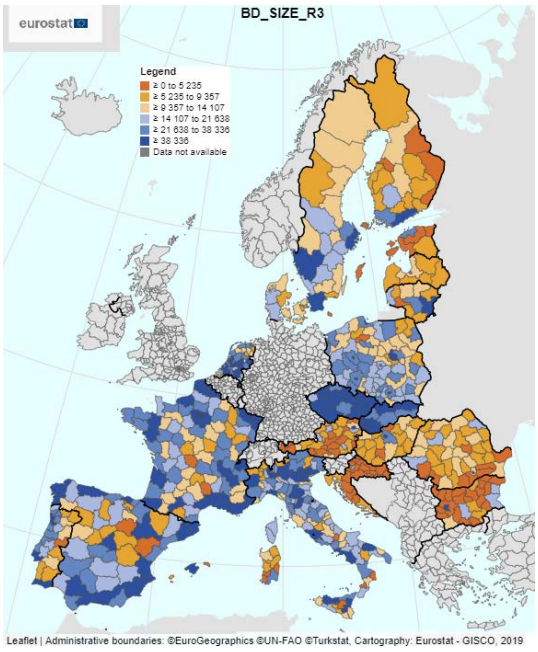
Figure 6. EU business demography, by size class, 2018



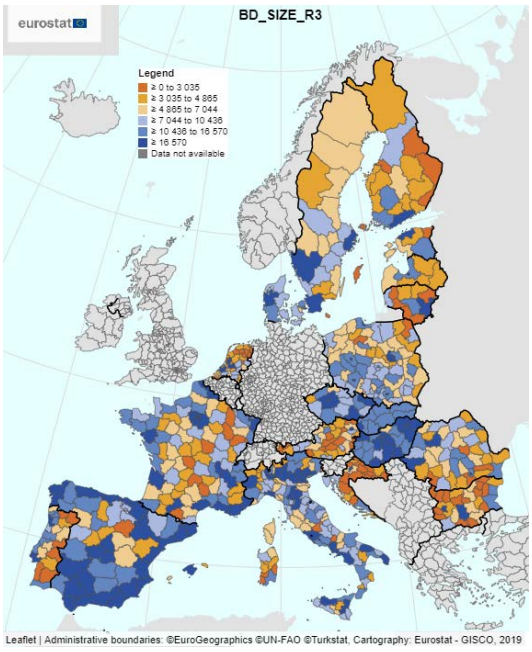
Source: Eurostat data online, table bd_9bd_sz_cl_r2 accessed in April 2021.

Note: The EU defines as 'micro' SMEs with 9 or fewer employees; as 'small' SMEs with 10-49 employees; and as 'medium' SMEs with 50-249 employees. Business demography statistics at the subnational level do not distinguish the share of SMEs (0-249 employees) in the total number of businesses.

Map 7. Distribution of microenterprises with 0 employees, 2018, NUTS3 level



Map 8. Distribution of microenterprises with 1-9 employees, 2018, NUTS3 level



Source: Eurostat mapping tool for online data code BD_SIZE_R3, accessed in April 2021.
No data for BE, DE, EL, IE and SI.

SMEs are at the core of many regions' economies. Several Dutch, Czech and Slovak regions show a high concentration of microenterprises. The same high concentration is found in some parts of France, Italy and Spain, as well as in the southern part of Sweden, in and around Helsinki-Uusimaa (Finland), and in Sostinės regionas (Lithuania). A high concentration of enterprises with 1-9 employees is found in all Hungarian regions and in several regions of Spain.

Digital transformation of business is defined in several ways and serves different purposes, but, overall, it is noted that its definition always implies a change in the way work and business are done. The change relates to business operations, organisation and culture, and implies the structural use and integration of digital technologies, processes and competencies in order to create value, new services and products as well as innovation. The dimensions of the digital transformation of SMEs are also used to develop digital maturity models against which the level of digital transformation of a business is assessed (Box 1).

Box 1. Key dimensions of a digital maturity model for SMEs

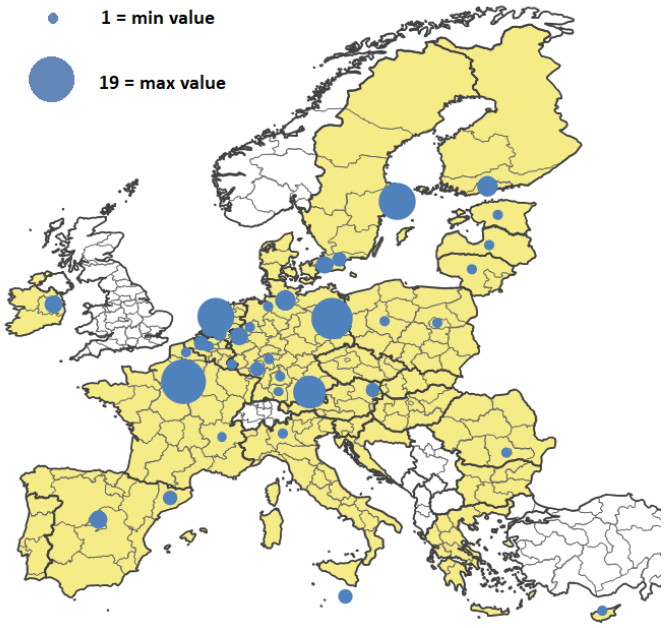
A recent literature review of theoretical digital maturity models tailored to SMEs finds that the essential dimensions to be considered are: strategies, products/services, technology, people/culture, management, and processes (Williams *et al.*, 2019). By drawing on the model used in the Interreg Project SMART-SPACE (2016-2020) and described in the deliverable 'D.T2.4.1: Coaching methodology to assist SMEs in their digital innovation process' (SMART-SPACE Project, 2018), the following synthesis of the dimensions of a digital maturity model for SMEs may be derived:

- **Strategy**: there is a digital transformation plan/strategy in place. Even better, the leadership for its implementation is defined (a person or a team in charge).
- **Products/services**: new products and services are developed and lead to the transformation of the business model, new value is created, innovation is fostered.
- **Technology**: digital technologies and software are considered, or they are leveraged. Examples of enabling technologies/software include: cloud approaches, Big Data solutions, AI applications, Cybersecurity, Networking, Blockchain, IoT, 3-D printing, VR, and AR.
- **People/culture**: workforce is enabled, digital skills are acquired, innovative approaches for digital transformation are encouraged.
- **Management**: brand management, customer management, portfolio management, etc. becomes agile and/or automated and/or integrated and/or smart and/or adaptive.
- **Processes**: processes are automated and/or digitally transformed.

In the 2030 Digital Compass, the EC intends to measure the digital transformation of businesses in terms of the uptake of **latest technologies** (such as cloud computing services, big data and Artificial Intelligence), the number of **unicorns**

and the **share of SMEs with at least a basic level of digital intensity**.[1,2] Out of these indicators, it is possible to compile a dataset at the regional level only for the number of unicorns located in the EU (Map 9).

Map 9. Regional distribution of unicorns across the EU, March 2021



Source: map created by the authors on the basis of online data from dealroom.co accessed in March 2021.

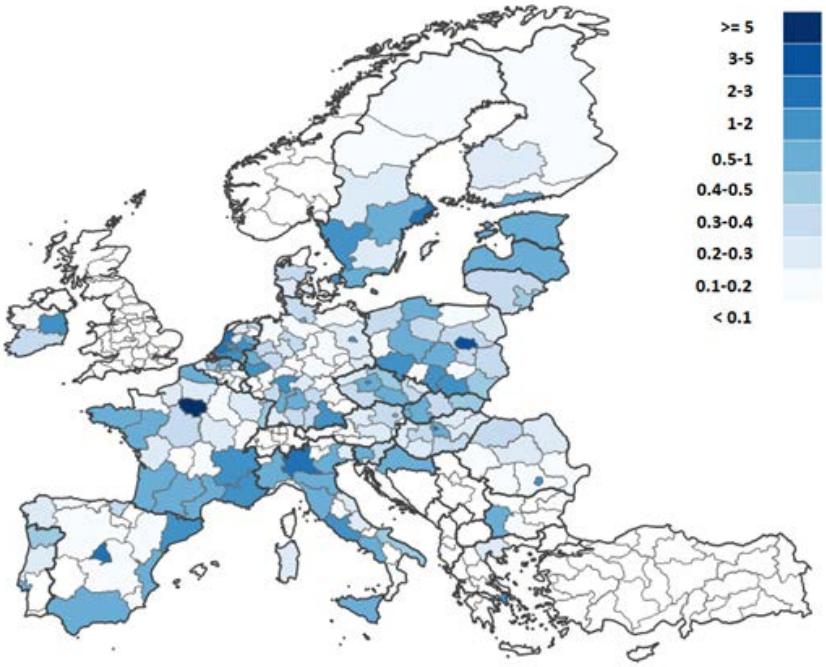
Unicorns are concentrated in the continental part of Europe and in capital regions. Out of the 126 unicorns mapped in the EU, the highest number is found in Île de France, followed by Berlin, Noord-Holland, Stockholm and Oberbayern.

Île de France is where 10.3% of all European enterprises in the Information & Communication (I&C) sector are concentrated. It is the only region which has a double-digit share of companies in the sector that, in 2018 (latest available data), corresponded to 109,373 units. Map 10 shows the distribution of I&C businesses across the EU. Apart from the capital region of France, among the top ten regions hosting the highest number of I&C enterprises are Warszawski stoleczny (3.2%), Stockholm (2.8%), Noord-Holland (2.8%), Lombardia (2.7%), Zuid-Holland (2.2%), Comunidad de Madrid (2.1%), Budapest (2.0%), Praha (1.9%) and Cataluña (1.7%). In some countries, a regional concentration is evident. In Greece, for example, Attiki hosts 11.310 units, or 1.1% of the total EU, while all the other Greek regions have a negligible number of I&C companies. In Bulgaria, I&C companies are concentrated in Yugozapaden, and in Finland they prevail in Helsinki-Uusimaa.

[1] A unicorn is a company valued over $1 billion.

[2] '*The Digital Intensity Index (DII) is a micro-based index that measures the availability at firm level of 12 different digital technologies: internet for at least 50% of employed persons, recourse to ICT specialists, fast broadband (30 Mbps or above), mobile internet devices for at least 20% of employed persons, a website, a website with sophisticated functions, social media, paying for advertising on the internet; the purchase of advanced cloud computing services; sending eInvoices, eCommerce turnover accounting for over 1% of total turnover and business-to-consumer (B2C) web sales of over 10% of total web sales. The value for the index therefore ranges from 0 to 12. The list of the aforesaid 12 indicators is reviewed and improved every year to keep up with latest technologies and policy priorities*' (EC, 2021). Although interesting, this index cannot be compiled at the regional level due to lack of data.

Map 10. Number of I&C enterprises as a share of the total EU27 I&C enterprises, %, 2018



Map created by the authors on the basis of Eurostat data online, table sbs_r_nuts06_r2 accessed in March 2021.

EU countries are requested to dedicate 20% of the resources of their recovery and resilience plans up to 2026 to the digital transition. This is meant to support the acceleration that had already started in 2020 due to the COVID-19 pandemic. A 2020 global survey by McKinsey across executives and senior managers from a variety of countries, industries and company sizes, found that **acceleration of digitalisation caused by the COVID-19 pandemic is significant and often quantifiable into 'years'** (McKinsey, 2020). Results for Europe show that the interaction with customers was digital in 55% of the cases in July 2020 versus 32% of the cases in December 2019. By comparing the growth with previous years' growth, the increase in the rate of adoption corresponds to an **acceleration of 3 years**.

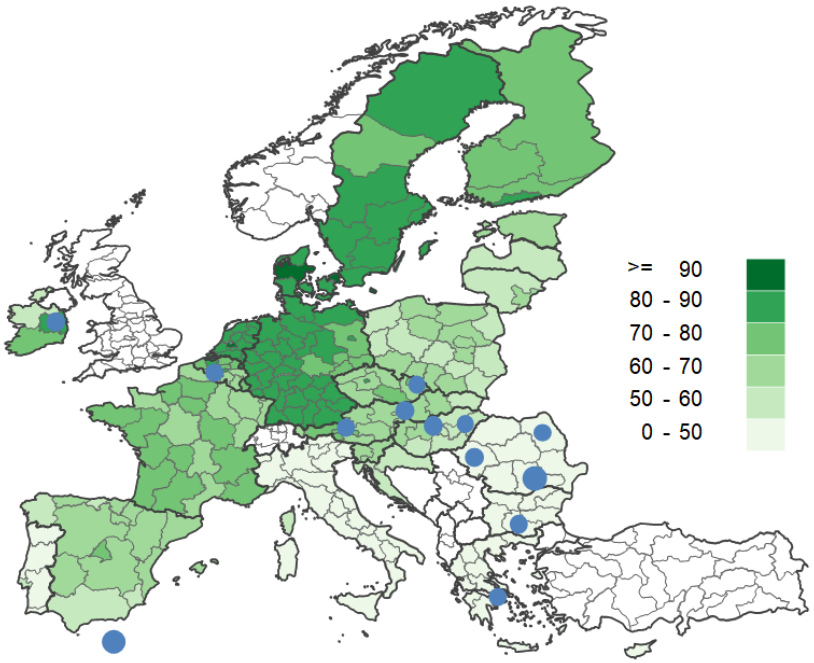
The most impressive acceleration is found with regard to the products and/or services which were partially and/or fully digitised further to the pandemic. In Europe, this share was 50% in July 2020 versus 34% in December 2019. By comparing the growth with previous years' growth, the increase in the rate of adoption corresponds to an **acceleration of 7 years**.

Accelerations were also reported for changes related to the way of doing business. In this case, the acceleration was determined according to the opinion of the respondents who were asked how long the same change would have taken without the occurrence of the pandemic. The highest acceleration rate (43) is found in the

increase of remote working. Acceleration rates of 23-27 are found in the increase of customer demand for online services and online sales/purchases, in the use of advanced technologies/solutions in operations and in business decision-making, and in the migration of business assets to the cloud. Aspects such as an increase in cybersecurity spending and developing supply chain resilience were attributed acceleration rates of 18-19 (McKinsey, 2020).

The 2020 global survey by McKinsey highlights **major COVID-19 induced changes to business models**. One of the three most common changes experienced by respondents was the **increase in customers' demand for online services and online sales/purchases**. Unfortunately, there are no data on e-commerce in enterprises at the regional level to verify this finding.[3] On average, at the EU27 level, enterprises with e-commerce sales increased from 20% in 2019 to 21% in 2020. Most significant increases are found in Croatia (+9 percentage points, from 22% to 31%), Romania (+7 p.p.), Spain (+6 p.p.), and Slovakia and Austria (+5 p.p. each). Map 11 shows the share of individuals who, in 2020, ordered goods or services over the internet for private use.

Map 11. Individuals who ordered goods or services over the internet for private use, 2020, % (p.p. for the change)



Map created by the authors on the basis of Eurostat data online isoc_r_blt12_i, accessed in March 2021.

Notes: 2019 data for France and Italy. No data for Åland, Finland. The big bubble at the south of Spain indicates the change occurred in Ciudad de Melilla which is located on the coast of Morocco (not shown on the map).

This indicator of demand at the regional level is used as a proxy of the online offer of goods/services. Bubbles highlight the regions characterised by the most

[3] The annual Community survey on ICT usage and e-commerce in enterprises only collects data at the national level.

important changes from 2019 to 2020. The share of individuals ordering online goods and services changed the most in Bucuresti-Ilfov (from 31% in 2019 to 56% in 2020) and Ciudad de Melilla (from 31% in 2019 to 55% in 2020). Notably, all regions in Romania show a double-digit increase from 2019 to 2020 which is reflected in an average national increase of 15 percentage points from 2019 to 2020.

The other two most common changes experienced by the respondents to the McKinsey's 2020 global survey are **increase in remote working/collaboration** and **changing of customers' needs**. Other changes experienced by more than one-third of the respondents include increased spending in data security aspects, increased use of advanced technologies in operations, and increased migration of assets to the clouds. Apart from the change in customers' needs or expectations (the cited example relates to 'increased hygiene awareness'), which is believed to continue even after the recovery by 62% of the respondents, only approximately 50% of the respondents, or less, believe that the other changes will be maintained in the future (McKinsey, 2020).

The changes induced by COVID-19 to business models require governments to **support the sustainability of businesses**. Primarily, this means to promote awareness of the available technologies which are relevant to the market segment and/or sector where SMEs operate, and then to provide appropriate digital skills and knowledge to these SMEs for the understanding, appreciation and/or implementation of the value added by these technologies. Another aspect to be considered is the provision of access to external capital to implement any transformation as often SMEs rely on liquidity internally generated to fund their operations (Gregurec *et al.*, 2021).

At the regional level this may require making digital maturity assessment tools and digital transformation design capacity available in order to support SMEs in defining their transformation paths according to opportunities. It is also important to achieve a massive involvement of SMEs across the territory, reaching as many businesses as possible, including those that are usually not involved/reached. Finally, regions may work towards the creation or strengthening of collaboration ecosystems by bringing together technology centres and business intermediaries where SMEs can easily access competencies and specialised support services.

Part 1. How to measure digital preparedness in regions

In this section, according to the specifications of the study, our research objective is to define the measurement framework of digital preparedness in regions (DPR), with a focus on the digitalisation of SMEs. Since preparedness is a 'state of readiness', for the scope of this study we define **digital preparedness in a region** as the **state of readiness for digitalisation in that region**, and digitalisation as the '*transformation of all sectors of our economy, government and society based on the large-scale adoption of existing and emerging digital technologies'* (Randall *et al.*, 2018).

Our approach to defining the measurement framework of DPR includes: 1) the outlining of the **conceptual framework for measuring digital preparedness** in regions; 2) the implementation of an **indicators' data gap analysis across the components of existing frameworks** for the measurement of digitalisation or digital readiness; and 3) the proposal of **relevant and new indicators to be used for measuring digital preparedness** in regions.

1.1 Outlining of the conceptual framework for measuring the level of digital preparedness in regions

The framework to measure DPR needs to reflect the several components that are embedded in the concepts of digitalisation and of digital transformation. In order to define such a framework, we build on existing research and perform the following three main steps:

- Identification of relevant existing frameworks.
- Mapping, comparison and analysis of their components.
- Outlining of the components that are deemed appropriate to frame the measurement of digital preparedness in regions.

1.1.1 Existing relevant frameworks

There are three indicator frameworks that are considered to be the most relevant to the scope of our work. They are designed and/or used to measure digitalisation (DESI framework), digital transformation (LORDI framework) and digital readiness (Cisco framework). In particular:

1) The Local and Regional Digital Indicator (LORDI), whose co-development is led by ESPON, focuses on the local level and in particular on cities. LORDI is still being developed and is not synthesised into an index. It outlines a set of indicators for mapping cities' and regions' efforts in digital transformation

according to five broad categories: 1) local digital infrastructure; 2) local digital skills and capacity building; 3) local digital economy and services; 4) governance and digital single market; and 5) socioeconomic context.

2) The Digital Economy and Society Index (DESI) is a composite index developed by the European Commission to monitor Europe's digital performance. The index is part of a well-established and broad measurement framework which is populated by means of regularly carried out surveys and studies. Examples of data collection initiatives include the Eurostat-Community survey on ICT usage in Households and by Individuals and the Eurostat-ICT Enterprises survey; examples of studies include the eGovernment Benchmarking reports and the reports on Broadband Coverage in Europe. With the exception of the broadband coverage studies, all the other initiatives collect data **only at the national level**. The 2020 edition of DESI includes 37 indicators to rank Member States based on their digital performance. The index is divided into five main components: 1) connectivity; 2) human capital; 3) use of internet services; 4) integration of digital technology; and 5) digital public services.

3) The Cisco holistic framework is meant to measure the digital readiness of countries. Cisco is a major ICT player at the global level. In 2018, it developed its conceptual framework contextually to a global digital readiness index based on reputable data sources. It is interesting to consider the Cisco framework in this study as it adds a non-European perspective to our framing exercise. In addition, it is the only framework specifically focused on the measurement of digital readiness (Yoo *et al.*, 2018; Cisco, 2020).

1.1.2 Mapping, comparison and analysis of the main components of LORDI, DESI and Cisco frameworks

In Table 1, the building components of LORDI, DESI and Cisco frameworks are compared in order to highlight similarities and divergences between them. The first column suggests a synthetic name of the component. It needs to be noted that the DESI thematic area of cybersecurity is currently not included in the five dimensions used by the EC to calculate the index, but it is part of the wider measurement framework developed for and around DESI.

Table 1. Comparison of the components of the measurement frameworks of LORDI, DESI and Cisco

	LORDI	DESI	CISCO
CONTEXT	**Context.** Size and location, population development, economic account and	-	**Basic needs.** It is assumed that new value brought in by technologies is appreciated only if

	labour market (general, not specific to the digital sector).		population basic needs are met. It measures the following indicators: life expectancy, mortality rate, population using safe drinking water services, access to electricity.
HUMAN CAPITAL	**Local digital skills and capacity building.** It measures access to higher education in relevant subjects, digital skills of end-users, professional skills, presence of labs/ hubs/accelerators/ incubators, private funding, and diversity of skills.	**Human capital.** It measures the skills of internet users and the presence of skilled human capital in ICT.	**Human capital.** The presence of skilled labour force able to support digital innovation is measured through: the labour force participation rate, adult literacy rate, the education index (years of schooling), and the harmonized test score.
BUSINESS ENVIRONMENT	**Governance and digital single market.** It measures political commitment, urban data platforms, interoperability, public procurement.	**Digital public services.** It measures eGovernment users, pre-filled forms, online service completion, digital public services for businesses, and open data.	**Ease of doing business.** It is measured by considering the local rule of law, the Ease of Doing Business Index, the Logistics Performance Index (LPI) infrastructure rating, and the time it takes businesses to obtain access to electricity.
PUBLIC & PRIVATE INVESTMENTS	Note: Public procurement is included under the 'Governance and digital single market' component. 'Private funding' is included under the 'Local digital skills and capacity building' component.	-	**Business and government investment.** It is assessed by measuring sources of private and public investment in innovation and technology such as foreign direct investment, research and development spending, and investment freedom.
START-UP ENVIRONMENT	-	-	**Start-up environment.** To foster innovation. It is assessed by measuring a country's venture capital availability and investment, new business density, and patent and trademark registrations.
DIGITAL INFRASTRUCTURE	**Local digital infrastructure.** It measures internet fixed infrastructure (coverage, speed, take-up, affordability, security), mobile broadband infrastructure (coverage, speed, take-up) and public wireless infrastructure (coverage), IoT infrastructure (networks and solutions) and other physical infrastructure (co-working spaces, affordability, and	**Connectivity.** It measures fixed and mobile broadband coverage and take-up, and the broadband price index.	**Technology infrastructure.** To enable digital activities. It is assessed by measuring active mobile broadband subscriptions, household internet access, fixed broadband subscriptions, and secure internet servers.

	technologies such as 3D, VR, AR)		
DIGITAL ECONOMY & SERVICES	**Local digital economy and services.** It measures macro-economic variables and services in the collaborative economy such as bike-sharing and hotel booking.	**Use of internet services.** It measures the use of internet, activities online and transactions. **Integration of digital technologies.** It measures business digitization and e-commerce.	**Technology adoption.** It is assessed by considering the demand for digital products and services in terms of mobile cellular penetration, internet usage, and cloud services.
CYBERSECURITY	Note: security is considered under the 'infrastructure' component.	**Cybersecurity.** It measures internet security (incidents and concerns among EU citizens) and ICT security (incidents and measures taken by EU enterprises).	Note: security is considered under the 'technology infrastructure' component.

1.1.3 Outlining of the components that are deemed appropriate to frame the measurement of digital preparedness in regions

In this section, we synthesise the information presented in Table 1 in order to outline a suitable conceptual framework for the measurement of the digital preparedness in regions.

As a first observation and considering the fact that we want to keep our framework focused, **we do not deem it necessary to include a 'general context' component**. This follows the DESI approach where a context component is not present.

A **human capital component** is shared by the three frameworks and **is indeed also deemed necessary for our conceptual framework.** Cisco underlines the importance of a skilled labour force to support digital innovation. This is also part of the LORDI framework but LORDI considers a rather high number of indicators which cover very diverse topics. The DESI framework adopts a simpler approach and focuses on the skills of internet users and on the presence of advanced skills (ICT specialists and graduates).

A component related to the **business environment** is also common to the three frameworks although it is proxied in very different ways. The LORDI component includes the highest number of variables that relate to public commitments, data platforms, interoperability and public procurement. The DESI framework focuses on eGovernment. The Cisco framework takes a more comprehensive look at the external conditions that facilitate and/or hamper business activities. Conceptually, **we consider this last interpretation as the most suitable for our scope**. However, in the definition of a business environment component in our

framework we will need to rely on different indicators than those used by Cisco which refer to global datasets and sources.

A component related to the **availability of public and private investment** specifically focused on innovation and technology is only included in the Cisco framework. We **deem this component relevant to frame digital preparedness in regions** and will propose appropriate metrics at the regional level accordingly.

A component specifically assessing **the start-up environment** is only included in the Cisco framework. Cisco justifies this component by affirming that '*Start-ups create new innovations that can benefit entire markets and communities. They also demonstrate high levels of agility in terms of their ability to adapt to new market conditions and are often the leading creators of new wealth from digital technologies, and a crucial source of job creation*' (Cisco, 2020). **We deem this component relevant to frame digital preparedness in regions but we prefer to merge it with the business environment component**. Thus, our conceptual framework will include only a consolidated component on 'business environment'.

The **digital infrastructure component** is common to the three frameworks. In all cases, **assessing the presence of fixed and mobile fast broadband is considered relevant**. LORDI introduces more variables related to the Internet of Things (IoT) and other physical infrastructures. Both LORDI and DESI have a variable related to the affordability of connection. LORDI and Cisco introduce a (cyber)security variable into this component.

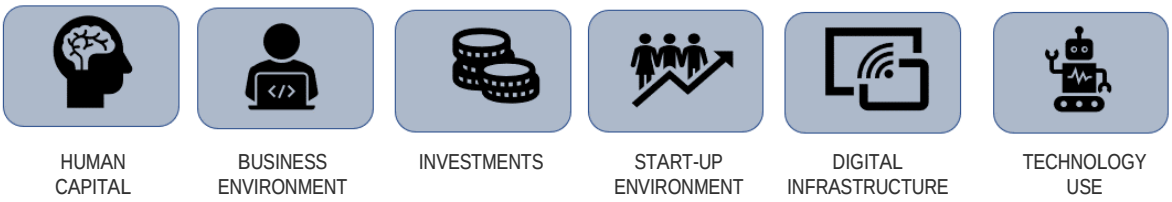
The **digital economy and services component** is common to the three frameworks, but it is measured in very diverse ways. LORDI considers economic parameters of ICT and the use of very specific services. Cisco assesses the demand for digital products and services by all. Only DESI distinguishes the use of internet services by all and by the business community. We deem **this component relevant for our conceptual framework and the DESI approach the most suitable** for measuring the state of digitalisation of SMEs.

Finally, cybersecurity is addressed by individual variables in all the three frameworks, but only DESI is currently developing a structured component dedicated to cybersecurity which, nevertheless, is not yet part of the index. **In our conceptual framework we consider it relevant to have a cybersecurity component which is separate from the other components.**

Figure 7 summarises the components we suggest including in our conceptual framework for measuring digital preparedness in regions. It is important to note that this is a **theoretical framework**. After the **indicators' data gap** analysis, it

will be evident that some of these components **cannot be measured at the regional level** due to the lack of available data.

Figure 7. Suggested components of the conceptual framework for measuring digital preparedness in regions



1.2 Indicators' gap analysis across the components of existing frameworks

In this section, we perform an indicators' data gap analysis across the components of the three measurement frameworks presented in section 1.1. The gap analysis is made in terms of relevance and availability of data at the regional level.

1.2.1 Assessment of the indicators of existing frameworks with respect to their relevance and availability

The analysis is enclosed in Annex II. It is carried out by listing the indicators used in the three frameworks presented in section 1.1, namely LORDI, DESI and Cisco.[4] Indicators are listed by component. For each indicator, **we assess its relevance with respect to the measurement of digital preparedness in regions, and in particular with a focus on the digitalisation of SMEs**. Relevance is assessed on the basis of expert knowledge. Indicators are labelled as 'not relevant' (red smiley), 'moderately relevant' (yellow smiley) and 'relevant' (green smiley).

Indicators assessed as 'relevant' (green smiley) are then assessed in terms of availability of data at the regional level across the EU. When an indicator assessed as 'relevant' is unavailable at the regional level, a **data gap** occurs. This is **highlighted in yellow** in the last column of the table. The identification of a data gap is accompanied by the **proposition of possible alternative indicators or proxies.** These propositions are **highlighted in green** in the last column of the table.

[4] The list of indicators used in LORDI was taken from the questionnaire distributed in the January 2021 online consultation.

It needs to be noted that several of the data sources indicated in the LORDI framework are unconventional and difficult to assess in terms of data collection process, data flow and availability of regional breakdown of data.

1.2.2 Data gap analysis

The above analysis outlines which indicators are assessed as relevant for measuring digital preparedness in regions with a focus **on the digitalisation of SMEs.** It also determines for which of these indicators data is not available at the regional level and for which no proxy could be identified. Table 2 summarises the results of the analysis and of the data gaps identified. In summary, the most important gaps existing at the NUTS2 level relate to the following variables/areas:

- Provision of digital public services for businesses.
- Ease of doing business.
- ICT human resources.
- Patent applications in ICT.
- Venture capital investment and availability for ICT.
- Ultrafast broadband coverage (fixed and mobile).
- Quality of the connection (download speed, upload speed, latency).
- Broadband price index.
- Take-up of ultrafast broadband (fixed and mobile)
- ICT usage and e-commerce in enterprises.
- Cybersecurity issues.

Table 2. Indicators' data gap analysis for measuring digital preparedness in regions

HUMAN CAPITAL		
Framework	**Indicator**	**Availability – regional level**
HC_01_L	Employment in ICT sector	Not available at the regional level = GAP. Alternative indicators (proxies) that may be considered at NUTS2 level (Eurostat) include: • Employment in high-tech sectors • Employment in information and communication
HC_02_L	Innovation Hubs: Innovation hubs per capita / Presence of innovation hubs	The data source for the 'innovation lab' indicator is not specified in LORDI = GAP. We propose considering the presence of 'digital innovation hubs' as a relevant indicator. The JRC 'yellow pages' of Digital Innovation Hubs is a possible source but not exhaustive as it is based on the voluntary registration of hubs.

HC_03_D	Advanced Skills and Development: (employed) ICT Specialists	Not available at the regional level = GAP. Alternative indicators (proxies) that may be considered at NUTS2 level (Eurostat) include: • Human resources graduated and employed in science and technology. • Employment in information and communication.
HC_04_D	Advanced Skills and Development: ICT graduates	Not available at the regional level and no proxy may be identified = GAP.

BUSINESS ENVIRONMENT

Framework	Indicator	Availability – regional level
BE_01_D	Digital public services for businesses	Not available at the regional level and no proxy may be identified = GAP.
BE_02_C	Ease of Doing Business Index	Source of the index: World Bank studies under the 'Doing Business' initiative. In the EU, they are available at the subnational level for GR, IE, IT, HR, CZ, PT, SK, BG, HU, RO, ES, PL. However, they refer to different years and not to regions but to cities = GAP

PUBLIC & PRIVATE INVESTMENTS

Framework	Indicator	Availability – regional level
PPI_01_L	Public procurement: Public money spent on SMEs by local authorities in purchasing digital goods and services	Source is TED Europa. Manual compilation of the dataset may be possible at the regional level. Criteria for selection of the relevant calls for tenders need to be determined.
PPI_02_C	Foreign direct investment	Data source is the IMF and therefore data are not available at the regional level. No equivalent indicator is available = GAP.
PPI_03_C	Research and development spending	Data source is UNESCO and therefore data are not available at the regional level = GAP. Alternative indicators (proxies) that may be considered at NUTS2 level (Eurostat) include: • Intramural R&D expenditure (GERD-Gross domestic expenditure on R&D) by source of funds (Eurostat).

START-UP ENVIRONMENT

Framework	Indicator	Availability – regional level
SUE_01_C	New Business Density	Data source is the World Bank and therefore data are not available at the regional level = GAP. Alternative indicators (proxies) that may be considered at NUTS2 level (Eurostat) include data on business demography, NACE Section J 'information and communication'. In this domain, the choice of indicators is limited by the fact that several datasets on business demography do not

		cover all Member States at the regional level. The following indicator is selected: • Number of enterprises in the I&C sector.
SUE_02_C	Patents Granted and Trademarks Registered	Data source is the World Intellectual Property Organization and therefore data are not available at the regional level = GAP. It could be replaced by OECD data on 'Patent applications in ICT' but latest data date back to 2015 and cover only 12 of the EU countries.
SUE_03_C	Venture Capital Investment and Availability	Data source are the Center for American Entrepreneurship and WEF therefore data are not available at the regional level = GAP. It could be replaced (proxy) by the number of unicorns per region. Open data on this indicator are available from dealroom.co. Manual extraction and compilation of the dataset is necessary.

DIGITAL INFRASTRUCTURE

Framework	Indicator	Availability – regional level
DI_01_L	Fixed broadband infrastructure: Households covered by fast broadband	Data source: DG CONNECT study on broadband coverage. Map at the territorial level.
DI_02_L	Fixed broadband infrastructure: Households covered by ultrafast broadband	Multiple sources are indicated in LORDI. One is the DG CONNECT study on broadband coverage which nevertheless provides only fast (NGA) broadband coverage at the subnational level. The source of ultrafast broadband coverage is unclear. An alternative source with info on fast and ultrafast coverage provides data for only 12 EU countries (European Broadband Mapping portal) = GAP.
DI_03_L	Fixed broadband infrastructure: Average broadband download speed	Not available at the regional level = GAP.
DI_04_L	Fixed broadband infrastructure: Average broadband upload speed	Not available at the regional level = GAP.
DI_05_L	Fixed broadband infrastructure: Average broadband latency	Not available at the regional level = GAP.
DI_06_D	Fixed broadband coverage: Fast broadband (NGA) coverage	Data source: DG CONNECT study on broadband coverage. Available as mapped info at the territorial level. It is distinguished into total coverage and coverage in rural areas.
DI_07_D	Fixed broadband coverage: Fixed Very High-Capacity Network (VHCN) coverage	Not available at the regional level = GAP.
DI_08_D	Fixed broadband take-up: Overall fixed broadband take-up	The following Eurostat indicator is available at the regional level: Households with broadband access.

DI_09_D	Fixed broadband take-up: At least 100 Mbps fixed broadband take-up	Not available at the regional level = GAP.
DI_10_D	Mobile broadband: 4G coverage	Not available at the regional level = GAP.
DI_11_D	Mobile broadband: Mobile broadband take-up	Not available at the regional level = GAP.
DI_12_D	Mobile broadband: 5G readiness	Not available at the regional level = GAP.
DI_13_D	Broadband price index	Not available at the regional level = GAP.

DIGITAL ECONOMY & SERVICES

Framework	Indicator	Availability – regional level
DES_01_L	Gross Value Added in ICT per capita in PPS	Not available at the regional level = GAP. Alternative indicators (proxies) that may be considered at NUTS2 level (Eurostat) include: • Gross value added at basic prices by NUTS 3 regions, NACE J: Information and communication.

CYBERSECURITY

Framework	Indicator	Availability – regional level
CS_01_D	Enterprises that experienced problems at least once due to an ICT related security incident (unavailability of ICT services, destruction or corruption of data, disclosure of confidential data) (% of enterprises)	Not available at the regional level. They are collected through the Survey on ICT usage and e-commerce in enterprises = GAP.
CS_02_D	Problems experienced due to ICT security incidents (% of enterprises)	
CS_03_D	Type of ICT security measures adopted by EU enterprises (% of enterprises)	
CS_04_D	Enterprises that make employees aware of their obligations in ICT security issues (% of enterprises)	
CS_05_D	Enterprises that make employees aware of their obligations in ICT security issues by compulsory training courses or compulsory material (% of enterprises)	
CS_06_D	Enterprises that make employees aware of their obligations in ICT security issues (% of enterprises)	
CS_07_D	Enterprises that make employees aware of their obligations in ICT security issues by compulsory training courses or compulsory material (% of enterprises)	

1.3 Proposal of indicators to be used for measuring digital preparedness in regions

In this section we select the indicators which we believe are the most appropriate to measure the components of our framework **and which are available or able to be compiled at the regional level**. They are presented in Table 3.

Table 3. Indicators proposed for measuring DPR, by component

HUMAN CAPITAL		
HC_01_L **HC_03_D**	**DPR1** **Employment in information and communication**	It provides a size of the economic sector defined by the NACE Section J - Information and Communication classification. Section J includes: publishing activities (Division 58); motion picture and sound recording activities (Division 59); programming and broadcasting activities (Division 60); wired, wireless and satellite telecommunications activities (Division 61); computer programming and consultancy activities (Division 62); information service activities such as data processing, hosting, web portals, news agencies, information search (Division 63). **Source**: Eurostat online data lfst_r_lfe2en2 for most updated dataset (2019) on Section J. Eurostat table sbs_r_nuts06_r2 for most updated (2018) breakdown of data into divisions.
HC_03_D	**DPR2** **Human resources graduated and employed in science and technology**	It provides information on highly skilled human capital employed in the region. Human Resources in Science & Technology (HRST) are considered essential to the development of a knowledge-based economy and of economic growth. **Source**: Eurostat online definitions and data hrst_st_rcat
BUSINESS ENVIRONMENT		
HC_02_L	**DPR3** **Presence of digital innovation hubs**	These hubs are intended by the EC as a way '*to help companies improve their processes, products and services through the use of digital technologies*' (EC DIHs webpage). **Source**: JRC 'yellow pages' of Digital Innovation Hubs, to be complemented by additional web-based search as the yellow pages are not exhaustive.
SUE_01_C	**DPR4** **Number of enterprises in information and communication (business creation)**	This business demography indicator measures the size of the NACE Section J - Information and Communication sector. The density of IC businesses is relevant as they may be pivotal to the digitalisation of other business sectors. **Source**: Eurostat online data sbs_r_nuts06_r2

SUE_03_C	**DPR5** **Number of unicorns**	Unicorns are considered an indicator of economic success. **Source**: open data on dealroom.co. The dataset is manually extracted and compiled by region.
PUBLIC & PRIVATE INVESTMENT		
PPI_01_L	**DPR6** **Public money spent by LRAs in purchasing digital goods and services through public procurement**	It is a measure of the public investment made by subnational authorities to drive the digitalisation of SMEs through public procurement. **Source**: Tenders Electronic Daily (TED). The dataset on awarded contracts/concessions by regional and local authorities/agencies is compiled manually. Results are filtered for Common Procurement Vocabulary 48000000 (Software package and information systems), 72000000 (IT services: consulting, software development, Internet and support), and 30200000 (Computer equipment and supplies).
PPI_03_C	**DPR7** **Intramural R&D expenditure by source of funds**	The gross domestic expenditure on R&D (GERD), expressed as a % of GDP, represents the R&D intensity which is often used as a measure for determining an economy's creative/innovative capacity. **Source**: Eurostat online data tgs00042.
DIGITAL INFRASTRUCTURE		
DI_01_L **DI_06_D**	**DPR8** **Fast broadband coverage**	Next Generation Access includes FTTP, VDSL, cable DOCSIS 3.0 and other high-speed broadband technologies with at least 30 Mbps download speed. This indicator is available for 2019 as 'total coverage' and 'coverage in rural areas'. **Source**: DG CONNECT study.
DI_08_D	**DPR9** **Broadband access**	This is an indicator of broadband access and indicates the % of households that are connectable to an exchange that has been converted to support xDSL-technology, to a cable network upgraded for internet traffic, or to other broadband technologies. **Source**: Eurostat online data tgs00048.
DIGITAL ECONOMY & SERVICES		
DES_01_L	**DPR10** **Gross value added at basic prices in the information and communication sector**	It measures the economic activity in the information and communication sector (NACE J section – Information and communication). **Source**: Eurostat online data nama_10r_3gva.

Part 2. Successful cooperation between business and LRAs for digital transformation: case studies from eight European regions

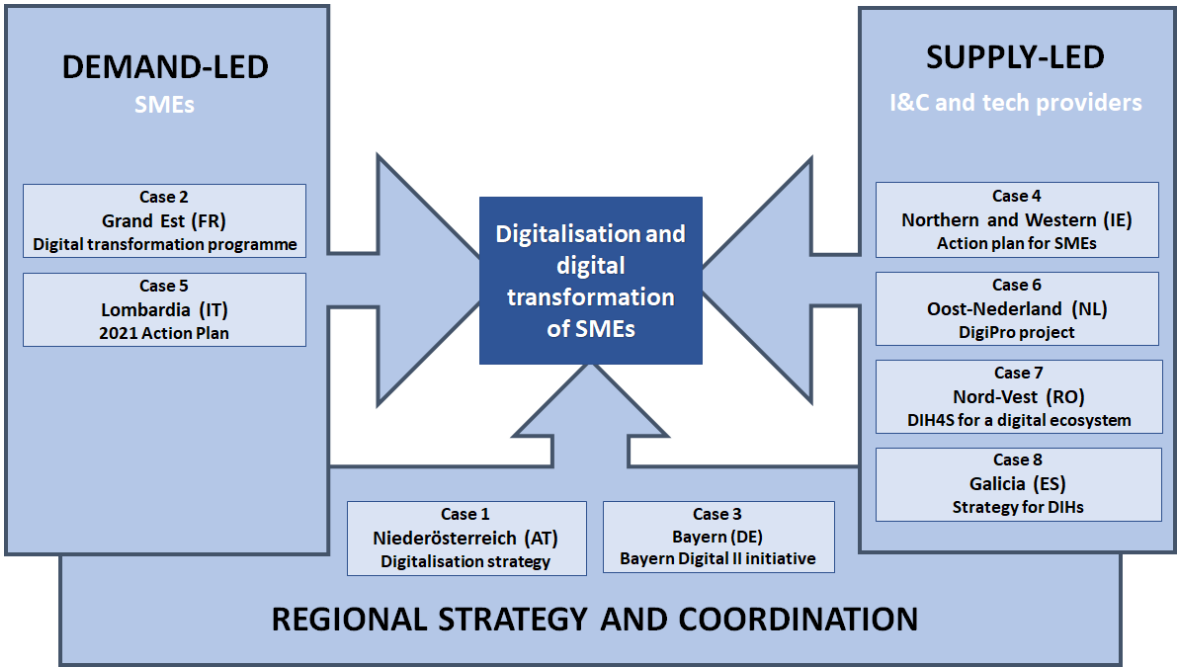
In this part, eight case studies are developed on successful initiatives and measures undertaken by regional authorities with the aim of accelerating the digital transformation of business. Some of these interventions were initiated as a result of the pandemic, but others began well before January 2020 and experienced adaptation or further development in order to support businesses during the COVID-19 crisis. The eight case studies were selected with a view to have a reasonable geographical balance across the EU and to illustrate different approaches by LRAs in promoting the digital transformation of SMEs in their territories.

Comprehensive region-wide approaches for the digitalisation of SMEs are found in Niederösterreich and Bayern. In both cases, digitalisation is addressed from the demand and supply side (see Figure 2). In Niederösterreich, SMEs' digitalisation is built into the Region's digitalisation strategy. It is a region-wide approach that takes advantage of existing regional stakeholders, regional funding and synergies with other relevant strategies such as the broadband deployment strategy. Its flagship project is the House of Digitalisation which is a collaborative platform. In Bayern, support for the digitalisation of SMEs comes in various forms under the umbrella of the Digital Bayern II funding initiative. This initiative has many digitalisation goals for the region's economic development. One of these is the digital transformation of SMEs which are addressed with specific instruments from a digital bonus to collaboration business-oriented platforms, coaching and tutoring in digital business labs and sector-specific initiatives.

In four of the cases the regional authorities act on the supply side of digitalisation. In Galicia, digitalisation of SMEs is pursued through a multi-pronged approach which has its core in the establishment of sectoral digital innovation hubs. These hubs have the task of involving SMEs and initiating their digital transformation. The Nord-Vest Romania case also focuses on the use of a digital innovation hub to develop a regional digital innovation ecosystem. The hub intends to connect digital solution providers and digital solution beneficiaries in order to support the integrated digitalisation of key stakeholders such as SMEs and local public authorities. The Northern and Western (Ireland) and the Oost-Nederland (Netherlands) cases are both project-based and both use ICT companies as a leverage for the involvement and digitalisation of other SMEs. Whereas the Irish case highlights the importance of tailoring the approach to rural SMEs and of considering the social impact of digitalisation, the Dutch case is a good example of cross-border cooperation.

Finally, two cases focus on actions aimed at addressing the demand side of digitalisation. The Grand Est case (France) was selected for its focus on SMEs of the agricultural, craft and tourism sector which are found mainly in rural areas. The Lombardia case (Italy) was selected because it is a regional intervention driven by the COVID-19 pandemic crisis.

Figure 8. Overview of the cases from a supply-demand perspective

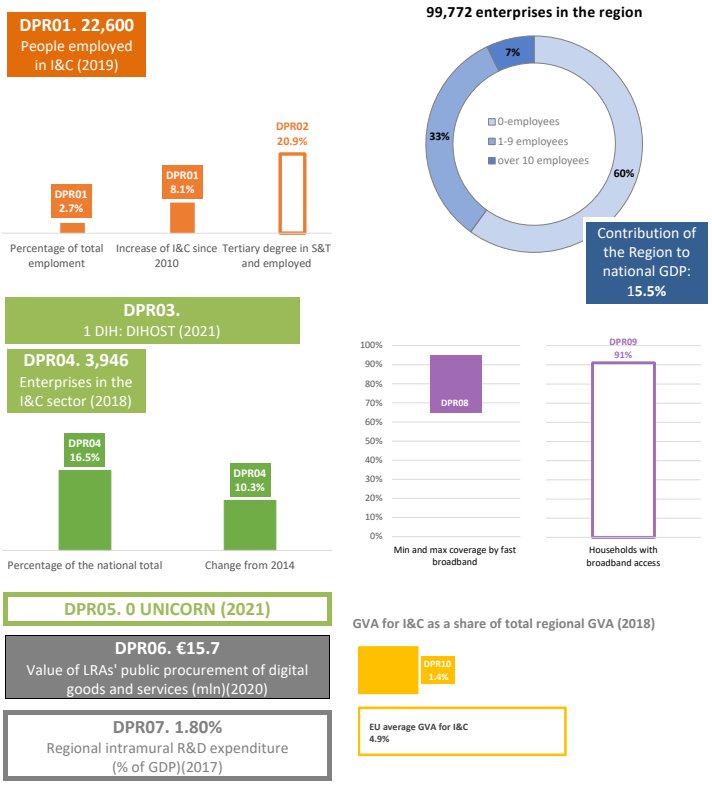


Case 2.1 Niederösterreich, Austria

Support for business transformation through the digitalisation strategy

In 2016, the Region of Niederösterreich started drafting its digitalisation strategy. Adopted in early 2018, the strategy targets the digitalisation of the whole society. People, businesses and public institutions of the region are considered instrumental to the achievement of the three strategic goals to secure and create new jobs, strengthen rural areas, and improve quality of life.

Where does the region stand in our digital preparedness framework?



Niederösterreich (AT12) has over 1.6 million inhabitants and slightly less than 100,000 enterprises. It contributes to 15.5% of the national GDP.

The region has a modest number of I&C companies (almost 4,000, increased by 10% over a five-year period). The I&C sector employs 22,600 people and has a GVA (1.4%) well below the EU average (4.9%). In May 2021, no unicorn was located in the region. Its intramural R&D expenditure is low (1.8% of GDP) and the share of people graduated and employed in S&T is modest (20.9%). On average, NGA connectivity is good. In 2020, public procurement for digital goods and services by regional and local authorities was modest (€15.7 million).

Context

In the spring of 2017, a Technology and Digitalisation Unit was established in the regional government's Department of Business, Tourism and Technology, with the mandate of finalising the digitalisation strategy and of following its implementation. The strategy addresses the region's challenges and builds on its opportunities. Among the key challenges is connectivity.

Even though the region has a good coverage of fast broadband, its ambitious goal is to achieve ultrafast connection (over 100 Mbps) by 2026. Currently, ultrafast broadband covers only 10-50% of the territory, with the exception of Wiener Umland/Südteil, in the south of Wien, where the coverage is over 50% (European

Broadband Mapping Portal). A fibre optic deployment strategy is being progressively implemented and is closely linked to the digital infrastructure pathway of the regional digitalisation strategy.

Another challenge relates to the heterogeneous structure of the business sector across the region. Heterogeneity is a direct consequence of socio-economic differences across the regions' territory in terms of accessibility, demography, purchasing power, economic growth and workforce potential (Office of the Lower Austrian Provincial Government, 2018). It is also determined by the structural changes the regional economy has been undergoing for the last two decades as the region has been moving towards a knowledge economy from an economy dominated by agriculture (EC-JRC, 2021). Because of this heterogeneity in firm performance and growth as well as in adoption of technologies (EC, 2019), the regional digitalisation strategy aims at reaching out to as many SMEs as possible, including those in rural areas for which a gradual expansion of innovative digital infrastructure and new services is foreseen.

Among the opportunities, the digitalisation strategy builds on the region's already existing dynamic research and education sector. Even though Niederösterreich has a relatively small education sector and lacks research-intensive universities, it has taken advantage, through cooperation and attraction of talent, of its proximity to Wien which, on the contrary, is rich in both (EC-JRC, 2021). In addition, two decades ago Niederösterreich began to structure interaction and collaboration between its research, education and business sectors, first by means of thematic clusters and then through the launch of a number of 'technopoles', namely physical places for interaction which have the scope of tackling innovation (EC-JRC, 2021). Both of these regional characteristics are used to strengthen the networking dimension of the digitalisation strategy.

Description

The strategy has defined three impact pathways to reach its goals: the first requires stakeholders to be ready for digitalisation (digital fitness); the second requires appropriate digital infrastructure to be in place; and the third requires that digital innovations and solutions are exploited.

Under the **digital fitness pathway**, awareness raising was carried out to inform SMEs on opportunities and benefits offered by digital technologies. In 2019, a 'digital roadshow' was organised with the support of the Niederösterreich's Chamber of Commerce, comprising the implementation of 2-hour information events in all the region's districts. The roadshow involved some 350 SMEs. Besides being presented with and learning about the new technologies, SMEs were also encouraged to start implementing their own digital innovation projects, for which support is available under the 'Digital Innovation Hub Niederösterreich

/Wien/Burgenland (DIHOST)' programme. Launched in September 2019 as a collaboration of the federal states of eastern Austria with the contribution of the central government, DIHOST is a service programme to support and speed the digital transformation of SMEs located in eastern Austria (Office of the Lower Austrian Provincial Government, 2020).

Under the **digital solutions pathway**, a networking platform was developed to improve communication processes, involve stakeholders and stimulate developments through collaborative projects. In practice, this measure was designed to increase business awareness of the advantages implied by digitalisation; enhance cooperation between business and research institutions; enhance coordination between research institutions and business intermediary agents; and create solutions responding to the needs of a variety of businesses, from the technological to the traditional ones. The 'House of Digitalisation' is considered a flagship programme of the strategy and a good example of regional cooperation for the digital transformation of SMEs. Begun in 2018, this intelligent digital network operates as a hub for networking, facilitating access to information, training, infrastructure, and potential partners across six nodes established in the towns of Tulln, Krems, Klosterneuburg, St. Pölten, Wieselburg and Wiener Neustadt. Besides benefiting from knowledge providers, the nodes also benefit from the contribution of intermediary agents such as business support organisations, chambers of commerce, and start-up agencies. The nodes are active in specific areas and transform the ideas and contributions of the network's participants into projects. In 2019, the nodes' projects related to blockchain, mixed reality, information security qualification (the Sec4Dig programme), and sensor-based data economy (the Dataskop project). Other solutions are being delivered in projects collaborated on with DIHOST, such as the optimisation of supply routes for foodstuffs, and the IoT weather stations to predict late frosts in viticulture (Office of the Lower Austrian Provincial Government, 2020).

In January 2019, the House of Digitalisation went online. Through the virtual version of the house, the launch of 234 projects involving 362 businesses was facilitated. The House of Digitalisation is expected to evolve further into a real construction to be built in Tulln by 2023. In addition, in 2019, the House of Digitalisation became part of the EU mentoring and coaching Digital Innovation Hub Enhanced-Learning Programme (DIHELP). Through this programme, selected Digital Innovation Hubs (DIHs) are supported for a period of nine months to develop and/or scale-up their activities.

The cost of the 'House of Digitalisation' programme (2018-2020) was €2.4 million. Half of it was covered by regional funds, the rest was financed by the ERDF through the Operational Programme 2014-2020 'Investments in Growth and Employment Austria', priority 'Increasing the number of innovative SMEs'

(Interreg Europe good practice profile; EU project factsheet). The project was managed by Ecoplus, the business agency of Niederösterreich that also manages several clusters and four technopoles across the regions.[5] Since 2019, the Ecoplus project team has started developing a service portfolio to ensure the network's financial sustainability beyond the project completion (Ecoplus website).

Changes induced by the COVID-19 crisis

Specific tools were elaborated in the virtual house to support business during the pandemic, in particular solutions to facilitate e-commerce and customer relations, and initiatives to deepen the understanding of cybersecurity issues through e-learning (webinars).

On 2 November 2020, a **regional funding instrument** aimed at building on the acceleration of digital transformation of business determined by the COVID-19 crisis was launched. The 'digi4economy' fund is addressed to SMEs and large enterprises and is explicitly linked to Niederösterreich's digitalisation strategy. A total of €10 million are provided in the form of grants. The source is the Niederösterreich's Economic and Tourism Fund. The instrument will be open until 31 October 2021, or as long as financial resources are available ('the first come, first served' rule applies). The fund aims to promote digital innovation of business with regard to the improvement of products' properties; the digitalisation of processes concerning suppliers and customers and hence related to purchasing, marketing and distribution; the digitalisation of services; and the digitalisation of production, for example through the use of digital solutions, of new production technologies such as 3D printing, or the real-time quality control of production. There are three types of grant available: 'digi assistant', for feasibility and planning activities (maximum grant of €3,300); 'digi concept', for the creation of a detailed project concept (50% co-financing, up to a maximum grant of €30,000); and 'digi investment', for the implementation of a concept (50% co-financing, up to a maximum grant of €70,000) (digi4economy website).

Key evidence

⏩ The **early establishment of a Technology and Digitalization Unit** in the Provincial Government was the first step towards the definition of a digitalisation strategy. Besides clarifying the responsibility for the strategy's implementation, it also created a core capacity for coordination, mobilisation and networking activities.

⏩ The Region understood the necessity **of reaching out to companies that had never been involved in regional innovation initiatives**. In order to widen

[5] Technopoles are funded through the ESIF and systematically support interaction of research, education and training, and business development (EC-JRC, 2021).

the audience of participant SMEs in the activities promoted by the strategy, 'traditional' outreach means such as TV advertisements were useful.

⏩ The contribution of the public sector in the digital transformation process is as important as the contribution of SMEs. For this reason, **in its early stages, the digitalisation strategy focused on e-administration**, and in 2019 it included specific measures aimed at the involvement of public employees and at their awareness raising of the benefits derived from the digital transformation.

⏩ The prior identification in the region of the knowledge providers and of the intermediaries was instrumental to the development of the House of Digitalisation. The region built on its existing endowment of research and education institutions, creating **specific contact points between these institutions and the business community**.

⏩ The alignment of the digital fitness of SMEs with the availability of **appropriate digital infrastructure is essential**. In Niederösterreich, this is pursued by creating synergies between the digitalisation strategy and the broadband deployment strategy.

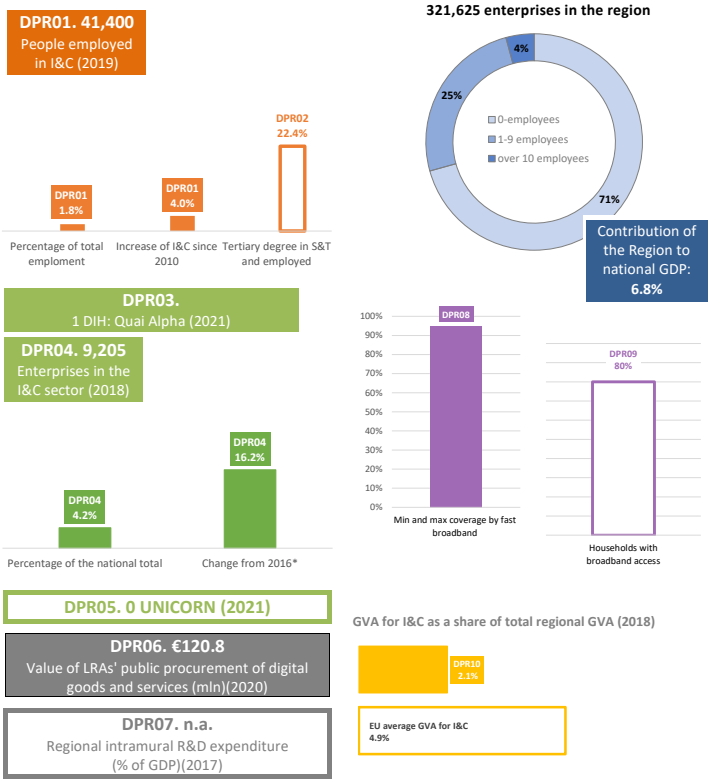
⏩ Making **funding available to SMEs in an easy-to-access way** overcomes the difficulty many micro- and small businesses have in accessing capital.

Case 2.2 Grand Est, France

The digital transformation programme for trade and crafts, tourism, agriculture and livestock

The regional digital transformation programme is meant to foster the digitalisation of enterprises in the sectors of trade and crafts, tourism, agriculture (including wineries) and livestock. It is also aimed at raising the online presence of businesses in rural communities. The programme foresees the provision of individual support to SMEs and of collective digital support to territories in terms of consultancy services and subsidies to implement a digital transformation process of their businesses.

Where does the region stand in our digital preparedness framework?



** Data for 2014 are missing.*

Grand Est (FRF) has some 5.5 million inhabitants and more than 300,000 enterprises. It contributes to 6.8% of the national GDP.

The region has a good number of I&C companies (9,205) that grew fairly (+16%) since 2016. The I&C sector employs 41,200 people but has a low GVA (2.1%), well below the EU average (4.9%). In May 2021, no unicorn was located in the region. The share of people graduated and employed in S&T is low (16%). NGA coverage is uneven and ranges from (0%-35%) to 95%. Only 80% of households has broadband access. In 2020, public procurement for digital goods and services by regional and local authorities was as high as €120.8 million.

Context

In November 2020, the Regional Council of Grand Est approved the Digital Transformation of Grand Est programme. The programme, officially launched in March 2021, is grounded in the regional 'Business Act Grand Est' 2020-2025, the strategic vision of the Region to fight the consequences of the COVID-19 crisis. The Business Act is the result of a co-creation approach initiated in April 2020 in response to the changes induced by the COVID-19 pandemic. For two months, under the aegis of the State and of the Regional Council supported by the regional

agency for innovation and internationalisation (Grand E-nov), experts, business representatives and citizens interacted to define a new strategic vision for addressing the crisis. The Business Act was adopted in July 2020 (Region Grand Est, 2020).

The Business Act envisions a region *'at the forefront of ecological and energy transition, which accelerates its digital transformation and is engaged in its industrial transformation.'* Among the actions foreseen to guarantee a sustainable recovery of the regional economy, those making leverage on the digital challenge are: 1) investment and financing of digital transformation; and 2) support for enterprises in their digital transformation journey by means of ad-hoc instruments which mobilise stakeholders and solutions providers on the territory. According to the Business Act, industry, health, agriculture and the bio-economy are the priority sectors for the digital challenge (Region Grand Est, 2020).

Description

Through the Digital Transformation programme, the Region intends to accelerate the digitalisation of SMEs in order to enable them to cope with the changes in consumption patterns and the new habits (e.g. reduced mobility) caused by the COVID-19 pandemic. The programme's final aim is to sustain the local economy in all the territories of the region (Grand Est webpage of the programme).

The programme explicitly targets three economic sectors: **trade and crafts,** which contribute to the attractiveness of the territory; **tourism**, whose online promotion of the qualified and diversified supply is essential; and **agriculture (including wineries) and livestock** which drive the local, regional and national economy. The priorities defined in the programme include:

- to digitise traders, artisans, tourism enterprises and wine and agricultural enterprises to enter into a multi-channel distribution strategy;
- to match consumption patterns with an adequate commercial offer (e.g. online sales);
- to integrate traders, artisans, tourism enterprises and agricultural, farming and wine-related enterprises into local distribution circuits.

The Digital Transformation programme offers comprehensive support that encourages enterprises to gain digital capacities and the equipment necessary to become digital. Enterprises can benefit from **two digital transformation paths**: an individual and a collective one.

Individual digitalisation paths are addressed to enterprises with fewer than 20 employees, having an annual turnover not exceeding 2 million euros and operating in trade and crafts, tourism, or agriculture, farming and wine business.

Four types of interventions tailored to the enterprises' digital needs (referred to as 'bricks') are available: brick 1: I want to know and master the digital tools allowing for the optimisation of the internal organisation of my enterprise; brick 2: I want to adapt my premises, my environment, my offer, to optimise the use of digital tools; brick 3: I want to adopt an online multi-channel marketing strategy; and brick 4: I want to adopt an online multi-channel communication strategy. Two steps are foreseen in the individual digitalisation paths. As a first step, the enterprise should submit an online request for a **digital maturity diagnosis** that is carried out by the Chamber of Commerce and Industry or by the *Chambre De Métiers* of reference. The diagnosis leads to a specific **digital deployment plan according to the identified digital needs** (or bricks). Once the enterprise selects a 'digital transformation operator' (among those recognised by the Region), a digital transformation voucher can be requested to a) foster the business transition towards a digital dimension and b) buy digital solutions. A Committee of the Regional Council is in charge of deciding on the granting of the vouchers to candidate enterprises.

The Digital Transformation voucher provides support for the above a) and b). A flat contribution of €600 (within the limit of expenses incurred) is available to optimise the enterprise's internal organisation (brick 1); of €800 (within the limit of expenses incurred) to adapt the digital proposal (brick 2); of €800 (within the limit of expenses incurred) to deploy a marketing strategy (brick 3); and of €800 (within the limit of expenses incurred) to deploy a strategy for communication (brick 4). Additional support of €3,000 within the limit of 70% of eligible expenditure is then available to address one of the bricks if the amount allocated is not enough. Acquisition of digital solutions is sustained with a maximum of €3,000 within the limit of 50% of eligible expenses (with €1,000 being the minimum enterprise expenses). Any enterprise can benefit from €6,000 as a maximum Digital Transformation voucher.

The collective digitalisation path foresees the implementation of joint actions led by a local actor. Among the eligible local actors are public establishments of intercommunal cooperation (*établissement public de coopération intercommunale* - EPCI); rural centres meeting specific criteria, such as being located in an area with fewer than 100,000 inhabitants; municipalities or EPCIs composed mainly of rural communities; and other communities subject to their validation by the Region.

The collective digitalisation path is composed of two components, supported by the Chamber of Commerce and Industry of Grand Est (CCI Grand Est): 1) the design of the action to support business digitalisation, and 2) the adoption of online platforms. Under component 1), the CCI Grand Est supports the local actor to design the action according to the needs of the territory and its business

structure. Four steps are foreseen: a diagnosis, to enable local actors to define their digital strategy for business development; actions for businesses awareness and engagement; collective workshops aimed at presenting new digital tools; and a feasibility study to identify the commercial potential, the operational model and the governance of an online platform. The local actors' efforts for this component are co-funded at 80%, with a maximum amount of €50,000 per local actor. Component 2) focuses on the assistance to buy digital solutions needed to implement cooperative or collective purchasing platforms, marketplaces, commercial platforms, or reservation platforms. The costs for digital solutions are co-funded at 50%, with a maximum amount of €20,000.

Requests for the collective digitalisation path are addressed to the Region and assessed by a technical committee. Criteria for assessment include the coherence and the strategic and operational approach of the joint action, the type of support requested by the local actors and the alignment with regional policies. For the component related to the platform, assessment criteria include the robustness of the economic model; the coherence with the needs of the territory and its business community; and the existence of a critical mass of businesses in the sector and area of interest.

Changes induced by the COVID-19 crisis

The 'Business Act Grand Est' 2020-2025 for the social, economic and environmental recovery of the region has been designed as a structural response to the COVID-19 crisis. Since its adoption in July 2020, digital transformation has been considered as a driver for the boosting of the regional economy. The Digital Transformation programme makes this driver operational by specifically addressing SMEs' needs.

Key evidence

⏩ **The spontaneous digital transformation of SMEs is limited without professional support**. Awareness/knowledge sharing actions on what is needed and on which options are available to address needs require the input of experts in the business and trade domain (such as chambers of commerce) and in digital solutions (such as ICT providers/suppliers).

⏩ **Rural areas and specific sectors require targeted support.** In order to address this challenge, the Digital Transformation programme provides two solutions that complement each other. On one side SMEs belonging to trade and craft, tourism and agriculture, including wineries, benefit from an individual digitalisation path sustained by vouchers; on the other side, communities in rural areas can pull SMEs' presence online by undertaking collective digitalisation paths.

⏩ **The digital maturity assessment of SMEs is a precondition** for defining a digital deployment plan. Within the digital deployment plan, the relevance of the specific SME's digitalisation needs is essential for determining the amount of the requested grant.

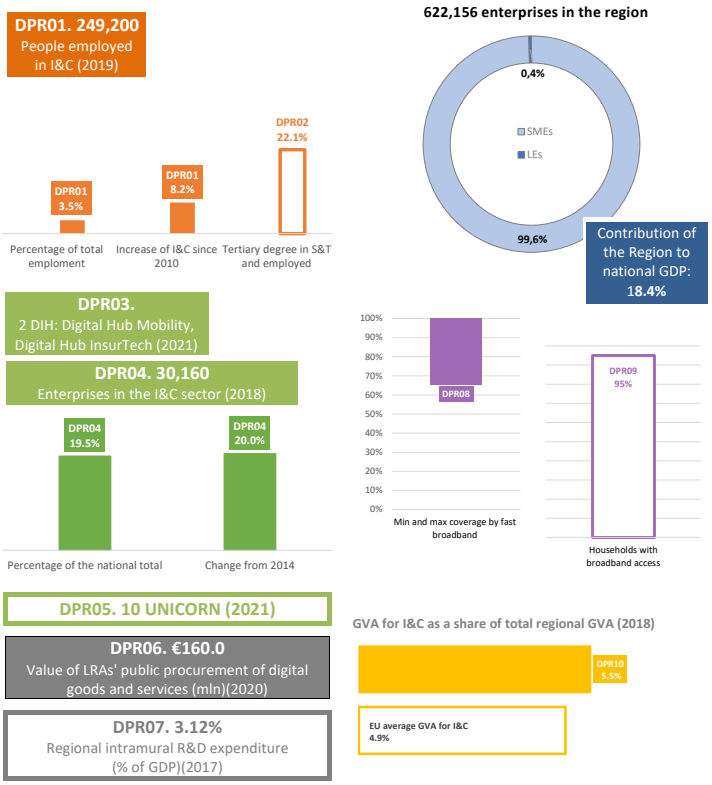
⏩ **The adoption of local digital platforms for raising the online presence of business communities in rural areas** is seen as a key instrument to boost commercial opportunities, attractiveness and visibility of the territory. These interventions are led by local institutional actors such as EPCIs or municipalities.

Case 2.3 Bayern, Germany

Digitalisation of SMEs under the Bayern Digital II initiative

Bayern Digital is an initiative of the regional government through which €6 billion will be invested in the digitalisation of the region from 2015 to 2022. After Bayern Digital I, the Bavarian government has defined in the Bayern Digital II its ten digitalisation goals for the period 2018-2022. Bayern Digital II is an investment programme addressed to the whole society and economy which, since its inception, has prioritised the digital transformation of SMEs.

Where does the region stand in our digital preparedness framework?



Bayern (DE2) has over 13 million inhabitants and more than 620,000 enterprises. It contributes to some 18% of the national GDP.

The region is a leader for high technology fields and has a very high number of I&C companies (30,160, increased by 20% over a five-year period). The I&C sector employs 250,000 and has a GVA (5.5%) well above the EU average (4.9%). In May 2021, the region counted 10 unicorns. Its intramural R&D expenditure is high (3.1% of GDP) but the share of people graduated and employed in S&T is moderate (22.1%). On average, NGA connectivity is good. In 2020, public procurement for digital goods and services by regional and local authorities was impressive (€160 million).

Note: as data for enterprises are not available on Eurostat, the source is the Regional Innovation Monitor Plus profile for Bavaria.

Context

The Bayern Digital II investment programme was adopted by the state government on 30 May 2017. Originally, it was allocated a budget of €3 billion to support the following ten initiatives over a period of five years (State of Bayern website): creating the digital infrastructure for Gigabit connectivity (WLAN hotspots and boost of 5G); becoming an IT security centre; setting new standards in digital education, including the introduction in all schools of computer sciences and information technologies as compulsory subjects; building the digital

competencies of academics in digital core disciplines; strengthening the digital skills of regional SMEs through funding, training and networking opportunities; tackling new fields of digital technologies and application such as AI, robotics, and 3D printing, including through the strengthening of the Centre for Digitalisation of Bavaria (ZD.B); becoming a leader in intelligent digital mobility; becoming a leader in digital medicine and care; digitalising the public administration; and putting people at the centre of digitalisation. The investment programme diversified even more when, in 2019, the regional government approved a Hightech Agenda Plus which put forward a further €2 billion investment up to 2024. In 2020, the new agenda was capped with additional €900 million.

The region's economy is heavily focused on the automotive sector which is mainly populated in its various supply chains by SMEs. This explains the priority given by regional authorities to the digitalisation of this group of economic operators. Still, under the Bayern Digital initiative, support is not limited to SMEs of the automotive sector and actually there are measures which focus on other sectors such as retail and tourism.

Description

The package of measures designed for SMEs under the Bayern Digital initiative include funding, networking, and training initiatives. The **digital bonus funding programme** is a well-functioning funding scheme to support the digitalisation of smaller enterprises. The first edition of the programme ran from 2016 to 2019. After its positive evaluation, the programme was renewed in 2020 for three additional years, i.e. up to the end of 2023. The digital bonus provides grants for the digital transformation of **small enterprises**, i.e. companies with fewer than 50 employees and an annual turnover below €10 million (digital bonus website). Funding is provided for the introduction, development or improvement of digital products, processes and services (area 1); or for the introduction or improvement of IT security aspects (area 2).

There are two types of digital bonus: a standard bonus, equivalent to a grant of up to €10,000 and 50% of the eligible costs, which may be required for each of the two eligible areas (e.g. the optimisation of company processes); and a 'plus' bonus, equivalent to a grant of up to €50,000 and 50% of the eligible costs, which may be required for an innovative intervention (e.g. transformation of the business model) in only one of the two eligible areas.

In its first phase (2016-2019), the programme received a total of 10,800 applications, the majority of which were from companies in rural areas. All sectors were covered, from industry to trade, services, tourism and handicraft. Against a total release of €120 million in grants, €380 million of investments were raised. In fact, '*37 percent of the companies have invested two to three times the*

amount of funding, 22 percent three to five times and eleven percent even more than five times'; in terms of impact, according to participating companies' self-assessment '*Around 39 percent of companies have digitized their internal processes through the digital bonus, around 31 percent have improved IT security and around 30 percent have digitized their products or services*' (Bayern Region press release dated 24/07/19). When the digital bonus was renewed in 2020, applications had increased to 18,000, granted amounts to €180 million and corresponding investments to €600 million (Bayern Region press release dated 07/10/20).

In its second phase, the digital bonus is allocated €60 million annually. It is administered by the district governments to which SMEs address their online application. The digital bonus website includes a 'success stories' page where examples of grants' use made by companies are described to inspire ideas.

Another type of financial support addressed to all SMEs with fewer than 250 employees and less than €50 million annual turnover is the **innovation loan 4.0**. Loans are provided at favourable conditions by the LfA Förderbank Bayern. Besides innovative projects, **loans are given to support digitalisation projects related to processes, products and strategy/organisation**. The loan goes from a minimum of €25,000 to a maximum of €7.5 million and may finance up to 100% of the eligible costs (LfA Förderbank Bayern website).

Under the Bayern Digital initiative, the Centre for Digitalisation of Bavaria (ZD.B), founded in 2016, is a flagship project to **promote collaboration and dialogue between business and knowledge organisations (industry, research institutes, universities) on digitalisation topics**. Cooperation is pursued by means of topic-specific platforms which accelerate the transfer of knowledge, networking and partnering with a view to scout new emerging digital technologies and initiate digitalisation projects (ZD.B website). For example, one of these **business-oriented ZD.B topic platforms** relates to 'Digital Production & Engineering'. Since April 2020, these platforms became part of Bayern Innovativ GmbH, a '*knowledge manager, initiator and accelerator of innovations*' whose primary goal '*is to support SMEs in promoting innovative digitalisation projects*' (Bayern Innovativ website). The company's sole shareholder is LfA Förderbank Bayern while the regional government chairs the Supervisory Board.

Bayern Digital also provides **sector-specific measures**. An example is the model project '**Digital Shopping City'**, where **retailers** and applicant municipalities go through a process of digitalisation and adoption of digital tools in order to transform the way the city's shopping is done. This model project was implemented beginning in 2015 and started its fourth edition in 2021 (Digital Shopping City webpage). Another example of sectorial support is found in the

tourism sector. The model project 'Digital Village', originally piloted to address challenges faced by villages in rural and alpine areas, is developing a thematic focus on tourism. Tourism is also addressed in the pilot 'Bayern Cloud in tourism' which is expected to develop a central data hub on tourist information that may support the development of new business models for tourism companies.

In addition to the above measures, the Region also promotes digital education through the use of **intensive SME-centred approaches where learning and practice are mixed**. This type of training/practice is provided in a digital business lab environment. In this lab, the Region, as part of its support for the digital transformation of SMEs, finances the development of new business models and products for SMEs up to the validation stage. In a second stage of its journey, the SME develops its prototype into a marketable Minimum Viable Product.

More traditional training and vocational training opportunities are also available for funding, for example under the ESF.

Changes induced by the COVID-19 crisis

LfA Förderbank Bayern made new funding instruments available for SMEs because of the coronavirus but not specifically within the framework of Digital Bayern. In general, no major changes/acceleration of the Digital Bayern initiative were determined by the COVID-19 crisis.

Key evidence

⏩ The success of the digital bonus is demonstrated by its wide outreach capacity across sectors and types of enterprises, including rural ones.

⏩ The Region is making an impressive investment in digitalisation. Apart from the impact on its business community, it can expect to substantially increase its attractiveness as a location for new companies.

⏩ Digital public funding is essential for those SMEs that do not access the capital markets. Differentiating financial instruments according to the size of the SME allows widening the audience of beneficiaries.

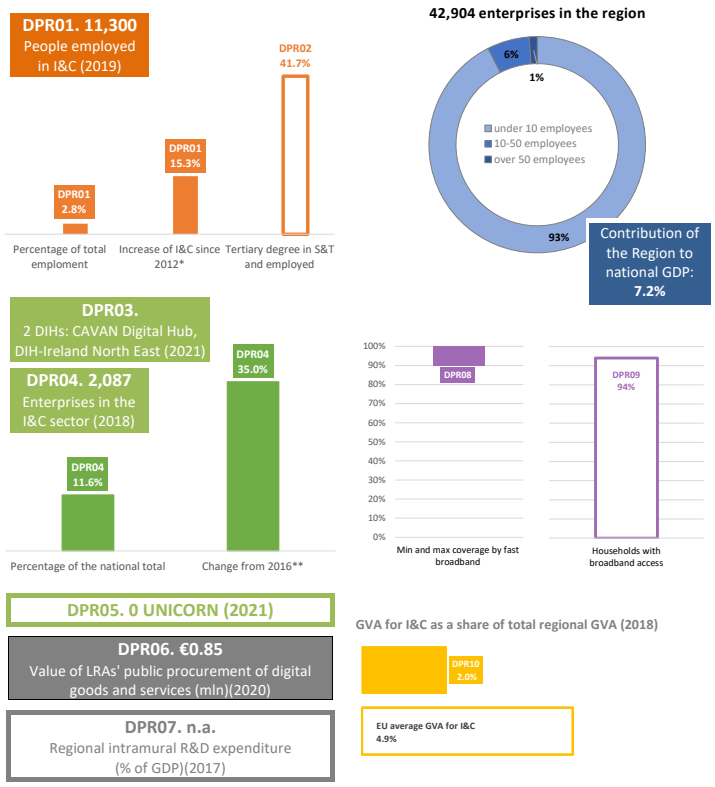
⏩ The Region offers both simple and complex instruments to facilitate the digitalisation of SMEs, from small grants to digital innovation labs for training and mentoring purposes and networking platforms for cooperative projects. This wide offer increases the outreach capacity of the Region to very diverse SMEs.

Case 2.4 Northern and Western, Ireland

NWRA's action plan for SMEs' digitalisation and investment in innovation and new technologies

As a result of its participation in the Interreg project DEVISE ('Digital tech SMEs at the service of Regional Smart Specialisation Strategies'), the Northern and Western Regional Assembly (NWRA), in liaison with other regional and national stakeholders, prepared an Action Plan to fit the support to SMEs' digitalisation in the forthcoming 2021-2027 Regional Operation Programme.

Where does the region stand in our digital preparedness framework?



Northern and Western Ireland (IE04) has about 877,000 inhabitants and almost 43,000 enterprises. It contributes to 7.2% of the national GDP.

The region has a modest number of I&C companies (2,087) but they grew importantly (+35%) over a five-year period. The I&C sector employs 11,300 people and has a GVA (2.0%) well below the EU average (4.9%). In May 2021, no unicorn was located in the region. The share of people graduated and employed in S&T is very high (41.7%). On average, NGA connectivity is good. In 2020, public procurement for digital goods and services by regional and local authorities was low (€0.85 million).

** Data for 2010 are missing.*
*** Data for 2014 are missing.*
Note: as data for enterprises are not available on Eurostat, the source is NRWA (2018).

Context

The DEVISE project runs over a 4-year period (2018-2022) with a budget of €1.6 million. Its objective is to **transfer the technology made available by ICT businesses into industry sectors** that are relevant to the smart specialisation strategy of the project's target regions. The project's partnership covers eight EU countries where ten regional enabling environments for SMEs' digitalisation will be developed **through the improvement of policy instruments**. Within the framework of DEVISE, the NRWA decided to develop an Action Plan for the

digitalisation of SMEs to be pursued in the forthcoming 2021-2027 Regional Operation Programme.

In January 2020, the NWRA adopted its Regional Spatial & Economic Strategy (RSES). This document, which sets the core of the Region's policy for its medium- to long-term (2020-2032) development, recognises the opportunities created by new technological developments and disruptive technologies, but also acknowledges the need to assess the impact that new ways of doing business, manufacturing products and making decisions will have on traditional business and jobs (NWRA, 2021; NWRA, 2018). Other framing polices which were considered by the Region in the preparation of its Action Plan include (NWRA, 2021):

- The North West Regional Enterprise Plan. This plan is aligned to the DEVISE project in its Strategic Objective 6 under which digital and technology-based SMEs are expected to enable digitalisation in other non-tech regional SMEs.
- Local Digital Strategies which are meant, among other objectives, to implement the National Broadband Plan and to foster the digital economy, the digitalisation of enterprises and of the public sector, and the development of digital skills.
- The needs analysis for ERDF/ESF+ Operational Programmes 2021-2027, which highlights the importance of investing not only in digital infrastructure but also in digital skills, including to avoid the social exclusion of individuals.
- The national Industry 4.0 Strategy 2020-2025, which puts SMEs at the core of the process of tackling innovation-led competitiveness in manufacturing.

A 2019 EIB study highlights how digitalisation is occurring at two different speeds in Ireland; if the country performs relatively well in terms of DESI index, digitalisation seems to primarily concern foreign-owned multinationals rather than traditional indigenous SMEs (EIB, 2019). The EIB study also found that **lack of knowledge about digital opportunities**, **lack of technical know-how** and **financing issues** are the main barriers to the digitalisation of SMEs. The NWRA reached the same conclusions as part of an analysis carried out to inform the preparation of the Action Plan on the needs and challenges faced by SMEs, and microenterprises in particular, in undertaking a digital transformation. In addition, the NWRA's analysis highlights the need for SMEs to have a **digital diagnostic capacity available** and to **increase B2B networking in order to create awareness of current technologies and of ICT businesses**.

Box 2. Survey on Irish SMEs by Vodafone Ireland

A survey conducted by Vodafone Ireland on a sample of 500 Irish SMEs to investigate, among other aspects, the role of technology and of digitalisation during the pandemic, confirms that the cost of investment in digital infrastructure is the major barrier (42%) for those SMEs that declared themselves willing to invest in digital technologies and transformation (51% of the total). Other barriers include problems related to the integration of new technologies in the existing systems (37%), and to the selection of the right supplier of technologies/services (35%). The survey also confirms the importance given by SMEs to digital skills, with almost 50% of the surveyed SMEs planning to invest in digital skills training and development of their employees. This share is higher (65%) if larger SMEs (50-250 employees) are considered. COVID-19 induced changes were primarily related to new technology for communicating with customers (42% of the SMEs) and for opening up digital channels for marketing (40%). Instead, only 25% of the SMEs reported having shifted to remote working and these were for the most part urban-based SMEs. Interestingly, among the rural enterprises that actually shifted to remote working, 70% of them declared that remote working implied more precarious working conditions.

Source: Vodafone Ireland (2020).

Description

The Action Plan includes three main actions. The first aims to have specific support for the digital transformation of SMEs included in the new regional operational programme. The second focuses on the design and development of an online Digital Maturity Assessment Tool for SMEs. The third aims to drive innovation and digitalisation in indigenous manufacturing SMEs in the region, in line with key national and regional policies and strategies.

Action 1. At the time of writing, Irish operational programmes 2021-2027 for ERDF and ESF+ are not yet publicly available. Whereas the other two Irish regions are classified as ‘more developed’, the NWR is designated as a ‘region in transition’ in the new programming period. As such, it will have its own Operational Programme (the other two Irish regions will share a joint OP) and the OP will be managed by the NRWA. The Region’s submission on the Partnership Agreement 2021-2027 refers to digitalisation as a horizontal topic that touches upon the areas of digital access, broadband deployment, smart specialisation, adoption of digital technologies, and attraction of businesses and industries working in the digital economy and creative industries. According to the Action Plan, the OP should include specific SME digitalisation measures in the target sectors of manufacturing, engineering and marine (NRWA, 2021).

Action 2. This action is a pilot supported through Interreg funding to develop an online digital maturity assessment tool. The tool will be common to three countries (Ireland, Spain and Bulgaria) as it will be developed jointly by three partners of the DEVISE project. Each partner will involve 50 SMEs in the pilot. The tool is a diagnostic instrument for traditional SMEs from low-tech industries/sectors. It is meant to understand their needs for digital transformation,

asses their maturity across eight dimensions (strategy, culture, organisation, processes, technology, risk, innovation, customers and partners) and produce a personalised guide for a digital vision and digitalisation plan (NRWA, 2021). This tool has been inspired by the 'Industry 4.0 Technology Audits' developed by the Regional Government of Cantabria.

Action 3. The aim of this action is to facilitate the understanding by SMEs of the type of digital/innovation journey that fits their needs and of the way it is implementable in each SME. This is pursued by creating a 'digital collaboration platform'. The platform is a meeting point between SMEs willing to innovate and technology-based businesses that will explain, demonstrate and offer available digital and technological solutions/products to SMEs. The information developed under Action 2 will be used to match SMEs with a specialist technology provider. Technology providers will be regional ICT firms with expertise in areas such as ERP, CRM, robotics, smart automation, digital fabrication, VR, AR, AI, IoT, Big Data, cloud and virtual office (NRWA, 2021).

Whereas NRWA is a project partner, the DEVISE project is led by ERNACT, the European Regions Network for the Application of Communications Technology. ERNACT developed an action plan for the Border Irish region (which is now part of the Northern and Western Region) which has the same overall goal of developing collaboration services between SMEs and technology providers. Still, the focus of this action plan is on linking existing innovation hubs with regional universities and institutes of technology across the Border and West regions. Target SMEs are from the manufacturing sector. Innovation hubs will play the role of promoting services to their business clients, of assessing each SME's situation and contacting the most appropriate technology providers. The latter will provide their expertise and consultancy services through cloud-based collaboration tools in order to source solutions for further implementation at the SMEs' level (ERNACT, 2021).

Changes induced by the COVID-19 crisis

The DEVISE project started before the COVID-19 crisis and will end in 2022. Since its scope is increasing the competitiveness and innovation level of SMEs, the project is by design appropriate '*to address the twin threats of Brexit and Covid-19*' (DEVISE webpage).

Key evidence

⏩ It is important to assess the impact that new ways of doing business, manufacturing products, and making decisions will have on traditional business and jobs.

⏩ Investment in digital skills is the way to avoid loss of jobs due to digital transformation.

⏩ Lack of knowledge of opportunities created by digital technologies and financing aspects are two of the major barriers to SMEs' digital transformation.

⏩ There seems to be a distinction between rural and urban SMEs in the appreciation of remote working modalities. This may imply the existence of different challenges and/or barriers to digital transformation faced by urban and rural SMEs that may need further investigation and understanding.

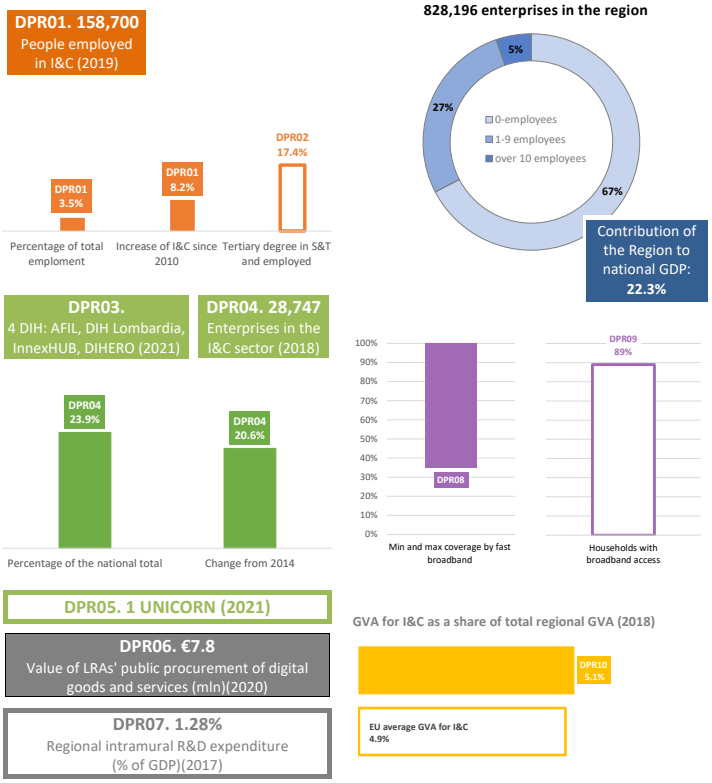
⏩ The core of the regional authority's approach is to create collaborative environments where technology and digital services providers are used to make strategic sectors businesses aware of these solutions/products. This in turn creates an advantage for the providers as it opens new markets to them. In practice, competitiveness and digitalisation of SMEs is improved using Digital Innovation as a Service (DIaaS).

Case 2.5 Lombardia, Italy

The joint post-emergency 2021 Action Plan of the Lombardia Region and of the regional chambers of commerce

Within the multi-year institutional agreement on regional economic development and competitiveness (2019-2022), the Lombardia Region and the regional chambers of commerce agreed on a 2021 Action Plan to fight the consequences of the COVID-19 pandemic. The Plan consists of actions related to business digitalisation, including two recently launched calls for regional micro-, small and medium-sized enterprises (MSMEs) which total a financial contribution of over €11 million.

Where does the region stand in our digital preparedness framework?



Lombardia (ITC4) has about 10 million inhabitants and more than 800,000 enterprises. It contributes to over 22% of the national GDP.

The region has a very high number of I&C enterprises (28,747), which has increased by 20.6% since 2014. The GVA for I&C (5.1%) is comparable to the EU average (4.9%). As at May 2001, one unicorn is located in the region. The share of people graduated and employed in S&T is modest (17.4%). The regional intramural R&D expenditure (1.28% of GDP) remains a weakness. On average, NGA connectivity is modest. In 2020, public procurement for digital goods and services by regional and local authorities was also modest (€7.8 million).

Context

Adopted in 2018, the Lombardia Region's 'Strategic Programme for Simplification and Digital Transformation' aims to simplify and innovate the interaction of the public administration with citizens, businesses and local authorities through the use of digital technologies. The Region's main challenges are to govern and regulate the use of these technologies for the provision of quality and resource-efficient digital services by all public entities. Ten strategic intervention lines aim at guiding this process: digital communication and access

to services; application programming interface (API) and interoperability; regulatory compliance; competence centres; digital functioning of organisations; innovative ICTs; information assets; advanced data analysis; networks and infrastructures; and security and privacy. The **Three-Year Digital Transformation Plan** (PTTD) **2021-2023** approved by the Region in November 2020 (Lombardia Region webpage) details 30 interventions for activating more digital services and concrete tools for the simplification and innovation of the public administration. Enterprises are targeted in most of the interventions, including those related to the sharing and reusing of data and to the improvement of access to services for business.

In addition, the Lombardia Region has taken a proactive role in facilitating a digital ecosystem for business by connecting competencies and expertise with resources, including financial ones. Since 2006, the Region has had an institutional agreement with the regional system of chambers of commerce, comprising the nine chambers of commerce in the region and their regional association ('Unioncamere Lombardia'), which is renewed regularly and aims at improving the **economic development and competitiveness** of the region. The multi-year institutional agreement 2019-2023 on regional economic development and competitiveness **sets the basis** for joint actions according to three axes: Axis 1 – Business competitiveness; Axis 2 – Attractiveness of territories; and Axis 3 – Human capital, entrepreneurship and administrative simplification. Implementation is through annual action plans, in which financial allocations are defined for each intervention. The 2021 Action Plan **focuses on digitalisation and digital transformation to fight the consequences of the COVID-19 pandemic.**

Description

Within the 2021 Action Plan, actions foreseen under Axis 1 – Business competitiveness were designed according to *'a model of technological-digital development oriented towards quality and sustainability and the adoption of new solutions in response to containment of the COVID-19 epidemic.'* Among them are: the consolidation of the results achieved by PIDs (i.e. 'Punto Impresa Digitali', the digital business points of the chambers of commerce) in providing training, guidance and assistance to businesses on technological (e.g. AI) and organisational (e.g. new business models) aspects; and the 'Digital Business' action to leverage on digital technologies for the creation of new business, and the enhancement of existing ones and/or the increase of market opportunities.

The **'Digital Business' action** is promoted in collaboration with Unioncamere Lombardia. Approved by the Regional Council on 26 April 2021, it makes a total financial endowment of €11.7 million available for digitalisation, e-commerce and innovation of regional MSMEs by means of open calls, namely the 'Digital

Voucher I4.0 Lombardia 2021' call and the 'E-commerce' call. The two calls of the 'Digital Business' action have as reference the Communication about the *'Temporary Framework for State aid measures to support the economy in the current COVID-19 outbreak'* COM (2020) 1863 final.

Both calls provide for grants for two types of interventions. Micro interventions are specifically addressed to microenterprises; against a minimum investment of €4,000, the grant provides a 70% contribution to eligible expenses up to a maximum of €5,000. Small-medium interventions are addressed to microenterprises and SMEs; the minimum investment for enterprises is €10,000, and the grant provides a 50% contribution to eligible expenses up to €15,000.

The **'Digital Vouchers I4.0 Lombardia 2021'** are addressed to regional MSMEs that intend to: a) collaborate with each other and with highly qualified entities to adopt I4.0 technologies, favouring both the sharing of technologies and the implementation of 'business 4.0' projects that highlight the advantages of the new technological paradigm for businesses; b) promote services or solutions focused on new skills and digital technologies in line with the implementation of the National Transition Plan 4.0 (2019-2020); c) favour digitalisation and automation interventions functional to business continuity during the COVID-19 crisis and in the post-emergency phase; and d) encourage green-oriented business models based on products or services with lower environmental and social impacts. The overall budget allocated to the call is €7.18 million. It comes from the Region (50%) and from the nine chambers of commerce of the region (50%). Among the eligible expenses are technologies related to digital innovation 4.0 (their design, planning and adoption) and consultancy services and training provided by qualified service providers (Box 3). The call was open for a period of one month during May-June 2021 and followed the principle of first come, first served.

Box 3. Categories of qualified service providers for digital innovation 4.0

Qualified service providers must fall into one of the following categories:

- Digital Innovation Hubs and Digital Ecosystems for Innovation referred to in the National Plan for Enterprises 4.0 adopted in July 2020 (also through their territorial units);
- research and technology transfer centres, competence centres referred to in the National Plan for Enterprises 4.0, science and technology parks, innovation centres, technopoles, technology clusters and other structures for technology transfer, accredited or recognised at the regional or national level;
- certified incubators as defined by Italian Law and accredited regional incubators;
- fablabs, defined as centres equipped for digital manufacturing that comply with the international requirements defined in the FabLab Charter;
- technology transfer centres on Industry 4.0 topics as defined by the Italian Ministry of Economic Development;
- innovative start-ups and Higher Technical Institutes, as defined by Italian Law;
- large enterprises, i.e. with more than 250 employees, with an annual turnover that exceeds €50 million or whose annual total balance sheet exceeds €43 million;

- suppliers registered in the 'List of I4.0 service and technology providers' available online on the Digital Experience Center portal.

Source: the 'Digital Voucher I4.0 Lombardia 2021' call.

Enterprises applying for vouchers are requested to submit their **digital maturity self-assessment report.** The digital business points of the chambers of commerce make two digital maturity assessment tools available: an online questionnaire proving the enterprise's positioning with respect to its production processes (i.e. SELFI4.0), or interviews with the ad-hoc Digital Promoter of the chambers of commerce (i.e. ZOOM4.0).

The **'E-commerce'** call is addressed to regional MSMEs interested in developing and in consolidating their position on the national and/or international market through an online commercial channel. Grants are available for using online ecommerce channels provided by third parties or developed within the enterprises' own websites. The overall budget allocated to the call is €4.52 million. More than half of the budget (54%) is contributed by the Region (€1.87 million from the Directorate General for Economic Development and €575,000 from the Directorate General for Tourism, Territorial Marketing and Fashion); the remaining (€2.07 million) is contributed by the regions' chambers of commerce. Also in this case, the call was open for a period of one month during May-June 2021 and followed the principle of first come, first served.

Changes induced by the COVID-19 crisis

The 2021 Action Plan defined within the multi-year institutional agreement 2019-2023 **focuses on interventions that support the recovery of the regional production system further to the COVID-19 crisis**. It is therefore a digitalisation intervention boosted by the pandemic situation.

The 'Digital Voucher I4.0 Lombardia 2021' specifically pursues the adoption by regional *MSMEs* of '*digital technological solutions for automating the production and digitising commercial channels in line with social distancing prescriptions dictated by the containment measures related to the COVID-19 health emergency'*, and of '*solutions for smart working and teleworking.'*

Key evidence

⏩ The **Region re-oriented the scope of an already existing instrument** which was **originally** aimed at generally tackling economic development and competitiveness towards the digital transformation of MSMEs. **This enabled a prompt reaction to fight the consequences of the COVID-19 crisis.**

⏩ The ‘Digital business’ action was intended as a **digital transformation budgetary boost** for MSMEs. **Grants of two different sizes** (i.e. micro and small-medium) aimed at **favouring outreach to microenterprises**.

⏩ Initiatives for digital transformation of enterprises co-funded by the regional authority and by the chambers of commerce led to a **medium-term sustainable approach with positive externalities on business and on the society**.

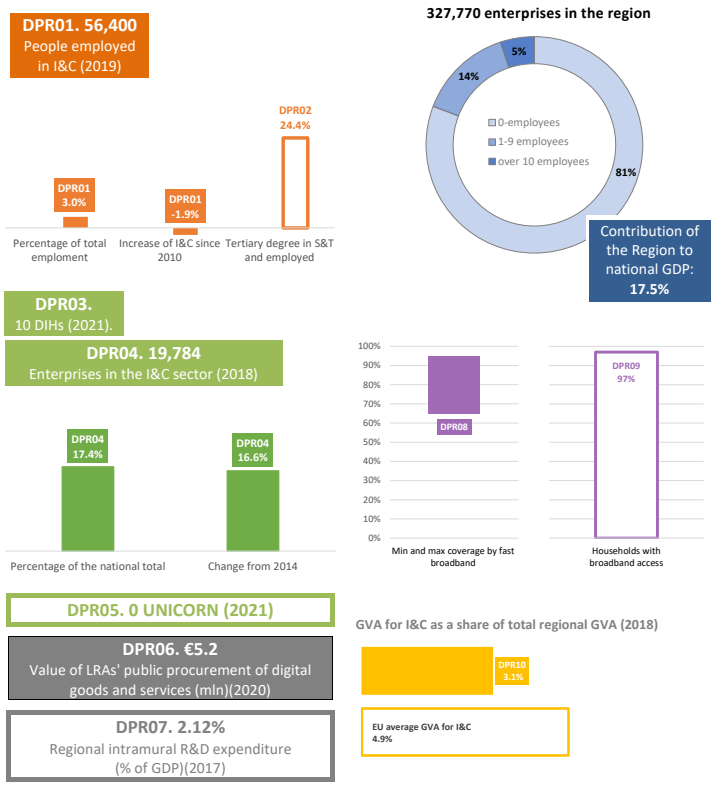
⏩ **MSMEs applying for digital vouchers are required to become aware** of their **digital maturity either through** a self-assessment tool or an interview. This prerequisite allows MSMEs to submit applications which are more focused on their actual needs.

Case 2.6 Oost-Nederland, the Netherlands

The DigiPro Project - Supporting SMEs' digital transformation through cross-border cooperation

DigiPro is an ambitious project co-funded through the Interreg VA programme Deutschland-Nederland. It is led by Oost NL, the Dutch development agency for Oost-Nederland, and joined by Euregio Rhein-Waal, which is the joint secretariat for the Interreg VA, and partners from Oost-Nederland, Zuid Nederland, and Nordrhein-Westfalen. DigiPro supports the digital transformation of production processes and products by leveraging on the innovation potential of Dutch and German SMEs.

Where does the region stand in our digital preparedness framework?



Oost-Nederland (NL2) has about 3.6 million inhabitants and almost 330,000 enterprises. It contributes to over 17.5% of the national GDP.

The region has a high number of I&C companies (19,784) that grew fairly (+16.6%) since 2014. The I&C sector employs 56,400 people but has a modest GVA (3.1%), well below the EU average (4.9%). In May 2021, no unicorn was located in the region. The share of people graduated and employed in S&T is good (25%). NGA connectivity is also good. In 2020, public procurement for digital goods and services by regional and local authorities was modest (€5.2 million).

Context

There is a long-standing cooperation between the Netherlands and Germany (about 50 years). The German-Dutch border region is supported through the 2014-2020 Programme Interreg VA. Financial contribution to this cooperation has totalled some €222 million made available from the ERDF (EC Interreg website). An analogous size of co-funding has been allocated by the participating national ministries, provinces and other regional and local organisations. Programme Interreg VA Deutschland-Nederland tackles two main priorities: increasing the region's competitiveness while facilitating its transition to a low-carbon economy,

and enhancing the regions' cohesion by facilitating cross-border cooperation between citizens, companies and institutions (EC Interreg website).

DigiPro, funded under the Programme, is fully aligned with these two priorities. Started in May 2017 and to be completed in October 2021, the project has a total budget of over €10 million, which is almost equally contributed to by the ERDF on one side (48%), and by the Dutch Ministry of Economic Affairs and Climate, by the provinces of Gelderland, Limburg and Noord-Brabant and by the government of Nordrhein-Westfalen on the other side (52%) (DigiPro keep.eu fact-sheet).

Oost NL, the Dutch developed agency for Oost-Nederland, is the leader of DigiPro. Partners include the Euregio Rijn-Waal[6], the Gelderland Regional Center for Technology (RCT Gelderland), the regional development and investment agency for Limburg (LIOF), the intermunicipal economic development company of the municipalities of Moers, Kamp-Lintfort, Neukirchen-Vluyn and Rheinberg (Wir4 AöR), the 'Huis van de Brabantse Kempen', the Niederrheinische Chamber of Commerce and Industry Duisburg-Wesel-Kleve (IHK Niederrhein), the Mobile Communication Cluster (MCC), and the Institute for Business Process Management and IT (GEMIT) of the Niederrhein University of Applied Sciences in Mönchengladbach (DigiPro website).

Even for the innovative SMEs of Oost-Nederland, digitalisation is a challenging task. In 2019, Oost NL carried out a study on the ICT sector in Oost-Nederland that highlighted opportunities, barriers and needs. The study concluded that: the ICT sector is relevant to Oost-Nederland as it has an economic impact; currently the focus is on hardware but software development may open new business development opportunities; among the challenges related to the ICT sector are the need for high-quality knowledge, talent and collaboration; the attractive business climate of Oost-Nederland is not sufficiently used to enlarge the sector and attract talent; and digital transformation is fast and SMEs have difficulties in following changes (Oost NL webpage on digitalisation). Oost-Nederland is indeed a well-endowed land in terms of digitalisation, as evidently demonstrated by the number of Digital Innovation Hubs (DIHs) that are located there: 10, the majority of which are in the field of Industry 4.0. Digitisation and Robotisation (e.g. automation, AI, IoT, cybersecurity) is one of the five socio-economic transitions in the Smart Specialisation Strategy 2021-2027 that the Region is successfully tackling even though the business community is experiencing some obstacles in order to actively follow (Technopolis, 2020). If enterprises in Oost-Nederland score well

[6] Euregio Rhein-Waal is a Dutch-German public body with some 55 affiliated municipalities and regional authorities of the two countries whose aim is to improve and intensify socio-economic cross-border cooperation.

in terms of digitalisation, attention is paid by the Region to the development of new business models such as gamification and the application of blockchain.

Description

New technologies and digital transformation are opportunities for SMEs that intend to face new challenges through innovation. Digipro is *'a springboard to the realisation of intelligent products, production processes and business models'* (DigiPro website). Digipro is addressed to SMEs that want **to (further) develop an innovative 'smart' product or process, to implement a 'risky' digitalisation idea which is different from already existing business processes, and that are open to international cooperation across the German-Dutch border**. DigiPro focuses on the areas of AI, sensors deployment, measurement and control technologies, internet and data network technologies, data recording and processing, control electronics and software, software/hardware for automation (DigiPro website).

The project provides experienced consultancy to SMEs, as well as competencies and financial support for each of the different stages of a digital transformation project. The support available for SMEs projects is structured into five modules: 1. Exploratory conversations; 2. In-depth conversations; 3. Concept development, with a 50% subsidy to projects of value up to €5,000 (maximum grant €2,500); 4. Feasibility study with a 40% subsidy to projects of value up to €20,000 (maximum grant €8,000); 5. Development of prototypes, processes and models with a 40% subsidy to projects of value up to €120,000 (maximum grant €48,000).

DigiPro also undertakes information meetings and workshops, coaching (with a maximum grant of €1,500 and max 50% of the eligible costs), clustering with other SMEs and knowledge institutions from the neighbouring country, exchange across the border between field labs and other shared facilities. An interactive dashboard, the Competencies Atlas, represents on a digital map all organisations involved or interested in cross-border cooperation projects, such as enterprises participating in other INTERREG programmes, shared facilities, service providers and network organisations. All the organisations in the Competencies Atlas can be filtered by key technology or sector.

At the end of 2020, DigiPro supported 352 enterprises, out of which more than 85% were SMEs, and funded 121 innovative projects. Examples of projects involving SMEs in Oost-Nederland include the creation of preventive air hygiene systems, the realisation of customised wheelchairs that optimise the seat for people with a physical disability through digital measurement, and the development of a tool based on a camera system able to measure the change in the bending process of steel plates and to identify the occurrence of cracks.

Changes induced by the COVID-19 crisis

In October 2020, three additional SMEs' projects were financially supported by Digipro. *'…due to the COVID-19 pandemic, some activities have not been able to take place. That is why, together with project management, we have explored the possibility of supporting a number of additional enterprises from the budget reserved for this.'* (Digipro news dated 23/11/20). Enterprises that had already successfully completed an economic and technical feasibility study, but that could no longer receive support due to budget exhaustion, were selected for the development phase of their innovation projects. For these projects the maximum project volume was €75,000 and the subsidy rate 40%.

Initially foreseen as a new programme 'Digipro Continued', extra-financial support to these SMEs' projects was provided within the current programme taking advantage also of the time extension granted from May 2021 to October 2021 due to the COVID-19 pandemic (Digipro news dated 23/11/20). Among these projects is that of Dombauhütte Xanten (DE), ISAVE Hochschule Düsseldorf (DE) and Opiliones Winterswijk (Gelderland - NL) on the application of digital sensors for the early detection and prevention of damages of historic windows (e.g. stained-glass windows in church buildings).

Key evidence

⏩ Innovative SMEs and SMEs which are already successful may also face challenges in their digital transformation.

⏩ The **projects supported by DigiPro match cross-border SMEs' digital transformation needs with approaches/technologies of other SMEs.** Digital transformation is intended as a bottom-up process that is facilitated by knowledge-sharing in a highly-interactive territory.

⏩ **Support for digital transformation is tailored to the actual needs of SMEs.** For this reason, DigiPro is organised into modules including subsidies for coaching, concept development and feasibility studies.

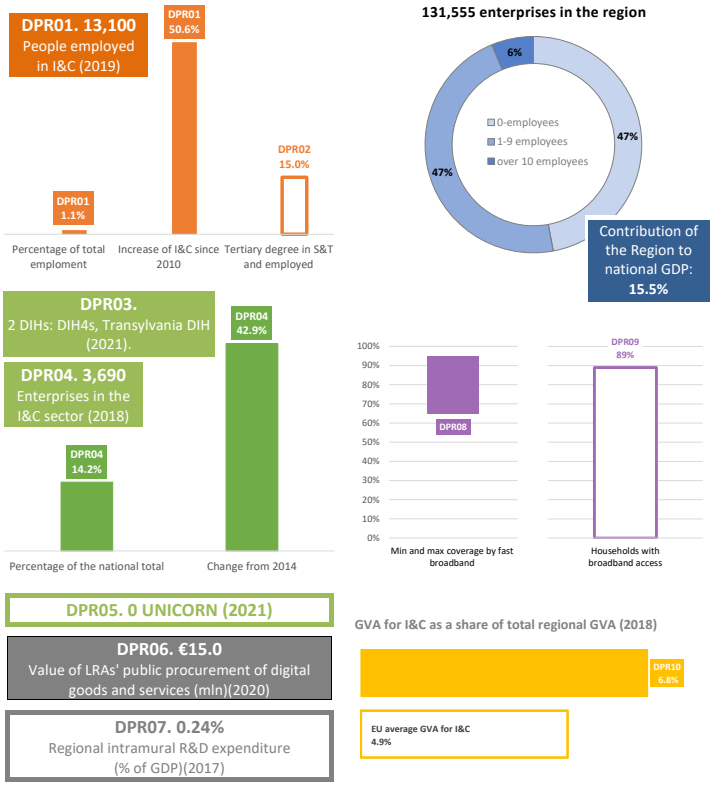
⏩ **The pandemic restrictions caused the concentration of resources on promising initiatives**. Limitations induced by the COVID-19 crisis generated budget savings in activities that were impossible to be realised in some projects. Savings were used to move implementation of already existing innovative projects forward.

Case 2.7 Nord-Vest, Romania

A Digital Innovation Hub for a regional digital innovation ecosystem

The headquarters of the DigitalInnovationHub4Society (DIH4S) are in Cluj-Napoca and its local offices are in the capital cities of each county. DIH4S acts as a node between digital solution providers and digital solution beneficiaries with a view to build a regional digital innovation ecosystem. It contributes to reinforcing the regional digitalisation ecosystem by fostering an integrated and structural digital transformation of major concerned actors: industry, largely represented by SMEs, and the local authorities.

Where does the region stand in our digital preparedness framework?



Nord-Vest (RO11) has some 2.5 million inhabitants and more than 130,000 enterprises. It contributes to approx.15% of the national GDP.

The region has a modest number of I&C companies (3,690) but their number grew importantly (+43%) over a five-year period. The I&C sector employs 13,100 people and has a very high GVA (6.8%), well above the EU average (4.9%). In May 2021, no unicorn was located in the region. The share of people graduated and employed in S&T is very low (15%). On average, NGA connectivity is good. In 2020, public procurement for digital goods and services by regional and local authorities was good (€15 million).

Context

The Nord-Vest Smart Specialisation Strategy (RIS3) 2021-2027 includes digital transformation and its Regional Digital Agenda as one of its three pillars (i.e. the III Pillar). The main objective is to favour the digitalisation of economy and society through the support of the ICT sector and of its innovative potential. Digital technologies are considered as a driving force that '*promotes the growth and development of all related industries, but can also contribute to increasing the quality of life and social inclusion of disadvantaged, marginalised groups.*' (Agenția de Dezvoltare Regională Nord-Vest, 2020). In addition, digital

transformation outcomes are expected to contribute to the other two pillars of the RIS3, namely *Pillar I - Innovation for health and well-being*, and *Pillar II - Development of emerging sectors*, and to their priorities. For example, within Pillar I, digital transformation takes a strategic role in processing agricultural products, promoting smart-agriculture, providing telemedicine solutions, and assisting vulnerable citizens such as the elderly or persons with disabilities.

In the last decade, the Nord-Vest Region has positioned itself strategically in most of the sectors related to ICT (i.e. software and IT services, custom software development activities, telecommunications, telecommunications activities through cable networks, hardware, manufacture of electronic subassemblies, manufacture of computers and peripheral equipment) ranking among the three top regions in Romania in terms of number of enterprises, turnover and number of employees. In 2018, the share of ICT enterprises in the region reached 15% of the national total, the share of employees in the ICT sector was 15% of the national total and the turnover of the ICT sector was almost 13% of the total ICT turnover in the country (in 2014, they were 14%, 13% and 10%, respectively). The best performers within the region were the Cluj and Bihor counties.

Cluj-Napoca also hosts the two clusters of the region, Cluj IT and the Transylvania IT Cluster. They are accredited technology transfer entities that contribute to a regional digital innovation ecosystem based on a quadruple helix approach. Their creation was promoted and supported by the Nord-Vest Regional Development Agency during the implementation of the Regional Innovation Strategy 2007-2013. Since an innovative ICT sector is characterised by a continuous stream of frontier knowledge, Cluj-Napoca has become the most attractive city given the role of its universities (i.e. the Babeș-Bolyai University, the Technical University of Cluj-Napoca) and public and private research centres in creating ICT high-skilled human capital (Agenția de Dezvoltare Regională Nord-Vest, 2020). Most of the innovative ICT enterprises are start-ups and/or micro-, small and medium-sized enterprises needing support and advice to grow.

The main goal of the Cluj IT is *'to create an ecosystem suitable for the development and manufacture of innovative software services and products, with high value-added, through close collaboration between the cluster's members, exchange of knowledge and ideas, public-private partnership and support of research – for the benefit of member organisations and with impact upon the society overall.'* (Cluj IT website). In 2017, the Cluj IT cluster established a Digital Innovation centre intending to *'act as an umbrella to bring together competencies of IT companies and research groups focused on digital technologies, AI, data science and industry 4.0 and prepare specialised services for non-IT private and public organisations on digitisation, digitalisation, digital innovation and digital transformation.'* (DIH4S website). Over time, other private

and public organisations joined this initiative. Among the first were the Technical University of Cluj-Napoca and the Chamber of Commerce and Industry Bistrita-Nasaud with the support of the Nord-Vest Regional Development Agency. In 2019, this four-actor partnership led to the establishment of the first DIH, the DigitalInnovationHub4Society (DIH4S), in the Nord-Vest Region of Romania as a not-for-profit organisation **to help enterprises and public administration to improve their competitiveness and effectiveness by adopting digital technologies.**

In May 2021, more than 40 organisations were partners of DIH4S: universities and R&D centres, digital solution providers and representatives of beneficiaries (e.g. the Chamber of Commerce and Industry Bistrita-Nasaud, the Chamber of Commerce and Industry Bihor, the Chamber of Commerce and Industry Salaj, the Chamber of Commerce, Industry and Agriculture Satu-Mare, the Association of Owners and Handcrafts Cluj, the Chamber of Commerce and Industry Brasov). In addition, the DIH is supported by local and regional authorities (e.g. the Nord-Vest Regional Development Agency, the Municipality of Bistrita, the Cluj County Council, the Municipality of Cluj-Napoca, the Municipality of Alba-Iulia) and by other national and international organisations (e.g. the National Cyber Security Incident Response Centre, the European Digital SME Alliance, the DIH Confindustria Emilia Romagna Ricerca, the Balkan, Black and Baltic Seas ICT Clusters Network, the ICT Cluster in Bulgaria).

Description

DIH4S has been designed around the concept that digital technologies contribute structurally to a smart, safe and sustainable society. The hub has a citizen-centred vision aimed at increasing the citizens' quality of life, through the smart and ethical use of the most advanced digital technologies (Emerging Europe, 2021). *'We look forward to the Nord-Vest region of Romania where all municipalities and county councils will adopt digitalisation at a large extend for better serving citizens and economic sector, and where the majority of SMEs and large organisations from the industrial sector will base their decision making and production processes on the support of deep integrated digital systems.'* (DIH4S website).

Its operational approach is **service-based**. Once the beneficiary and its technological needs are defined, applied projects are carried out through a large group of experts/digital solution providers in artificial intelligence (e.g. data science, machine learning, neuronal networks, natural language processing) and in smart robotics (e.g. social robotics, autonomous mobile robots, cloud robotics, robotic process automation). Cybersecurity, cloud computing and IoT are among the competencies of DIH4S.

DIH4S provides a range of services targeted to SMEs, large enterprises and public organisations (including local authorities, hospitals and education institutions) by adopting its **'8-D Digital Innovation Journey' model**. The model includes the following phases: 1. Discover. Targeting the customer's business to identify opportunities for digital innovations; 2. Define. Together with the customer, planning the steps for digitalisation and, if appropriate, digital transformation; 3. Develop. Structuring the solution following a mixed approach of design thinking, customer-oriented organisational paradigms, lean innovation and competitive engineering (i.e. a methodology called CALDET); 4. Delivery. Implementing the solution using a value engineering methodology detailing the value-for-money to the customer; 5. Deploy. Integrating the solution with the existing business processes; 6. Disseminate. Training users on the specific solutions and on additional opportunities of digital innovation; 7. Delegate. Assisting the customer to reorganise roles and operations to optimally fit with the adopted digital innovation; 8. Disrupt. Supporting the customer in rethinking its business model to exploit competitive advantage through digital innovation.

The service includes: a) **assistance to investing in digitalisation** through: workshops, webinars and seminars to raise awareness on digital transformation and on advanced digital technologies; assessment of digital maturity and digital innovation; auditing to optimise digitalisation strategies, plans and projects; demo events on digitalisation; pilot projects to test digitalisation opportunities; knowledge and technology transfer for digitalisation; b) **consultancy for digitalisation and digital transformation** in terms of: strategies; specific projects for management and for operational processes; integration, adaptation and customisation of digital technologies; enhancement of traditional services and products with digitalisation; redesign of business models and creation of value using digital solutions; c) **training to develop digital skills** for: executives and employees in SMEs or large companies from any industrial sector; and students and professionals in engineering, computer science, cybernetics, digital design not excluding high schools; d) **support in identifying funding opportunities for digitalisation** including assistance to prepare business plans, to access investors' networks and other relevant funding mechanisms such as structural funds; e) **networking to develop digital innovations** including assistance to find partners for digital innovations, to develop start-ups and to organise B2B events; f) **facilitation to access infrastructure for testing/developing digital solutions** including labs of members of the Cluj IT network.

Through research and innovation projects funded at the European level, DIH4S supports Cluj IT in addressing additional specific digital needs of SMEs. Examples are the GEIGER project (H2020) for cybersecurity issues, the IoT Tribe Space Endeavour project (H2020) to exploit digital opportunities of space technologies, the UFO project (H2020) to benefit from the innovative products

and services by integrating new technological solutions and know-how provided by Small Flying Objects.

Changes induced by the COVID-19 crisis

During the COVID-19, DIH4S services focused on the needs of the actors of the local health system. For example, a pilot telehealth system allowing remote medical control through a mobile device app (BidiCOV20 App) was implemented in partnership with the Cluj IT Cluster, the County Emergency Clinical Hospital and Spectator Company (from the Netherlands). DIH4S also facilitated the support of the ICT solution providers members of Cluj IT in developing a medical analysis report software for COVID-19 for the Research Centre for Functional Genomics, Biomedicine and Translational Medicine within the Iuliu Hatieganu University of Medicine and Pharmacy in Cluj-Napoca.

Key evidence

⏩ DIH4S has a **twofold objective towards the regional SMEs:** facilitate growth and competitiveness of ICT SMEs through the provision of solutions and services for digitalisation and digital transformation at the local level, and foster digital innovation adoption by SMEs in non-ICT sectors. Geographical proximity favours awareness raising by the non-ICT SMEs on the opportunities for digital transformation.

⏩ **A regional digital innovation ecosystem requires a societal digital transformation** intended as a **systemic process** in which all the territorial actors should be involved: enterprises, public administration and citizens. For this reason, DIH4S offers **diversified services**: advanced technological solutions for SMEs and public administrations, and adequate ICT skills and competencies for students, workers and managers.

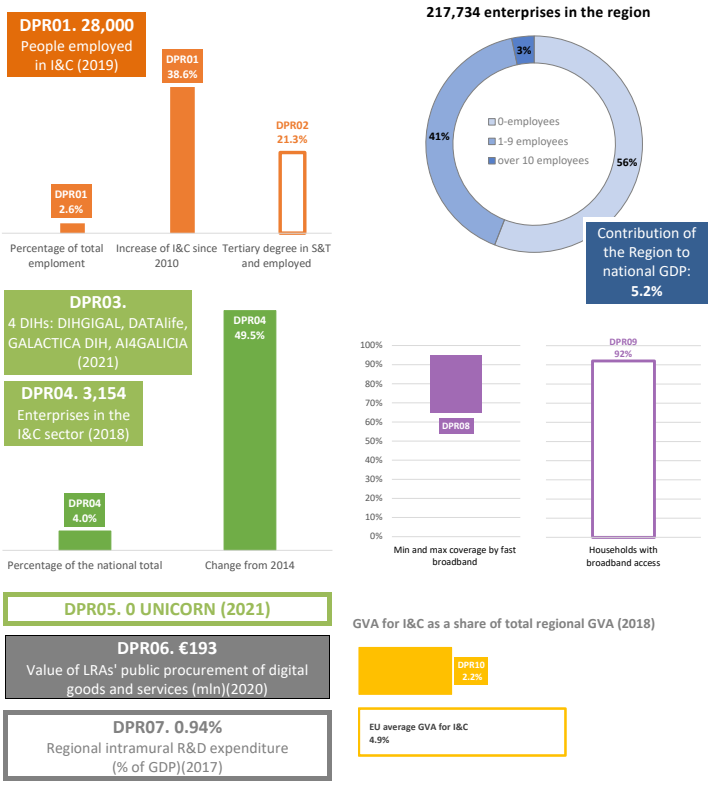
⏩ DIH4S does not provide services for free. **Limited SME-specific funds for digital transformation during the COVID-19 crisis shifted its services towards the health sector**, where more financial resources were available. The RIS3 strategy for 2021-2017 has been structured to address this funding gap.

Case 2.8 Galicia, Spain

The Galician Strategy for Digital Innovation Hubs

Coordinated by the Galician Ministry of Economy, Business and Industry, the regional strategy for digital innovation hubs aims at providing all regional companies, and SMEs in particular, with access to technologies and tools necessary for their digital transformation through the nomination and development of sectoral digital innovation hubs.

Where does the region stand in our digital preparedness framework?



Galicia (ES11) has about 2.7 million inhabitants and almost 220,000 enterprises. It contributes to 5.2% of the national GDP.

The region has a modest number of I&C companies (3,154) but an impressive increase in their number over a five-year period (+50%). The I&C sector employs 28,000 people and has a GVA (2.2%) well below the EU average (4.9%). In May 2021, no unicorn was located in the region. Its intramural R&D expenditure is very low (0.9% of GDP) and the share of people graduated and employed in S&T is modest (21.3%). On average, NGA connectivity is good. In 2020, public procurement for digital goods and services by regional and local authorities was very good (€193 million).

Context

The Galician Strategy for Digital Innovation Hubs is grounded in the **regional smart specialisation strategy** (RIS3) 2014-2020. The latter defines the framework for regional research and innovation policies and outlines the challenges against which investment priorities are to be made.[7] The instrument for achieving the objectives set in the RIS3 is the Plan Galicia Innova 2020. Published in 2018, this plan foresees a total investment of €1,775 million in

[7] RIS3 2021-2027 is currently under development.

research, development and innovation (R&D&I), out of which 55% are from the public sector and 45% from the private sector. The **strategy for digital innovation hubs** is outlined in this plan. DIHs are, in fact, at the core of the innovation model put forward in the Plan Galicia Innova 2020 and are expected to (Region of Galicia, 2018):

- provide a collaboration framework for universities, knowledge centres and business, encouraging the establishment of stable alliances which capitalise on knowledge;
- focus on the strategic areas of the RIS3, namely industry 4.0, aeronautics and bioeconomy;
- involve companies, and SMEs in particular, from the beginning in order to ensure that they respond to business needs, meet their demand and are linked to value chains and the market;
- support and stimulate the adoption of new technologies and innovation by SMEs, including through the provision of services for business value creation.

The Region selects its hubs of digital innovation on the basis of competitive calls and according to the three evaluation criteria of 'vision', 'operation' and 'technical capacity'. Each criterion is divided in a number of sub-criteria all of which were set in a Resolution by the Galician Innovation Agency dated 4 December 2018. The Resolution specifies that the selection of a hub does not imply the granting of direct aid, but implies the recognition of the hub's strategic nature for the Region according to which the hub is given access to public support. The Resolution also defines a digital innovation hub as a '*functional support structure that helps companies, especially SMEs, to be more competitive, to improve their business or production processes, as well as their products and services through digital technology. Its main goal is to encourage value creation through the adoption of new technologies.*' (Galician Innovation Agency, 2018). Hubs' operations are determined by the demand of businesses. They have an independent management structure and are expected to become economically self-sustaining over time (Gain press release dated 09/12/20).

The Plan Galicia Innova 2020 recognises that digitalisation is a key requirement and that digital innovations add value to products and services, and redefine business and production models. Therefore, the plan also envisages a role in business digitalisation for the ICT Demonstration Centre of Galicia and for the ReAcciona Programme (Box 4). At the regional level, digitalisation is further supported through the Galicia Digital Strategy 2030 which is allocated over €2,450 million of public funds including from the Next Generation EU and the MFF 2021-2027 (Galicia Digital Strategy 2030 website).

Box 4. The ReAcciona Programme

ReAcciona is a regional programme jointly promoted by the regional institute for economic promotion 'Igape' (that comes under the regional Ministry of Economy, Business and Innovation), the regional agency for technological modernisation 'Amtega', and the regional innovation agency 'Gain'. The programme provides businesses with 15 services listed under the four areas which are considered to be key to their competitiveness, namely: strategy, professionalisation, digitization and innovation. Among the services offered under the digitalisation area is the 'definition of a digital business strategy' and the 'definition and implementation of a cybersecurity strategy'. Each service is delivered by the involved agencies in close cooperation with the beneficiary company. The service is designed to have tangible results and lasts 3-6 months. It is subsidised with public funds (ERDF) for 80% of its cost, where the cost varies according to the number of employees of the requesting company.
Source: ReAcciona website.

The region of Galicia is characterised by smaller enterprises than the EU average. In fact, the enterprises with fewer than 10 employees represent 97% of the total enterprises. In terms of digitalisation, according to the third study on the state of digitalisation of Spanish companies and public administrations carried out by Vodafone, the majority of Galician companies, in 2019, self-assessed their digitalisation level as an intermediary one (63%); 16% reported to be at an advanced level; and the remaining 21% to be at a basic level, or less. Galician companies believe that the biggest advantage brought by digitalisation is an increased efficiency of processes and tasks (38%) followed by reduction of costs/increase in time and money savings (31%). The most important barrier to digitalisation is reported to be the cost of its implementation (29% of respondents); the second most important barrier is the resistance of employees to it (18%). Some 37% of the Galician companies have a digitalisation plan and 75% have invested in digitalisation in the last two years; 21% of these companies invested more than €30,000, and 37% between €30,000 and €3,000. Security and connectivity are the two most important aspects pursued by Galician companies. Finally, only 22% of the companies rely on their capacity to support their digitalisation. This reflects a professionalisation of the process that in most of the cases (65%) is provided by local service suppliers (Vodafone España, 2018).

Description

In December 2019, the regional government of Galicia signed agreements with the two digital innovation hubs which were selected through the competitive procedure initiated in 2018. Contextually to the agreements, the hubs received €200,000 each to start their operations (Gain press release dated 09/12/20).

- DIHGIGAL - The Strategic Industrial Digital Innovation Hub for Galicia. It is organised as a non-profit entity named the Association for the Digitization of the Galician Industry which is led by the Automotive Cluster

(CEAGA) and also includes the Galician Food Cluster (Clusaga), the Cluster Naval (ACLUNAGA), and the ICT Cluster.

DIHGIGAL focuses on applying the IoT, AI, high performance computing and cybersecurity to the value chains of the automotive, naval, food, ICT, textile, stone, forestry and aeronautics sectors. The hub is made of 450 companies, out of which 376 are SMEs, and 19 innovation entities which employ some 52,000 people in the region, and have a joint turnover of over €19 billion, equivalent to about 30% of the regional GDP.

The hub has a catalogue of services available online which range from brokering and matchmaking to development of competencies, counselling for digital transformation, provision of coworking facilities, counselling for new business model development, and access to funding.

- DATAlife - the digital innovation lab for the primary, biotechnology and health sectors. It is organised as a non-profit entity and is led by the Life Sciences Business Technology Cluster (Bioga).

DATAlife focuses on applying AI, Big Data, IoT, high performance computing and cybersecurity to the value chains of biotech, health, agri-food, sea-based industries, and forestry. In its strategic plan, the hub operates around three main areas of intervention: 1) providing services according to a catalogue which is meant to be aligned with the needs of regional SMEs; 2) communicating, to disseminate information but also to promote digitalisation within the ecosystem; and 3) networking, including by facilitating members' participation in European and international projects (JRC DIH profile). As at early April 2021, there is no catalogue of services available on the hub's website but there is evidence of an ongoing investigation on the needs of regional SMEs through an online survey on 'challenges and opportunities in the field of digitalisation'. Technological challenges addressed by the hub refer to (DATAlife website):

- Industrialisation and digitalisation of the forest sector, including through the digitalisation of production processes and of information flows, the implementation of technologies, such as blockchain, in the wood supply chain that provide trust and traceability, and the implementation of systems for the digital management of forest resource.
- Digitization of the silver economy, including through the digital transformation of the healthcare model, the development of clinical decision support systems, and the development of new diagnostic processes.

- The optimised management of resources in agriculture and fisheries in order to improve control, quality and safety, including through the use of AI and data analytics.
- The consolidation of the regional biotechnology sector, including through the design and implementation of a sectorial digitalisation plan based on emerging technologies.

Both DIHGIGAL and DATAlife are among the Spanish candidate hubs proposed to join the European Digital Innovation Hubs (EDIH) network.[8]

Changes induced by the COVID-19 crisis

In late 2020, the Region launched the Connect Hubs programme which made €6.8 million available under the form of grants to support collaborative R&D&I projects in the areas of specialisation covered by DIHGIGAL and DATAlife. The programme intends to stimulate the participation of SMEs and **has the double aim of tackling the long-term political priorities of the Region and of providing immediate relief to the local economy by supporting the resilience of regional SMEs.** The programme also introduces a collaborative model which is based on the contribution of the hubs in assessing the proposed projects in terms of suitability of their contribution to the regional specialisations (Galician Innovation Agency, 2021).

The programme provides support for two types of projects: 1) industrial research projects, experimental development and innovation in process and organisation; and 2) product innovation projects. The beneficiaries of the programme are primarily SMEs. Large companies may participate in projects of type 1) if they are essential to implementation, but with a limited budget. Grants will cover between 15 and 80% of the total eligible cost, depending on the type of beneficiary (Galician Innovation Agency, 2021).

Also in late 2020, the Region approved a set of instruments to finance the digitalisation of SMEs and of the self-employed. These instruments are detailed in Box 5. One of these schemes, the digitalisation cheque, was also run in 2020 to help SMEs and the self-employed to respond to the difficulties imposed by the COVID-19 pandemic through the use of digital solutions.

Box 5. Regional financial support to digitalisation

The Region will mobilise over €13 million, out of which €9 million will be subsidised by public funds and will support more than 1,300 beneficiaries. The main schemes for supporting the digitalisation of SMEs include: 1) The Galicia Exporta Dixital. It provides support in the form

[8] EDIH will include about 200 hubs Europe-wide (the number will depend on resources). These hubs will be selected in 2021 by the European Commission among the candidates put forward by the Member States.

of subsidies for the digital internationalisation of SMEs and of retail trade. SMEs based in Galicia may apply for grants covering 80% of eligible expenses. Their projects must have a cost comprised between €25,000 and €125,000 (lower amounts are allowed for SMEs of the agricultural and fishery sectors). Projects must tackle the subsidy's objective which is to develop and implement a company digital internationalisation plan. Among the suggested eligible expenses mentioned are consultancy services to determine the digital export potential, to develop the plan and to get legal advice; and software costs for, for example, product information management, data analytics and visualisation, and automated solutions. 2) The 'Cheque Dixitalización'. This aid is funded through the ERDF for up to 80% of the eligible costs (which may range from €1,500 to €15,000). Interventions must involve the implementation of digital solutions related, for example, to remote working or connectivity in rural areas. It is given on a first come, first served basis up to completion of the total allocated budget of almost €3 million. 3) The 'digitalisation of the industry 4.0'. This aid will be distributed on the basis of competitive calls and will be aimed at implementing digital solutions in SMEs such as big data and AI. Aid will cover 30% of the cost of tangible and intangible assets and 50% of the expenses incurred for external collaborations.

Source: Instituto Gallego de Promoción Económica website.

In terms of adaptation of activities by the digital innovation hubs, some evidence has been found only for DIHGIGAL which organised two seminars to support companies in the transition to teleworking. The hub made this service available in response to the difficulties faced by some companies which lacked the experience and/or the coordination capabilities to efficiently manage telework. Webinars were held at the end of March 2020 and at the beginning of April 2020, during the lockdown period. They were attended by 113 people from 103 companies, 68 of which were members of the four clusters involved in the hub (DIHGIGAL website).

Key evidence

⏩ The Region's strategy is to **develop several hubs, each focusing on specific sectors of specialisation** which reflect the specialisations identified in the RIS3.

⏩ The Galician **concept of DIH goes beyond digital transformation**. In practice, hubs are intended to support businesses in maturing technologies, expanding their application and opening up new markets with innovative products and services. By facilitating access to the most innovative technologies, companies strengthen their competitive market position while knowledge centres extend their activities to market-oriented products and services. Hubs are **collaborative ecosystems providing competencies and services but also linking to the market**.

⏩ **Participation by SMEs in the activities of the digital innovation hubs has to be incentivised.** The Connect Hubs programme aims at widening the

audience of SMEs involved in building up and benefitting from the ecosystem created through the hubs.

⏩ **Financial support is essential and so is its diversification** in order to address the widest possible audience of beneficiaries, whose needs vary from simple digital solutions and teleworking implementation to complex digital solutions in order to remain competitive on the international markets.

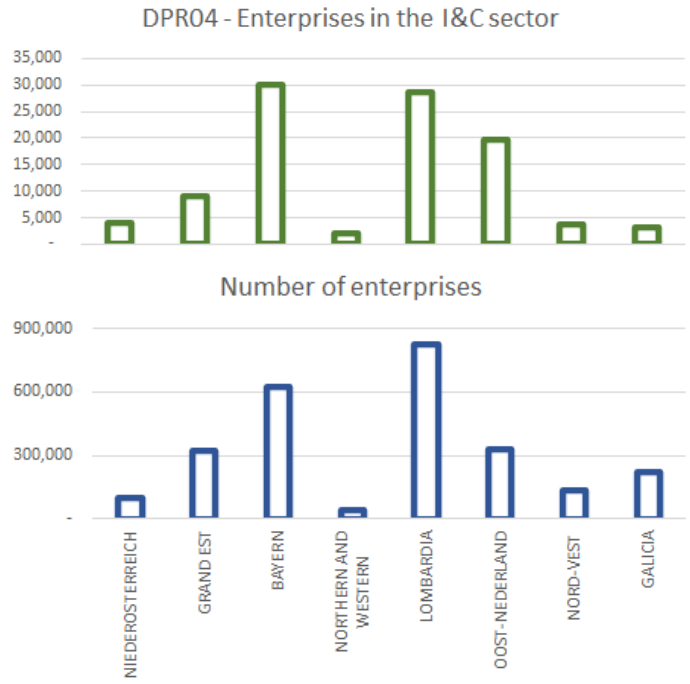
⏩ DIHs are not the only instrument used by the Region to support the digitalisation of SMEs. Other regional actors and strategies have the same mandate, indicating the need to use **multi-pronged approaches** to pursue the digital transformation goal.

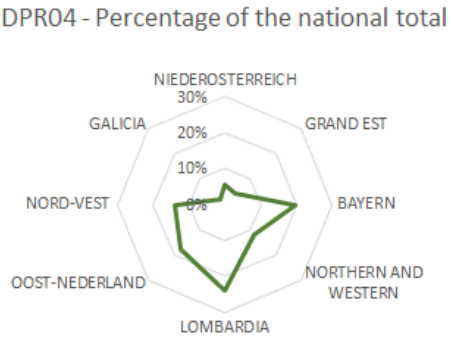
2.9 Overview of digital preparedness in the regions of the eight case studies

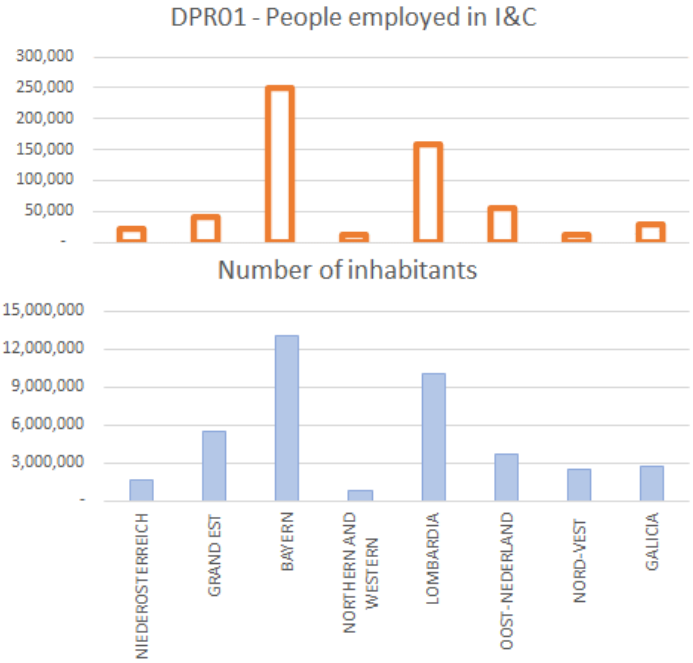
Case studies cover NUTS1 (Bayern, Oost-Nederland, Grand Est) and NUTS2 (Niederösterreich, Galicia, Northern and Western, Lombardia, and Nord-Vest) regions.

This partially explains the difference in absolute values of the number of I&C enterprises (DPR04). Bayern is the region with the highest number of I&C enterprises (30,160) followed by Lombardia (28,747) and Oost-Nederland (19,784). Bayern and Lombardia are the only two regions in our sample with unicorns (10 and 1, respectively) (DPR05). Lombardia is the region with the highest absolute number of active enterprises (over 800,000) and the highest share of national total I&C enterprises (23.9%). The lowest number of I&C enterprises is in the Northern and Western region of Ireland (around 2,000), while Galicia is the region with the lowest share of national total I&C enterprises (1.8%).

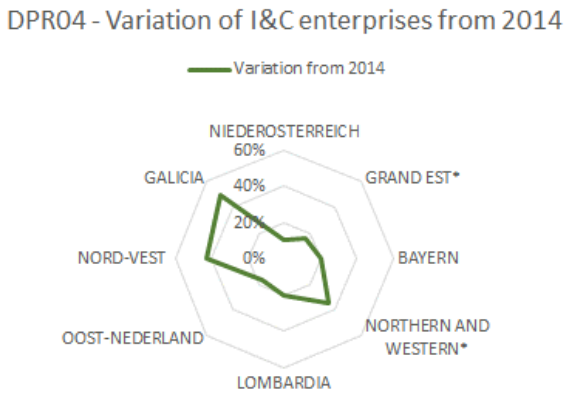
Considering the people employed in I&C (DPR01) figures are aligned with the population size. Bayern, the most populated region (13 million inhabitants), is the top region with 250,000 I&C employees. Exceptions are Nord-Vest in Romania and Grand Est in France, the two regions in our sample in which the share of I&C employees is less than 1% of the population.



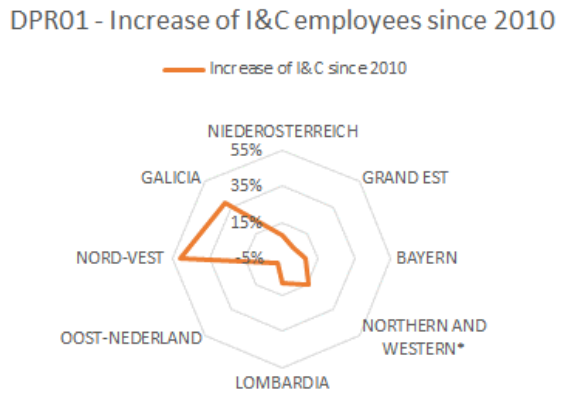




Two regions compete for the primacy in the growth of the I&C sector in the last years. Since 2014, Galicia has increased its number of I&C enterprises by 50% and Nord-Vest by 43%. Concerning employment in I&C, since 2010, in Nord-Vest it increased by 51%, and in Galicia by 39%. Niederösterreich records the lowest variation of I&C enterprises since 2014 (+10%) while Oost-Nederland records a decrease in I&C employment since 2010 (-2%).

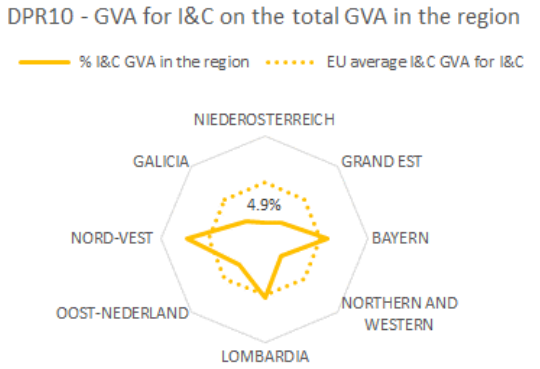


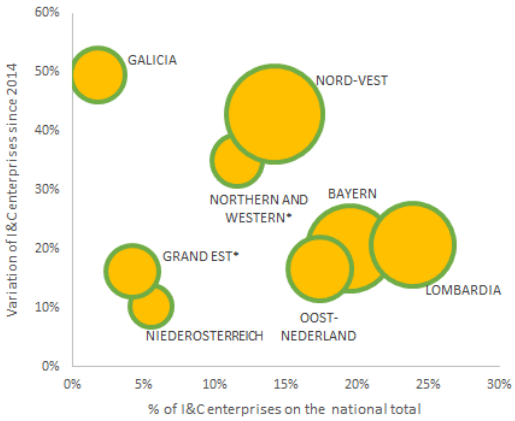
** Variation for Grand Est and Northern and Western is from 2016*



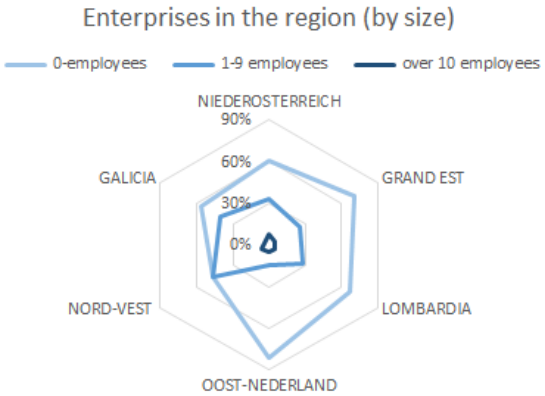
** Change for Northern and Western is from 2012*

The GVA of I&C on the total regional GVA is higher than the EU average (4.9%) in Nord-Vest (6.8%), Bayern (5.5%) and Lombardia (5.1%). By plotting the share of regional I&C enterprises on the national total, the variation of the I&C enterprises in the region since 2014, and the I&C GVA on the total regional GVA (represented by the size of the bubbles), four clusters are evident.





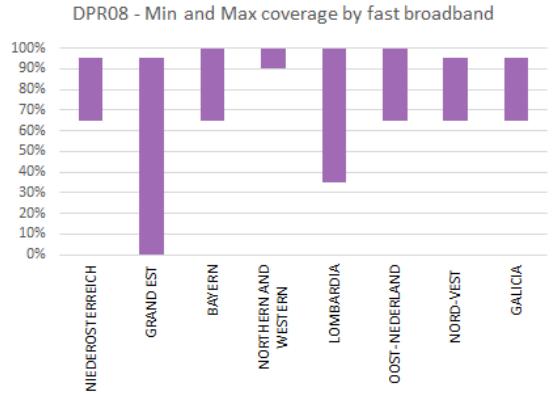
** Variation of I&C enterprises for Gran Est and Northern and Western is from 2016*

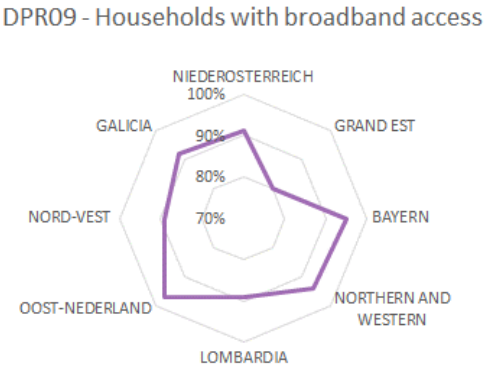


Note: data for Bayern and Northern and Western are not available.

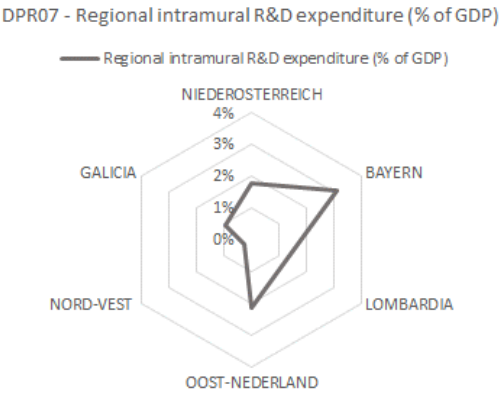
Although Eurostat statistics on business size are missing for two of our regions and information on business size in the I&C sector is not available at the regional level, it appears that the cluster with the highest number of I&C enterprises and the lowest growth rate (Lombardia, Bayern, and Oost-Nederland) is characterised by a high number of 0-employee enterprises, while in the fast-growing cluster (Nord-Vest in Romania and Northern and Western in Ireland) small enterprises (1-9 employees) prevail.

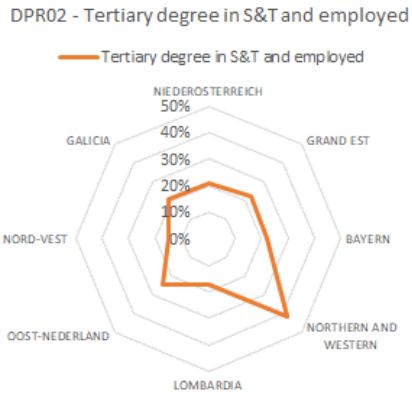
NGA coverage (DPR08) measures the endowment of the digital infrastructures which are expected to support business digital transformation. In some parts of the territory of Northern and Western in Ireland, Bayern, Lombardia and Oost-Nederland the maximum coverage (100%) is available. The highest variability of coverage is found in Grand Est in France. Oost-Nederland and Bayern have the highest percentage of households with broadband access (97% and 95%, respectively) (DPR09). In Grand Est, only 80% of households have access to broadband.



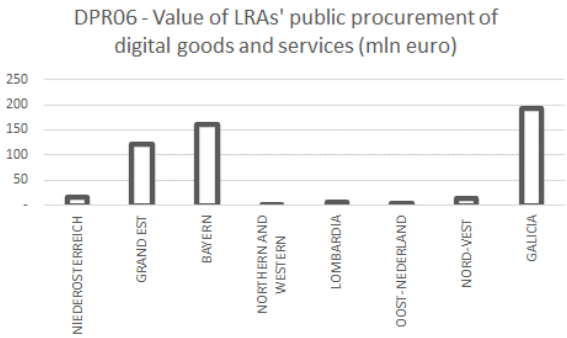


Digital Innovation Hubs (DPR03) are boosters for the digital transformation of businesses. At least one fully operational DIH is present in each of our case regions. Oost-Nederland hosts 10 DIHs, and Lombardia and Galicia have four each. The inclination to research and innovation activities is proxied by the regional intramural R&D expenditure (DPR07) and by the share of employees with a tertiary degree in S&T (DPR02). Data on R&D expenditure are available only for six of our regions; among them, Bayern has the highest expenditure for R&D (3% of the regional GDP). The highest employment of S&T graduates is found in Northern and Western in Ireland (42%).





Note: data for Grand Est and Northern and Western are not available.



Considering the public procurement of digital goods and services by LRAs, 2020 data outline two main groups of regions. The first group which includes Galicia, Bayern and Grand Est importantly pulls the digital market with awarded contracts valued between €100 and 200 million. The second group with the other five regions has made contracts valued 10 times less (from less than €1 million to €15 million).

Part 3. Where do SMEs stand in the digital transformation process? The role of regions.

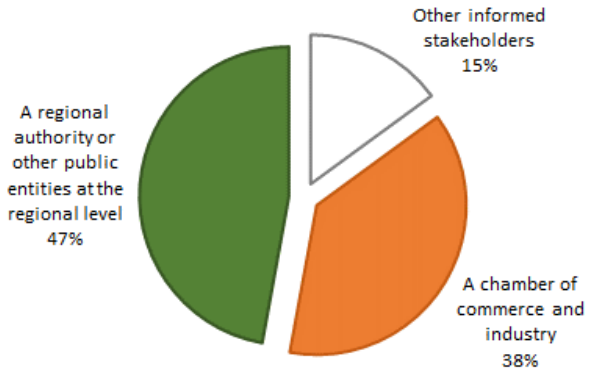
To widen our understanding of how LRAs are currently favouring the digital transformation of SMEs, of the progress of digital transformation in SMEs and of the type of support LRAs may provide in the short and medium term, we designed a questionnaire for an online consultation. The consultation was jointly implemented by the European Committee of the Regions and EUROCHAMBRES, the Association of European Chambers of Commerce and Industry, and was distributed to their respective stakeholders, namely European local and regional authorities, chambers of commerce and industry, and other informed stakeholders. The survey was launched on 30 April 2021 and closed on 6 June 2021.

The questionnaire is composed of five sections and 13 questions (see Annex III). Section 1 includes two questions on respondents' details. The other four sections concern digital preparedness in regions, changes in business models driven by the digital transformation, impact of the COVID-19 outbreak on the digital transformation process, and actions to support SMEs' digital transformation.

As the consultation was not directly addressed to SMEs, its goal is to collect respondents' perception of **SMEs' digital transformation in their regions**. The 87 respondents belong to 21 EU Member States and provided information on 54 NUTS2 regions.

Most of the respondents are representatives of *regional authorities or other public authorities at the regional level* (41), and of *chambers of commerce and industry* (33). The 13 *other informed stakeholders* include representatives of Local Action Groups (LAGs), representatives of cities, SMEs, and researchers/experts in the domain (Figure 9).

Figure 9. Respondents to the questionnaire

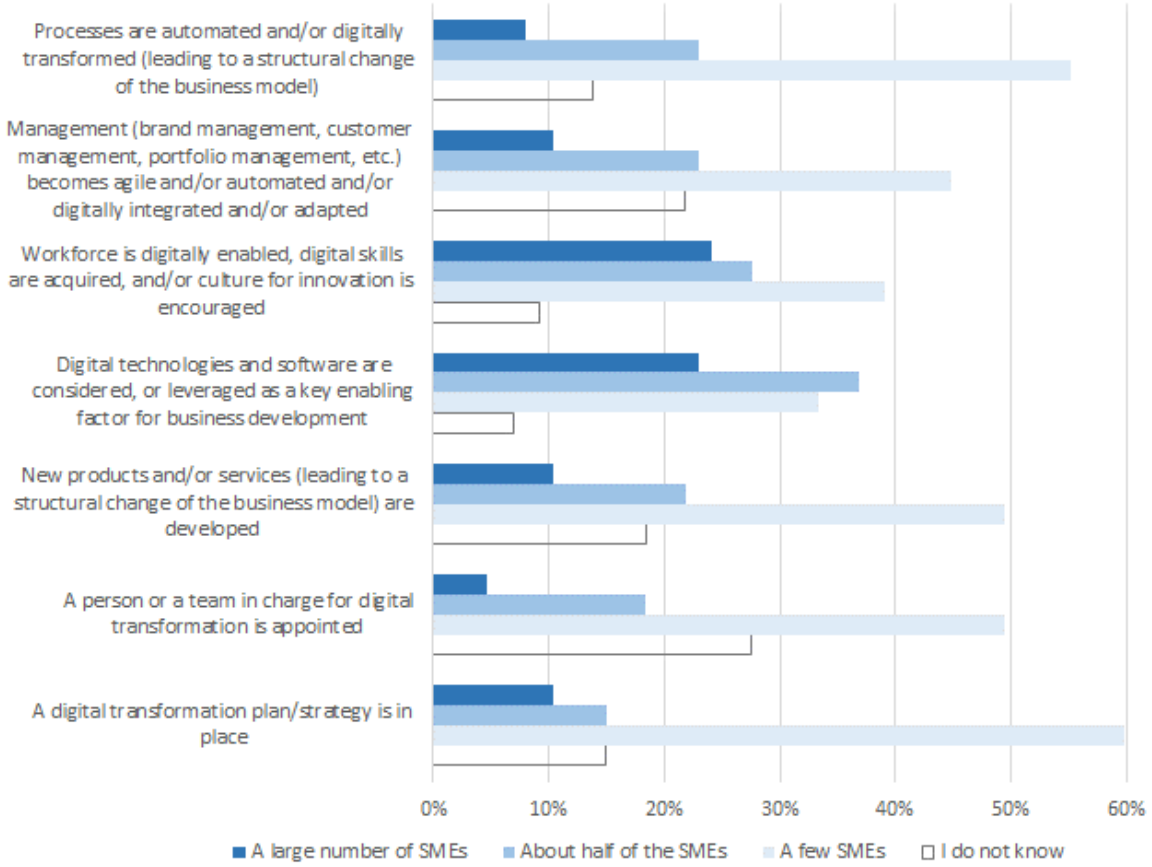


3.1 Digital preparedness in regions

Section 2 was designed to understand SMEs' digital maturity in regions prior to the COVID-19 outbreak as well as the factors which favoured the process of SMEs' digital transformation and the actors that supported it.

Since target respondents were not SMEs but *regional authorities or other public authorities at the regional level* (hereafter 'regional authorities'), *chambers of commerce and industry* (hereafter 'chambers of commerce') and *other informed stakeholders*, **questions are about respondents' perception**. Respondents were asked to assess to what extent specific aspects characterising the digital maturity of a business were implemented/adopted by SMEs before 2020 (Q2.1). Most of the respondents indicate that all the given aspects were implemented/adopted by 'a few SMEs' in the region, except for digital technologies and software which were considered, or leveraged, by 'about half of the SMEs' in the region (Figure 10).

Figure 10. Q2.1 – In your region, in how many SMEs did the following aspects related to digital maturity occur before 2020?



According to 60% of the respondents, a **digital transformation plan/strategy** ranks first among the top three aspects implemented/adopted **by a few SMEs prior to the COVID-19 outbreak**. The fact that **a person or a team in charge**

of digital transformation has been appointed in a few SMEs for 49% of the respondents, indicates that the digital transformation process is lacking a strategic approach at the business level. This is also confirmed by the high percentages of respondents (55% and 49%, respectively) who perceive that the two aspects which relate to **a structural change of the existing business models** (i.e. automation and/or digital transformation of the processes, and development of new products and/or services) are implemented/adopted by a few SMEs. Table 4 summarises the top three aspects perceived to be implemented/adopted by only a few SMEs.

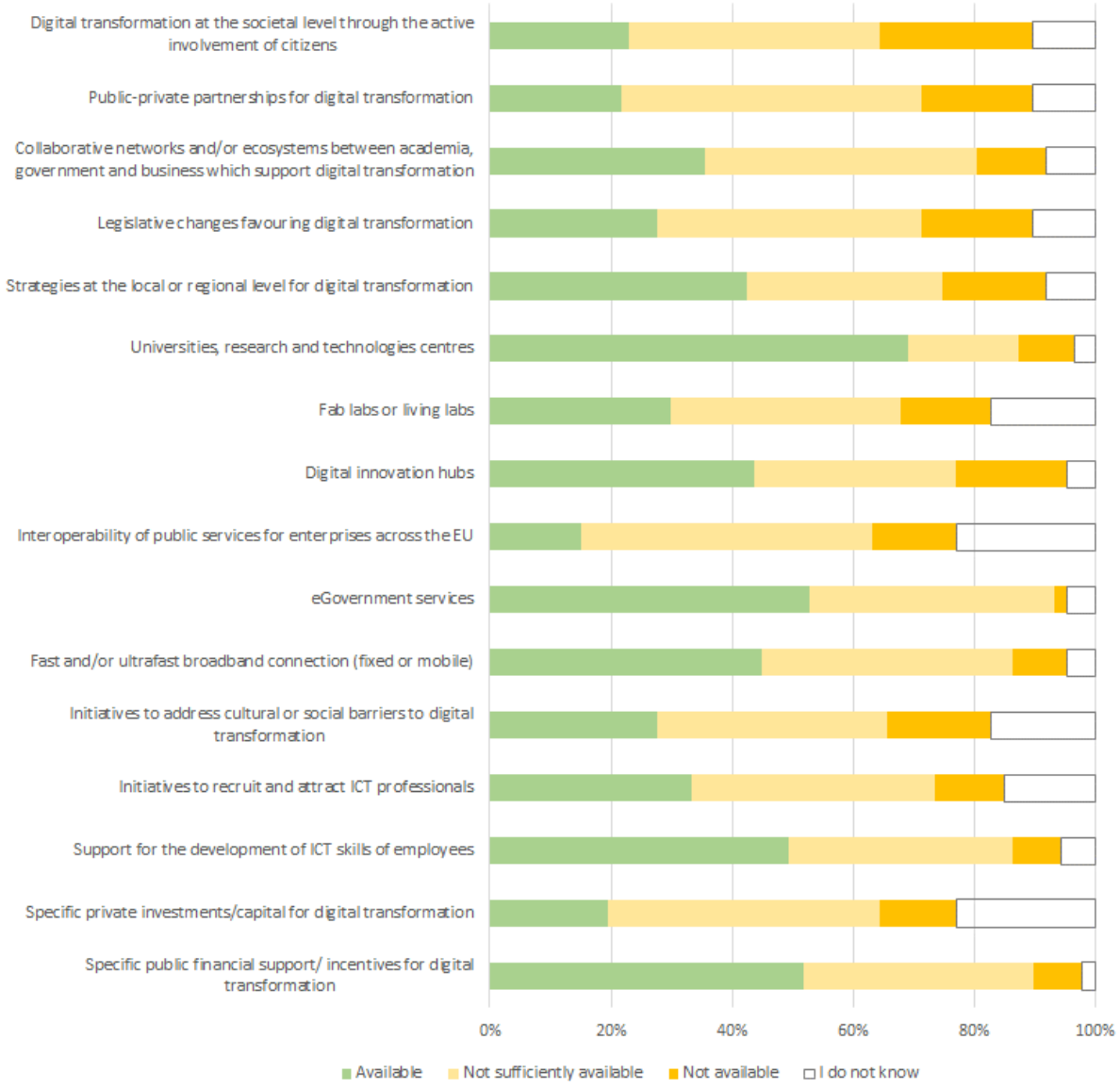
Table 4. Answers to Q2.1 for 'a few SMEs' in the region

What was implemented/adopted by a few SMEs in the region (before 2020) Top three aspects indicated by the respondents (percentage of respondents)		
1	A digital transformation plan/strategy is in place	60%
2	Processes are automated and/or digitally transformed (leading to a structural change of the business model)	55%
3	A person or a team in charge for digital transformation is appointed	49%
3	New products and/or services (leading to a structural change of the business model) are developed	49%

Respondents believe that the two aspects achieved by a **large number of SMEs in the region (before 2020)** are mainly **digital skills of the workforce** (i.e. '*Workforce is digitally enabled, digital skills are acquired, and/or culture for innovation is encouraged'*) (24% of the respondents) and use of **digital technologies and software** (i.e. '*digital technologies and software are considered, or leveraged as* ***a key enabling factor*** *for business development'*) (23% of the respondents).

With regard to the various contextual conditions supporting digital transformation, respondents were asked about the availability of these conditions in the region (Q2.2). A large number of conditions was considered as '*Not sufficiently available'*, namely: public-private partnerships (PPP) for digital transformation (49% of the respondents), interoperability of public services for enterprises across the EU (48%), specific private investments/capital for digital transformation (45%), collaborative networks and/or ecosystems between academia, government and business which support digital transformation (45%), legislative changes favouring digital transformation (44%), digital transformation at the societal level through the active involvement of citizens (41%), initiatives to recruit and attract ICT professionals (40%), initiatives to address cultural or social barriers to digital transformation (38%), and fab labs or living labs (38%) (Figure 11).

Figure 11. Q2.2 – In your region, which of the following has been available to support the digital transformation of SMEs?



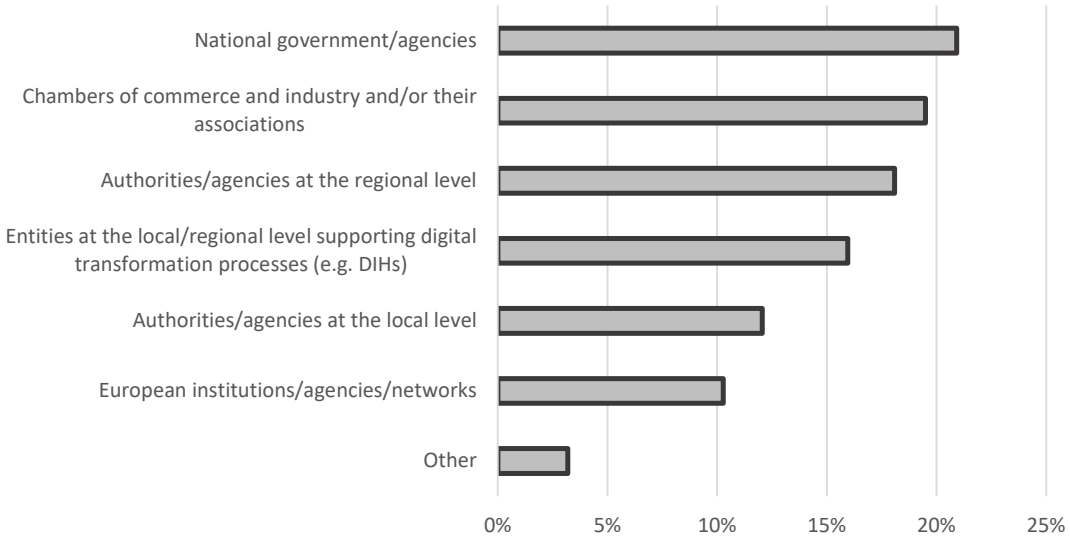
'Universities, research and technologies centres' are considered available for more than two-thirds of the respondents (69%). For half of them, ***'eGoverment services'*** and ***'specific financial support/incentives for digital transformation'*** are available (53% and 52%, respectively). The most selected among the 'not available' contextual conditions (25% of the respondents) is **the digital transformation at the societal level**. It is followed (18% of the respondents) by digital innovation hubs, legislative changes favouring digital transformation, and public-private partnership for digital transformation (Table 5).

Table 5. Answers to Q2.2 related to 'available' and 'not available' conditions in the region

What supports the digital transformation of SMEs in the region **Top three conditions indicated by the respondents (percentage of respondents)**	
AVAILABLE	
1 Universities, research and technologies centres	69%
2 eGovernment services	53%
3 Specific public financial support/incentives for digital transformation	52%
NOT AVAILABLE	
1 Digital transformation at the societal level through the active involvement of citizens	25%
2 Digital innovation hubs	18%
2 Legislative changes favouring digital transformation	18%
2 Public-private partnerships for digital transformation	18%
3 Initiatives to address cultural or social barriers to digital transformation	17%
3 Strategies at the local or regional level for digital transformation	17%

The most selected[9] **actors with a role in facilitating the digital transformation of SMEs** (by more than one-fifth of the respondents) were **national government/agencies** (Q2.3). **Chambers of commerce** and **authorities / agencies at the regional level** rank second (20%) and third (18%), respectively (Figure 12). This result confirms the relevance of the territorial dimension in businesses' digital transformation.

Figure 12. Q2.3 – In your region, which actors have a role in facilitating the digital transformation of SMEs?



[9] More than one selection was possible.

DIHs or similar entities at the local/regional level were selected by only 16% of the respondents. The limited relevance assigned to these actors may be related to the fact that they are among the top *'not available'* contextual factors in Q2.2.

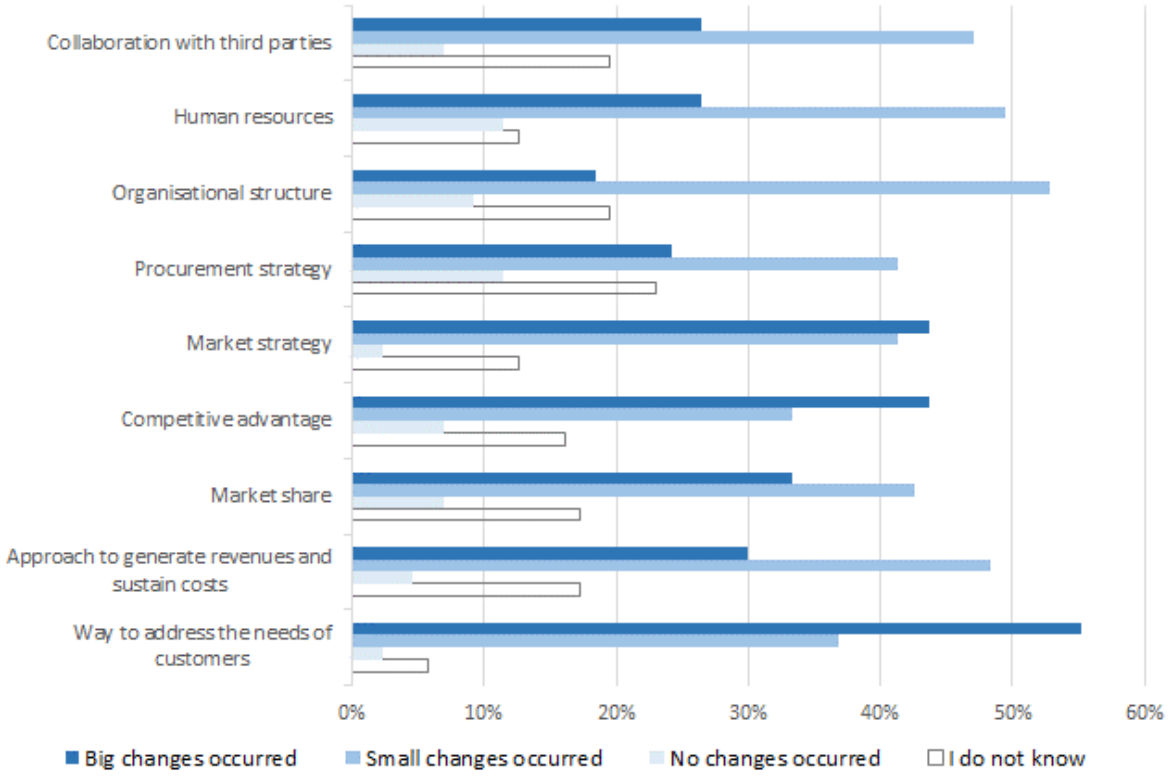
A **perceived complementarity of the actors and their roles** is evident when considering that 70% of the respondents indicate **at least three actors.** Nine respondents also suggest other actors such as universities, NGOs, private initiatives, IT clusters, professional associations (sectorial and not) and Local Action Groups (LAGs).

3.2 Changes in the business models driven by the digital transformation

Section 3 was designed to understand if and how digital transformation has started to affect the '*usual way of doing business'* in SMEs according to the perception of regional authorities, chambers of commerce and other informed stakeholders.

Respondents were asked to what extent key aspects of the SMEs' business models changed because of digital transformation in the last five years (*'no changes occurred', 'small changes occurred', 'big changes occurred'*) (Q3.1, Figure 13).

Figure 13. Q3.1 – In the last 5 years, which of the following aspects of SMEs' business models have changed because of the digital transformation?



Answers to this question appear to have been affected by the respondents' limited knowledge of the internal evolution of SMEs' business models. For aspects such as procurement strategy, collaborations with third parties and organisational structure more than one-fifth of the respondents answer *'I do not know'*.

Respondents **mainly perceive *'small changes'*** in the **organisational structure** (53%), in the **human resources** (49%), in the **approach to generate revenues and sustain cost** (48%), in the **collaborations with third parties** (47%), in the **market share** (43%) and in the **procurement strategy** (41%).

The top three perceived **big changes in the SMEs' business model** are reported in Table 6. The **way to address the needs of customers** is the aspect in which the largest share of the respondents (55%) perceive that *'big changes occurred'*, followed by **competitive advantage** and **market strategy** (for 44% of the respondents).

Table 6. Answers to Q3.1 related to 'big changes occurred' in the SMEs' business model

What was changed to a large extent in the SMEs' business model because of the digital transformation (last 5 years)		
Top three aspects indicated by the respondents (percentage of respondents)		
1	Way to address the needs of customers	55%
2	Competitive advantage	44%
2	Market strategy	44%
3	Market share*	33%

* For a higher percentage of the respondents (43%), SMEs experienced only small changes due to digital transformation in their market share.

The **procurement strategy** and **human resources** are the aspects for which the highest percentage of respondents perceived **'no changes'** in the business model of SMEs due to digital transformation in the last five years (11% of the respondents for both aspects).

Limited changes to SMEs' business models because of digital transformation may have different reasons. Some of these are related to the contextual factors such as those concerning the digital preparedness of regions (e.g. unavailability of a societal digital transformation, lack of DIHs, absence of an adequate legislative framework, limited practice of public-private partnership); in other cases, they relate to barriers faced at the business level.

When asked to assess the relevance of 14 potential **barriers to the digital transformation of SMEs** (from *'not relevant'* to *'very relevant'*), **most of the**

respondents considered 11 of these barriers *'relevant'*[10] (Q3.2, Table 7). The other three potential barriers are perceived as 'not so relevant'. One of them is strictly related to the business (i.e., the lack of the ICT equipment and services perceived by the 38% of the respondents), while the other two *'not so relevant'* barriers (i.e. the inadequate broadband connection and the lack of eGoverment services) depend on the territorial context.

Table 7. Answers to Q3.1, potential barriers to digital transformation of SMES by relevance

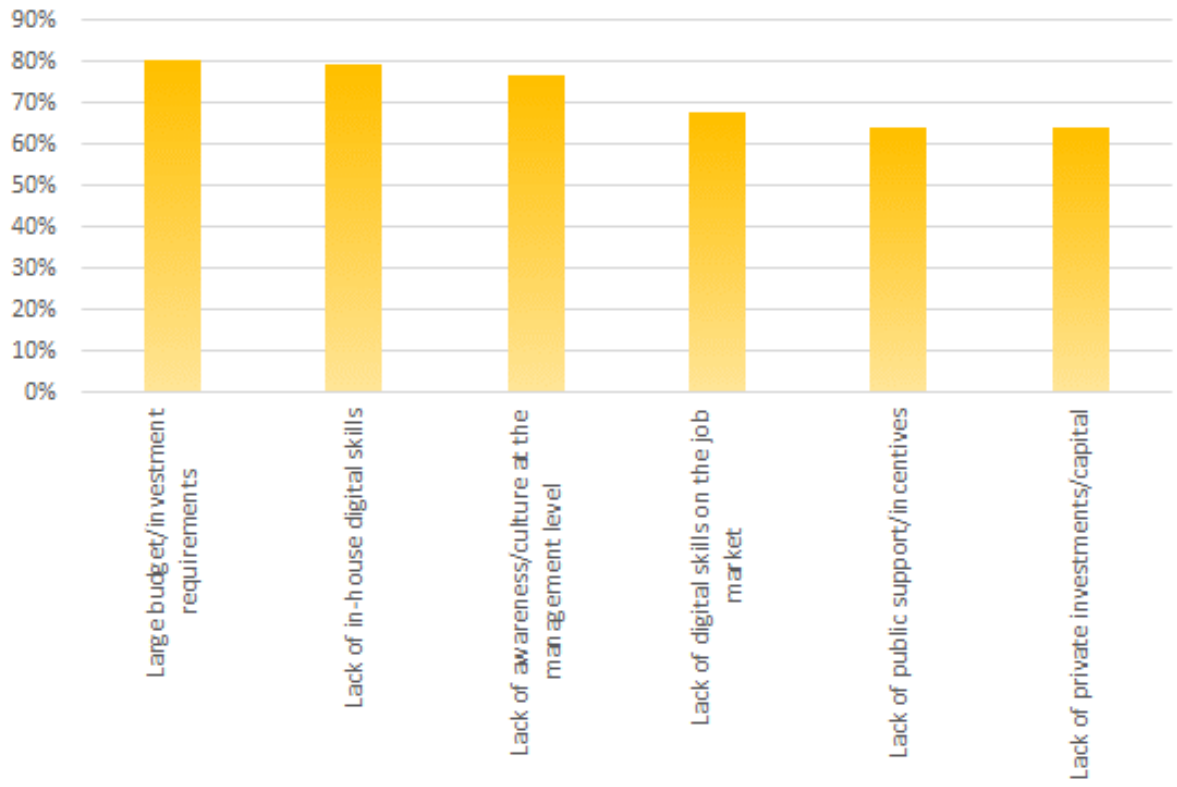
Relevance of potential barriers to digital transformation of SMEs (percentage of respondents)

	Very relevant	Relevant	Not so relevant	Not relevant	I do not know
Large budget/investment requirements	37%	**44%**	15%	3%	1%
Lack of public support/incentives	17%	**47%**	29%	5%	2%
Lack of private investments/capital	20%	**45%**	24%	1%	10%
Lack of awareness/culture at the management level	33%	**44%**	13%	6%	5%
Lack of in-house digital skills	34%	**45%**	16%	2%	2%
Lack of digital skills on the job market	24%	**44%**	20%	10%	2%
Lack of ICT equipment and services	11%	31%	**38%**	16%	3%
No adequate broadband connection	18%	25%	**34%**	20%	2%
Lack of eGovernment services	13%	30%	**34%**	20%	3%
Lack of interoperability of public services for enterprises across the EU	17%	**30%**	24%	9%	20%
No adequate local/regional strategies	14%	**34%**	26%	22%	3%
No adequate legislative context	15%	**29%**	26%	16%	14%
Lack of public-private partnerships for digital transformation	14%	**34%**	26%	17%	8%
No adequate digital transformation at the societal level	20%	**32%**	28%	14%	7%

[10] The lack of interoperability of public services for enterprises across the EU is mainly considered a *'relevant barrier'* (30% of the respondents) but the high percentage of respondents (20%) that answer 'I do not know' is worth noting.

Looking at the top potential barriers that are perceived to be at least relevant by the respondents (i.e. those considered *'relevant'* and *'very relevant'*) (Q3.2, Figure 14), the first five are barriers related 1) to financial aspects: **large budget/investment requirements** (80% of the respondents), **lack of public support/incentives** and **lack of private investments/capital** (64% of the respondents each); and 2) to digital competencies/culture: **lack of in-house digital skills** (79% of the respondents), **lack of awareness/culture at the management level** (77% of the respondents), **lack of digital skills on the job market** (68% of the respondents).

Figure 14. Q3.2 – The top five 'relevant' and 'very relevant' potential barriers to the digital transformation of SMEs



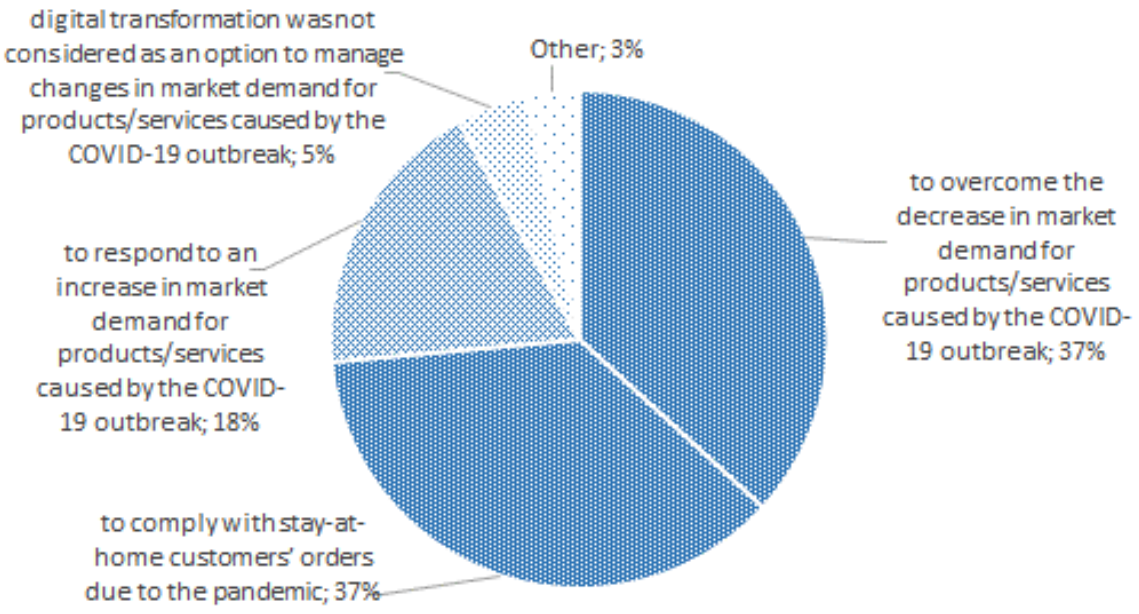
In this question, respondents also had the opportunity to suggest other barriers. Among the barriers mentioned is **the lack of appropriate broadband connection in rural areas**. The **duration of some processes** is also indicated as a structural limitation which does not favour the SMEs' digital uptake. Examples include the gradual adaptation of SMEs in exploiting e-commerce opportunities; the limited promptness of some regions in applying for EDIHs; the bureaucracy for requesting public support combined with the time needed to receive it once it is granted.

3.3 Impact of the COVID-19 outbreak on the digital transformation

Section 4 was designed to understand if COVID-19 influenced the acceleration of SMEs' digital transformation, the main COVID-19 challenges faced by SMEs for digital transformation, and if SMEs actions are part of a strategic approach (that will continue in the post-COVID phase) or are recovery solutions adopted in an emergency period.

Three-quarters of the respondents indicate that the acceleration of digital transformation was due to a decrease or a change in the type of demand caused by the COVID-19 outbreak. More precisely, for 37% of the respondents SMEs' digital transformation was accelerated to overcome the decrease of market demand for products/services and for another 37% of the respondents SMEs' digital transformation was accelerated to comply with stay-at-home customers' orders due to the pandemic. An acceleration of SMEs' digital transformation in 2020 resulting from an increase in demand is perceived by only 18% of the respondents (Q4.2, Figure 15).

Figure 15. Q4.2 – In your region, the acceleration of digital transformation in SMEs was primarily:

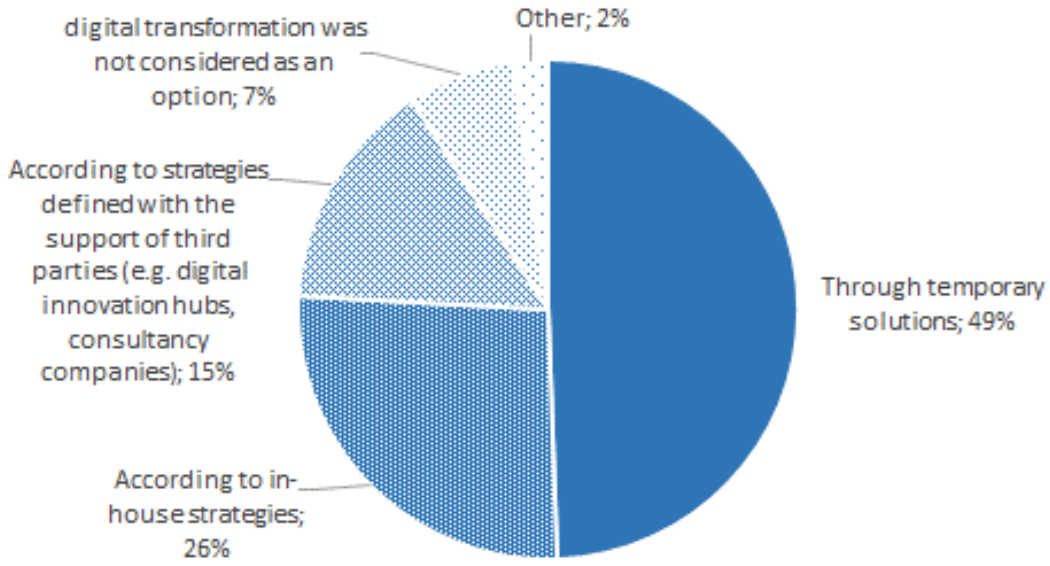


For only 5% of the respondents, digital transformation is not considered an option for managing changes of market demand for products/services caused by the COVID-19 outbreak. Among the other perceived reasons for the acceleration of SMEs' digital transformation, one respondent suggests that it was actually due to

a mix of the increase, the decrease and the change in the demand for products/services.

Half of the respondents indicate that in 2020 acceleration of digital transformation during the COVID-19 outbreak was 'temporary' in nature, while 7% does not perceive digital transformation as an option for coping with COVID-19 challenges. Strategies were leading the acceleration of the digital transformation for SMEs, according to the remaining 40% of respondents. One-fourth of the respondents indicate that adopted strategies were in-house while 15% of them referred to strategies defined with the support of third parties (such as DIHs) (Q4.1, Figure 16).

Figure 16. Q4.1 – In 2020, SMEs in your region accelerated the digital transformation to cope with the COVID-19 outbreak



Investments to increase digital maturity represented an option for SMEs in addressing COVID-19 challenges. Respondents were asked to assess their relevance (from *'not relevant'* to *'very relevant'*) (Q4.3, Figure 17).

By ranking the aspects in which SMEs are perceived to consider investments *'relevant'* and *'very relevant'* further to the outbreak of the pandemic (Q4.3, Table 8), it is noted that the top investment choices are not essentially different from those that occurred before 2020 (Q2.1). ***Investment in digitally enabled workforce, acquisition of digital skills, promotion of culture for innovation*** ranks first (85% of the respondents), followed by ***the adoption of digital technologies and software as key enabling factors for business development*** (83% of the respondents). The **definition of digital transformation plans/strategies** seems **to not gain importance** when addressing COVID-19

challenges. It is perceived as implemented/adopted only in a few SMEs by a high percentage of the respondents (60%) before 2020 and the definition of digital transformation plans/strategies ranks in the last position of investments considered at least relevant (for 64% of the respondents) for addressing COVID-19 challenges.

Figure 17. Q4.3 – In your region, which of the following aspects related to digital maturity do SMEs consider relevant for investment in order to address the challenges caused by the COVID-19 outbreak?

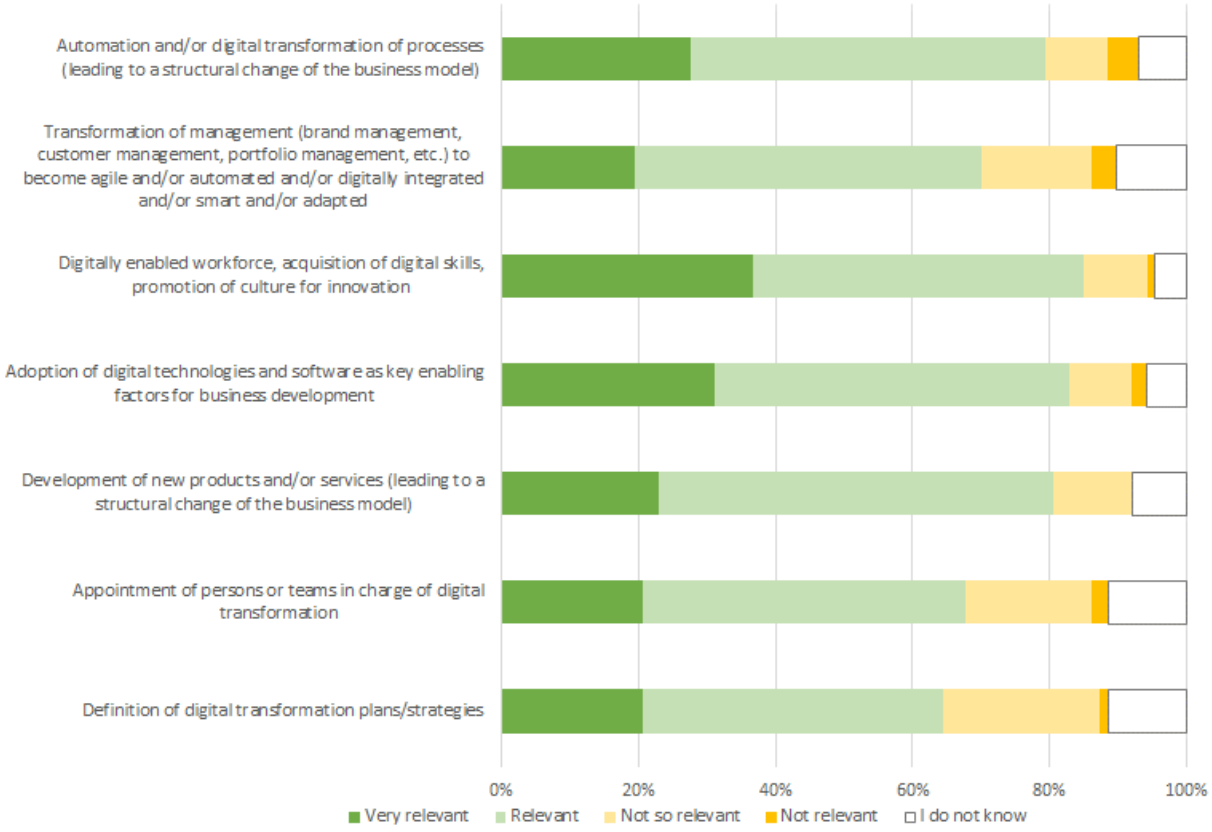
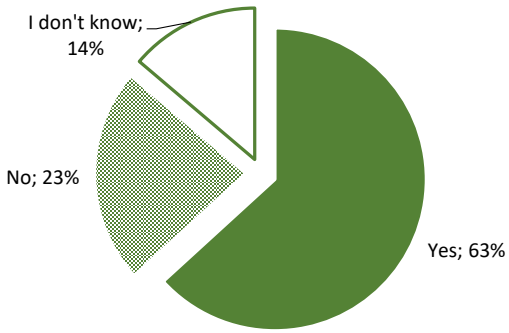


Table 8. Answers to Q4.3, investments to address COVID-19 changes

Aspects of digital maturity considered *'very relevant'* or *'relevant'* for investment by SMEs to address COVID-19 challenges Ranking of aspects (percentage of respondents)		
1	Digitally enabled workforce, acquisition of digital skills, promotion of culture for innovation	85%
2	Adoption of digital technologies and software as key enabling factors for business development	83%
3	Development of new products and/or services (leading to a structural change of the business model)	80%
4	Automation and/or digital transformation of processes (leading to a structural change of the business model)	79%
5	Transformation of management to become agile and/or automated and/or digitally integrated and/or smart and/or adapted	70%
6	Appointment of persons or teams in charge of digital transformation	68%
7	Definition of digital transformation plans/strategies	64%

One question asked about the perceived increase in the type and level of eGovernment services made available to SMEs by local and regional public authorities and/or agencies during the COVID-19 outbreak. More than two-thirds of the respondents perceived such an increase, which can be intended as an improvement of the contextual conditions supporting the digital transformation of SMEs (Q4.4, Figure 18).

Figure 18. Q4.4 – In your region, did the COVID-19 outbreak increase the type and level of eGovernment services made available to SMEs by local and regional public authorities and/or agencies?

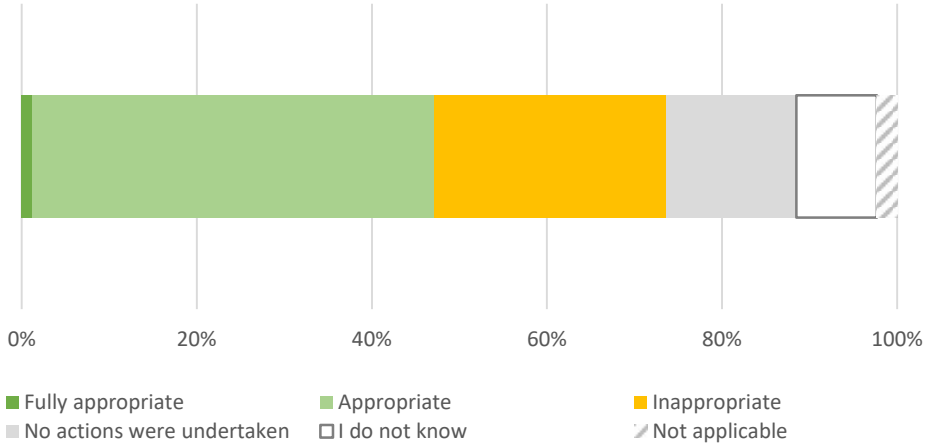


3.4 Actions to support the digital transformation of SMEs in regions

Section 5 was designed to understand the perception of respondents about the appropriateness of the actions undertaken by local/regional public authorities in the last years to address digital transformation needs. It also aimed at identifying the most urgent and necessary actions to be taken to favour the digital transformation of SMEs in the future.

Actions undertaken by local/regional public authorities for SMEs' digital transformation over the period 2018-2020 were considered 'fully appropriate' by only 1% of the respondents, **'appropriate' by 46% of the respondents**, and **'inappropriate' by 26% of the respondents.** In the opinion of 15% of the respondents, *'No actions were undertaken'* (Q5.1, Figure 19).

Figure 19. Q5.1 – In your region, taking into account the needs of SMEs in terms of digital transformation, the actions undertaken by local/regional public authorities in the last 3 years (2018-2020) were:



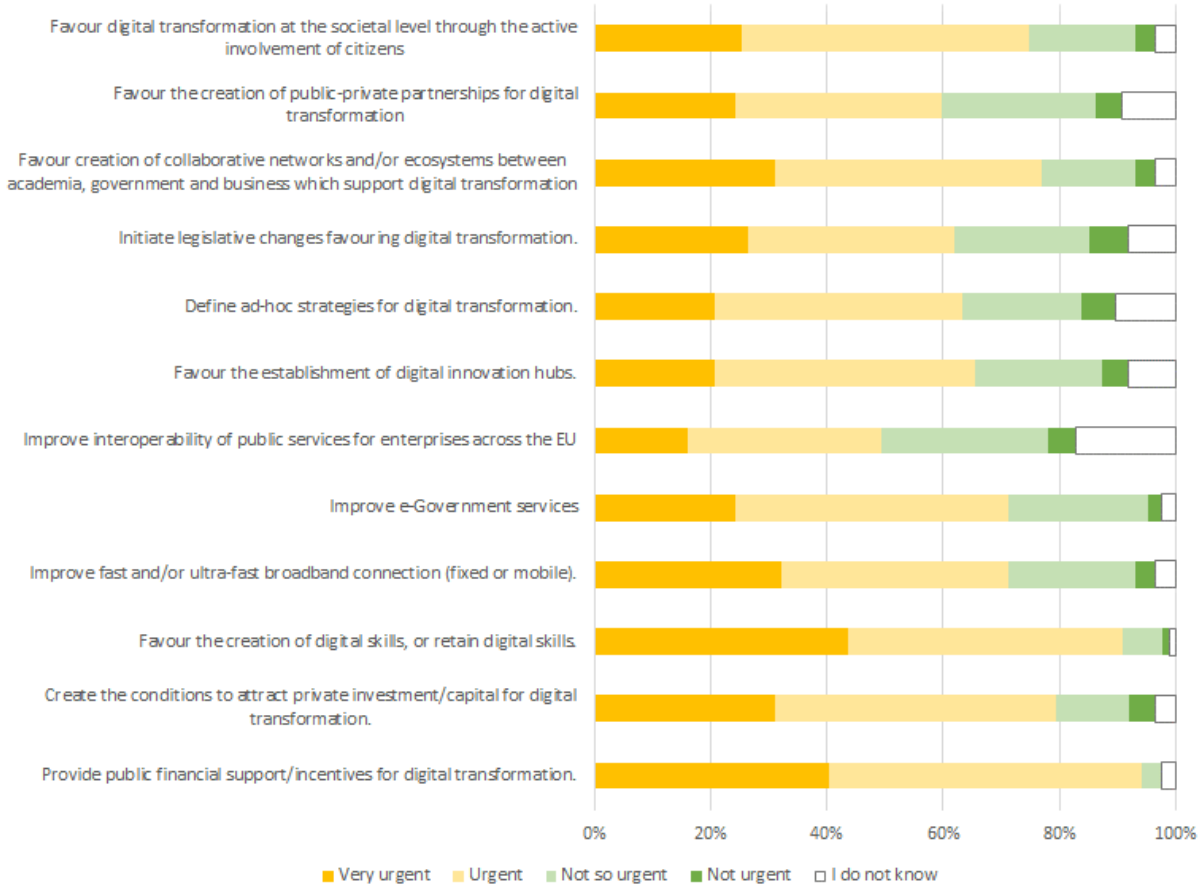
Respondents assessing the actions undertaken by local/regional public authorities as *'appropriate'* provide several examples. Among them, financial incentives and/or grants made available to support SMEs in the digital transformation; the digital transformation of the local public administration; improvements in eGovernement services including those provided in cooperation with chambers of commerce (e.g. the provision of export documents such as the certificates of origin); availability of training and awareness raising activities to introduce new technologies and their opportunities to businesses; the supportive role of the chambers of commerce as points of contact for digitalisation in businesses; initiatives, supported through national funds, for the dissemination of the digital culture and of grant opportunities promoted by the chambers of commerce and by the DIHs; and the inclusion in the RIS strategy of the reach out of digital transformation solutions for industrial modernisation.

Nevertheless, the need for additional effort is highlighted in more than one case. One respondent explicitly indicates that actions have been initiated but also that more resources need to be allocated in terms of funds and support services. For another respondent, some steps have been achieved in digitalisation of public services, but most of them remain not digitalised.

Respondents considering the actions undertaken by local/regional public authorities for SMEs' digital transformation over the period 2018-2020 as *'inappropriate'* refer to the urgent need to provide a suitable broadband connection in all territories; set up programmes and supporting initiatives for digitalisation and technological development which reduce the financial burden on SMEs; increase the limited funding made available compared to SMEs' needs; reduce bureaucracy; make aid to businesses more accessible and readily available; provide consultancy support when funding is available; take advantage of resources available for the EDIHs; raise SMEs' awareness about the existing opportunities linked to digital transformation in terms, for example, of funding, subsidies, and EU projects; and connect all existing public databases and information systems to provide comprehensive digital services. A respondent also notes that there was an insufficient effort to digitally transform SMEs during the COVID-19 crisis as health and education issues were prioritised by local/regional authorities.

Respondents were then asked to provide indications on the most urgent actions to be taken over the period 2021-2023 to favour the digital transformation of SMEs (replies range from *'not urgent'* to *'very urgent'*) (Figure 20). All the suggested actions were considered *'urgent'* by the highest percentage of respondents. The actions perceived as *'very urgent'* by the highest percentages of the respondents are: **to favour the creation of digital skills, or retain digital skills** (44% of the respondents), **to provide public financial support/incentives for digital transformation** (40%) and **to improve fast and/or ultra-fast broadband connection** (fixed or mobile) (32%).

Figure 20. Q5.2 – In your region, which are the most urgent actions to be taken over the period 2021-2023 to favour digital transformation of SMEs?



Other urgent actions to be taken over the period 2021-2023 suggested by the respondents include the support for the creation of digital innovation hubs, the increase of PPPs and the need to recognise a more active role for the chambers of commerce in the design phase of initiatives, programmes and strategies aimed at the digital transformation of SMEs, so as to make them part of the local/regional digital ecosystems.

By distinguishing replies provided by regional authorities and chambers of commerce, within the 'very urgent' and 'urgent' actions **regional authorities prioritise the provision of public financial support/incentives for digital transformation** (93% of the respondents), **the creation of conditions for attracting private investment/capital for digital transformation** (90% of the respondents), **the support for the creation of digital skills, or retainment of digital skills** (90% of the respondents), and **the creation of collaborative networks and/or ecosystems between academia, government and business** (80% of the respondents) (Q5.2, Table 9).

Table 9. Answers to Q5.2, actions to be taken according to the perspective of regional authorities

Top five actions to be taken over the period 2021-2023 to favour the digital transformation of SMEs (the perspective of regional authorities for 'very urgent' or 'urgent' actions)		
1	Provide public financial support/incentives for digital transformation	93%
2	Create the conditions to attract private investment/capital for digital transformation	90%
2	Favour the creation of digital skills, or retain digital skills	90%
3	Favour the creation of collaborative networks and/or ecosystems between academia, government and business	80%
4	Favour digital transformation at the societal level through the active involvement of citizens	76%
5	Improve e-Government services	73%

For the chambers of commerce, the **provision of public financial support/incentives for digital transformation, the support to favour the creation of digital skills, or retain digital skills** and **the creation of collaborative networks and/or ecosystems between academia, government and business** are also top priorities (97%, 94% and 82% of the respondents, respectively) but **the attraction of private investment/capital** only ranks fourth, considered 'very urgent' and 'urgent' for 76% of the respondents (against 90% of the respondents for regional authorities). Similarly to regional authorities, three-quarters of the respondents consider the **digital transformation at the societal level through the active involvement of citizens** 'very urgent' and 'urgent' (Q5.2, Table 10).

Finally, Figure 21 compares the perceived availability of conditions supporting the digital transformation of SMEs in regions before 2020 with the *'very urgent'* actions needed in the future.

For more than one-third of the regional authorities the *'very urgent'* actions to be taken in the next years are those facilitating the creation of digital skills[11] (44%), the availability of public financial support/incentives (44%), and private investment/capital for digital transformation (34%). Among them, **private investment/capital** is perceived as the least *'available'* (20% of the respondents).

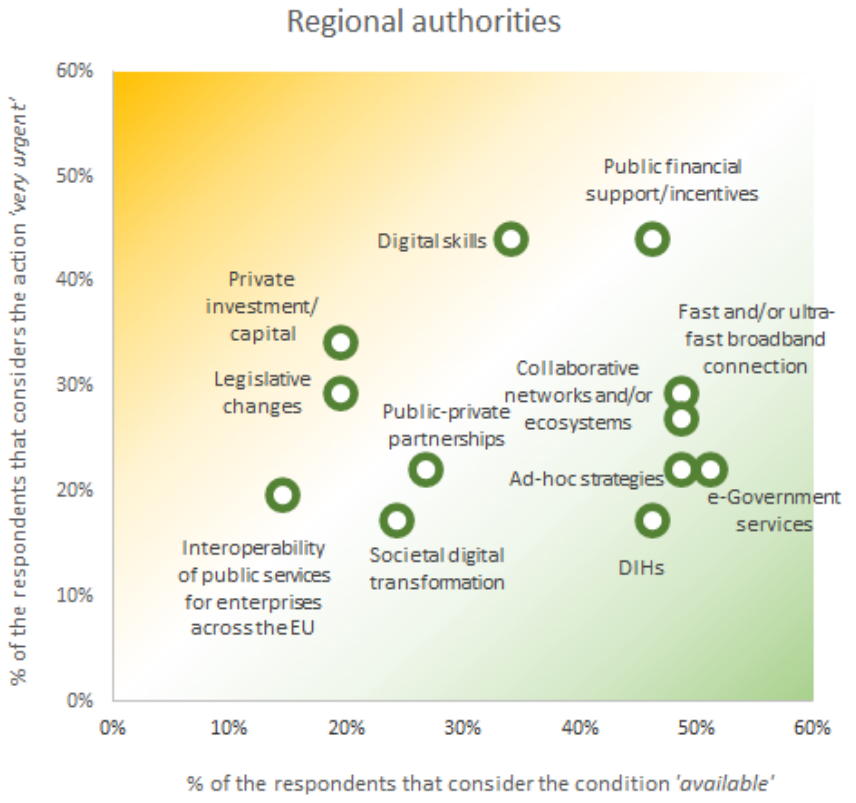
[11] The percentage of the respondents that consider digital skills *'available'* has been proxied by the average percentage of the respondents that considers a *support for the development of ICT skills of employees 'available'* and of the respondents that considers *'initiatives to recruit and attract ICT professionals available'*.

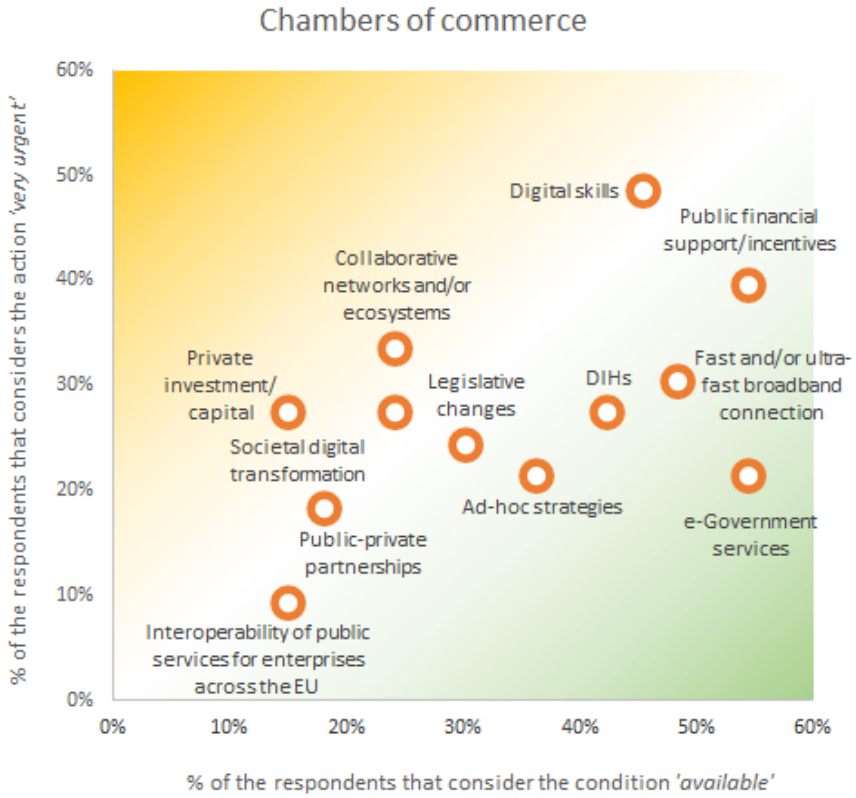
Table 10. Answers to Q5.2, actions to be taken according to the perspective of chambers of commerce

Top five actions to be taken over the period 2021-2023 to favour the digital transformation of SMEs (the perspective of chambers of commerce for 'very urgent' or 'urgent' actions)		
1	Provide public financial support/incentives for digital transformation	97%
2	Favour the creation of digital skills, or retain digital skills	94%
3	Favour the creation of collaborative networks and/or ecosystems between academia, government and business	82%
4	Favour digital transformation at the societal level through the active involvement of citizens	76%
4	Create the conditions to attract private investment/capital for digital transformation	76%
5	Initiate legislative changes favouring digital transformation	73%
5	Improve e-Government services	73%
5	Improve fast and/or ultra-fast broadband connection (fixed or mobile)	73%

For more than one-third of the chambers of commerce the *'very urgent'* actions to be taken in the next years are those facilitating the creation of digital skills (48%), the availability of public financial support/incentives (39%), and the establishment of collaborative networks and/or ecosystems between academia, government and business (33%). Among them, **collaborative networks and/or ecosystems between academia, government and business** is perceived as the least *'available'* (24% of the respondents).

Figure 21. Q2.2 and Q5.2 – Comparison between conditions perceived as *'available'* before 2020 in the regions, and *'very urgent'* actions to be undertaken in the future, by type of respondent, percentage of respondents





Part 4. Conclusions and recommendations

Since early 2020, the COVID-19 pandemic outbreak in Europe has evidenced the unused potential of digital technologies for the whole society. In addition, it has significantly accelerated changes in the way business gets done. Change was a response to the sudden limitation of businesses' operational capacity during the pandemic and to an unexpected change in demand of goods and services driven by the imposed restrictions.

It is unclear how much this new paradigm will persist in the post-COVID-19 era and there is evidence that changes did not concern all enterprises. Some businesses simply closed down and either did not re-open at the end of the acute phase of the pandemic, or survived because of government subsidies and re-opened in a business-as-usual modality.

From the point of view of policymakers, the essential aspect is that digital technologies, solutions and services increased the resilience of the business community and, in turn, the resilience of the society. **In a preparedness perspective, digitalisation and digital transformation support the sustainability of businesses as they allow for more flexibility in case of demand shocks**. It is therefore essential for policymakers to take advantage of the momentum and promote this 'digital sustainability' by means of awareness raising on the digital opportunities which are relevant to the market segment and/or sector where SMEs operate. Policymakers should also facilitate the acquisition of appropriate digital skills and competencies by these SMEs for the understanding and appreciation of the value added by digitalisation.

The context is extremely favourable. Resources are available from the EU long-term budget and the Recovery and Resilience Facility of the Next Generation EU (where **at least 20% of the expenditure needs to foster digital transformation**). Under the Single Market, Innovation and Digital heading of the MMF 2021-2027, a new Digital Europe Programme has been allocated a budget of €7.6 billion to finance projects in cybersecurity, AI, advanced digital skills, supercomputing, and DIHs. On the latter, the EU will support the creation of a European network of co-funded digital innovation hubs (EDIHs), with one hub per region (as a proxy), that will work towards the digital transformation of industry and of public services in coordination with territorial stakeholders such as local and regional authorities, SMEs associations and others (EC-DG CONNECT, 2021).

Building on the evidence collected through desk research, including the case studies and the results of the survey, this study draws some main conclusions and suggests proposals for political recommendations (R), distinguishing between

those favouring contextual conditions for digital transformation and those directly supporting SMEs' digital transformation.

In addition, lack of availability of data at the subnational level is highlighted as a hampering factor to properly inform decision making on the digital transformation of European SMEs at the territorial level.

4.1 Suggestions to favour the contextual conditions for the digital transformation of SMEs

4.1.1 Digitalising the public sector

In some countries there is evidence of poor provision of eGovernment services by **subnational public authorities**. It is a contradiction for governments to ask or to support the business community to digitally transform if the public administration has not itself gone through this process. The contribution of the public sector in the digital transformation process is important for the society in general and for speeding up the digitalisation of SMEs.

R1. *The **digital transformation of the public sector has to be achieved first** not only to create awareness among public employees and end users (businesses and citizens) of the potential of digital technologies and solutions but also to produce a pull effect for digital transformation on the whole society, including through strategic public procurement.*

Evidence in Niederösterreich shows that **prioritising the public administration before focusing on the business community** harvests good results. This suggests the need for public authorities to create synergies and shared milestones at the planning stage between the transformation process of the public and the private sectors. Still in Niederösterreich, the nomination of an **office in charge of digitalisation strategy** deployment clarifies responsibilities and creates a core capacity for coordination, mobilisation and networking activities. In Lombardia, the multi-year institutional agreement 2019-2023 on regional economic development and competitiveness signed by the Region and the regional chambers of commerce includes among its three axes of intervention measures for a **digitally-based simplification of the public administration** (Axis III) and for business competitiveness (Axis I). Relevant training is targeted to public servants working for the regional authority as well as in the chambers of commerce. The digital transformation services provided by the DIH4S in Nord-Vest **target SMEs and local public authorities equally**. Among the sector-specific measures implemented under the Bayern Digital initiative, the 'Digital Shopping City' **involves both retailers and municipalities as the digital transformation of both must go hand in hand.**

Evidence from the consultation
With regard to the various contextual conditions existing before 2020 and supporting digital transformation in regions, ***'eGovernment services'*** *are considered* ***available*** by 53% of the respondents. However, more than two-thirds of the respondents indicate an **increase in the type and level of eGovernment services made available to SMEs by LRAs and/or agencies during the COVID-19 outbreak**, thus giving the impression that digitalisation of the public sector in some regions was accelerated by the pandemic.

4.1.2 Diminishing the rural-urban digital divide in businesses' operational conditions

The uneven deployment of fast and ultrafast broadband and the uneven provision of e-administration and eGovernment services for businesses across the **EU Member States** create unbalanced operational conditions for SMEs. More effort is required by **policymakers at the national and subnational level** to develop supportive framework conditions and design digitalisation approaches which fit the territories where SMEs operate and also the different economic sectors.

R2. *There should be a better understanding of* ***the needs of rural SMEs in terms of type of digital transformation and type of support required*** *also in the light of the existing rural-urban digital divide. Sector-wide digital maturity assessments could help in understanding the barriers, the unexplored digitally-led opportunities, and the most appropriate support for specific categories of SMEs such as those belonging to the more traditional sectors.*

A survey across Irish SMEs shows that remote working **during the lockdown period implied much worse occupational conditions for rural SMEs**. Thus, it is very likely that rural and urban SMEs need technological transformation to happen in diverse ways. The Grand Est Region's **collective digitalisation path** is an example of a **specific approach to digital transformation in rural areas**. Instead, the Galicia Region differentiates its support to sectors by relying on **digital innovation hubs with specific focus domains** (e.g. health, agriculture, fisheries, forestry, and biotechnology).

Evidence from the consultation
Among the barriers to SMEs' digital transformation suggested by the respondents, **the lack of appropriate broadband connection in rural areas** is mentioned**.**
Among the top *'very urgent'* actions to be taken over the period 2021-2023 to favour the digital transformation of SMEs, one-third of the respondents includes the **improvement of fast and/or ultra-fast broadband connection.**

4.1.3 Achieving a digital cohesion

Digital transformation is a challenge for all types of SMEs, including those that are innovative and successful for which change always comes with the risk of lessening their success. Business sectors have different propensities for digitalisation and transformation, and different needs. Pursuing digital transformation should be used as an opportunity for **smoothing differences across the EU and within countries rather than generating further asymmetry**. As digital transformation is meant to increase the competitiveness of SMEs, this opportunity should be made available to all.

R3. *There is a need **to reach out to as many businesses as possible** when undertaking a support intervention for digital transformation.*

The case of Niederösterreich suggests that territorial reach out through a digital roadshow is useful as is the use of traditional media such as TV advertisements. It is therefore advisable to **accompany any support intervention with a comprehensive reach out strategy** which may be differentiated according to the sector.

Evidence from the consultation
Two-thirds of the respondents believe that a **digital transformation plan/strategy** had been implemented/adopted **by only a few SMEs before the COVID-19 outbreak.** The fact that for half of the respondents **a person or a team in charge of digital transformation is appointed in only a few SMEs** indicates that the digital transformation process in businesses lacks a strategic approach. **Acceleration of digital transformation during the COVID-19 outbreak** is considered **'temporary' in nature** by **half of the respondents.**

4.1.4 Avoiding the negative externalities of digital transformation on jobs and labour market exclusion

Enough emphasis is given to the fact that digital transformation is expected to have a positive economic impact for SMEs. However, its social impact should not be overlooked. When pursuing their policies of digital transformation of business, **LRAs** should be supported by a **socio-economic impact assessment** indicating ways to secure jobs and avoid labour market exclusion of some individuals. SMEs who have begun a journey of digital transformation should be facilitated on accessing the types of resources/programmes available to train their employees. Additionally, as it is the case in the public administration where employees are first trained and then the processes are changed, this same sequence could also be applied in the private sector.

R4. *It is necessary to focus digital* ***investments in the existing workforce, favouring the development of its digital skills and competencies*** *in order to make digital transformation a win-win situation for both employers and employees.*

Among Galician SMEs, the second most important barrier to digitalisation is considered to be **the resistance of employees to change**. Resistance could be due to the fear that digitalisation leads to different requirements by employers in terms of capacities and skills, or that digitalisation requires fewer human resources. In the case of the Northern and Western region, attention is paid by regional authorities to **potential negative effects of digital transformation on jobs and social exclusion of workers**. Structural funds, DIHs, qualified digital environments such as the digital business lab under the Bayern Digital initiative, or intermediaries such as chambers of commerce provide **training opportunities**. DIH4S in Nord-Vest provides training **to develop digital skills for executives and employees in SMEs or large companies from any industrial sector**. It also fosters digital education for students (including in high schools) and professionals in engineering, computer science, cybernetics and digital design.

Evidence from the consultation
One-fourth of the respondents believe that before 2020 **a large number of SMEs tackled a digitally skilled workforce**. **Lack of in-house digital skills and lack of digital skills on the job market** are perceived among the most important barriers to SMEs' digital transformation (by 79% and 68% of the respondents, respectively). In the opinion of the majority of the respondents (85%), the first investment priority for SMEs to address COVID-19-related challenges is a **digitally enabled workforce, acquisition of digital skills, and promotion of culture for innovation**. Still, for 44% of the respondents, basic digital skills and professional competencies remain at the top of the *'very urgent'* actions **to be taken over the period 2021-2023** to favour the digital transformation of SMEs.

4.2 Suggestions to directly support SMEs in their digital transformation

4.2.1 Overcoming the financial barriers to digital transformation

Once a business becomes aware of the opportunities of digital transformation, the most important barrier to the digitalisation of SMEs is the cost of its implementation. As SMEs often rely on internally generated liquidity to fund their operations, this cost may be one of the reasons why a SME does not consider digital transformation a feasible option. The organisational and technical complexity of the digitalisation/digital transformation process implies that SMEs have to pay for specialised services, including those rendered by digital innovation hubs. Spontaneous and autonomous digitalisation processes rarely occur. **LRAs** are in the position **of designing the appropriate financing instruments for digital transformation and defining ad-hoc access rules for**

their territories' **SMEs**. Instruments based on co-funding shares such as grants, or on favourable repayment rates such as loans, also guarantee the commitment of beneficiaries for an effective activation/speed up of a digital transformation path.

R5. It is necessary to *facilitate* ***access to external capital to support the implementation of any kind of digital transformation*** *in any type of SME, paying particular attention to the micro- and small enterprises.*

Vouchers and grants are the most common instruments used to support SMEs. Examples from cases are numerous and demonstrate how these instruments are differentiated to better address the digital needs of the beneficiaries (by type of SMEs, by amount, by co-funding, by eligibility conditions, and by pre-conditions for request). Digital Voucher I4.0 of Lombardia is tailored for micro- and small interventions and aims at supporting collaboration on I4.0 technologies, **creation of new skills in digital technologies as well as business continuity during the COVID-19 crisis and in the post-emergency phase**. The digital transformation voucher foreseen in the individual digitalisation path of the Gran Est region can be used **to design the business transition according to a digitalisation path and to buy digital solutions**. The Digipro project in Oost-Nederland provides experienced consultancy to SMEs, as well as financial support for **concept development, feasibility studies and prototype development**. The Digital Bonus of the Bayern Region is a successful example of easy-to-access funding for the digitalisation of small enterprises which requires a 50% co-financing by the SMEs. The bonus distinguishes between two types of interventions and rewards **those interventions that are innovative and more transformative** with **a higher grant**. Finally, the funding need required for the digital transformation of SMEs has led the DIH4S of Nord-Vest to provide as a service, **the identification of funding opportunities for digitalisation** from local and European sources **and the facilitation of access to investors' networks.**

Evidence from the consultation

With regard to the various contextual conditions supporting digital transformation before 2020, ***'specific financial support/incentives for digital transformation' was considered to be available*** by half of the respondents. The top potential barriers perceived 'relevant' are those related to financial aspects, namely: **necessity of large budget/investment requirements** (80% of the respondents), **lack of public support/incentives** (64% of the respondents), and **lack of private investments/capital** (64% of the respondents). **Among the '*very urgent*' actions to be taken in the next future**, **the provision of public financial support/incentives for digital transformation ranks second** (40% of the respondents). Regional authorities, in particular, prioritise **the creation of conditions to attract private investment/capital for digital transformation** (90% of the responding regional authorities) within the '*very urgent*' or '*urgent*' actions, after the provision of public financial support/incentives for digital transformation (93% of the responding regional authorities).

4.2.2 Raising awareness on digital maturity as the entry point to the digital transformation journey of SMEs

Awareness about digital maturity, opportunities provided by digitalisation, and related competitive advantages are the first steps to start with in the digital transformation journey of businesses. Digital maturity assessment is an integral part of the digital transformation process. In some cases, assessment tools are made available for free by intermediary entities such as **chambers of commerce**, corporate categories such as sectoral **association of enterprises**, or **DIHs**. In general, it is noted that these assessment tools are not publicly available online and that there is not a standard reference approach for digital maturity assessment adopted at the European level.

Recommendation 6. *It is crucial that entities with a Europe-wide presence across territories such as the chambers of commerce take the lead in involving SMEs in **massive digital maturity assessment campaigns** to create potential entry points into a digital transformation path.*

In some of the cases, digital maturity assessment is required as a precondition to apply for subsidies. This is a good practice as it increases the awareness of SMEs on their needs and may thus improve the impact achieved with the granted incentives. The Lombardia Region provides for two different tools, an online tool and interviews, which are made available through the **digital business points of the chambers of commerce**. The **Chamber of Commerce and Industry and the *Chambre De Métiers* are in charge of the digital maturity diagnosis of SMEs applying for the individual digitalisation path** of the Grand Est Region. In the Northern and Western region, a **full diagnostic** is also the first step to undertake beginning a digital transformation.

Evidence from the consultation
Three-quarters of the respondents perceive **lack of digital awareness/culture at the management level** as one of the most important barriers to SMEs' digital transformation.

4.2.3 Facilitating the leveraging effect of digital innovation as a service

SMEs do not have enough knowledge of the opportunities created by the adoption of digital solutions. Digitalisation is primarily seen as a cost and not as a way to improve their competitiveness. Demand for digitalisation from SMEs may be accelerated by using the leverage effect of **ICT companies, their aggregations such as ICT clusters, or intermediaries for digital innovation such as DIHs** which are offering digital products and solutions to the market. In practice, by supporting the creation of an accessible tech marketplace, uptake of digital technologies by SMEs is facilitated as a push factor to increase SMEs' awareness

and knowledge of available technologies and services and of the opportunities/advantages they create.

Recommendation 7. ***ICT supply side actors shall be used as a leverage to initiate the digital transformation of SMEs.*** *ICT companies, ICT clusters and DIHs have the competencies to illustrate and present the advantages of their digital products and solutions and the economic interest to promote these technologies' uptake by SMEs. LRAs should contribute in facilitating the creation of physical and virtual tech marketplaces that use digital innovation as a service (DIaaS).*

In the Northern and Western region, a **digital collaboration platform** is designed as a meeting point between SMEs which are willing to innovate and technology-based businesses that will explain, demonstrate and offer available digital and technological solutions/products to SMEs. The more this tech marketplace is tailored to the needs of the SMEs, the higher the chances are of involving SMEs. In the Nord-Vest, **the DIH was established on the initiative of the existing ICT cluster** to reach out to SMEs needing to initiate a digital transition. Qualified digital solution providers are also used by regional authorities to provide digital transformation services which are co-funded with public money. This occurs for example in Lombardia with the **definition of the qualified service provider categories for digital innovation 4.0**, and in Oost-Nederland through the identification of **service providers in the Competencies Atlas.**

Evidence from the consultation
With regard to the various contextual conditions supporting digital transformation before 2020, **44% of the respondents considers *digital innovation hubs 'available',*** 33% *'not sufficiently available'* and 18% *'not available'*. By ranking the aspects in which SMEs are perceived to consider investments *'relevant'* or *'very relevant'* further to the outbreak of the pandemic, ***the adoption of digital technologies and software as key enabling factors for business development*** ranks second (83% of the respondents).

4.2.4 Facilitating digital changes in business models through intermediaries

ICT suppliers of knowledge and technology can push SMEs' digital transformation by offering their solutions. In this case, DIHs, ICT clusters and platforms take the role of 'technical intermediaries' for digital transformation. However, transition of business models towards new paradigms also requires the involvement of organisational and business expertise. Together with other actors at the European level, such as the European Enterprise Network, the **chambers of commerce** can take up the role of business intermediaries.

Recommendation 8. ***The role of intermediaries such as the chambers of commerce in supporting SMEs in digitally changing their business models*** *should be integrated with the territorial policies for competitiveness and economic growth.*

The **multi-annual agreement of the Lombardia Region** with the regional chambers of commerce is an example of structured cooperation. The region's nine chambers of commerce assess the digital needs of the territory's SMEs, contribute to fund vouchers for digital transformation, provide grants for e-commerce, and assist the local business community daily on digital transition through informative points. The chambers of commerce are also among the **intermediary agents contributing to the nodes of the 'House of Digitalisation' network in Niederösterreich**, and **partners of the Digital Innovation Hub in Nord-Vest**.

Evidence from the consultation
Half of the respondents perceive that before the COVID-19 outbreak the two aspects related to **a structural change of the existing business model** (i.e. automation and/or digital transformation of the processes, and development of new products and/or services) have been implemented/adopted **by a few SMEs**.
The **chambers of commerce** are the second most selected actor considered to have **a role in facilitating the digital transformation of SMEs**.

4.2.5 Establishing collaborative and integrated digital innovation ecosystems

Each region has its own endowment of knowledge providers, research centres, thematic clusters and the like. It is natural to take advantage of each region's characteristics to capitalise on knowledge and create favourable conditions for digital outcomes. **Collaborative and integrated digital ecosystems at the territorial level** may provide SMEs with a virtual and physical reference point for any step of a digital transition path starting from access to information to deployment of the solutions. These ecosystems supported by **LRAs** may link to market as they transform the ideas and contributions of the network's participants into products, services or, eventually, benefit from research projects funded at the EU or international level.

Recommendation 9: ***Regional authorities shall identify the actors in their territory*** *who are potential providers as well as beneficiaries of knowledge, technologies and innovation in order to create* ***collaborative integrated digital innovation ecosystems*** *that can become a stable reference system for digital transformation of SMEs in the region. Strategies for competitiveness, innovation and economic growth should be coupled with those for digital transition.*

The House of Digitalisation in Niederösterreich integrates the contribution of **business support organisations, chambers of commerce, and start-up agencies**. In Galicia, the **digital innovation hubs** established by the Region are also **collaborative ecosystems** providing competencies and services but also linking to the market. They are intended to support businesses in maturing

technologies, expanding their application and opening up new markets with innovative products and services. By facilitating access to the most innovative technologies, companies strengthen their competitive position while the competence centres that provide knowledge extend their activities to market-oriented products and services. In the Bayern's example, **business-oriented and topic-specific platforms** are used to accelerate the transfer of knowledge, networking and partnering with a view to scout new emerging digital technologies and initiate digitalisation projects. The digital transformation initiatives of Galicia and Oost-Nederland presented in this study are grounded on the **regional smart specialisation strategy** (RIS3).

Evidence from the consultation
With regard to the various contextual conditions supporting digital transformation before 2020, the majority of respondents consider **collaborative networks and/or ecosystems between academia, government and business which support digital transformation** as ***'Not sufficiently available'*** (45% of the respondents). Those considering collaborative networks and/or ecosystem 'available' are 36%. **Strategies at the local or regional level for digital transformation have been considered *'Available'* by 42% of the respondents**, *'Not sufficiently available' by* 32% of the respondents and *'Not available' by* 17% of the respondents. A **perceived complementarity of the actors and their roles in SMEs' digital transformation** is evident when considering that 70% of the respondents indicated **at least three of them.**
The creation of collaborative networks and/or ecosystems between academia, government and business ranks third among the *'urgent'* priorities of regional authorities (80% of the respondents) and chambers of commerce (82% of the respondents) in terms of actions to be taken over the period 2021-2023 to favour the digital transformation of SMEs.

4.3 Data failure in informing on the progress of digital transformation at the subnational level

As a last point, this study, through an in-depth analysis of data availability in the digital domain, has demonstrated the presence of several and important data gaps to properly define the state of play of digital transformation of business at the regional level. The gap analysis carried out to define a framework for the measurement of digital preparedness in regions with a focus on the digitalisation of SMEs (Part 1) has found that it is not possible to monitor progress in key domains such as eGovernment services for businesses, human resources in ICT, quality of the connection, ICT usage and e-commerce in enterprises, and cybersecurity aspects.

Whereas the territorial dimension of SMEs' digital transformation is evident, European official statistics fail in properly informing on progress and benchmarks at the subnational level.

Recommendation 10. *If the Commission vision is 'A Europe fit for the digital age' (i.e. one of the six Commission's priorities for the period 2019-2024), it should* ***widen the geographical scope of existing data collection processes and regularly collect information for at least some basic variables at the regional level.*** *Possibly, this may be supported by further modernising or (digitally) transforming the current data collection processes.*

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Annex II. Assessment of the indicators used in existing frameworks

HUMAN CAPITAL				
Framework	**Indicator**	**Relevance assessment**	**Remarks**	**Availability – regional level**
LORDI	Presence and rating of universities in Computer Sciences and Information Systems		Universities in these subjects are relevant sources of human capital for the digitalisation of SMEs but these indicators go into too much detail, are hardly measurable and attainable.	
	Presence and rating of universities in Engineering: mech., manuf. & aeronautics			
	Presence and rating of universities in Statistics			
	Social media users: Facebook users per capita		This is a measurement of internet users' activity – not directly relevant for SMEs.	
	Social media users: Twitter users			
	Crowdsourcing contributions: % of TripAdvisor/Yelp/Foursquare contributors			
	Crowdsourcing contributions: % of Wikipedia contributors			
	Crowdsourcing contributions: % of Open Street Map contributors			
HC_01_L	Employment in ICT sector		This is an indicator of employed skilled professionals, including in SMEs. It is highly relevant as it focuses on the ICT sector.	Not available at the regional level (LORDI data source refers to metropolitan regions only) = GAP Alternative indicators (proxies) at NUTS2 level (Eurostat) are: • Employment in high-tech sectors • Employment in information and communication
	Collaboration skills: % of GitHub users (15-65)		Potentially relevant but hardly measurable and attainable. Indicated sources (https://api.stackexchange.com/ and https://docs.github.com/en/free-pro-team@latest/rest) are unlikely to provide a regional breakdown of data.	
	Collaboration skills: % of GitHub users			
	Data skills: % employees with data skills (15-65)			
	Data skills: % advanced data experts (15- 65)			
	Programming skills: % employees with programming skills (15-65)			
	Programming skills: % advanced programming experts (15-65)			

	Service design skills: % employers with service design skills (15-65)			
	Living Labs: Living labs per capita / Presence of a living lab		Not relevant because living labs do not necessarily focus on the digital transformation of SMEs.	
	Living Labs: Projects funded per capita		Too detailed information. Their added value is unclear.	
	Living Labs: End-users involved per capita			
	Living Labs: National partners per living lab			
	Living Labs: International partners per living lab			
HC_02_L	Innovation Hubs: Innovation hubs per capita / Presence of innovation hubs		The presence of an innovation hub may support the digital transformation of SMEs **but the indicator should focus on <u>digital</u> innovation hubs**, i.e. hubs focussing on digital innovation.	The data source for the 'innovation hub' indicator is not specified in LORDI = GAP We propose to use as source for the presence of 'digital innovation hubs' the JRC 'yellow pages' of Digital Innovation Hubs.
	Innovation Hubs: Business and public sector entities supported		Too detailed information. Their added value is difficult to assess.	
	Innovation Hubs: Digital maturity of entities supported			
	IoT labs: Mobile IoT labs per capita		Potentially relevant indicator even if its focus on SMEs is unclear. In addition, the data source for this indicator is not specified in LORDI.	
	Sex and age: % female founders in tech		Insufficiently clear the role of 'diversity' in fostering the digital transformation of SMEs.	
	Sex and age: Facebook users (M, F, 13-15), per age/sex group			
	Sex and age: Facebook users (M, F, 15-65), per age/sex group			
	Sex and age: Facebook users (M, F, 65+), per age/sex group			
	Education: % of founders in tech who do not hold a degree			
DESI	Internet User Skills: 2b2 Female ICT specialists		This is a measurement of internet users' skills – not directly relevant for SMEs.	
	Internet User Skills: Above basic digital skills			
	Internet User Skills: At least basic software skills			

HC_03_D	Advanced Skills and Development: (employed) ICT Specialists		This is a relevant indicator of employed professionals (including in SMEs) who are skilled in ICT.	Not available at the regional level = GAP Alternative indicators (proxies) at NUTS2 level (Eurostat) are: • Human resources graduated and employed in science and technology • Employment in information and communication
	Advanced Skills and Development: Female ICT specialists		Insufficiently clear the role of 'diversity' in fostering the digital transformation of SMEs.	
HC_04_D	Advanced Skills and Development: ICT graduates		This is a relevant indicator as it measures the graduates by education level in the ICT field of education, i.e. the human capital available to SMEs.	Not available at the regional level = GAP No proxy may be identified.
CISCO	Labour Force Participation Rate (proportion of the population aged 15 years and older that is economically active)		These indicators are considered too general and therefore not specific and relevant enough.	
	Adult Literacy Rate			
	Education Index (Years of School)			
	Harmonized Test Scores from major international student achievement testing programs			

BUSINESS ENVIRONMENT

Framework	Indicator	Relevance assessment	Remarks	Availability – regional level
LORDI	Political commitments: Signed 'Join, Boost, Sustain' declaration (Y/N)		These indicators refer to the city level only.	
	Political commitments: Signed 'Green Digital Charter' (Y/N)			
	Participating in key networks: City is part of OASC (Y/N)			
	Participating in key networks: City is part of Eurocities (Y /N)			
	Participating in key networks: City takes part of ICC (Y/N)			

	Participating in key networks: City took part in DCC (Y/N)			
	Participating in key networks: City is part of EIP-SCC			
	Urban data platforms (UDP) (self- assessment in the survey)			
	Interoperable DSM: Information management (adopted MIM1)		Source is OASC – Open and Agile Smart Cities, a network of smart cities. Thus, these indicators are all at the city level.	
	Interoperable DSM: Common data models (adopted MIM2)			
	Interoperable DSM: Data marketplace (adopted MIM3)			
	Interoperable DSM: Personal data management (adopted MIM4)			
	Interoperable DSM: Fair AI (adopted MIM5)			
DESI	e-Government Users		These indicators are not specific for SMEs.	
	Pre-filled Forms			
	Online Service Completion			
BE_01_D	Digital public services for businesses		Relevant and important indicator as it measures the share of public services needed for starting a business and for conducting regular business operations that are available online.	Not available at the regional level = GAP. No proxy may be identified.
	Open Data		It measures to what extent countries have an Open Data policy in place. It is not focused on business activity.	
CISCO	Local rule of law		Potentially relevant but it is a global index based on several variables so it is not attainable for regions.	
BE_02_C	Ease of Doing Business Index		Relevant indicator. It ranks cities according to: Ease of Doing Business, Starting a Business, Dealing with Construction Permits, Getting Electricity, Registering Property, Getting Credit, Protecting Minority Investors, Paying Taxes, Trading across Borders, Enforcing	Source of the index: World Bank studies, including at the subnational level, carried out under the 'Doing Business' initiative. In the EU, they are available at the subnational level for GR, IE, IT, HR, CZ, PT, SK, BG, HU, RO, ES, PL. However, they refer to different years and not to regions but to

			Contracts, Resolving Insolvency	cities = GAP. No alternative data source identified.
	Logistics Performance Index (LPI) – Infrastructure rating		Potentially relevant but it is a global index based on several variables. The source is 'Transparency International' and data are not available at the regional level.	
	Time to Get Electricity		Not relevant for the EU.	

PUBLIC & PRIVATE INVESTMENTS

Framework	Indicator	Relevance assessment	Remarks	Availability – regional level
LORDI	Private funding - Business support: Organisations in impact investment		Potentially relevant indicators but multiple and also unclear data sources are indicated in LORDI. Data comparability across sources is unlikely, making the indicators not measurable and attainable.	
	Private funding – Crowdfunding: ICT related businesses supported by crowdfunding			
	Public procurement: Number of joint PCP and PCI initiatives		Pre-commercial procurement and procurement of innovation are not necessarily related to digitalisation. In addition, they are not attainable as the data source for the two indicators is not specified in LORDI.	
	Public procurement: Budget engaged in joint PCP and PCI initiatives			
PPI_01_L	Public procurement: Public money spent on SMEs by local authorities in purchasing digital goods and services		Relevant.	Source is TED Europa. Manual compilation of the dataset may be possible at the regional level. Criteria for selection of the relevant calls for tenders need to be determined.
CISCO **PPI_02_C**	Foreign direct investment		Relevant indicator. It channels not only capitals but also technologies and know-how. Important.	Data source is the IMF and therefore data are not available at the regional level = GAP. No equivalent indicator or proxy is available

PPI_03_C	Research and development spending		Relevant indicator.	Data source is UNESCO and therefore data are not available at the regional level = GAP. It could be replaced by the following Eurostat indicator: intramural R&D expenditure (GERD- Gross domestic expenditure on R&D) by source of funds.
	Investment freedom		Potentially relevant but it is a global index based on several variables so it is not measurable at the regional level.	

START-UP ENVIRONMENT

Framework	Indicator	Relevance assessment	Remarks	Availability – regional level
CISCO SUE_01_C	New Business Density		Relevant indicator if it is focused on specific sectors.	Data source is the World Bank and therefore data are not available at the regional level. No equivalent indicator is available = GAP. It could be replaced by Eurostat data on business demography, NACE Section J 'information and communication'.
SUE_02_C	Patents Granted and Trademarks Registered		Relevant indicator if it is focused on specific sectors.	Data source is the World Intellectual Property Organization and therefore data are not available at the regional level = GAP. Eurostat regional data on patents/trademarks are outdated. An alternative dataset is the OECD 'Patent applications in ICT' but latest data date back to 2015 and cover only 12 of the EU countries.
SUE_03_C	Venture Capital Investment and Availability		Relevant and important.	Data source are the Center for American Entrepreneurship and WEF therefore data are not available at the regional level = GAP

				An alternative data source is dealroom.co but online open data on VC are incomplete. Instead, open data on unicorns (proxy – they are considered an indicator of economic success) are available and may be manually compiled at the regional level.

DIGITAL INFRASTRUCTURE

Framework	Indicator	Relevance assessment	Remarks	Availability – regional level
LORDI **DI_01_L**	Fixed broadband infrastructure: Households covered by fast broadband		This is a key broadband coverage indicator.	The data source is a DG CONNECT study on broadband coverage. Map at the territorial level is available.
DI_02_L	Fixed broadband infrastructure: Households covered by ultrafast broadband		This is a key broadband coverage indicator.	Multiple sources are indicated in LORDI. One is the DG CONNECT study on broadband coverage which nevertheless provides only fast (NGA) broadband coverage at the subnational level. The European Broadband Mapping portal provides info of fast and ultrafast coverage for 12 EU Member States only = GAP. No alternative data sources are identified.
DI_03_L	Fixed broadband infrastructure: Average broadband download speed		These three indicators relate to the quality of the connection and are all relevant.	Not available at the regional level = GAP.
DI_04_L	Fixed broadband infrastructure: Average broadband upload speed			
DI_05_L	Fixed broadband infrastructure: Average broadband latency			
	Fixed broadband infrastructure take-up: Unique WIFI networks per households		The added value of this indicator is unclear.	
	Fixed broadband infrastructure security: % of WIFI networks with default SSID		Potentially relevant as these indicators introduce a 'security' component which is	

	Fixed broadband infrastructure security: % of wireless encryption technologies		important. However, they are hardly measurable and attainable. The indicated source (https://api.wigle.net/) is unlikely to provide a regional breakdown of data.	
	Fixed broadband infrastructure affordability: Monthly fee as % of disposable income		Potentially relevant but the data source for this indicator is not specified in LORDI, so it is not measurable.	
	Mobile broadband infrastructure coverage: Number of cell towers per capita		Potentially relevant but multiple data sources are indicated. Unclear data collection process and data flow make these indicators hardly measurable and attainable.	
	Mobile broadband infrastructure coverage: % of population covered by 4G network			
	Mobile broadband infrastructure coverage: % of population covered by 5G network			
	Mobile broadband infrastructure: Average mobile download speed		These three indicators relate to the quality of the connection and are all relevant but multiple data sources are indicated. Unclear data collection process and data flow make these indicators hardly measurable and attainable.	
	Mobile broadband infrastructure: Average mobile upload speed			
	Mobile broadband infrastructure: Average mobile latency			
	Mobile broadband infrastructure take-up: Number of BT devices per capita		The added value of this indicator is unclear.	
	Public wireless infrastructure: Number of free hotspots per capita		Not relevant for the business sector.	
	IoT infrastructure network: Availability of LTE-M network (Y/N)		Potentially relevant but the source indicated by LORDI provides only national data. These indicators are thus not attainable for regions.	
	IoT infrastructure network: Availability of NB-IoT network (Y/N)			
	IoT infrastructure network: Availability of LTE-M & NB IoT networks (Y/N)			
	IoT infrastructure solutions: EV charging stations per capita/vehicles		Not relevant for the business sector.	
	IoT infrastructure solutions: Smart lampposts per capita			

	IoT infrastructure solutions: CCTVs per capita			
	IoT infrastructure solutions: Speed traps per capita			
	Co-working infrastructure: Co-working spaces per capita (15-65)		Potentially relevant indicators. The data source is coworker.com. The data collection process/data flow are unclear and unlikely to provide a regional breakdown of data.	
	Co-working infrastructure: Meeting spaces per capita (15- 65)			
	Co-working infrastructure: Fabrication and manufacturing facilities per capita (15-65)		Potentially relevant indicators but multiple and also unclear data sources are indicated in LORDI. Data comparability across sources is unlikely, making the indicators not measurable and attainable.	
	Affordability: Monthly fee as % of disposable income		Unclear what affordability refers to in this case.	
	Technology: Shared 3D printing equipment per capita (15-65)		This info goes into too much detail.	
	Technology: Shared VR equipment per capita (15-65)			
	Technology: Shared AR equipment per capita (15-65)			
	Technology: Shared supercomputers per capita (15-65)			
DESI **DI_06_D**	Fixed broadband coverage: Fast broadband (NGA) coverage		This is a key broadband coverage indicator.	Available as a mapped info at the territorial level from DG CONNECT studies. It is distinguished into total coverage and coverage in rural areas.
DI_07_D	Fixed broadband coverage: Fixed Very High-Capacity Network (VHCN) coverage		This is a key broadband coverage indicator.	Not available at the regional level = GAP.
DI_08_D	Fixed broadband take-up: Overall fixed broadband take-up		This is a key indicator for take-up.	The following Eurostat indicator is available at the regional level: Households with broadband access
DI_09_D	Fixed broadband take-up: At least 100 Mbps fixed broadband take-up		This is a key indicator for take-up.	Not available at the regional level = GAP.
DI_10_D	Mobile broadband: 4G coverage		This is a key broadband coverage indicator.	Not available at the regional level = GAP.
DI_11_D	Mobile broadband: Mobile broadband take-up		This is a key indicator of take-up.	Not available at the regional level = GAP.

DI_12_D	Mobile broadband: 5G readiness		This is a key indicator for digitalisation	Not available at the regional level = GAP.
DI_13_D	Broadband price index		Relevant and important. It measures the prices of representative baskets of fixed, mobile and converged broadband offers.	Not available at the regional level = GAP.
CISCO	Mobile Broadband Subscriptions		These are relevant indicators of take-up but the data source is ITU and therefore are not attainable for regions.	
	Fixed Broadband Subscriptions			
	Household Internet Access			
	Secure Internet Servers		Potentially relevant. The data source is netcraft.com a UK-based company. It is not clear the type of reports they may produce/provide. Unclear data collection process and data flow make this indicator hardly attainable.	

DIGITAL ECONOMY & SERVICES

Framework	Indicator	Relevance assessment	Remarks	Availability – regional level
LORDI DES_01_L	Gross Value Added in ICT per capita in PPS		Relevant.	Not available at the regional level = GAP.
				An alternative indicator (proxy) that may be considered at NUTS2 level (Eurostat) is: Gross value added at basic prices by NUTS 3 regions, NACE J: Information and communication.
	Intensity of 4.0 patents per capita		Potentially relevant but it is based on ad-hoc analysis of EPO. Eurostat data at regional level are old. A relevant study has been released by EPO in 2020. It provides data at national and cluster level (i.e. large urban agglomerations such as Stuttgart, Eindhoven, etc.). Therefore, it is not	

			attainable for regions.	
	Total deal value in FDI projects by ICT sector		Unclear definition of this indicator which is also based on multiple sources.	
	Short-term accommodation services: % of nights booked from individuals		Not directly relevant to the digitalisation of SMEs.	
	Short-term accommodation services: % of nights booked from hotels			
	Short-term accommodation services: % of individuals booking from individuals			
	Short-term accommodation services: % of individuals booking from hotels			
	Shared transport services: Availability of bike sharing system (Y/UD/N)			
	Shared transport services: Bikeshare operators per capita			
	Shared transport services: Bicycle docking stations per capita			
	Shared transport services: Shared bikes per capita			
	Shared transport services: Shared bikes in use per capita			
	Shared transport services: Number of cars in car sharing per capita			
	Shared transport services: Number of daily trips per capita			
DESI	Internet use: People who never used the internet		Not directly relevant to the digitalisation of SMEs.	
	Internet use: Internet Users			
	Activities online: News		These indicators refer to activities of individuals and therefore are not directly relevant to the digitalisation of SMEs.	
	Activities online: Music, Videos and Games			
	Activities online: Video on Demand			
	Activities online: Video calls			
	Activities online: Social Networks			
	Activities online: Doing an online course			
	Transactions: Banking		These indicators refer to activities of individuals and are not directly relevant to the digitalisation of SMEs.	
	Transactions: Shopping			
	Transactions: Selling online			

CISCO	Mobile Cellular Penetration		These are relevant indicators of adoption but the data source is ITU and therefore are not attainable for regions.	
	Internet Usage			
	Cloud Services (Spend, IT Forecast Data)		Not bounded to a geographical level.	

CYBERSECURITY

Framework	Indicator	Relevance assessment	Remarks	Availability – regional level
DESI	Individuals who experienced a security-related problem (% of internet users)		These indicators refer to activities of individuals and therefore are not directly relevant to the digitalisation of SMEs.	
	Type of security-related problems experienced (% of internet users)			
	Individuals who were limited or prevented from performing selected online activities because of security concerns (% of internet users)			
	Security incidents and security concerns (% of internet users)			
	Online activities limited or prevented because of security concerns (% of internet users)			
CS_01_D	Enterprises that experienced at least once problems due to an ICT related security incident (unavailability of ICT services, destruction or corruption of data, disclosure of confidential data) (% of enterprises)		These indicators are all relevant.	Not available at the regional level. They are collected through the Survey on ICT usage and e-commerce in enterprises = GAP
CS_02_D	Problems experienced due to ICT security incidents (% of enterprises)			
CS_03_D	Type of ICT security measures adopted by EU enterprises (% of enterprises)			
CS_04_D	Enterprises that make persons employed aware of their obligations in ICT security issues (% of enterprises)			
CS_05_D	Enterprises make persons employed aware of their obligations in ICT security issues by compulsory training courses or compulsory material (% of enterprises)			
CS_06_D	Enterprises that make persons employed aware of			

	their obligations in ICT security issues (% of enterprises)			
CS_07_D	Enterprises make persons employed aware of their obligations in ICT security issues by compulsory training courses or compulsory material (% of enterprises)			

Annex III. Questionnaire

Questionnaire of the survey conducted by the European Committee of the Regions (CoR) and EUROCHAMBRES, the Association of European Chambers of Commerce and Industry, on digital preparedness in regions, changes in the business model driven by the digital transformation, impact of the COVID-19 outbreak on the digital transformation and actions to support the digital transformation of SMEs in regions.

Section 1 – Details of the respondent

*(Questions with * are mandatory)*

Q1.1 – Information on the respondent

*First name: [Open answer]*_____
*Last name: [Open answer]*_____
Email:[Open answer]*_____
Function/position: [Open answer]*_____
Organisation: [Open answer]*_____
Country in which the organisation is based: [drop down menu with the EU27 Member States]*
Region in which the organisation is based: [drop down menu with the NUTS2 of the selected Member States]*

Q1.2 – Are you replying to this questionnaire on behalf of*: [only one answer allowed]

A regional authority or other public entities at the regional level.
A chamber of commerce and industry.
Other informed stakeholders (please specify): *[Open answer]*_____

Section 2 – Digital preparedness in regions

*(Questions with * are mandatory)*

Q2.1 – To the best of your knowledge, in your region, in how many SMEs did the following aspects related to digital maturity occur before 2020?* [only one selection allowed for each listed condition]

	A few SMEs	*About half of the SMEs*	*A large number of SMEs*	*I do not know*
A digital transformation plan/strategy is in place				
A person or a team in charge for digital transformation is appointed				
New products and/or services (leading to a structural change of the business model) are developed				
Digital technologies and software are considered, or leveraged as a key enabling factor for business development				
Workforce is digitally enabled, digital skills are acquired, and/or culture for innovation is encouraged				
Management (brand management, customer management, portfolio management, etc.) becomes agile and/or automated and/or digitally integrated and/or adapted				

Processes are automated and/or digitally transformed (leading to a structural change of the business model)				

Q2.2 – To the best of your knowledge, in your region, which of the following has been available to support the digital transformation of SMEs*? [only one selection allowed for each listed condition]

	Available	*Not sufficiently available*	*Not available*	*I do not know*
Specific public financial support/ incentives for digital transformation				
Specific private investments/capital for digital transformation				
Support for the development of ICT skills of employees				
Initiatives to recruit and attract ICT professionals				
Initiatives to address cultural or social barriers to digital transformation				
Fast and/or ultrafast broadband connection (fixed or mobile)				
eGovernment services				
Interoperability of public services for enterprises across the EU				
Digital innovation hubs				
Fab labs or living labs				
Universities, research and technologies centres				
Strategies at the local or regional level for digital transformation				
Legislative changes favouring digital transformation				
Collaborative networks and/or ecosystems between academia, government and business which support digital transformation				
Public-private partnerships for digital transformation				
Digital transformation at the societal level through the active involvement of citizens				

Q2.3 – To the best of your knowledge, in your region, which actors have a role in facilitating the digital transformation of SMEs [a maximum of three selections allowed]*?

European institutions/agencies/networks.
National government/agencies.
Authorities/agencies at the regional level.
Authorities/agencies at the local level.
Entities at the local/regional level supporting digital transformation processes (e.g. digital innovation hubs).
Chambers of commerce and industry and/or their associations.
Other (please specify) *[open answer]*_____

Section 3 – Changes in the business model driven by the digital transformation

*(Questions with * are mandatory)*

Q3.1 – To the best of your knowledge, in the last 5 years, which of the following aspects of SMEs' business model have changed because of the digital transformation?*: [only one selection allowed for each listed condition]

	No changes occurred	*Small changes occurred*	*Big changes occurred*	*I do not know*
Way to address the needs of customers				
Approach to generate revenues and sustain costs				
Market share				
Competitive advantage				
Market strategy				
Procurement strategy				
Organisational structure				
Human resources				
Collaboration with third parties				

Q3.2 – To the best of your knowledge which are the most relevant barriers to the digital transformation of SMEs?*: [only one selection allowed for each listed condition]

	Very relevant	*Relevant*	*Not so relevant*	*Not relevant*	*I do not know*
Large budget/investment requirements.					
Lack of public support/incentives.					
Lack of private investments/capital.					
Lack of awareness/culture at the management level.					
Lack of in-house digital skills					
Lack of digital skills on the job market.					
Lack of ICT equipment and services.					
Not adequate broadband connection.					
Lack of eGovernment services.					
Lack of interoperability of public services for enterprises across the EU					
Not adequate local/regional strategies					
Not adequate legislative context					
Lack of public-private partnerships for digital transformation					
Not adequate digital transformation at the societal level					

Other (please specify) [Open answer]

_____

Section 4 – Impact of the COVID-19 outbreak on the digital transformation

*(Questions with * are mandatory)*

Q4.1 – To the best of your knowledge, in 2020, SMEs in your region accelerated the digital transformation *:[only one answer allowed]

to cope with the COVID-19 outbreak through temporary solutions.
to cope with the COVID-19 outbreak according to in-house strategies.
to cope with the COVID-19 outbreak according to strategies defined with the support of third parties (e.g. digital innovation hubs, consultancy companies).
digital transformation was not considered as an option to cope with the COVID-19 outbreak.
Other (please specify) *[open answer]* _____

Q4.2 – To the best of your knowledge, in 2020, in your region, the acceleration of digital transformation in SMEs was primarily: *: [only one answer allowed]

to respond to an increase of market demand for products/services caused by the COVID-19 outbreak.
to overcome the decrease of market demand for products/services caused by the COVID-19 outbreak.
to comply with stay-at-home customers' orders due to the pandemic.
digital transformation was not considered as an option to manage changes of market demand for products/services caused by the COVID-19 outbreak.
Other (please specify) *[open answer]* _____

Q4.3 – To the best of your knowledge, in your region, which of the following aspects related to digital maturity do SMEs consider relevant for investment in order to address the challenges caused by the COVID-19 outbreak?*: [only one selection allowed for each listed condition]

	Very relevant	*Relevant*	*Not so relevant*	*Not relevant*	*I do not know*
Definition of digital transformation plans/strategies					
Appointment of persons or teams in charge for digital transformation					
Development of new products and/or services (leading to a structural change of the business model)					
Adoption of digital technologies and software as key enabling factors for business development					
Digitally enabled workforce, acquisition of digital skills, promotion of culture for innovation					
Transformation of management (brand management, customer management, portfolio management, etc.) to become agile and/or automated and/or digitally integrated and/or smart and/or adapted					
Automation and/or digital transformation of processes (leading to a structural change of the business model)					

Q4.4 – To the best of your knowledge, in your region, did the COVID-19 outbreak increase the type and level of eGovernment services made available to SMEs by local and regional public authorities and/or agencies? * [only one answer allowed]
Yes.
No.
I do not know.

Section 5 – Actions to support the digital transformation of SMEs in regions

*(Question with * are mandatory)*

Q5.1 – To the best of your knowledge, in your region, taking into account the needs of SMEs in terms of digital transformation, the actions undertaken by local/regional public authorities in the last 3 years (2018-2020), were*: [only one answer allowed]

Fully appropriate.
Appropriate.
Inappropriate.
No actions were undertaken.
I do not know.
Not applicable.

Please explain your answer *[open answer]:*

_____

Q5.2 – To the best of your knowledge, in your region, which are the most urgent actions to be taken over the period 2021-2023 to favour the digital transformation of SMEs?* ? [only one selection allowed for each listed condition]

	Very urgent	*Urgent*	*Not so urgent*	*Not urgent*	*I do not know*
Provide public financial support/incentives for digital transformation.					
Create the conditions to attract private investment/capital for digital transformation.					
Favour the creation of digital skills, or retain digital skills.					
Improve fast and/or ultra-fast broadband connection (fixed or mobile).					
Improve e-Government services					
Improve interoperability of public services for enterprises across the EU					
Favour the establishment of digital innovation hubs.					
Define ad-hoc strategies for digital transformation.					
Initiate legislative changes favouring digital transformation.					
Favour creation of collaborative networks and/or ecosystems between academia, government and business which support digital transformation					
Favour the creation of public-private partnerships for digital transformation					
Favour digital transformation at the societal level through the active involvement of citizens					

Other (please specify) *[open answer]* _____

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