Deloitte.

The impact of digitization in Spain

Contribution of DigitalES companies to the Spanish economy

2019

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Resume executive

The digital revolution is transforming the economy and the way we live, society lives, works and relates. In Spain, the 48 companies that make up the Spanish Association for Digitization (DigitalES) occupy a fundamental position in the digital ecosystem that drives this revolution.

The objective of this study is to analyze the impact of these companies in the Spanish economy and in people, and explore good international practices to promote digitization.

VALUE ADDED TOTAL GROSS

34,500

MILLIONS OF EUROS

almost 3.3% of the total

This report estimates that, in 2017, the activities of DigitalES companies generated a total of 34,500 million euros of Gross Value Added in the Spanish economy, that is, almost 3.3% of the total, including direct impacts , indirect and induced.

In the same year, it is estimated that the activity of these companies has supported more than 250,000 total jobs in Spain, and the collection of 9,000 million euros in taxes and social contributions, also including direct, indirect and induced impacts.

TOTAL EMPLOYMENT

250,000

JOB POSITIONS

Finally, it is estimated that DigitalES companies drove an investment of more than 3,500 million euros and allocated more than 2,000 million euros to Research, Development and innovation (R & D & I) in Spain in 2017.

INVESTMENT

3,500

MILLIONS OF EUROS

The contribution of DigitalES companies increases with the impact of their products and services on the productivity of the Spanish economic fabric. For this reason, this report studies the relationship between digitization, reflected in the Digital Economy and Society Index, DESI (hereinafter, 'DESI Digitization Index') produced by the European Commission, and economic growth, represented by the Gross Domestic Product (GDP) per capita.

The 'DESI Digitization Index' makes it possible to compare the situation and evolution of European countries in this area between 2013 and 2018. Spain is in eleventh place of the 28 European countries considered by the Index, although it is advancing at a speed above average. In the last six years, the Spanish Index has increased by almost 16 points, from 40.5 to 56.1 points. This represents an annualized increase of almost 7%, more than 0.5 percentage points above the European average.

The result of the econometric models developed for this study suggests that the greater the digitization, the greater the growth in real GDP per capita, in line with what is established in the economic literature. Specifically, it is estimated that, in the European average, a 10% increase in the 'DESI Digitization Index' would contribute approximately 1 percentage point to the growth of real GDP per capita.

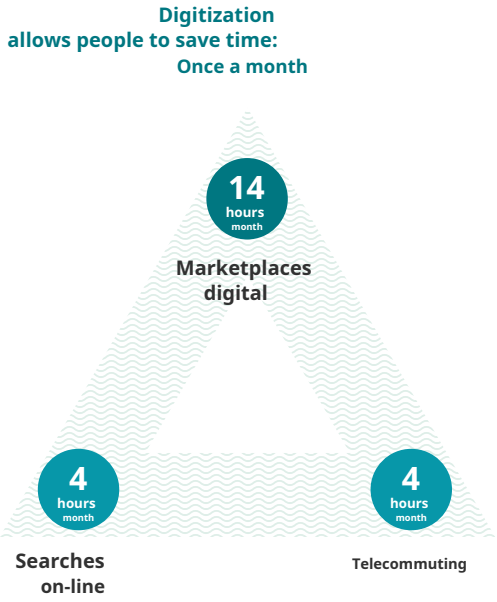
Applying the average relationship between evolution of the 'DESI digitization index' and GDP per capita in European countries to the Spanish context, the broader impact of digitization is illustrated: it is estimated that the evolution of digitization in Spain could have contributed an annual average of up to 7.5 billion euros[1] to real GDP between 2013 and 2018, keeping other factors of the economy constant. This magnitude is similar to the size of the economy of an autonomous community like La Rioja.

The evolution of digitization in Spain could have contributed with an annual average up to € 7,500M to real GDP between 2013 and 2018

1. Constant euros

Beyond the economic aspects, the changes driven by the digital revolution have a social impact on people's daily lives.

Digitization has saved people time previously spent waiting, traveling or more repetitive tasks. Digitization will allow people to save up to almost one day a month to enjoy their family or alternative leisure activities.



The companies of DigitalES and the digitization participate in the development of the economy and society.

This report highlights a number of successful international experiences that can be learned from to advance these opportunities. Of these, a brief selection is presented that we group into five pillars that promote digitization.

SELECTION OF PRACTICES FOR THE PROMOTION OF DIGITALIZATION IN LEADING COUNTRIES

KNOWLEDGE

Continuous training

- The United Kingdom has funds to support continuous training and programs such as the Returner Program that promote the recruitment and training of people, generally women, who have not participated in the labor market for a long time.

INNOVATION

Collaborate between public and private institutions

- The British Government collaborates with the private sector in research and innovation in the sector of new technologies and digitization through programs such as Digital Catapult.

INVESTMENT

Long-term planning and specialized entrepreneurship centers

- The Chinese government presented the Made in China 2025 plan to restructure and develop its industrial sector in the long term.

REGULATION AND TAXATION

A flexible regulatory environment

- Sandboxes are being tested in the United States in which regulators collaborate with industry to better understand new technologies.

INFRASTRUCTURE

The new generation infrastructure

- Spain has the largest fiber network to the home in the European Union and 4G coverage of more than 99.5% of the population, due to the investment effort of telecommunications operators and the necessary public-private collaboration, materialized in certain public aid launched from the public administration.

Introduction

The digital revolution is transforming the way society lives, work and relates. Today, billions of people are connected through mobile devices with unprecedented processing, storage and access to knowledge. These possibilities will multiply with technological advances emerging in fields such as artificial intelligence, robotics, the internet of things (IoT), connected vehicles, 3D printing, biotechnology, energy storage and quantum computing, among others.

The digital ecosystem has a great impact on companies and on people's daily lives. Companies are experiencing how new technologies provide innovative solutions to their needs and transform their value chains into digital supply networks.

Consumer behavior patterns are also undergoing a profound change as a result of digitization. This process is transforming the way companies operate; for example, how they carry out their activities to design, market and deliver their products and services.

In this context, the Spanish Association for Digitization, DigitalES, integrates the main companies in the digital technology and innovation sector in Spain and works so that citizens discover and take advantage of the great impact of digitization.

DigitalES companies are promoters of the digital environment in Spain. These companies contribute and act throughout the entire digitization process. This contribution includes the production and distribution of content, digital services, technology services and network components, devices and consulting services; as well as the investment and maintenance of the infrastructure that facilitates connectivity and access to these products and services.

The activity of the companies associated with DigitalES has an impact on people and the Spanish economy. The main objective of this report is **analyze this impact and explore the international practices that encourage digitization**

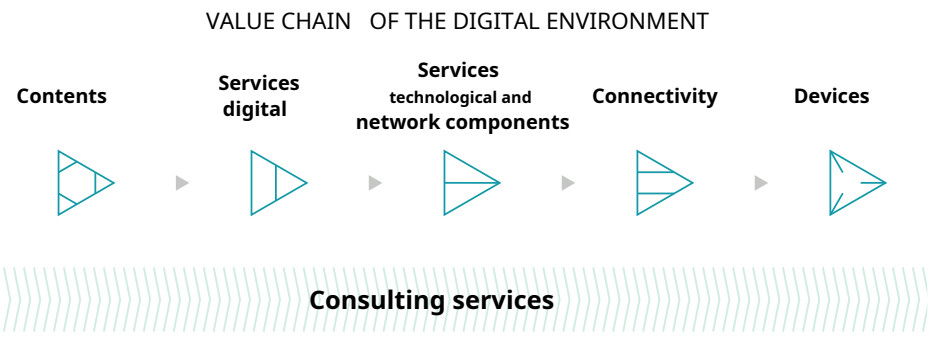
Contribution economic of Digital

L play an essential role in the economy and society
a company is associated with DigitalES Spanish. This section analyzes the contribution of companies associated with DigitalES to the national economy.

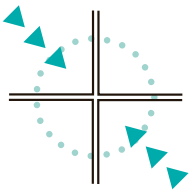
The activity of DigitalES associates is very broad and takes place in the different links of the digital chain, providing added value to other industries or directly to the end user.

The economic impact of this activity is measured as the contribution to the Gross Value Added (GVA) two, jobs supported and tax collection related to the economic activity of DigitalES companies. Their investment in Spain and other indicators that reflect how DigitalES companies contribute to economic development are also considered. These economic impacts are
quantify in two ways:

Figure 1. Impacts of the digital ecosystem

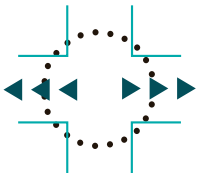


Source: Deloitte elaboration based on GSMA



The impact *narrow*

The impact *narrow* It represents the contribution of the business activity of the associates to the national economy (for example, developing a service that requires employees and spending on raw materials).



The impact *broad*

The impact *broad* considers the broader economic impact driven by productivity improvements. These improvements are facilitated by the products and / or services of DigitalES companies and digitization in general (for example, many companies use mobile internet to speed up and maximize the sale of their products and services, which promotes an increase in activity economic).

2. The Gross Value Added (GVA) refers to the value of the production of goods and services minus intermediate consumption, and is very closely related to the Gross Domestic Product (GDP). GDP is equivalent to GVA plus net taxes on products

The impact *narrow:* how the activity of DigitalES companies contributes to economic development

The impact *narrow* of DigitalES companies analyzes the contribution of their business activity to the Spanish economy.

This impact *narrow* **total** is broken down into three dimensions:

- The impact **direct,** through the added value generated in the production of goods and / or services provided by the associated companies.
- The impact **indirect,** which contemplates the added value through expenses in the supply chain as a result of its business activity.
- The impact **induced,** which quantifies the added value generated by an increase in consumption, a consequence of the increase in direct and indirect employee income and, therefore, in their expenses.

DigitalES companies have provided economic-financial information with which the contribution has been estimated *narrow* applying the methodology *input-output* and economic multipliers (See Annex) .

Economic impact of DigitalES companies

2017	Impact total	Impact direct	Impact indirect	Impact induced
Value added Stupid mill. from €	34,500	15,600	8,500	10,400
Careers	250,000	95,000	60,000	95,000
Taxes and social contributions mill. from €	9,000	6,300	1,300	1,400
Direct investment in assets mill. from €	3,500	3,500		
Direct R&D expenditure mill. from €	2,000	2,000		

Impact on Gross Value Added

It is estimated that, in 2017, the activities of DigitalES companies generated a total of 34,500 million euros of Gross Value Added (GVA) in the Spanish economy, that is, almost a 3.3% of the total, including direct, indirect and induced impacts.

The activity of DigitalES companies has a direct impact on the economy estimated at more than 15,600 million euros of GVA, which represents the 1.5% of the total in Spain. As mentioned, DigitalES integrates representative companies of the digital sector, but the sector is even broader and, despite this, its direct economic contribution is compared with sectors specific to the Spanish economy.

The direct contribution of DigitalES to the Spanish GVA exceeds the contribution of industrial sectors such as textiles, clothing and footwear (0.5%), rental services (0.7%) and chemical products (1%), and other industrial sectors such as motor vehicles, trailers and other transport materials (1.2%). Likewise, the contribution is similar to the metallurgy sector (1.5%) and slightly lower than that of artistic, recreational and entertainment activities. Finally, the contribution of the

DigitalES companies represent more than half of that contributed by the agriculture and fishing sector (2.7%), and it is slightly less than half of the contribution of sectors such as energy (3.6%) and financial (3, 9%).

This activity typical of DigitalES companies has a multiplier effect on the Spanish economy. The indirect impact, that is, on the value chain of DigitalES companies, is estimated at 8,500 million GVA. The induced impact generated by the increase in consumption, as a consequence of direct and indirect activity, is estimated at 10,400 million euros, generated by an increase in the income of direct and indirect employees and, therefore, in their expenses.

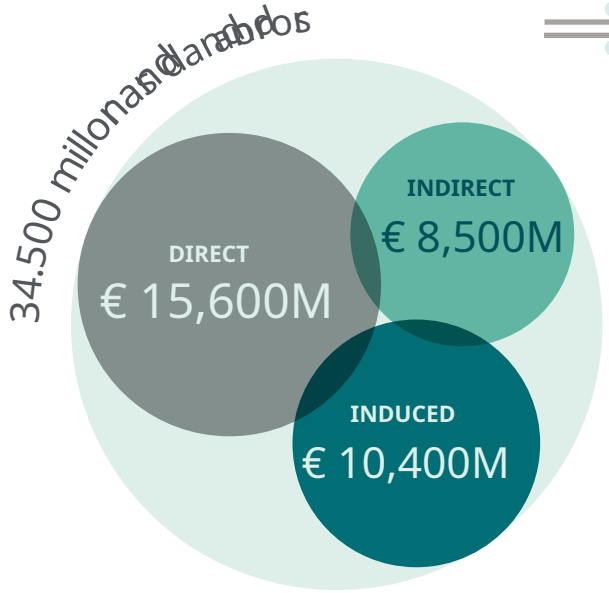


Table 1. Direct economic contribution of different economic sectors (INE sector code)

Sector	Direct GVA, % total
Wood and cork (7)	0.2%
Extractive Industries (4)	0.2%
Paper and Paper Products (8)	0.3%
Pharmaceutical Products (12)	0.5%
Textiles, clothing, and footwear (36) Rubber and	0.5%
plastic products (13)	0.5%
Rental services (50)	0.7%
Chemicals (11)	1.0%
Repair and installation services of machinery and equipment (23)	1.1%
Motor vehicles, trailers and other transport materials (20, 21)	1.2%
Metallurgy products and metal products (15, 16)	1.5%
Digital	1.5%
Artistic, recreational and entertainment activities (58, 59)	1.9%
Agriculture and fishing (1, 2 and 3)	2.7%
Energy, water and waste (24, 25 and 26)	3.6%
Finance and insurance (41, 42 and 43)	3.9%
Construction (26)	5.9%
Accommodation and food and beverage services (36)	6.6%
Commerce (28, 29 and 30)	11.6%
Real Estate Services (44)	13.2%

Source: INE, Deloitte Analysis

Impact on employment

In the same year, it is estimated that the activity of these DigitalES companies has generated a total of 250,000 jobs in Spain, or 1.4% of total employment, also including direct, indirect and induced jobs.

The activity of the companies associated with DigitalES generates a direct impact of 5,000 million euros in salaries and 95,000 jobs in Spain, representing 0.5% of total employment. This contribution is higher than employment in the pharmaceutical products (0.2%) and rental services (0.3%) sectors, and similar to the industrial machinery and equipment repair and installation sectors (0.6%), textile products, clothing and footwear (0.6%), and chemical products (0.7%). The direct contribution of DigitalES companies is half that of the energy sector (1.1%) and represents slightly less than a third of the jobs in the financial sector (2.0%). That said, the Gross Value Added per Employee of DigitalES companies is one of the highest, only behind the real estate and energy sector, and is three times higher than the average for the Spanish economy.

This direct activity of DigitalES companies makes possible an additional business activity in its value chain - the indirect impact - which in turn employs around 60,000 people. The activity, direct and indirect, generates an increase in disposable income for Spanish families, which promotes an increase in the expenditure that contributes to increased economic activity. This induced activity employs 95,000 more people.

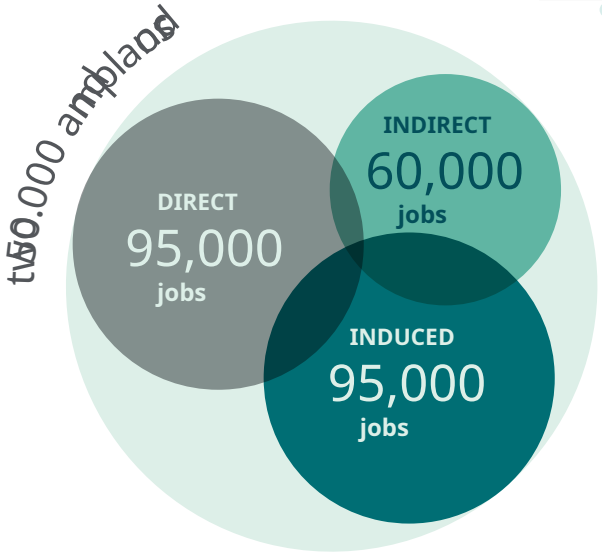


Table 2. Direct contribution to employment of different economic sectors

Sector	Direct employment % total
Extractive industries	0.2%
Pharmaceutical products	0.2%
Wood and cork	0.2%
Paper and paper products	0.2%
Rental services	0.3%
Rubber and plastic products	0.5%
Digital	**0.5%**
Repair and installation services of machinery and equipment	0.6%
Textile products, clothing, and footwear	0.6%
Chemical products	0.7%
Energy, water and waste	1.1%
Motor vehicles, trailers and other transport materials Real estate	1.2%
services	1.2%
Finance and insurance	2.0%
Metallurgical products and metal products Artistic,	2.1%
recreational and entertainment activities Agriculture and	2.9%
fishing	3.9%
Building	6.1%
Accommodation and food and beverage services	7.1%
Commerce	18.3%

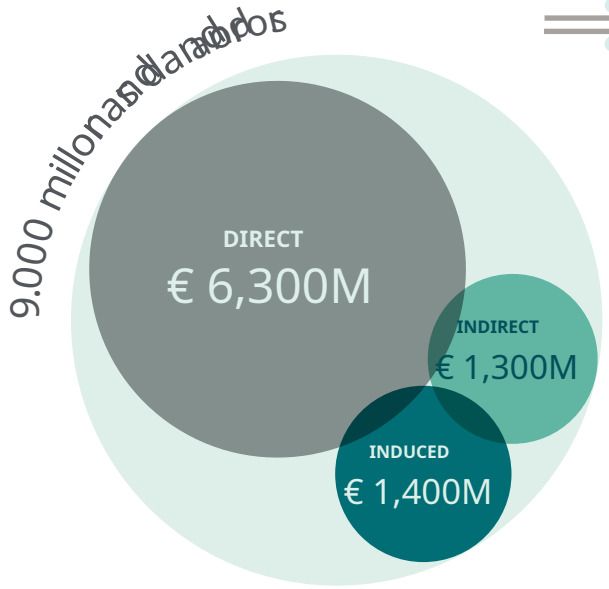
Source: INE, Deloitte Analysis

Impact on the collection of taxes and social contributions

In 2017, it is estimated that the activity of DigitalES companies contributed with a total collection of more than 9,000 million euros in taxes and social contributions, also including direct, indirect and induced impacts.

The activity of the companies associated with DigitalES generates a direct impact of 6,300 million euros in taxes and social contributions in Spain.

The indirect activity promoted in the value chain of DigitalES companies facilitates the collection of more than 1,300 million euros. Induced activity, generated through an increase in spending by Spanish families due to the increase in their income from the activity of DigitalES companies, may result in an additional collection of 1,400 million euros.



Contribution to investment in assets and spending on R + D + i

Finally, in 2017, it is estimated that DigitalES companies invested more than 3,500 million euros in assets in Spain and 2,000 million euros in Research, Development and innovation (R + D + i).

DigitalES companies play a particularly relevant role in R + D + i - their investment represents 15% of the total investment of almost 14,000 million in R + D + i from all companies in Spain[3], a contribution higher than that of sectors with high investment such as motor vehicles (11% of the total) and pharmaceuticals (9%), and others of great economic weight such as commerce (4% of the total) and construction (1% of the total).

The companies by DigitalES **they invested more than 3,500 millions of euros in assets in Spain** Y 2,000 million in research, Development and innovation in 2017

3. National Institute of Statistics (2016); "Spending on innovation"

The impact *broad:* as digitization contributes to economic development

The impact *broad* refers to the broader contribution related to the role of digitization, stimulated by the products and services of DigitalES companies, as a driver of economic development. The objective of this section is to consider this impact on the Spanish economy.

To do this, the relationship between the fundamental dimensions of digitization and economic growth has been explored. Michael Minges (2015) presents a review of economic studies for the World Bank entitled "Exploring the relationship between broadband and economic growth" [Four.]

This review of academic literature concludes that, in general, the impact of fixed broadband on economic growth is positive. Likewise, most of the studies considered that evaluate the band effect mobile broadband also find a positive relationship with GDP per capita, economic growth or equivalent.

The study by Minges (2015) considers that the evidence is not conclusive as to whether or not the impact of broadband on economic growth suffers from diminishing returns over the years. A study by Koutroumpis concludes that, the higher the broadband penetration, the greater the impact, mainly due to the network effects generated.

4. Minges, Michael (2015); "Exploring the Relationship between Broadband and Economic Growth"; Background Paper prepared for the World Development Report 2016: Digital Dividends

A more recent study by Katz and Callorda (2018) considers "The economic contribution of broadband, digitization and ICT regulation"[5] for the International Telecommunication Union. In this study, it is confirmed that the penetration of fixed and mobile broadband has a positive relationship with GDP. This result is based on panel econometric models that use the experience of 139 countries between 2014 and 2017.

Katz and Callorda also develop a digital ecosystem index for 75 countries, based on 64 indicators, which they use to perform a panel econometric model of 73 countries between 2004 and 2015. This model helps them to quantify the impact of digitization on GDP . In this case, it is estimated that a rise in the index of 10% would mean an increase in GDP per capita of 1.3%, on average. A study by Qu et al (2017)[6] confirms that advances in digitization are related to increases in GDP per capita in a similar order of magnitude. Aza and Escribano (2019)[7]

They also study the contribution of digitization between 1996 and 2017, in this case using the growth accounting methodology, and estimate that digitization is responsible for up to 30% of the growth in value added in Spain between 2015 and 2017.

Another study[8], carried out by Bruegel for the Committee on the Internal Market and Consumer Protection of the European Parliament, and published in January 2019, explores the potential economic contribution of the European Digital Single Market (DSM). The study focuses on estimating the economic benefit that could facilitate DSM through improvements in the competitiveness and productivity of the European economy.

In particular, this study by Bruegel (2019) also considers the relationship between GDP per capita and digitization, in this case represented by the components of the Digital Economy and Society Index, DESI (in hereinafter 'DESI Digitization Index')[9] produced by the European Commission. Their analysis establishes, through a fixed effects panel econometric model, that certain components of the 'DESI digitization index' play a relevant role in the evolution of GDP per capita, such as connectivity and digitization of services public.

This Deloitte report for DigitalES proposes a complementary perspective in the study of the relationship between digitization and economic growth in the European context. For this, the academic literature has been considered and the most recent data on digitization in Spain have been explored. Finally, econometric models of fixed effects panel data have been developed that analyze the evolution of the real GDP per capita of 28 European countries between 2013 and 2018[10], with the aim of isolating the quantitative contribution of digitization, captured by the 'DESI Digitization Index' (See Annex)[eleven].

The 'DESI Digitization Index' offers a comparable indicator on the situation and evolution of European countries in their digitization. This index is based on indicators that describe five dimensions of digitization:

In this report a **perspective complementary in the study of the relationship between digitization and growth economic** in the European context

5. Katz, Raul and Callorda, Fernando (2018); "The economic contribution of broadband, digitization and ICT regulation"; International Telecommunications Union
6. What, Jason; Simes, Ric; O'Mahony, John (2017) "How Do Digital Technologies Drive Economic Growth?", Economic Society of Australia, VOL. 93, Special Issue, June, 2017, pp 57-69
7. Aza, Claudia and Escribano, Álvaro (2019); "Effects of Digitization and Productivity in the Spanish Economy: An International Comparison", Universidad Carlos III de Madrid, Working Paper 2019-06
8. Bruegel (2019); "Contribution to growth: The European Digital Single Market; delivering economic benefits for citizens and businesses "; "European Parliament's Committee on the Internal Market and Consumer Protection"
9. European Commission (2018); "The Digital Economy and Society Index"
10. Data from DESI 2014 to DESI 2019 on the situation in the years 2013 and 2018 respectively

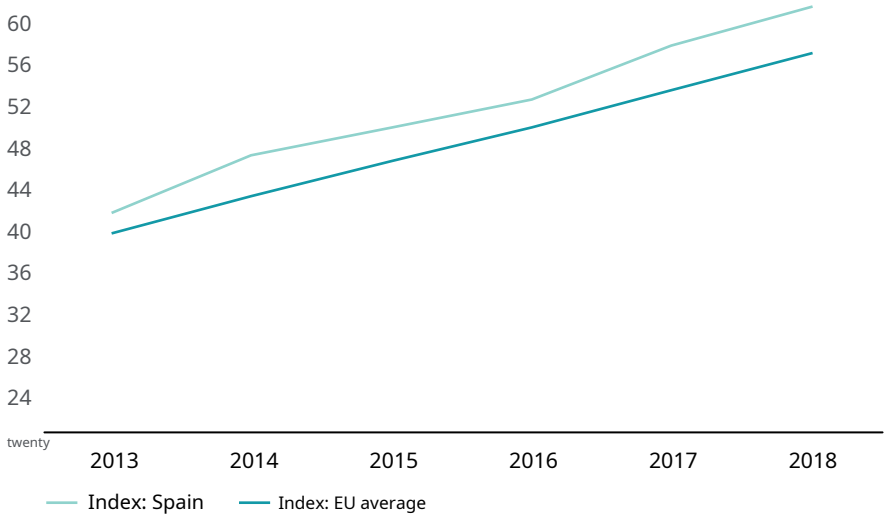
eleven. The models developed for this study have an adjusted R2 greater than 90%, that is, a high explanatory power, and have passed the tests expected for this type of analysis.

- Connectivity, which measures the deployment of broadband infrastructure, its quality, and access to fast and ultra-fast broadband services.
- Human capital, which evaluates the skills necessary to take advantage of the possibilities offered by digitization.
- The use of internet services, which represents activities *on-line* by internet users, for example, content consumption *online* video calls, purchasing and financial management.
- The integration of digital technology, which measures the digitization of companies and commerce.
- Digital public services, which include the evolution of the electronic administration and the management of the electronic health service.

Spain is in eleventh place of the 28 European countries considered by the 'DESI Digitization Index', although it is advancing at a speed above the average. In the last six years, Spain's 'DESI Digitization Index' has increased 16 points, from 40.5 to 56.1. This has meant an annualized increase of almost 7%, more than 0.5 percentage points above the European average. In 2017 in particular, the Spanish index grew by 8% (see Figure 2).

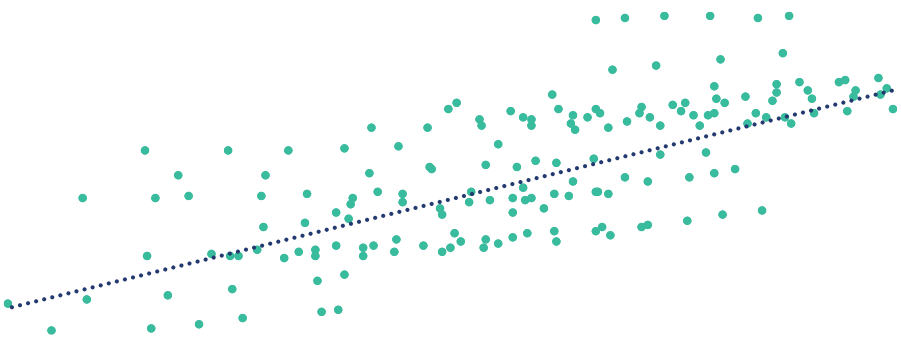
In this context, the correlation between the 'DESI Digitization Index' and real GDP per capita has been explored. This correlation reflects a possible positive relationship between digitization and real GDP per capita (see Figure 3).

Figure 2. 'DESI digitization index' of Spain versus EU 28 average



Source: European Commission

Figure 3. The relationship between digitization and real GDP per capita



Source: self made

This positive relationship has been corroborated through models of the evolution of real GDP per capita, both from the perspective of supply and spending. These econometric models provide a complementary perspective by isolating the relationship between real GDP per capita and digitization represented by the 'DESI Digitization Index'. In addition, they have in

An increment

Through models of the evolution of real GDP per capita, both from the perspective of supply and spending. These econometric models provide a complementary perspective by isolating the relationship between real GDP per capita and digitization represented by the 'DESI Digitization Index'. In addition, they have in average of up to 3,500 million euros[12] to real GDP between 2015 and 2018, keeping other factors of the economy constant. This magnitude is similar to the size of the economy of an autonomous community like La Rioja.

takes into account the contribution of other variables, such as, for example, gross training capital, public spending, the degree of trade openness of the economy and other macroeconomic variables.

The modeling results suggest that the more digitization, the higher the real GDP per capita growth. Specifically, it is estimated that, in the European average, a 10% increase in the 'DESI digitization index' would contribute approximately 1 percentage point to the growth of real GDP per capita, having isolated the contribution of other macroeconomic variables. Applying the average relationship between the evolution of the 'DESI digitization index' and GDP per capita in European countries to the Spanish context, the broader impact of digitization is illustrated: it is estimated that the evolution of digitization in

10% in the 'Index of digitization

DESI 'would contribute on average

1 point percentage to increase of GDP per real capita

12. Constant euros

The social impact of digitization

AND digital products and services in people's daily lives

This section analyzes the impact of in particular, when it comes to reducing waiting and repetitive tasks, and facilitating access to a greater commercial offer.

The infrastructures of telecommunications constitute the A fundamental pillar on which the connectivity necessary for the development and enjoyment of digital products and services is based. In this sense, Spain has fiber coverage to the home (FTTH) higher than 77% of homes [13] and 4G coverage that covers more than 99% of the population [14].
These levels of connectivity have been driven by large-scale private investment made in recent years in our country. Only the telecommunications and audiovisual sector has invested more than 15,000 million euros between 2015 and 2017 [fifteen].

Access to new digital technologies, facilitated by connectivity, has caused a profound transformation in people's daily habits and activities, such as making daily purchases or access to information.

Technology provides endless solutions to meet needs and manage our day to day in a much more efficient way. In this way, it is possible to save time on repetitive tasks, access a greater offer of products and services at more competitive prices and be more connected and spend more time with our families and leisure or any other activity that facilitates a higher quality of life. .

The report does not consider other current public debates such as privacy, personal autonomy or the right to be forgotten.

13. Ministry of Economy and Business (2019); "Report of Broadband Coverage in Spain in 2018"
14. Ministry of Economy and Business (2019); "Report of Broadband Coverage in Spain in 2018"
15. National Commission for Markets and Competition (2019); "CNMC Data. Total investment of the sector "

More time for ours

Improvements in connectivity in recent years have facilitated the development of digital services that have transformed everyday activities such as shopping for food or clothing, managing savings or personal finances or searching for information. The

Technological and connectivity advances have also facilitated the growing trend of teleworking, avoiding travel to the place of employment.

These changes have generated savings in the time it takes us to do these activities.

Figure 4. Estimated time savings due to digital activities

Thanks to the increasing digitization of society and the increased use of fixed and mobile broadband, *marketplaces* digital have experienced great popularity in recent years. In addition, the consumer has a greater range of products and obtains more information about them. Currently, 42% of people decide to buy online to save time, avoiding travel, queues and waiting.

These *marketplaces* They offer multiple digital services, with which users can interact 24 hours a day. The digitization of these services has also simplified payment models and enabled delivery at the desired time and place.

The large banking entities that operate in Spain, in turn, are betting on an increasingly digital user experience. Online banking services allow a user to avoid the trip to the bank branch and the waiting time to be attended, in addition to allowing access to online operations whenever they want.

An average consumer who buys or makes use of digital services can save 14 hours a month by avoiding travel and waiting times [16].

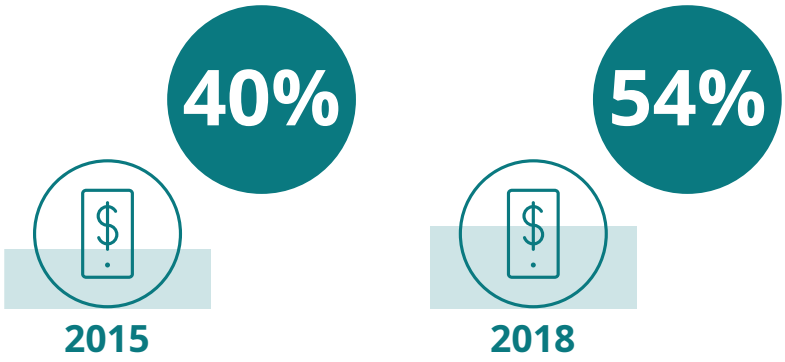
On the other hand, access to information has completely changed. The Online searches and access to digital documentation has followed a growing trend since they appeared at the end of the 20th century, replacing traditional methods (libraries, encyclopedias,

etc.). A person can save more than four hours a month [17] thanks to searches in online format and access to digital documentation, compared to classical methods.

Figure 5. Users who buy products and services online

Source: ONTSI (2018); "Household Panel"

Figure 6. Electronic banking users



Source: ONTSI (2018); "Household Panel"

16. Deloitte analysis based on data from the Federal Reserve, Kronos, AFI and Food and Society in 21st Century Spain. Calculated as an estimate of temporary savings by a user when purchasing an online supermarket, using online banking services and digital delivery services.

17. Deloitte methodology based on data from Hal Varian and Yan Chen

Companies have also integrated technology into the core of their activity, both in offices and factories. This makes it easy for the workplace to no longer be confined to one physical location - professionals can get work done from anywhere, on any device, and at any time.

This encourages the worker to have greater flexibility, being able to improve aspects such as work-life balance, since 2 out of 3 workers declare they have problems to combine your working day with your personal or family life [18]. Thanks to improvements in home connectivity, teleworking has become a growing trend in Spain. In 2018, the number of employed persons who teleworked from home was almost 1.5 million people, 20% more than in 2016 [19].

A person who telecommutes one day a week can save 4 hours a month in commuting to their workplace [twenty]. This time increases in cities and suburban areas.

Applications such as e-learning can also have a favorable impact since it is estimated that an average worker has 20 minutes a week to dedicate to their training and development [twenty-one]. In this way, people can choose the time and place to take the courses, in addition to reducing costs for the company.

18. Adecco Group (2018); "XII Adecco Survey"
19. National Institute of Statistics (2018); "Spain in figures 2018"
20. Deloitte methodology based on data from the National Institute of Statistics
21. Deloitte; “Leading in Learning. Building capabilities to deliver on your business strategy ”

We enjoy more for less

The cost that users pay for mobile connectivity services (price of *gigabyte)* has dropped more than 85% since 2012 [22], facilitating its access to the entire population. In general terms, according to the National Institute of Statistics, the prices of ICT services have fallen by more than 20% since the year 2000, compared to a 45% increase in general prices in Spain [2. 3.]

In turn, digitization has allowed the emergence of multiple platforms that offer all kinds of services, as is the case with the popular flight comparators. Today's traveler is very connected: most of Spaniards book their vacations online, which allows them to compare and personalize their trips.

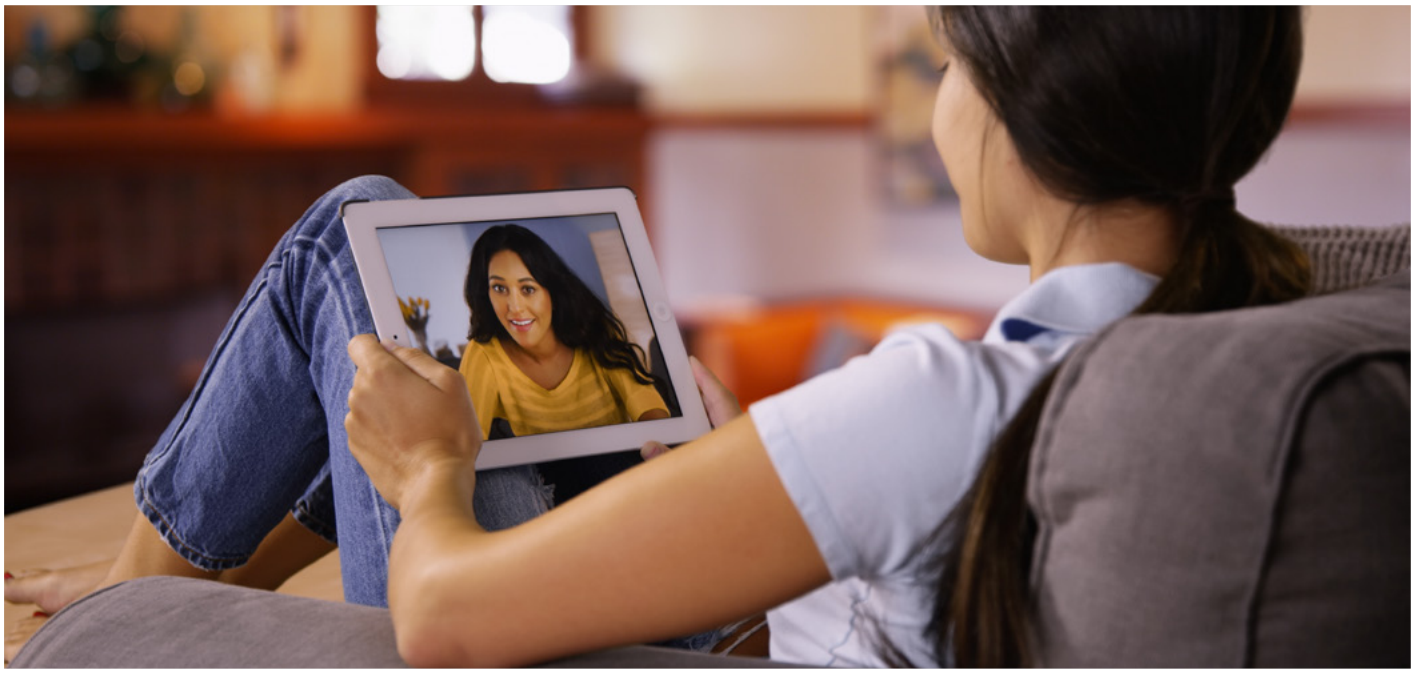
On the other hand, digital public services are increasingly present in administrative procedures. The penetration of the "e-Administration" reaches 40% of citizens, who use it mainly to file income tax returns, obtain information from the Administration (procedures, applications, etc.) or carry out tax inquiries [24.] In Spain, it is estimated that thanks to this service users save an average of 75 euros per procedure [25.]

22. Deloitte analysis based on CNMC Data database (Mobile broadband revenue and Traffic from mobile broadband services)

23. National Institute of Statistics (2018); "Harmonized consumer price index"

24. ONTSI (III Trim 2018); "ICT in Spanish homes"

25. Electronic Administration Observatory (2018); "Report on the Development of Electronic Administration in the General State Administration"



We are more connected

Thanks to telecommunications infrastructures, people we are increasingly connected. In fact, we call by mobile 30% more than in 2010 [26]. In addition, the deployments of FTTH and 4G, as well as the commercialization of offers with higher connection speeds, have facilitated the appearance of new digital services with higher quality, offering more opportunities to interact with family and friends.

Video calls, for example, have transformed the way we communicate, allowing us to be closer to other people, even if they are not physically close. These types of applications, traditionally more focused on the work environment, have extended their use to the personal sphere.

Another way to stay connected are social networks, bringing together more than 25 million users in Spain. Through them, users can be in contact with each other in a ubiquitous and continuous. We spend an hour a day browsing and interacting through social networks, a fact that would have been unthinkable 20 years ago.

Finally, another noteworthy fact is the improvement in digital inclusion in recent years in Spain. Rural areas have fast broadband coverage [27] above 54% [28] of the population, growing 11 pp in a single year, enabling access to digital services to more and more people regardless of where they live.

2 out of 10 people use video calling to be in contact with family and friends, mainly from their *smartphones*

Source: ONTSI (2018); "ICT in Spanish homes"

26. National Commission of Markets and Competition (2019); "CNMC Data. Mobile phone minutes per traffic "
27. Speeds greater than 30 Mbps
28. Ministry of Economy and Business (2019); "Report of Broadband Coverage in Spain in 2018"

We have an increasingly digital leisure offer

The way of consuming leisure activities has completely changed, taking advantage of the advantages offered by the new digital environment.

The impulse of wearables in the health sector follows a growing trend in recent years. In Spain, the adoption of these devices, which allow people to track their physical activity, is 22% [29]. According to some studies, three out of ten people say they do more physical exercise [30], so it is reasonable to think that these devices help to avoid unhealthy habits.

Sport is one of the most important areas of leisure in Spain, not only through its practice but also through through sports monitoring and interaction with other people and groups of athletes or followers. Today, Spaniards spend an average of 90 minutes a day informing ourselves about sports, twice as much as in 2011, and we do it both through television and the internet [31].

Technology has also brought about a drastic change in the way video content is consumed. More than 60% of connected adults in Spain already watch movies, series and television programs through content applications *on-line* [32] that allow the user to consume content when and where they want, without modifying their daily routine. In Spain, a person spends more than 10 hours a week watching series and movies *on-line* [33].

29. Deloitte (2018); "Global Mobile Consumer Survey in Spain"
30. BMC Public Health (2017) "Users' experiences of wearable activity trackers: a cross sectional study"
31. Deloitte Insights (2018); "Conecta Report 2018"
32. Kantar Media (2019); "TGI Global Quick View Spain"
33. IAB Spain (2018); "Annual Online Video Study"

Video game consumption *on-line* through game consoles and mobile applications also differs greatly from consumption *offline* from the 90s. Today technology allows you to interact in real time with other players anywhere in the world. In 2018, Spaniards spent an average of 6.2 hours a week playing video games [3. 4] and e-sports reached an audience of 6.9 million people in total [35],

being the eighth country in the world with the largest number of followers.

To this have recently been added immersive technologies, such as virtual and augmented reality. These solutions offer a perception of depth and vision of the environment in 360º, providing a feeling of reality and enjoyment in video games and sports broadcasts.

The technologies of the future, with increasingly digitized environments, follow the trend of making life easier for people and offering new forms of entertainment focused on the consumer experience.

34. Spanish Association of Videogames –AEVI- (2018); "Yearbook of the video game industry"
35. Spanish Association of Videogames –AEVI- (2018); "Yearbook of the video game industry"

International internships to promote digitization

La a key factor for transformation and digitization has become sustainable global economy. Its potential continues to grow with the emergence of new technologies and digital services.

The main economic powers have begun to build growth strategies that revolve around digitization, based on the development of key technologies and on supporting innovation-oriented companies. 36.

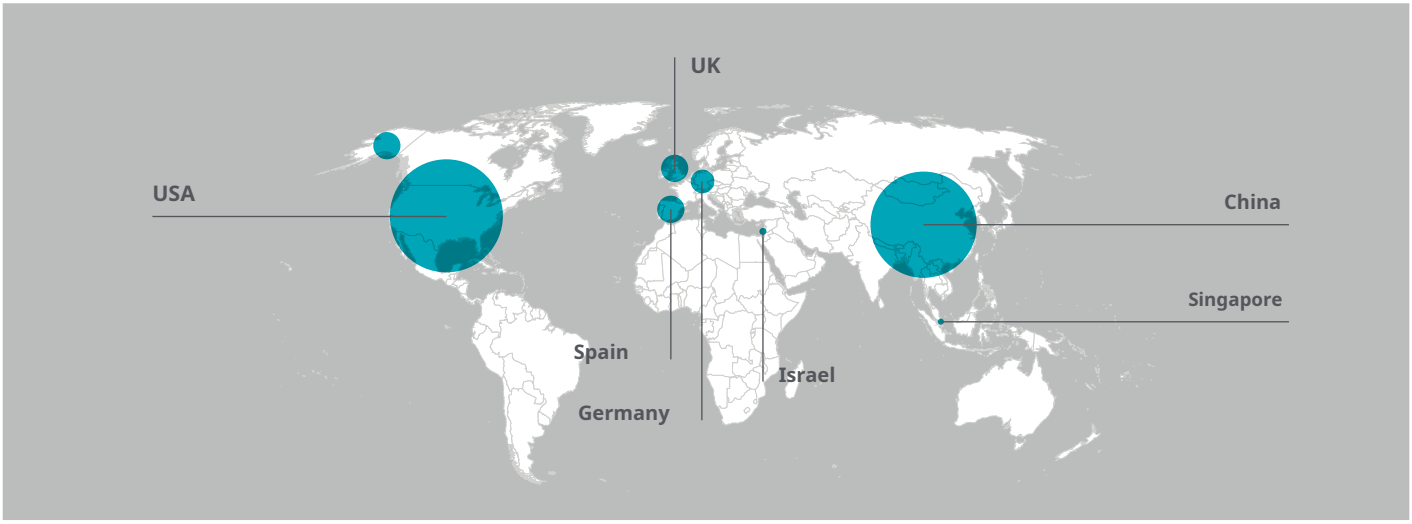
In this section, we consider the situation of digitization in different leading countries, and a selection of successful international experiences or good practices that have helped these countries achieve digital leadership.

Situation of digitization in the international context

Many countries promote the evolution of the digital ecosystem 37, both for the benefits it generates for citizens and for the attraction of investment it entails. Some governments have even presented plans to promote digitization, with public policies that advance towards the achievement of the digital economy and society.

In this context, the degree of digitization in various countries has been studied to compare and analyze the Spanish situation. For this, six countries have been taken as a reference: two in Europe, two in Asia, one in the Middle East region and another in the American continent.

Figure 7. Countries analyzed for the digital context



36. “Made in China 2025”, “UK Digital Strategy” and “UE” s Digital Single Market strategy ”among other strategies

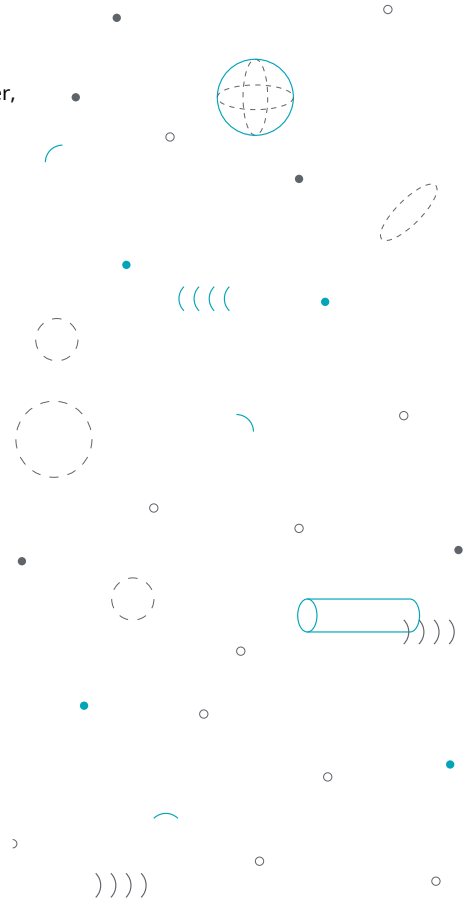
37. 140 countries offer online services through their national portals "UN E-Government Survey 2018", United Nations

These countries - United States, Singapore, the United Kingdom, Germany, Israel and China - are world powers and benchmarks in the digital environment and innovation, standing out in multiple digital indicators.

Three indices have been selected that measure different aspects of the digital and innovation landscape, from the communications infrastructures available in the country, to the situation of the education sector and the political context.

The selected indexes and classifications have been: Global Innovation Index, (GII) by Cornell University, INSEAD and World Intellectual Property Organization (WIPO); IMDWorld Competitiveness Online, from the International Institute for Management Development (IMD); and Enabling Digitalization Index (EDI) from Euler Hermes - Allianz.

- The GII classifies the capabilities and results of innovation in world economies. The index takes into account the human aspects of innovation, essential for the design of policies that help promote economic development and the most prone environments.
  to innovation at the local level.
- The goal of IMD World Competitiveness Online is to evaluate the extent to which a country adopts and explores digital technologies that lead to the transformation of government practices, business models of companies in the country and society in general.
- EDI measures the capacity and agility of countries to help, on the one hand, already digitized companies to prosper and, on the other, traditional companies to take advantage of the digital environment. However, it does not measure digital adoption or its activity, that is, the *outputs* of digitization.



The United States stands out in these rankings, ranking first in two of the indices analyzed. The American country stands out for the spending of its companies in research and development and for the quality of its universities, with a significant investment in scientific branches. In addition, the creation of organizational models focused on ICT, the export of creative services and the tradition that the country has with venture capital entities, among other aspects, explains why the United States leads these classifications.

In comparison, Spain is in intermediate positions and below these six benchmark countries in the digital and innovative field.

Table 3. Position of the countries in representative indices of the digitization situation

	Enabling Digitalization Index 2018	IMDWorld Competitiveness 2018	Global Innovation Index 2018
USA	1	1	6
Singapore	8	two	5
UK	5	10	4
Germany	two	18	9
Israel	25	12	eleven
China	17	30	17
Spain	27	31	28

Sources: Global Innovation Index 2018 - Cornell University, INSEAD, and WIPO; IMDWorld Digital Competitiveness Ranking 2018 - International Institute for Management Development and The Enabling Digitalization Index 2018 Euler Hermes

International internships

Innovation and digitization are key aspects for a country to achieve a better competitive position and sustainable economic growth [38].

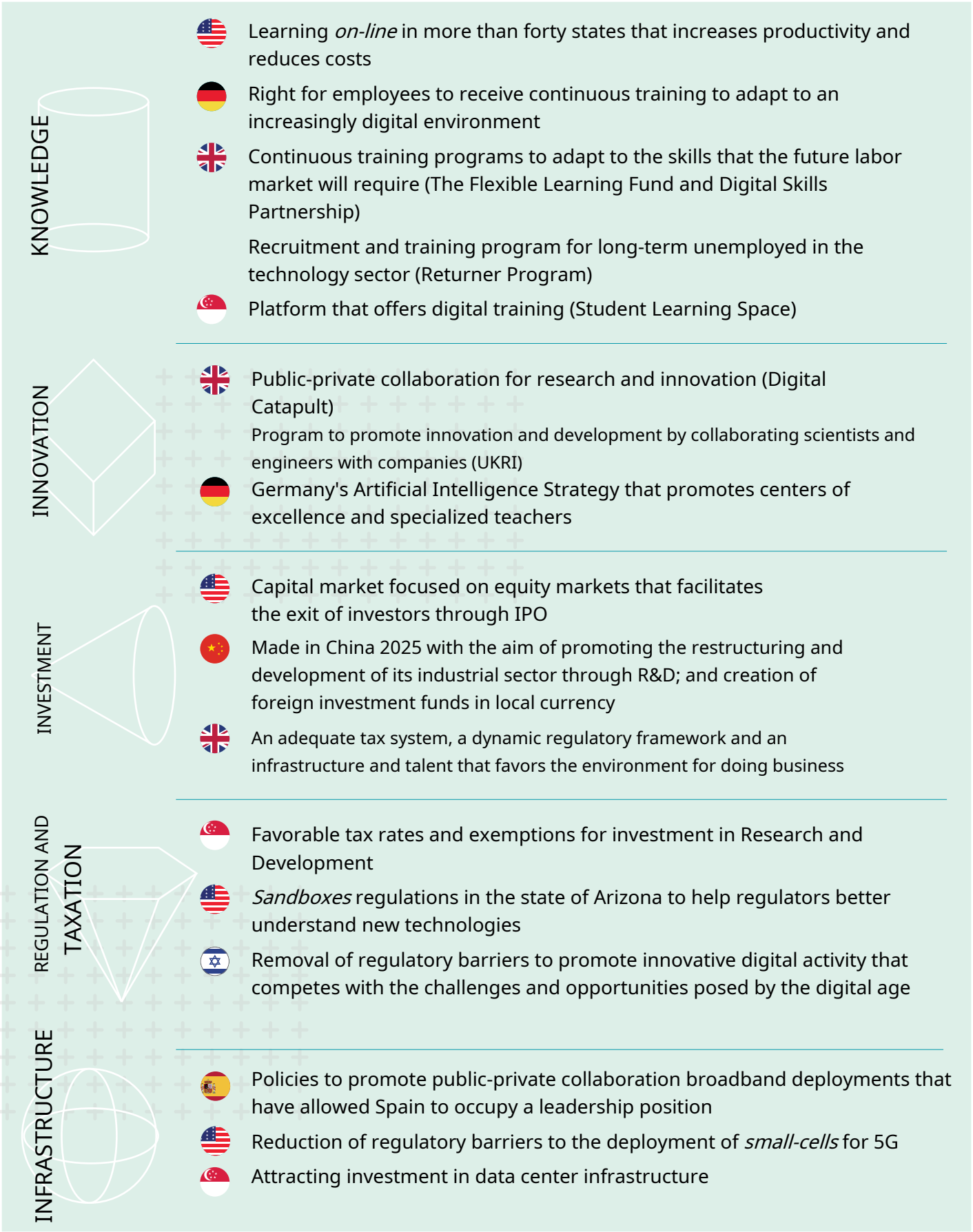
To promote digitization in Spain and reach the levels observed in the six leading countries in this environment, the policies and initiatives developed in these territories have been analyzed.

After this analysis, some practices have been identified that have been grouped into five basic pillars: knowledge, innovation, investment, regulation and taxation and infrastructure, of which different examples have been identified in table 8.

The sections below consider, in more detail, the different actions and / or policies implemented in the six identified countries that have contributed to its technological leadership.

38. ITU (2017); "Social and economic impact of digital transformation on the economy"

Figure 8. International practices of digitization by country



Knowledge

The promotion of continuous training and the development of digital skills are key for a society to achieve its objectives in terms of digitization [39]

For this reason, two actions have been identified that have been successful in some leading countries in this area: promoting continuous training at throughout the professional life in the face of a changing labor market and increasingly digitized jobs, and boost learning *on-line.*

It is estimated that 65% of students who now begin their primary education in Spain will work in activities that do not exist today, with a significant digital component [40]. The speed and magnitude of this change implies the need for permanent monitoring and study of the professional qualifications demanded and their evolution in the different productive sectors [41]. Therefore, the learning model and academic orientation should be flexible and adapt to this reality, ensuring that new generations acquire the necessary skills to face this digital transformation.

The study "The Digital Edge: middleskill workers and careers" [42] concludes that jobs that require people with medium non-university qualifications and digital skills receive higher salaries than people with medium qualifications without these skills. In general, jobs that require more advanced skills earn an average hourly wage 40% higher than other jobs with less digitized functions.

The German Federal Ministry of Labor and Social Affairs published the document "Work 4.0" in 2017 [43]. Their contributions focus on how to preserve and strengthen those qualified and quality jobs in the era of digital transformation, among other aspects. As a result, the German country has introduced the right for employees to receive continuous training [44].

Continuous training enables workers to adapt to a constantly evolving demand for skills [Four. Five.] For example, the UK Ministry of Education launched in October

39. Corsham Institute, RAND Europe and St. George's House Windsor Castle (2017); "Building our Connected Society"
40. CEOE (2018); "Digital Plan 2025: Digitization in Spanish society"
41. CEOE (2018); "Digital Plan 2025: Digitization in Spanish society"
42. Capital One and Burning Glass (2017); "The Digital Edge: middle-skill workers and careers"
43. Federal Ministry of Labor and Social Affairs (2017); "White paper Work 4.0"
44. Bundesrat (Federal Council of Germany), (2019); "Gesetz zur Stärkung der Chancen für Qualifizierung und für mehr Schutz in der Arbeitslosenversicherung- Law to strengthen opportunities for qualification and greater protection in unemployment insurance

[Four. Five.] British government; (2018); "Future of Skills & Lifelong Learning"

2017 a project known as The Flexible Learning Fund [46], whose objective is to promote the best way to promote continuous training for both workers and the unemployed who seek to return to the market labor. In particular, the British Government has allocated 40 million pounds [47] to projects presented by companies and institutions that propose an innovative approach to carry out such training.

Another example of continuing education in the UK is the Returner Program [48]. This program, with an initial budget of 5 million pounds, is aimed at promoting the recruitment and training of adults, generally women, with relevant professional experience.
who have not participated in the labor market for a long time for different reasons, such as caring for a family member, etc. In 2017 alone, the number of companies implementing these programs went from 3 to 40 in sectors with high added value such as the most technological, the financial sector, and the professional services and consulting sector.

For its part, the United Kingdom Government has launched a new association known as the Digital Skills Partnership with the aim of attracting and working together with the main local and international companies, regional governments, charities, etc. from the country. Currently, the British Government already has the collaboration of a number of major financial (Lloyds Banking Group, Barclays) and technology (IBM, Cisco) companies that have committed to being even more ambitious in expanding the reach of their programs and investment in training and digitization [49].

The learning *on-line* offers new opportunities for access to education. Singapore has opted for the Student Learning Space [fifty], a project launched by GovTech, the Technology Agency, and the Ministry of Education, focused on the use of information and communications technology. The platform offers digital training to enhance student learning and collaboration from elementary schools to first cycle universities. In addition, this tool also helps teachers to design their lessons using resources developed by the Ministry of Education. It has been extended to all schools and therefore all Singaporean students, who can access all kinds of resources and tools from anywhere

interactive [51]. This initiative obtained international recognition and won the "IDC Smart City Asia Pacific Awards (Education) 2018" [52].

46. UK Department for Education (2017); "The Flexible Learning Fund"
47. UK Department for Education (2018); "Decisions of adult learners"
48. UK Government Equalities Office (2018); "Returners Programs: Best Practice Guidance for Employers"
49. HM Government (2017); "Building our Industrial Strategy green paper"
50. GovTech (2017/2018); "Leading digital government transformation"
51. Stait Times (2018); "Schools remain relevant as technology change the way of education"
52. GovTech (2017/2018); "Leading digital government transformation"

The United States, for its part, has a significant number of learning centers *on-line*. This enables increased educational productivity by accelerating the rate of learning, reducing costs associated with instructional materials or program delivery, and making better use of teacher time. More than 40 states support the opportunities what offers learning *on-line.* [53]

Centers like Florida Virtual School o North Carolina Virtual Public School offer full-time online courses. The students who attend these centers receive all the training and carry out their assessment tests through the school *on-line.* At the North Carolina Virtual Public School each year, more than 35,000 students take advantage of the more than 150 courses available at the online school, including level resources.

advanced, languages, elective courses and subject recovery.

There are also other centers that offer hybrid learning models *on-line* and face-to-face, allowing students to work before or after school, adapting to diverse learning styles. Of this type is the Walled Lake Consolidated School District in the state of Michigan, which offers the recovery of subjects in its summer school among its different programs. With this recovery program it was possible to reduce costs per student by 57% [54].

Digitization offers significant benefits for companies, Public Administrations and society as a whole in relation to information access and management.

53. US Department of Education; "Use of Technology in Teaching and Learning"

54. US Department of Education; "Use of Technology in Teaching and Learning"

Innovation

Innovation is considered one of the engines of economic growth

An initiative implemented in the highlighted countries has been selected: to promote public-private partnerships to promote innovation and early adoption of technology.

The collaboration of the public and private sectors favors the development of innovation. In Spain, this collaboration has been focused mainly on public infrastructures and the health field, however, recently the IA.nnovation Space has been created, located at the Polytechnic University of Madrid, which focuses on creating research support spaces and innovation to generate innovative solutions based on Artificial Intelligence.

Likewise, Telefónica and the IMDEA Networks institute have established a co-creation laboratory called 5TONIC, with the participation of other DigitalES partners such as Ericsson and Altran. This laboratory promotes an open space in which members collaborate on research projects in innovation related to 5G, key to the connectivity of the future. [55.]

Germany estimates that the development and use of Artificial Intelligence (AI) in the manufacturing sector will generate 31.8 billion euros between 2018 and 2023 [56.]

Consequently, the Federal Government of Germany has assumed the political leadership in this field and at the end of 2018 adopted its Artificial Intelligence Strategy. To carry it out, they will initially allocate 500 million euros, starting in 2019, and it is estimated that in 2025 the accumulated investment will be 3,000 million euros [57.]

The objectives promote concrete initiatives such as the development of 12 AI centers of excellence, the creation of 100 AI faculty positions for the higher education system or the creation of new opportunities for venture capital, among others.

For its part, Spain has recently taken the first step, publishing in March 2019 a document that will serve as the basis for the future National Artificial Intelligence Strategy.

Within the framework of the industrial and digital strategy, the British Government has created a new body called United Kingdom Research and Innovation (UKRI). This entity aims to consolidate and enhance the UK's leading position in the world in terms of innovation and development, with a budget of more than £ 7 billion. UKRI works in partnership with universities, research organizations, companies, organizations charities and other governments for research and innovation to flourish in the British country [58.]

55. https://www.5tonic.org/

56. Institut für Innovation und Technik (2018); 'Potenziale der Künstlichen Intelligenz im produzierenden Gewerbe in Deutschland'

57. Federal Ministry of Education and Research, Federal Ministry for Economic Affairs and Federal Ministry of Labor and Social Affairs (2018); 'Artificial Intelligence Strategy'

58. UKRI - United Kingdom Research and Innovation (2019)

Digital Catapult is another of the initiatives proposed by the United Kingdom that arises from the Technology Strategy Board. This program promotes innovation and development through a collaborative network of scientists and engineers so that companies improve their competitiveness and productivity. [59].

Digital Catapult focuses its attention on three technological areas:

- Future networks: development of future business models from conception to implementation implementation through IoT projects, 5G networks and LPWAN.
- Artificial intelligence: expansion of its AI program with the aim of accelerating its adoption in the different industries and grow the ecosystem of *British machine learning.* Some renowned projects that are currently being implemented
  in this aspect they are Machine Learning Garage and ContractAI.
- Digital Immersion: Digital Catapult aims to make the UK the best country to produce digital content and immersive applications through projects such as CreativeXR, Augmentor and Immersive Labs.

According to UKRI itself, with programs such as Digital Catapult and other policies planned to promote R&D, it will be possible to connect the best researchers and innovators with clients, users and the general public.

59. GOV.UK (2019); "Digital Catapult".

Investment

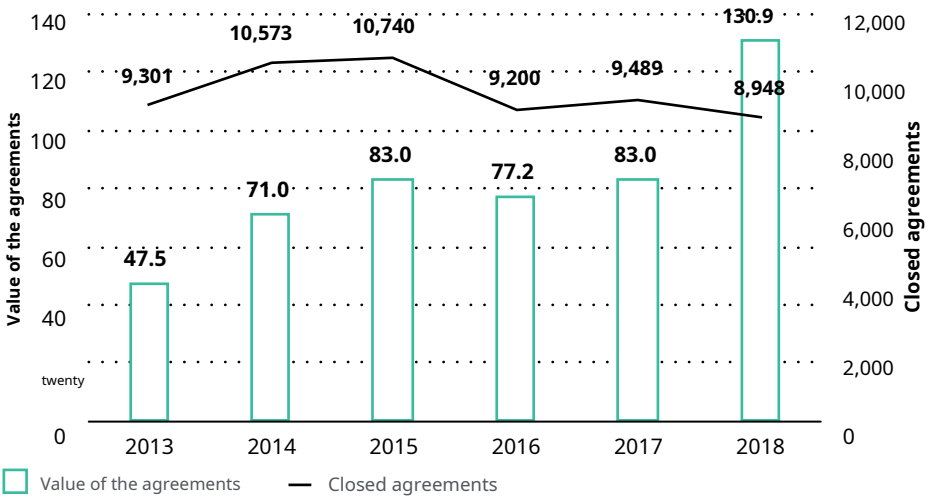
The progress of technology requires investment in new infrastructures, machines, facilities and ways of working

To do this, two areas are identified on which some leading countries in digitization have acted: supporting the process of attracting new investors, in part with low-tax policies, and facilitating growth environments through *hubs* Y *clusters* technologies that favor entrepreneurship and the attraction of talent.

In Spain, planning in the digital field is established in the short-medium term, as is the case of the Digital Agenda for Spain, which sets the roadmap for the fulfillment of the objectives of the Digital Agenda for Europe in 2015 and in 2020. On the other hand, in relation to venture capital, Madrid and Barcelona are the main private investment centers. Both cities concentrated more than 750 million euros of investment in start-ups in 2017 [60]. Foreign presence is usually present in advanced phases of investment, while investments in initial phases are financed by Spanish firms. The size of the venture capital rounds continues to lag behind more mature markets, such as Silicon Valley or London.

In the United States, investment in *start ups* it is deeply rooted in its culture of entrepreneurship. In the last five years, the joint assessment of all the *venture capital* has grown at an annual rate of 22.5%, to 130,900 million in 2018. This figure places the American country as the leader worldwide in this area. It also ranks first in the number of agreements closed in this sector, despite the decrease suffered since 2015. This trend means that agreements have an increasingly higher average valuation.

Figure 9. Value and number of agreements *venture capital* in United States



Source: Pitchbook-NVCA Venture Monitor

The United States also stands out for having many actors in the different investment phases, from *angels* or seed capital to more advanced series - series A, B and C for business optimization, development and scalability, respectively. According to the "Venture Capital and Private Equity Country Attractiveness Index 2018" prepared by the IESE Business School

60. Osborne Clarke (2018); "Private equity and venture capital in Spain"

of the University of Navarra, one of the pillars of attraction for venture capital investors is the situation of the capital markets. In this sense, the report argues that capital markets focused on equity markets encourage venture capital by facilitating the exit of investors through Public Offerings for Sale (IPO). The United States is, precisely, one of the main capital markets focused on securities markets and therefore it ranks as the most attractive country for venture capital according to the IESE index.

In 2015 [61], The Chinese government presented the Made in China 2025 plan, through which it expects the country to become the world leader in innovation by 2045. To this end, the government will promote the restructuring and development of its industrial sector through research and development. development, automation and promotion of smart technologies. In addition, the plan includes the creation of 15 new national science centers and technological innovation hubs by 2020 and 40 additional centers by 2025.

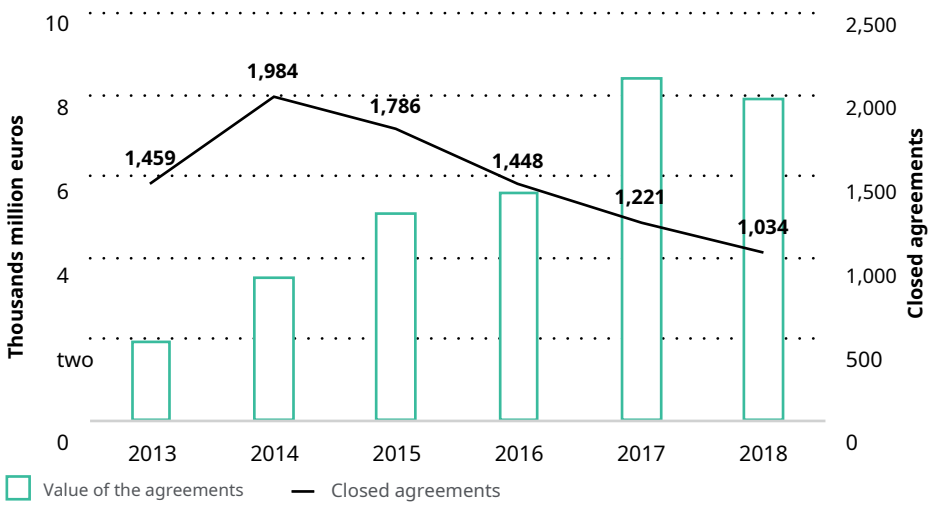
In Europe, the United Kingdom has one of the most promising ecosystems for all those early-stage companies with expansion prospects, being the EU country with the highest volume of investment in venture capital. The British country concentrates about 40% of venture capital activity in Europe [62] and it is the leader in both the number of agreements closed and in added value, with a total investment of 7.7 billion euros in 2018 [63].

The UK's leadership is due, in part, to its great capacity to attract talent, as London is one of the cities preferred by students of higher programs.

The British capital also has 4 universities recognized among the 10 best in the world, more than any other city.

Likewise, there is a willingness among investors and the private sector to invest, thanks to an adequate tax system, a dynamic regulatory framework and the best infrastructure for the creation and development of companies. In this regard, the "Doing Business 2019" report places the United Kingdom in 9th position in the ranking of countries with a more favorable environment for doing business, at the same level as the United States and only behind Norway and Denmark in Europe.

Figure 11. Value and number of agreements *venture capital* in the United Kingdom



Source: Preqin

61. ICEX and the Economic and Commercial Office of the Spanish Embassy in Beijing (2016); Plan"

62. Pitchbook (2017); "European Venture Report"

63. Dealroom (2018); "Annual European Venture Capital Report"

Regulation and taxation

A regulatory and fiscal environment that encourages knowledge, innovation and investment, thus promoting digitization

Three main actions that leading countries in digital transformation have adopted have been identified: reducing the tax burden and introducing tax incentives, eliminating regulatory barriers to promote digital activity, and adopting flexible regulation that considers emerging technologies that lead to new business models. and services.

With technological evolution, the set of communications services
it has been transformed in recent years. Currently the telephony and broadband services offered by traditional telecommunications operators coexist with
Over The Top (OTT) services, such as Internet calls or messages. According to DigitalES, the similarity of these services would require regulatory symmetry or *level playing field,* that allows the different agents to compete under equal and non-discriminatory conditions.

On the other hand, to encourage the development of digitization and innovation, more favorable tax rates would help companies [64]

to have more resources to promote said development.

In Spain there are different instruments to encourage business innovation through tax incentives. Among the tax incentives, the tax deduction that can reach up to 42% of the expenses made in R&D activities and the possibility of requesting the tax check under certain conditions stands out. The tax deduction is divided into two sections, a first section of 25% applicable to expenses incurred that are within the average of the last two years and a deduction of 42% of expenses incurred that exceed the average expense in I + D carried out in the last two years. With regard to the tax check, this instrument allows companies to request the payment of deductions that could not be applied due to the absence of a quota and is associated with a tax rate of 20% on the amount paid.

If we consider the group of European Union countries, the tax incentives are relatively similar to those mentioned for Spain with small exceptions. In particular, some neighboring countries allow a slightly higher payment of the deduction, of up to 30%, and this amount is not subject to any tax rate. [65].

64. U. Akcigit, J. Grigsby, T. Nicholas, and S. Stantcheva (2018); "Taxation and Innovation in the 20th Century"

65. Deloitte (2018) Survey of Global Investment and Innovation Incentives (Link)

Outside of Europe, the Singapore government conveys confidence to companies seeking to increase their innovation capabilities in the region. This country has a partial exemption plan for the first SGD 100,000 of the taxable profits of SMEs and a reduced rate of 50% on the subsequent SGD 200,000 [66]. On the other hand, Singapore allows a double tax deduction for international expansion and a tax deduction of 200% on expenses made in development activities and market expansion abroad [67].

It also has a tax exemption plan for new companies during the first three years of activity. [68].

The Israeli Government, following the Digital Israel National Initiative, issued a resolution through which it manifested its intention to adapt the legislation to the digital age. To this end, the Government has appointed a team called the Law and Technology Team, supervised by the Chief Legal Counsel, to carry out a review with the fundamental objective of eliminating all regulatory barriers that go against the aforementioned initiative and thus strengthen a digital activity innovative that meets the challenges and opportunities posed by the digital age.

Along these lines, several governments are exploring flexible and adaptable regulation [69], as well as prototypes and test scenarios (*sandboxes).* In these *sandboxes* Regulatory entities partner with private companies and entrepreneurs to experiment with new technologies in environments that foster innovation.

The United States, specifically the state of Arizona, is testing the *sandboxes* Regulations for Unmanned Aerial Systems (UAS) [70]. The Federal Aviation Administration of the Department of Transportation has chosen ten public-private partnerships to test UAS.

In this case, the goal of the State of Arizona is to help regulators better understand new technologies and work collaboratively with industry players to develop appropriate rules and regulations for emerging products, services, and business models.

66. Banco Santander (2019); "Singapore: Taxation"
67. ASEAN Briefing (2019); "Singapore: the digitization of a financial power"
68. Banco Santander (2019); "Singapore: Taxation"
69. Deloitte Insights (2018); "The future of regulation. Principles for regulating emerging technologies "
70. Deloitte Insights (2018); "The future of regulation. Principles for regulating emerging technologies "

Infrastructure

Digitization requires a solid infrastructure foundation to make compared to the traffic generated by users and companies, which grows exponentially

The most digitized countries have an infrastructure network that stimulates the development and implementation of new technologies, as well as the use of new services.

In this context, two successful actions are identified in some leading countries in the digital field: promotion of cooperation between telecommunications operators and industries that use infrastructure of new generation and updating and flexibility of current regulations to facilitate investment in modern infrastructure.

Regarding fixed broadband infrastructure, Spain occupies a positive starting position. The fiber optic network to the home (FTTH) installed is the largest in the European Union, covering more than 77% of homes. Regarding mobile broadband, 4G coverage is higher than 99% of the population, being above the average for the European Union [71].

The Spanish fiber optic infrastructure contrasts with the situation of the main countries of the European Union -France, Germany, Italy, Spain and the United Kingdom-.

Table 4. Fiber optic coverage in the EU-5 countries

	Spain	France	Germany	Italy	United Kingdom
FTTH coverage / FTTP (% of households)	77.4%	37.8%	8.5%	23.9%	3.8%

Sources: European Commission. Digital Agenda Scoreboard Key Indicators

71. Ministry of Economy and Business (2019); "Report of Broadband Coverage in Spain in 2018"

The Spanish reality is due to the determined investment policy in networks carried out by the telecommunications operators, as well as to the measures promoted by the public administrations.

The future of investment in digital infrastructures will be featuring 5G, a technology that will be key to boosting multiple sectors of the economy. The GSMA "Mobile Economy 2019" report reveals that 16 countries around the world will have commercial 5G networks this year, following the first launches in South Korea and the United States in 2018. The new generation of technology is on its way to represent the 15% of global mobile connections by 2025.

To cope with the deployment of this new infrastructure, a stable regulatory framework will be necessary to encourage investment by telecommunications operators. In line with the EU 5G Action Plan, Spain has published a National 5G Plan 2018-2020.

According to the GSMA report, "The Mobile Economy China", both the Chinese Government and the Ministry of Industry and Information Technology ("MIIT") [72] recognize the need to ensure the timely release of 5G spectrum and promote its efficient use. MIIT has issued trial licenses, in the bands of 2.6,

3.5, 4.9 Ghz, highlighting its commitment to supporting pre-commercial deployments. In 2019, MIIT plans to issue temporary 5G network licenses in some cities.

The Government hopes that 5G technology will bring new opportunities and favors the growth of the Chinese digital economy, as well as fosters the digital transformation of many sectors, in particular those of industry and the automotive industry [73], where it will be used more intensively.

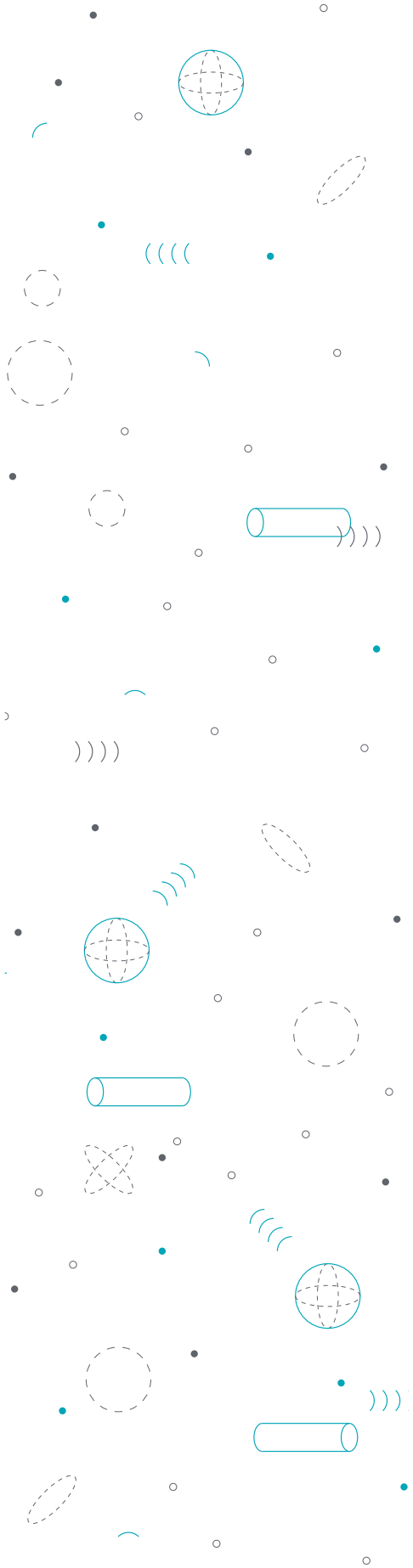
In 2018, the Federal Communications Commission of the United States ("FCC") developed a strategic plan to promote 5G technology, based on the following aspects: promotion of 5G spectrum, update of infrastructure policy and modernization of regulations [74].

Regarding the deployment of infrastructures, the FCC defined the following initiatives:

- Adoption of new rules to reduce federal regulatory barriers to the deployment of *small-cells,* infrastructure needed for 5G.
- Reform of outdated laws on *macro-cells,* with the aim of eliminating or reducing the existing digital divide between the different areas within the country.

On the other hand, an update of the current infrastructure policy was carried out. These updates include:

- Adoption of the "Restoring Internet FreedomOrder", which establishes a national policy aimed at the different Internet providers.
- Updating of the rules governing the connection of new network equipment to reduce costs and accelerate the process of deployment of *backhaul* 5G.
- Accelerating the IP transition through the revision of standards to make it easier for companies to invest in the next generation of networks and services instead of existing networks.



72. GSMA (2019); "The Mobile Economy China" "
73. Nikei Asian Review (2019); "Chinese 5G investment set to quicken with 1st licenses ready"
74. Federal Communications Commission (2018); "Government Policies for 5G in the United States of America"

- Enterprise data services: To incentivize investment in modern fiber networks, the FCC updated the rules for specialized high-speed services.

On the other hand, with the development of infrastructures and new digital services, an increasing amount of data is generated that requires an infrastructure for its storage and use. In this way, data centers become indispensable technological platforms. What's more,
These host multiple cloud-based internet services, increasing energy efficiency due to economies of scale [75].

In this area, Singapore stands out as the main data center market in the Asian region [76]. Reasons such as a low tax environment, a favorable framework for investment and international connectivity with Europe, the United States and the main Asian countries make this country one of the leaders in this market.

Europe, Germany and the United Kingdom have traditionally attracted investment in data centers as the economic hubs of the continent. However, in recent years, the Nordic countries have attracted the creation of new data centers by having competitive energy prices, favorable weather for the maintenance of these centers and high connectivity.

75. International Energy Agency (2019); 'Data centers and data transmission networks'

76. Cushman & Wakefield (2017); 'Data Center Investment. A Rare opportunity for the right investor '

Annex: Methodology

Narrow impact calculation

DigitalES companies have provided economic information- with which your contribution has been estimated *narrow.*

To estimate the direct contribution of companies to Gross Value Added (GVA) in Spain, we start from the income of DigitalES companies and apply the ratio between GVA and production of the relevant sector [77].

Some companies have not been able to share data on other relevant variables, and a methodology has been developed to mitigate this lack. In particular, relationships have been identified between the different variables with lack of data and other available variables such as gross income, benefits or wages and salaries of the different DigitalES associates. These relationships have been applied to complete the database with a reasonable estimate of your contribution *narrow.* In more detail:

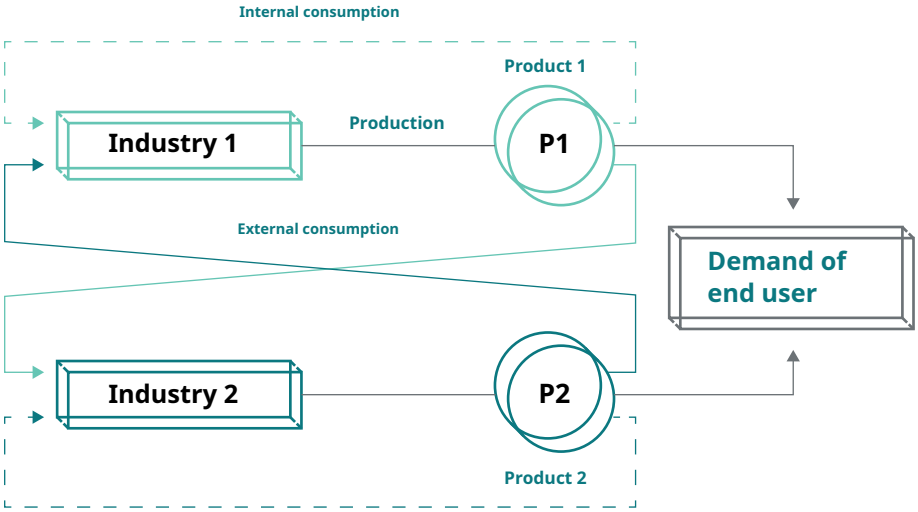
- Wages and salaries: 15% of total salaries and salaries have been estimated based on the number of employees, provided by the companies as a whole, and the average salary, which is based on the companies that have had the opportunity to provide data .
- Tax burden: 5% of the total tax burden has been estimated, based on the ratio of tax burden to profits of the companies that have provided data.
- Social contributions: 60% of social contributions has been estimated, based on the ratio of social contributions to wages and salaries of the companies that have provided data.
- Investment: 15% has been estimated based on the investment to income ratio of the companies that have provided data.
- Total expenditure: 30% has been estimated based on the ratio of expenditure to income of the companies that have provided data.
- R & D & i expenditure: 25% has been estimated based on two approaches; a first approach for companies in the telecommunications sector, in which the average expenditure on R & D & i compiled by the INE with respect to the sector's production is applied to estimate the expenditure on R&D for companies that have not provided this data; and a second approach for companies that do not belong to the telecommunications sector, in which the average relationship between spending on R & D & i and the income of similar companies that have provided data for this study is used.

To calculate the indirect and induced impacts, economic concepts, the InputOutput methodology and economic multipliers have been applied.

As a context, the InputOutput, or Leontief methodology, is based on economic interactions between different industrial sectors. Every industry needs a certain number of inputs to

77. The sectors are telecommunications services, programming, consulting and other related services, and computer, electronic and optical products. The ratio between the GVA and the production of each of these sectors is obtained based on the Input-Output tables of the National Institute of Statistics

Figure 13. Input-Output Model



Source: Deloitte elaboration

produce their products or services, that is, the outputs (output).

The Input-Output model models all inputs and outputs, that is, the relationships between all industrial sectors, and, therefore, the economic structure of a country. Mathematically, this is represented in a square matrix estimated by the National Institute of Statistics. This matrix is used to calculate the different multipliers

Indirect and Induced Economic.

In this study, the following methodology has been used, which includes the use of indirect and induced production multipliers, calculated from the Input-Output tables of the National Institute of Statistics. In more detail by indicator:

- GVA: The indirect impact has been based on the total expenditure of the companies to which wages and salaries, social contributions, and overlaps in the value chains of DigitalES companies are subtracted. The relationship between GVA and production in the Spanish economy is finally applied to this figure. The induced impact has been estimated using the weighted average of the production multipliers of the relevant sectors. Finally, the ratio between GVA and production in the Spanish economy is applied to this figure.

- Employment: Indirect and induced impacts have been calculated by applying to direct employment the weighted average of the employment multipliers of the sectors relevant to the contribution of DigitalES companies.

- Tax burden and social contributions: Indirect and induced impacts have been calculated by applying the proportion of tax burden and social contributions

on production in the Spanish economy to indirect and induced production supported by DigitalEs.

Calculation of broad impact

The economic literature establishes that there is a positive relationship between digitization and economic growth, in part through improvements in productivity.

This Deloitte report for DigitalES proposes a breakthrough in the study of the relationship between digitization and economic growth, particularly in the European context.

The European Commission has developed the 'DESI Digitization Index', which brings together information on this process in European countries using a series of indicators, and helps to study and compare the evolution of their digital performance over time.

The Commission has been publishing data from this Index since 2014. There are some studies that explore the relationship between digitization, represented by different indices, and productivity and economic growth, some of which explores correlations, and even others that explore whether there is any statistically significant relationship between components of the 'DESI Digitization Index' and GDP per capita. However, no studies have been found that seek to quantify the relationship between the evolution of the 'DESI Digitization Index' as a measure of digitization in European countries and GDP per capita.

This study has sought to quantify this relationship between the 'DESI digitization index' and real GDP per capita at the European level (28 countries). This section discusses the data used, the approach, and the results.

Data

Data have been collected from Eurostat, the European Commission, the World Economic Outlook of the Monetary Fund International, and the Penn World Table version 9.1 on: the evolution of the 'DESI Digitization Index' in the 28 countries of the European Union between 2013 and 2018, real GDP per capita, a human capital index from Penn World Tables, the number of employees, population, capital, gross capital formation

fixed, exports and imports, and public spending, among others.

Focus

This study has focused on the development of 6-year, fixed-effects panel econometric models. To come up with a model

Finally, different specifications have been developed from the perspective of spending and supply. Given the available data, models based on the expenditure perspective seem to better explain the evolution of real GDP per capita (higher R_{two}).

$$\log(\text{GDP per capita}_{Item}) = \beta_1 \log(\text{GDP per capita}_{it-1}) + \beta_{two} \log(\text{DESI}_{Item}) + \beta_3 \log(\text{Public expenditure}_{Item} / \text{Real GDP})_{Item} + \beta_4 \log(\text{Exports and imports}_{Item} / \text{Real GDP}_{Item})$$

After the iterations, the final equation that supports the estimates in the study is the following:

The fixed effects models take into account the variables or aspects that are not included in the previous equation and remain constant during the period of time considered, such as, for example, the quality of the institutions or the economic structure of a country, in In particular, since we are talking about a relatively short period of time.

The model produces estimates of the coefficients (β) that $\hat{}$ capture the marginal impact that the variables on the right side of the equation have on the dependent variable (log of real GDP per capita). In the above equation, the estimated coefficient for *log(* DESI), that is, $\hat{\beta}_{two,}$ can be interpreted in such a way that a 1% change in the 'DESI digitization index' is related, on average, to an increase in the Real GDP per capita of $\hat{\beta}_{two\%,}$ keeping the other factors constant.

Results

The modeling results suggest that the more digitization, the higher the real GDP per capita growth. Specifically, it is estimated that, in the European context, an increase of 10% in the 'Digitization Index DESI 'has contributed an average of 1 percentage point to real GDP per capita growth between 2013 and 2018.

The models developed for this study have an R_{two} adjusted above 90%, that is, they have a high explanatory power; and they have been validated with different standard tests.

Likewise, different specifications of the model have been tested, both from the economic perspective of spending and the offer. In general, the coefficient 'DESI digitization index' is usually statistically significant and oscillates around 0.1.

It is suggested to explore models and alternative methodologies as data availability increases.

Fixed Effects Model	
Number of observations:	139
Number of countries:	28
Period in time:	2013 - 2018

Independent variables	Coefficients
log (GDP per capita real t-1)	0.56 ***
log (DESI)	0.11 ***
log (Public spending / real GDP)	- 0.34 ***
log (Exp. and Imp. / real GDP)	0.09 *

* * * Significant at 1%
* * Significant at 5%
* Significant at 10%

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