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# BASQUE DIGITAL TRANSFORMATION IN THE GLOBAL ECONOMY: INDUSTRY 4.0 AND BACKSHORING RECONFIGURATION OF GLOBAL VALUE CHAINS

DEPARTMENT OF POLICY, RESEARCH AND STATISTICS

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**Basque digital transformation in the global economy:  
Industry 4.0 and backshoring reconfiguration of global  
value chains**

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## **Abstract**

This paper introduces the agenda for the Basque Country's industrial transformation, which promotes resource efficient manufacturing by taking advantage of digitalization to incorporate added value to processes, products and services. This strategy builds on previous business development strategies and plans, research and innovation which together represent a sustainable industrial policy viewed internationally as a success story.

This paper analyses the results of a large-scale survey conducted by the Basque Business Development Agency (SPRI) on the adoption of digital technologies and examines the degree with which Basque firms expect that the uptake of digital technologies will impact on the location of their manufacturing activities. Insights into the motivations underlying the acquisition of foreign production plants by a set of Basque firms interviewed are also presented.

**Keywords:** Basque Industry 4.0; industrial policy; digital transformation; backshoring

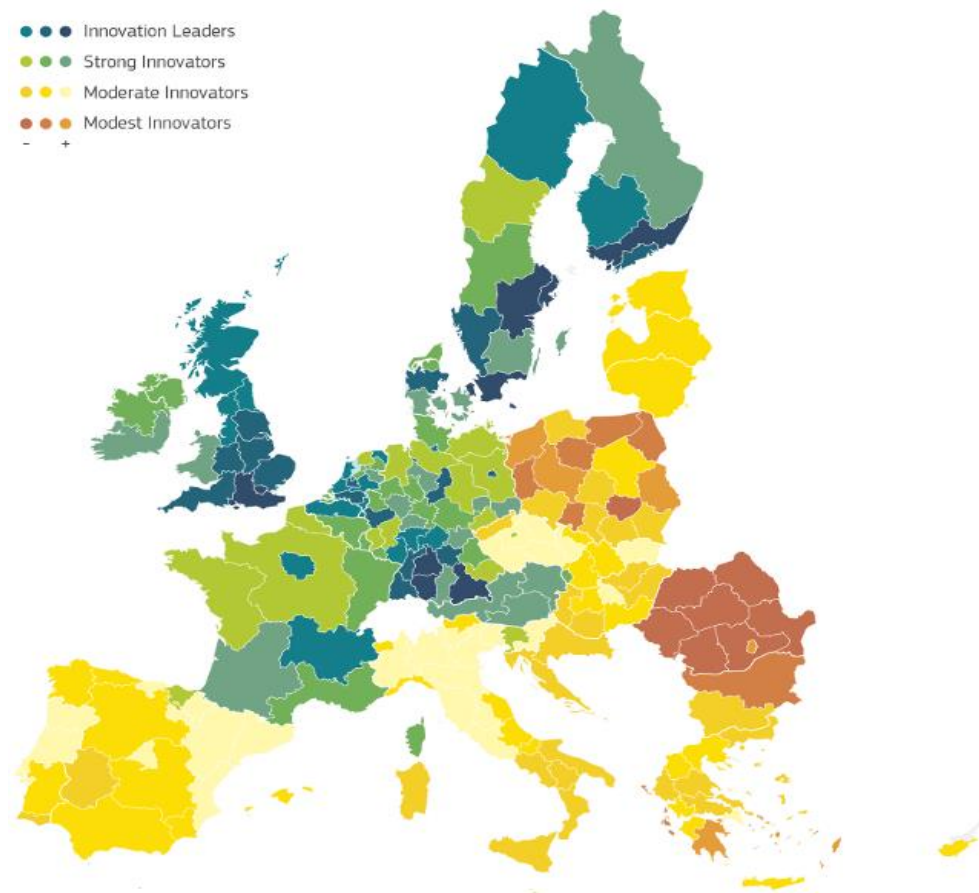
# 1 Overview of industrial policy in the Basque Country

## 1.1 Region's profile

The Basque Country, with a population of 2.1 million and covering 7,233 square kilometres, is an autonomous region located in northern Spain and has one of the largest industrial concentrations in the country, with industrial activity accounting for 24 per cent of the Basque Country's GDP.

According to the European Regional Innovation Scoreboard 2017 (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2017), the Basque Country is a successful innovator and its strengths include tertiary education and innovative SME collaboration. The RIS 2017 describes the Basque Country as a regional innovation pole in a moderately innovative country and highlights the Basque Country's structural differences including its higher employment share in manufacturing, higher GDP per capita and higher GDP per capita growth than the average European region.

**Figure 1: Regional innovation performance**



Source: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2017a:5).



The Basque Country has historically been one of the most important industrial centres in Spain with a high degree of specialization in the iron and steel industry, shipbuilding and machinery. In the last 40 years, the Basque economy has been profoundly transformed and modernized. The region became a model following its successful First Great Transformation to restructure its industry and make the region competitive through tailored industrial policies during the 1980s and 90s (OECD, 2011), moving from a steel-dominated economy with a focus on the domestic market to a diversified economy focussed on international markets, quality and technological innovation. In 2001, a new phase of regional development with the second economic transformation of the Basque economy (Porter et al., 2013) aimed to move the region towards a modern information society with knowledge-based activities throughout the economy, and innovation as a key driver.

The cluster policy, firms' internationalization programmes, investment incentives, technological development and the promotion of quality and innovation have been associated with the achievement and maintenance of a competitive industrial fabric since the first great transformation and have continued to be key drivers of the Basque government's consecutive industrial plans, which have implemented specific planning tools for industrial policy since 2006.

**Table 1: Basque Country's key figures**

<b>BASQUE COUNTRY – BASQUE COUNTRY</b>	<b>2017</b>
GDP CURRENT PRICES (MILLION €)	73.643
GDP PER CAPITA CURRENT PRICES (€)	33.846
PER CAPITA GDP (EU-28 = 100)	121
PRODUCTIVITY PER PERSON EMPLOYED (UE-28 = 100)	123,3
INFLATION (%)	1,1
INDUSTRY (% S/GDP) (EU: 19.6%. SPAIN: 18.1%)	24,2
RATE OF OCCUPATION (16 TO 64 YEARS, %)	66,5
EXPORTS (MILLION €)	23.857
IMPORTS (MILLION €)	18.653
EXPORTING PROPENSION (EXPORTS/GDP) (%)	32,4

Source: Eustat (2018), INE (2018)

## 1.2 Industrial plan

The Industrial Plan 2017–2020 “Basque Industry 4.0” (Departamento de Desarrollo Económico e Infraestructuras, 2017) represent some of the commitments of the Basque Country’s 2020 Government Programme, which includes 15 strategic plans within the framework of the United Nations Sustainable Development Goals. Including “Basque Industry 4.0” in the Plan’s title denotes the relevance of Industry 4.0 and the Fourth Industrial Revolution.

The Plan has three overarching objectives:

- Increasing the level of employment, reducing unemployment to below 10 per cent.
- Achieving greater wealth, reaching 125 per cent of the European Union’s average GDP per capita.
- Redistribution of improved wealth, reducing the poverty rate by 20 per cent.

In addition to these objectives, the Industrial Plan 2017–2020 seeks to comply with the quantitative strategic objective of achieving a contribution of industry to the Basque GDP of at least 25 per cent.

Moreover, it includes additional complementary objectives:

- Better industry: achievement of a new position in the Industry 4.0 paradigm, facilitation of a qualitative leap on the international stage, improvement in competitiveness and establishment of strong connections between business needs and supply of skilled labour.
- Efficient industrial policy: an industrial policy that supports the abovementioned objectives.

For 2017–2020, the Industrial Plan “Basque Industry 4.0” presents six priority actions:

- Development and competitiveness of SMEs
- Strategic industrial projects
- Technology, innovation and advanced industry
- Internationalization of businesses
- Context for competitiveness
- Trained workers and quality employment.

### 1.3 The Basque Business Development Agency (SPRI)

With the intensification of the economic crisis at the beginning of the 1980s, the Basque government deemed it necessary to launch public initiatives aimed at stimulating and strengthening the collective efforts of companies and economic agents to reorganize and restructure the industrial framework. In 1981, SPRI was created as a public agency. Focussing on medium-sized companies, this new agency sought to boost the Basque economy by promoting and reforming the industrial sector to increase its competitiveness, diversification and technological level in the short term.

SPRI's mandate has evolved considerably from industrial restructuring towards the launching of innovation policies to promote industrial competitiveness. The current objective of SPRI is to support Basque companies by introducing various programmes and services to implement the Basque government's economic promotion policies at the business level:

- Promote the design and execution of plans and programmes to promote industrial and business activities, investment, development, diversification and industrial competitiveness, innovation, internationalization, the development of the information and knowledge society and the promotion of entrepreneurial activity.
- Promote foreign industrial investment in high added value and employment generation projects.
- Boost the promotion and industrial organization of districts in the Basque Country that have special needs, including a need for re-industrialization and industrial measures, in collaboration with other relevant institutional bodies.
- Develop programmes and action plans for companies experiencing temporary difficulties and promoting relaunches with the aim of retaining jobs and fostering competitive industrial activity.
- Promote and consolidate the public support system for the internationalization of Basque companies, supporting the implementation of Basque companies abroad.
- Promote physical infrastructure and the technological environment that allow for the establishment and suitable competitive development of industrial projects.

SPRI's objective is "to be a European benchmark, as a public institution, for the competitive transformation of the business fabric"<sup>1</sup>. Its mission is to "support, promote and contribute to the competitive improvement of Basque companies, thereby collaborating with generating wealth in

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<sup>1</sup> <https://www.spri.eus/en/who-we-are/>

the Basque country and improving the well-being of its citizens by means of sustainable human development, within the scope of the Basque Government Economic Promotion Policy”<sup>2</sup>.

#### 1.4 Cluster policy

In the 1990s, the Basque industrial policy was framed within the framework of the European integration process and the consequent geographic focus on Europe. At that time, the focus was on the development and support of a clusters policy based on public-private collaboration. The government’s commitment to the consolidation of inter-business cooperation has continued, fostering a stable framework of support for the generation and development of different clusters. As a result, the Basque region now has several powerful industrial clusters that play a key role in the internationalization and innovation processes of Basque companies. These clusters, which are the result of private-public partnerships, promote collaboration projects in different areas (research, internationalization, etc.) within the sectoral value chain and between clusters, generating a distinct relational framework for the Basque industry.

The region’s main industrial clusters are:

- **Advanced machinery:** the region is one of the largest European manufacturers of machine tools. The companies that operate in this industry produce various components for aeronautical, automotive and other firms, producing over 2,000 machine models and a wide range of highly competitive products.
- **Automotive:** over 45 per cent of the production volume of Spain’s automotive industry is manufactured in the Basque Country. Basque component manufacturers are present in 29 countries with 250 production plants. AIC is a specialized global competence centre that aims to stimulate sectoral knowledge, increase basic and applied research related to the given industry, foster automotive training, create new business projects with high added value in the industry, and attract innovative projects.
- **Aeronautical:** half of all large commercial aircraft have an engine that is manufactured in the Basque Country (ITP/Rolls Royce). The Aeronautics Advanced Manufacturing Centre represents an international milestone with an estimated investment of EUR 9 million and manufactures technologically advanced machinery for companies.
- **Energy:** a strong industry that consists of nearly 350 companies, with a turnover of around EUR 47.000 million, employing 63,000 people. The industry is highly dynamic throughout the value chain as well as in the manufacturing of equipment or services for the installation and maintenance of energy infrastructure. The Basque Country has

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<sup>2</sup> <https://www.spri.eus/en/who-we-are/>

promoted an Advanced Manufacturing Centre for the wind sector (WINDBOX) with an investment of EUR 13 million to enhance the technological position and international competitiveness of the suppliers of subsystems and products for the wind power industry.

- **Rail industry:** it is identified as one of the most pioneering industries, with solutions and services adapted to the specific requirements of each operator and project. The headquarters of the Spanish Railway Association, MAFEX, is located in the Basque Country, which in itself demonstrates the weight of this industry. The railway systems of many cities worldwide bear the stamp of a Basque company, CAF.
- **ICTs:** the industry's turnover in the Basque Country is around EUR 3 billion. Comprehensive electronic, IT and telecommunication solutions focus on optimized management of business processes of industrial, commercial and services firms.

## **1.5 Internationalization plan**

Internationalization is and has been one of the priorities of Basque industrial policy. The first measures introduced by the Basque government in the 1980s aimed to promote business internationalization, and focussed on stimulating external trade through support programmes to encourage sales, provide training in external trade and increase awareness.

This export-focussed vision has since been broadened to incorporate initiatives aimed at consolidating Basque businesses abroad (breaking into new markets, developing links between Basque and foreign companies and attracting direct foreign investment into the Basque Country). Business internationalization has evolved as a major component in policies for industry promotion. External promotion plans have been drawn up and internationalization has become a fundamental pillar of economic promotion and business competitiveness plans.

In line with the Basque government's current programme, an Internationalization Plan (Eusko Jarlauritza Gobierno Vasco, 2020) was elaborated in 2017 based on the following vision: to position the Basque Country as a global actor with its own space in the construction of the European project; to become a cohesive, attractive, competitive region acknowledged for its uniqueness, its high level of sustainable human development as well as its solidarity and openness to the rest of the world and its close connection to Basque communities abroad. To that end, 13 internationalization projects were developed in alignment with the government's programme and five common vectors for internationalization:

- Projecting the Basque Country/Basque Country brand abroad
- Promoting and fostering sectoral interests
- Contributing to the resolution of global challenges to sustainable development
- Contributing to the European project
- Capturing knowledge.

The implementation of these five vectors of internationalization was organized around 27 thematic areas of action: External Action, Internationalization of Business, Culture, Tourism, Development Cooperation, Sport, Open Government, Coexistence and Human Rights, Equality, Public Governance, Science Technology and Innovation, Energy, Agriculture Fishing and Food, Infrastructure and Transport, Employment, Social Policies, Environment, Territorial Policy, Housing, Taxation and the Economy, Education, Vocational Training, Universities and Research, Health, Language Policy, Security and Justice.

**Figure 2: Structure of the Basque Country’s internationalization strategy**



Source: Eusko Jarlaritza Gobierno Vasco (2020)

## 1.6 Science and technology policy

The Basque Country has undertaken considerable efforts for several decades to develop a competitive science and technology (S&T) policy. This has resulted in the creation of a Basque science, technology and innovation system, at the heart of which are the members of the Basque Science, Technology and Innovation Network, composed of 120 bodies: the Centres for Basic Research and Excellence (BERC), the Research Structures of the Universities, Cooperative Research Centres (CIC), Multi-focussed Technology Centres, Sectorial Technology Centres, Agents for the Outreach of Science, Technology and Innovation, Supply/Demand Intermediation Agents, Corporate R&D Units, Health R&D Organizations and Health Research Institutes. Among these, the IK4 Research Alliance and the Tecnalia Corporation, which are global reference technology centres, and employ over 2,800 people.

The Basque Country has four universities: the public University of the Basque Country (UPV/EHU), with three campuses, 20 faculties and schools, and around 45,000 students and 5,000 teaching staff, and three private universities, the Mondragon University, which belongs to the Mondragón Cooperative Group, the Deusto University, founded by Jesuits in 1886, and a campus of the University of Navarra.

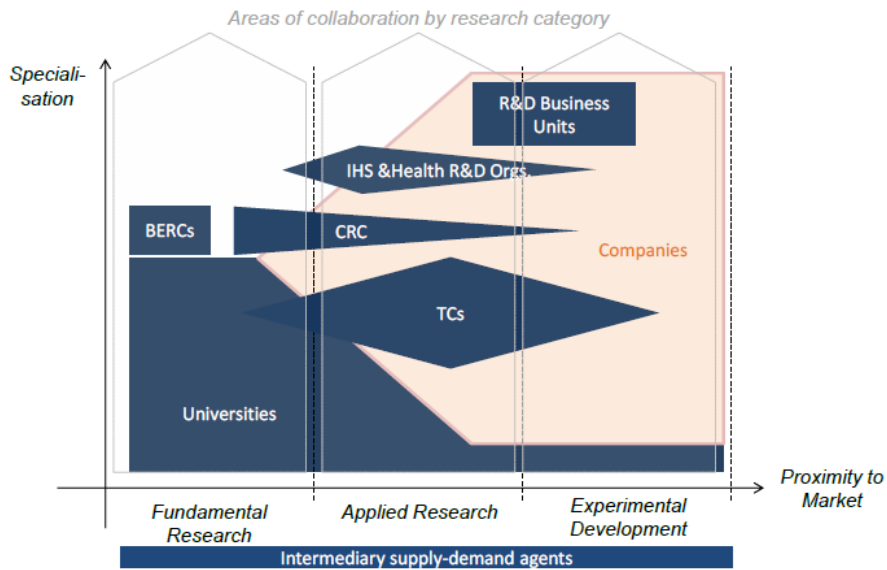
The Basque Country has been established as a European reference point for vocational training and is the first EU testbed for the introduction of applied innovation learning. The Vocational Education and Training (VET) offers around 150 training cycles adapted to different professional requirements, aimed at ensuring that people acquire the necessary professional skills to enter qualified jobs.

According to the Basque Country's regional Competitiveness Observatory<sup>3</sup>, total employment in R&D in the region accounts for 1.98 per cent of total employment, i.e. 42,913 employees are engaged in R&D activities.

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<sup>3</sup> <https://www.orquestra.deusto.es/competitiveness-observatory/en/ES21/dashboard>

**Figure 3: Map of BSTIN agents and collaborative spaces**



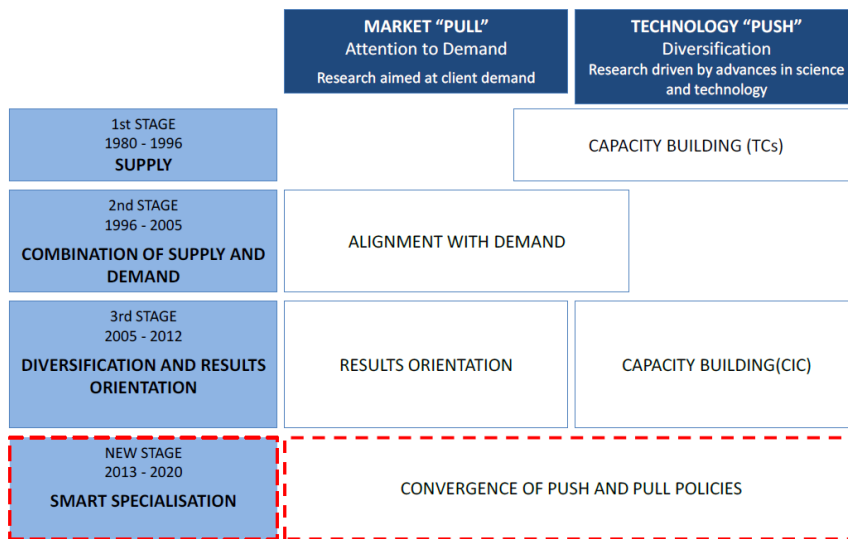
Source: PCTI EUSKADI (2020: 87)

From the creation of basic skills in the 1980s and 90s, PUSH policies to support the supply of S&T have been combined with other PULL policies to ensure orientation of research towards the demands of the market and society.

Backed by advanced S&T policies and commitment to improving the efficiency of R&D&I investments, the Basque S&T policy has entered a new stage characterized by the need to focus efforts on achieving convergence between research oriented towards the demands of the market and society and research driven by advances in S&T through smart specialization. This entails a process of generating new capabilities and optimizing existing resources, aiming to substantially improve the return on investments. The underlying objective is the generation of greater value for businesses and society by improving the system’s productivity.



**Figure 4: Evolution of S&T policy in the Basque Country**



Source: PCTI EUSKADI (2020: 12)

In line with the Europe 2020 Strategy, the Basque Country’s new approach to research and innovation aims to increase collaboration along the entire chain of research and innovation, thereby reducing the time between the conception of an idea and its introduction in the market.

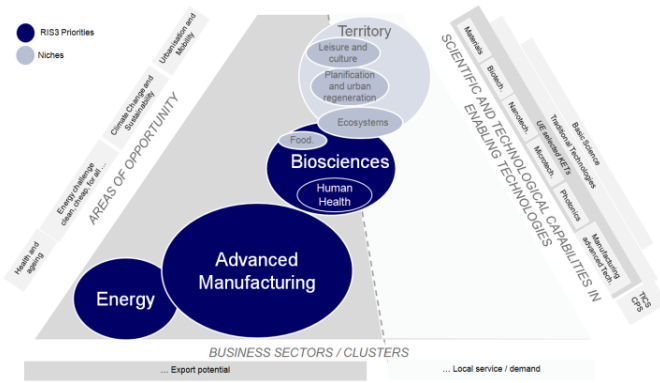
## 2 Basque Industry 4.0 - Advanced Manufacturing Strategy

### 2.1 Smart Specialisation Strategy (RIS3) Framework

The Basque Smart Specialisation Strategy RIS3, which is embedded in the Basque government’s (PCTI EUSKADI, 2020), outlines the areas of productive specialization based on the Basque Country’s industrial structure and technological capabilities.

The Basque RIS3 is the result of the combination of structural or functional priorities with vertical priority areas (“bets”) under the premise of increasing the economic impact of investments by transferring knowledge to industry. Advanced manufacturing, energy and biosciences are key priority areas for scientific, technological and industrial development.

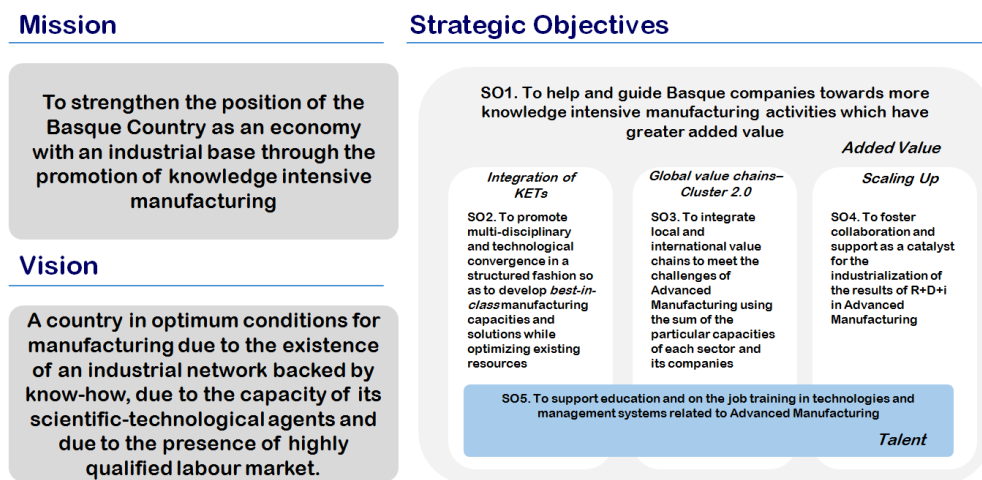
**Figure 5: Basque Country’s RIS3 priorities**



Source: PCTI EUSKADI (2014)

One of those priority areas is “Advanced Manufacturing”, for which the Basque government has developed a specific strategy, the Basque Industry 4.0 Strategy (BI 4.0)<sup>4</sup>. The BI 4.0 seeks to strengthen the Basque Country’s position as an economy with an industrial base by promoting knowledge-intensive manufacturing.

**Figure 6: Mission, vision and strategic objectives of the Basque Industry 4.0 Strategy**



Source: Basque Government (2015)

The Basque Industry 4.0 Strategy focusses on the incorporation of artificial intelligence in production means and systems, the use of emerging technologies and capabilities in new products and processes, the integration of advanced materials in solutions with higher added value and improved processes, efficiency and sustainability of the resources used, and the integration of high added value services. It is implemented by a public-private partnership led by a steering

<sup>4</sup> <https://www.spri.eus/en/basque-industry/#estrategia>

group composed of relevant manufacturing firms in the region and high-level government representatives.

The Basque government has designed several support programmes for the integration of advanced manufacturing technologies by Basque companies that specialize in the transfer of digital technologies. The Basque government has also focussed efforts on industrial cybersecurity to support the convergence and integration of protection systems against industrial cyberattacks.

## **2.2 Basque Country Digital Agenda 2020**

Basque Industry 4.0., as a strategy to promote technological and industrial development, and the Basque Country Digital Agenda 2020<sup>5</sup> support digitalization, the main objectives being:

- Build the Basque industry of the future defined in the Basque Industry 4.0 Strategy through the development and integration of the new generation of digital technologies in the Basque Country's industrial structure.
- Promote—in accordance with the recommended EU guidelines—essential digital competences, as well as their improvement, validation and enhancement.
- Converge towards a unified, efficient and updated model of technological management of the Basque public sector as the basis for the modernization and innovation within public services.
- Deploy next generation broadband infrastructure throughout the entire Basque territory, the high level of connectivity being a key element of cohesion and territorial organization.

In 2018, the Basque Competitiveness Institute, Orkestra, carried out the first detailed study of the Digital Economy and Society in the Basque Country<sup>6</sup> using the standards of the European Digital Economy and Society Index (DESI)<sup>7</sup>.

The results of the study show that the Basque Country's performance in the development of the digital economy and society based on the DESI Index of the European Commission is solid. The Basque Country's performance closely follows those regions that are leaders in digitalization owing to its high connectivity capabilities, human capital development and notable level of integration of technology in businesses and public administration.

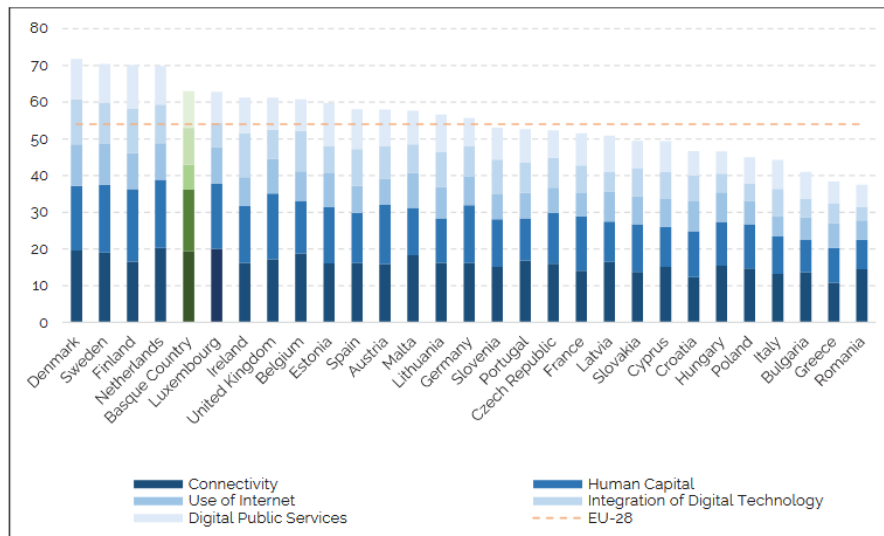
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<sup>5</sup> <https://www.spri.eus/archivos/19777/Agenda-Digital-de-Euskadi-2020.pdf>

<sup>6</sup> [https://www.orkestra.deusto.es/images/investigacion/publicaciones/cuadernos/Digital\\_Economy\\_and\\_Society\\_in\\_the\\_Basque\\_Country\\_2018.pdf](https://www.orkestra.deusto.es/images/investigacion/publicaciones/cuadernos/Digital_Economy_and_Society_in_the_Basque_Country_2018.pdf)

<sup>7</sup> <https://ec.europa.eu/digital-single-market/en/news/digital-economy-and-society-index-2018-report>

**Figure 7: DESI 2018 (%)**



*Source:* Zubillaga Rego, A. and Peletier Espiga, C. (2019, p.7)

The integration of digital technologies in businesses (48.27 per cent) is a solid performance in relation to the leading countries in this area, namely Nordic countries: Denmark (55.75 per cent), Ireland (54.28 per cent), Sweden (50.75 per cent) and Finland (50.47 per cent). Technological integration in business mainly occurs due to the digitalization of business and, to a lesser extent, to the use of electronic commerce.

Digitalization is a lever of territorial competitiveness, which has the ability to have an influence on all agents and processes of the regional ecosystem. The uniqueness, relevance and characteristics of each of the Basque economy’s industries are translated into different digital transformation strategies. For example, the digitalization strategy of the advanced manufacturing industry is much more clearly defined than that of other industries.

### 2.3 The Basque Digital Innovation Hub

Despite being in a good position at European level overall, there is room for improvement.

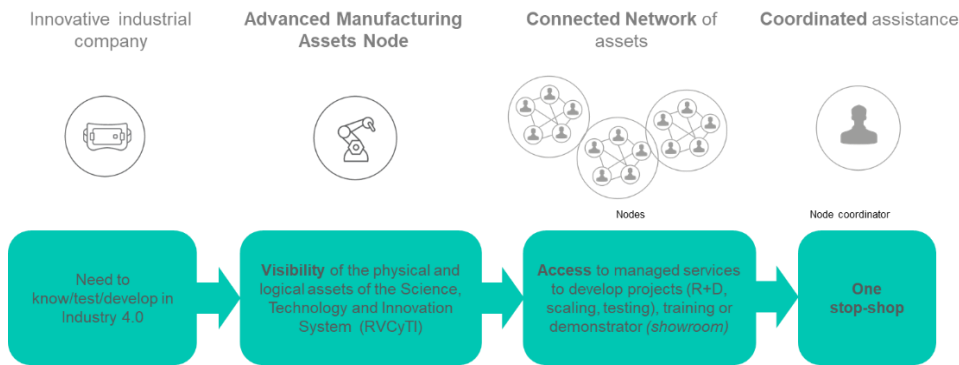
To provide Basque companies—mainly SMEs—with the technological capabilities necessary to meet the digital challenges, the Basque government launched the “Basque Digital Innovation Hub (BDIH)”<sup>8</sup> initiative within the Basque Industry 4.0 Strategy.

The objective of BIDH is to make available a straightforward and cost-effective connected network of assets (infrastructure, laboratories, test benches, pilot plants, equipment, software,

<sup>8</sup> <https://www.spri.eus/en/basque-industry/basque-digital-innovation-hub/#estrategia>

etc.) for Basque industrial SMEs, and to promote innovative and excellent scientific-technological capabilities in the area of advanced manufacturing. The BDIH makes it possible for companies to cover their potential needs to design, develop and test products or processes, to carry out R&D projects, scaling, training and demonstration focussed on Industry 4.0.

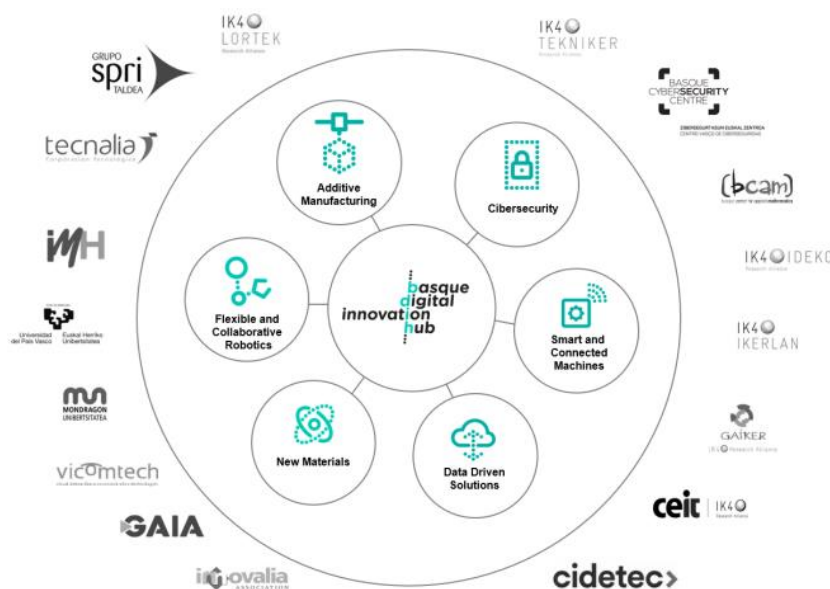
**Figure 8: Basque Digital Innovation Hub model**



Source: Basque Digital Innovation Hub

The BDIH is composed of six technology-oriented nodes of which three are currently operational (flexible and collaborative robotics, additive manufacturing and cybersecurity), and another three which are being further defined (smart and connected machines, data driven solutions and new materials).

**Figure 9: Basque Digital Innovation Hub nodes and members**



Source: Basque Digital Innovation Hub

### **3 Basque Digital transformation in the global economy**

#### **3.1 Industry 4.0 and backshoring reconfiguration of global value chains analysis**

A growing body of literature has emerged about the impact of Industry 4.0 technologies on the course of international business, i.e. studies that examine the impact of the adoption of digital technologies on the structure of global value chains (Laplume et al., 2016; Rehnberg & Ponte, 2016) and on the international configuration of business apparatuses (Rezk, Srari, & Williamson, 2016). In a similar vein, there is growing interest in investigating how technologies that increase productivity (e.g. advanced robotics) might influence the geography of production, for instance, the extent to which their application in advanced countries could favour backshoring of productive activities from emerging economies (Bals et al., 2015; Fratocchi, Di Mauro, Barbieri, Nassimbeni, & Zanoni, 2014).

To examine the degree to which Basque firms expect the adoption of digital technologies to impact the location of their manufacturing activities, the Basque Business Development Agency (SPRI) conducted a large-scale survey. The base population for the survey consisted of some 2,000 firms that SPRI had recent contact with. These contacts developed from expressions of interest or applications on behalf of these firms for innovation, R&D, and internationalization support programmes offered by the Basque government. As such, the base population may not be representative of all firms established in the Basque Country, but since we are primarily interested in the adoption of digital technology (related to innovation) and decisions in the realm of international business (related to offshoring and/or backshoring), it can be argued that we have a relevant set of ‘likely instances’ to source valid insights from.

The design of the questionnaire was based on the “Digital Transformation Monitor”,<sup>9</sup> the “European Manufacturing Survey”<sup>10</sup> and ad hoc questionnaires that either SPRI or UNIDO had recently used to inquire about issues related to global value chains and Industry 4.0/digital transformation. Several preliminary versions of the questionnaire were circulated between representatives of SPRI, UNIDO, the Basque Competitiveness Institute (Orkestra) and the Austrian Institute of Technology (AIT). Ultimately, the survey included questions that asked the participating firms:

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<sup>9</sup> <https://ec.europa.eu/growth/tools-databases/dem/monitor/content/welcome>

<sup>10</sup> <https://www.isi.fraunhofer.de/en/themen/industrielle-wettbewerbsfaehigkeit/fems.html>

- Size in terms of revenue and employees
- Value chain position
- Principal sectoral markets
- Cluster affiliation
- Reliance on income from product sales and service provision
- Foreign branch plants
- Adoption of a broad variety of digital technologies and their impacts on several process, output and outcome parameters
- Skill base to deal with the implementation of these technologies
- Provision of support from public institutions to adopt digital technologies and/or develop different business functions
- Experience and decisions on offshoring and backshoring manufacturing activities.

The survey was launched at the end of January 2019 and was carried out until the end of February 2019, resulting in around 475 valid questionnaires. The answers of these 475 companies were processed both at the aggregate level of respondents, and for 2 subsets. To characterize the sample in general terms and in terms of their degree of digitalization, we used the entire set of responses. To analyse the relationship between the adoption of digital technologies, on the one hand, and offshoring/backshoring dynamics, on the other, we used two specific subsets among the entire respondent population.

In addition, at the end of February 2019, representatives of UNIDO and AIT came to the Basque Country for a complementary fact-finding mission, during which they were accompanied by members of SPRI and Orkestra. Over three days, industrial firms and cluster associations with considerable relevance for the region's international business and digitalization of business processes were visited and interviewed.

**Table 2: Companies interviewed**

<b>BASQUE COMPANIES INTERVIEWED</b>		
<b>FAGOR INDUSTRIAL</b>	<a href="http://www.fagorindustrial.com/en">www.fagorindustrial.com/en</a>	Leading manufacturer of equipment for the hotel, restaurant and laundry industries, present in the world's best kitchens and facilities. Fagor Industrial forms part of the international ONNERA Group of companies, with 8 factories distributed around the world, employing more than 2,000 workers.
<b>ORMAZABAL</b>	<a href="http://www.ormazabal.com/en">www.ormazabal.com/en</a>	Leading company specialized in the electric industry founded in 1967, with over 2,000 employees in its industrial facilities and commercial offices in 5 continents.
<b>GESTAMP</b>	<a href="http://www.gestamp.com/">www.gestamp.com/</a>	International group dedicated to the design, development and manufacture of highly engineered metal automotive components with more than 40,000 employees in over 100 plants in 22 countries
<b>ARTECHE</b>	<a href="http://www.arteche.com/en">www.arteche.com/en</a>	Global company that designs, engineers and manufactures equipment and systems for the electric power industry, focussed on generation, transmission and distribution grids with companies in Europe, America, Asia and Oceania, and a service that has more than 80 technical-commercial offices
<b>SNA EUROPE</b>	<a href="http://www.bahco.com/en-gb">www.bahco.com/en-gb</a>	SNA Europe is the premier pan-European manufacturer of hand tools and saws, and is part of Snap-on Incorporated. Snap-on employs 11,400 persons globally and has manufacturing facilities in 11 European countries while its market presence spans from Santiago, Chile, to Auckland, New Zealand
<b>NBI BEARINGS</b>	<a href="http://www.nbibearings.com/">http://www.nbibearings.com/</a>	Founded almost one decade ago with extensive experience in bearing design and production with a production plant in China offering a complete product range, and with a large quantity of leading partners in diverse industries that produce goods that are in high demand
<b>ORBEA</b>	<a href="http://www.orbea.com">www.orbea.com</a>	Cooperative company dedicated to the manufacture of bicycles, from road bikes to mountain bikes or promenades; from its headquarters in the Basque Country, they sell their products worldwide; Spain, the United States and France are the main markets.



**Table 3: Cluster associations interviewed**

BASQUE CLUSTER ASSOCIATIONS INTERVIEWED		
<b>ACICAE. Basque Automotive Cluster</b>	<a href="http://www.acicae.es">www.acicae.es</a>	Cluster with the mission to boost the Basque automotive industry, enabling cooperation among Basque companies to respond to the major challenges the industry faces. This is the first automotive cluster to be set up in Europe. Since its establishment in 1993, it has rapidly evolved, and has contributed to multiplying the turnover of the Basque automotive industry six-fold in the last 25 years.
<b>GAIA. Electronic and Information Technologies</b>	<a href="http://www.gaia.es/">http://www.gaia.es/</a>	The Association of Electronic and Information Technologies in the Basque Country, a private and professional non-profit organization, established in 1983, currently made up of 260 companies that offer products and services in the field of electronics, information technology and telecommunications.
<b>AFM. Advanced Manufacturing Cluster</b>	<a href="http://www.afm.es/">www.afm.es/</a>	Advanced Manufacturing Technologies, the Spanish Association of Manufacturers of Machine Tools, accessories, parts and tools, represents 90% of machine tool and advanced manufacturing technology companies in Spain. AFM, based in San Sebastian and with an office in China (Tianjin), works to promote internationalization and through its INVEMA (Foundation for Machine Tool Research) technology unit, the technological innovation of its member companies.
<b>ENERGY. Basque Energy Cluster</b>	<a href="http://www.clusterenergia.com/">http://www.clusterenergia.com/</a>	The Basque Energy Cluster comprises the leading companies in the energy industry located in the Basque Country (energy operators, component and equipment manufacturers), agents of the Basque Science, Technology and Innovation Network and public administration bodies involved in the energy field. The Cluster is a non-profit organization which was set up at the end of 1996 within the framework of the Basque government's policy to foster the industrial sector's competitiveness. It is currently made up of over 150 companies and entities active in the energy industry.

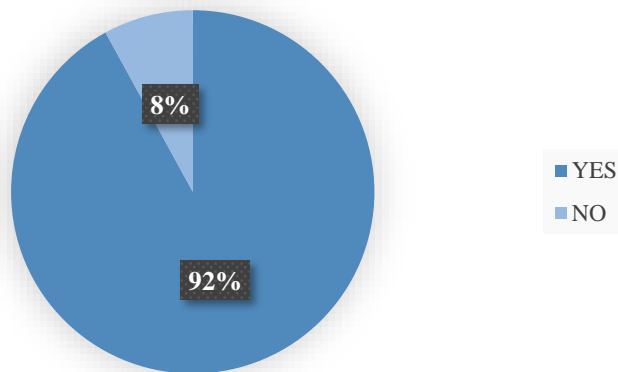
These visits and interviews, together with desk research activities, served to put the findings from the survey into perspective. For the interviews, we used a semi-structured interview guide developed by UNIDO (see Annex 1).

### 3.2 Results on the adoption of digital technologies

The analysis of the rate of digital technology adoption by Basque companies is based on the answers to the question about the uptake of such technologies over the last three years of any of the 15 digital technologies included in the survey, namely: big data, cloud computing, cybersecurity, IoT, automated machinery, robotics, 3D printing, artificial intelligence, mobile services, social networks, machine to machine communication, cyber-physical systems, augmented reality, virtual simulation and digital twins (the definitions are annexed in Annex 2).

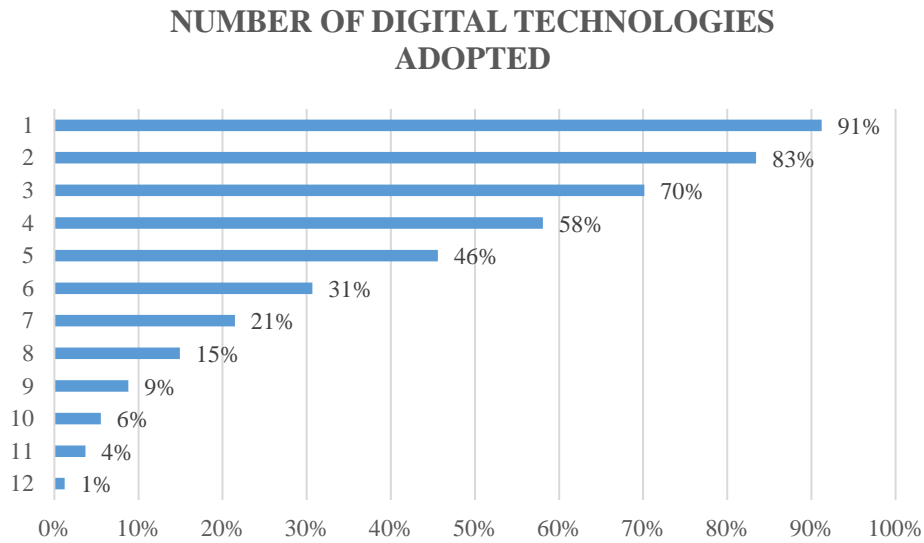
**Figure 10: Percentage of companies stating they have or have not adopted any of the digital technologies proposed in the survey over the last three years**

#### DIGITAL TECHNOLOGY ADOPTION

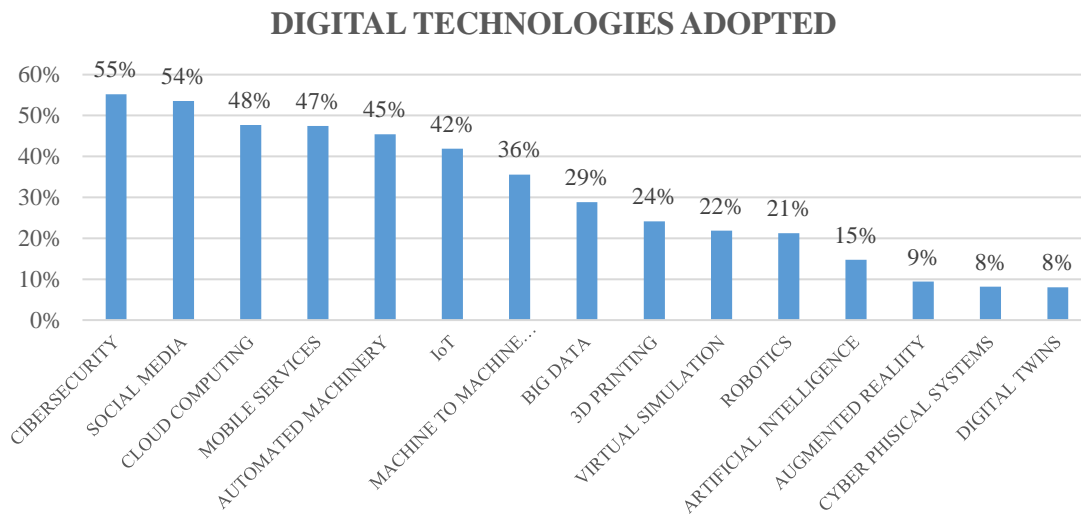


According to the sample, the rate of digital technology adoption by Basque firms is high, approximately 92 per cent of respondents have adopted at least one technology and approx. 83 per cent have adopted at least two technologies. By contrast, only 10 per cent of firms have incorporated 10 or more digital technologies into their activities.

**Figure 11: Percentage of companies by number of digital technologies adopted in the last three years**



**Figure 12: Percentage of companies by digital technologies adopted in the last three years**



In the last three years, cybersecurity, social media and cloud technologies have been the most commonly adopted digital technologies by Basque companies among the 15 technologies assessed by survey participants, with adoption rates of 55 per cent, 54 per cent and 48 per cent, respectively.

The rate of adoption of other digital technologies such as mobile services, automated machinery, Internet of Things and machine to machine communication is also high at 47 per cent, 45 per cent, 42 per cent and 36 per cent, respectively.

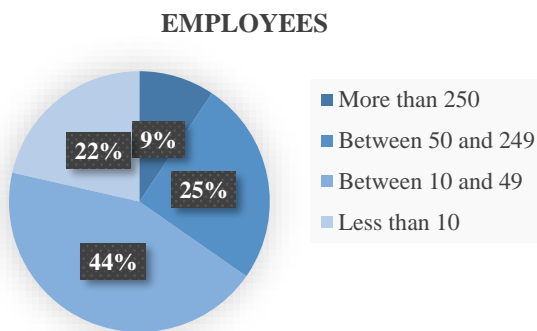
By contrast, augmented reality, cyber-physical systems and digital twins have lower adoption rates at less than 10 per cent.

Basque firms have incorporated a variety of technologies. While this might indicate a more mixed character of the Basque sample (sector-wise and/or in terms of position in the value chain), it is more likely that this diversity is due to an earlier (long ongoing) ramp up time among Basque firms in terms of the adoption of the technologies in question.

Characterization of the sample

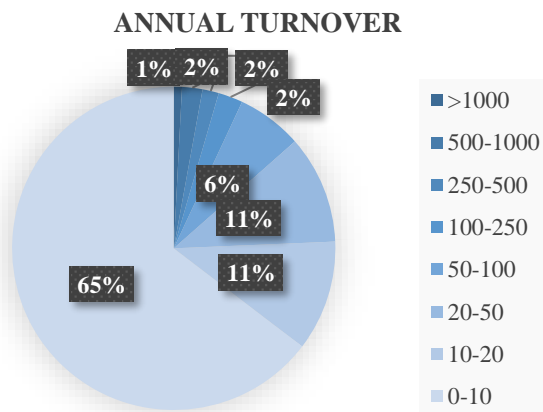
Taking into account the number of employees and in line with the European Commission’s definition, 22 per cent of the sample are micro firms with less than 10 employees. Sixty-nine per cent of the sample are SMEs and 9 per cent are large companies with more than 250 employees.

**Figure 13: Percentage of companies by number of employees**



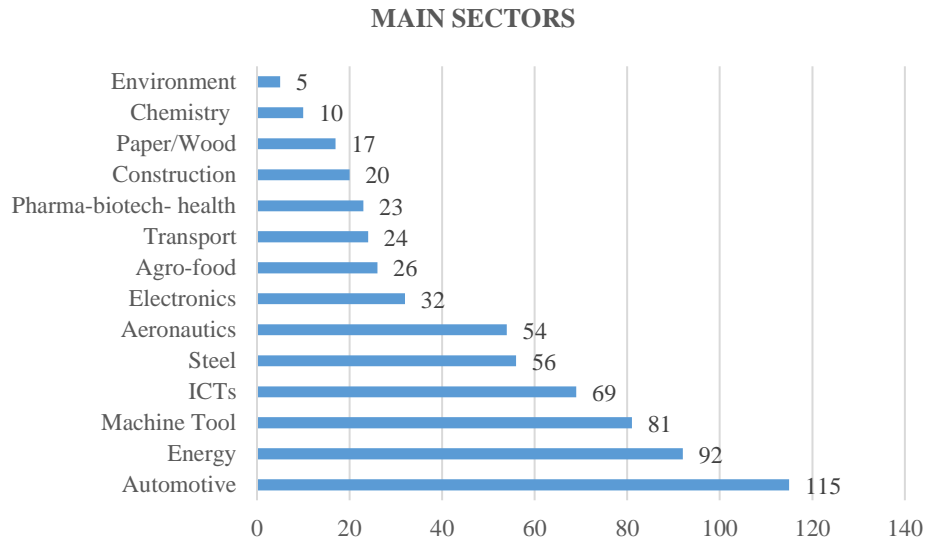
Approximately 65 per cent of firms have an annual turnover of less than EUR 10 million and only 5 per cent of the sample have an annual turnover of more than EUR 250 million.

**Figure 14: Percentage of companies by annual turnover (million €)**



The main sectors of activity of the sample firms are:

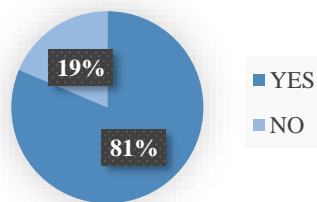
**Figure 15: Number of companies in each industrial sector**



More than 80 per cent of the sample are engaged in R&D activities in the Basque Country. Some of the firms (approx.. 8 per cent of the sample) are also engaged in R&D activities outside the Basque Country, develop R&D activities in other areas in Spain, and in South America or North America where they have production plants.

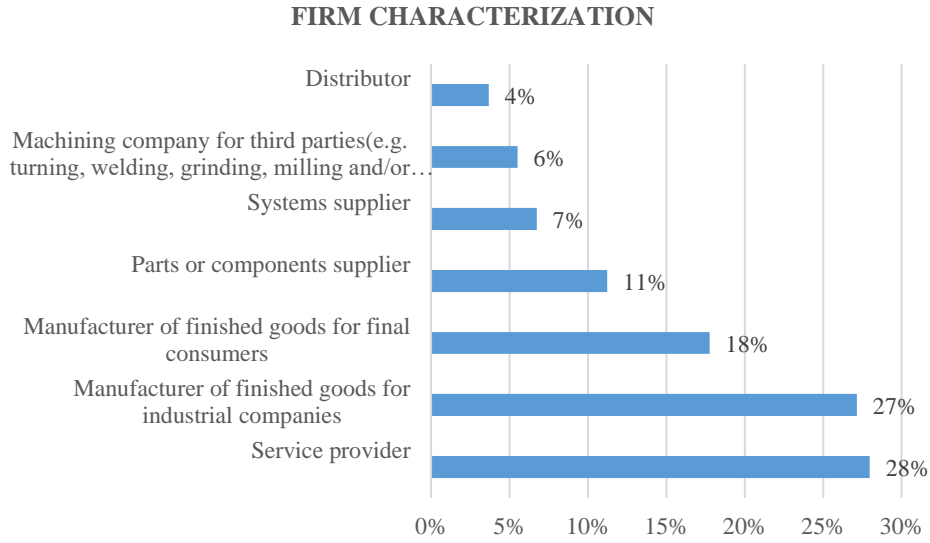
**Figure 16: Percentage of companies engaged in R&D activities in the Basque Country**

**R&D ACTIVITIES IN THE  
BASQUE COUNTRY**



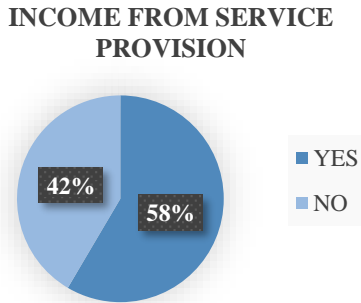
Twenty-eight per cent of companies are service providers while 63 per cent are manufacturers (27 per cent are manufacturers of finished goods for industrial companies, 18 per cent are producers of finished goods for final customers, and 18 per cent are manufacturers of systems and components).

**Figure 17: Percentage of companies by type of activity**

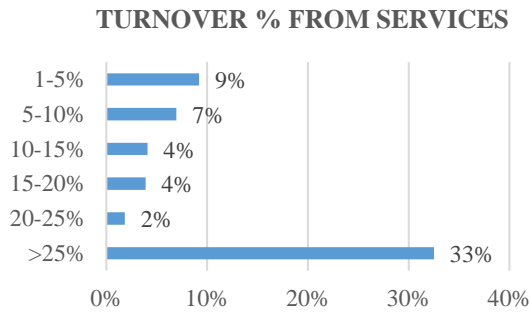


Fifty-eight per cent of the sample receive income from the provision of services, independently of their main activity (service provision, manufacturing, distribution, processing). Thirty-three per cent of the sample assert that more than 25 per cent of their annual turnover is generated through service provision.

**Figure 18: Percentage of companies with incomes from service provision**



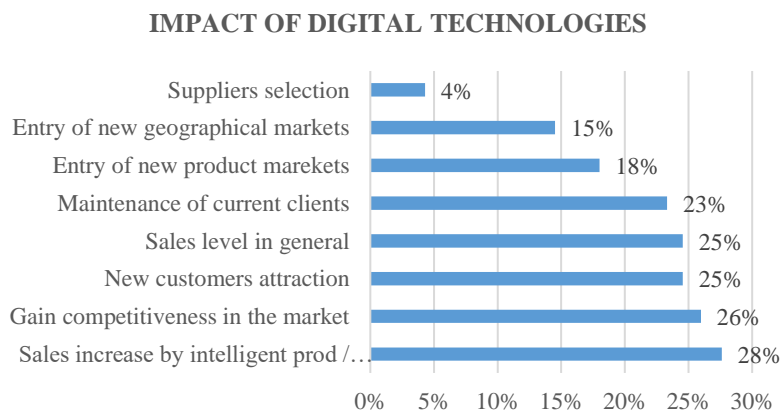
**Figure 19: Percentage of companies by percentage of turnover derived from services**



### 3.2.1 Impact of the adoption of digital technologies

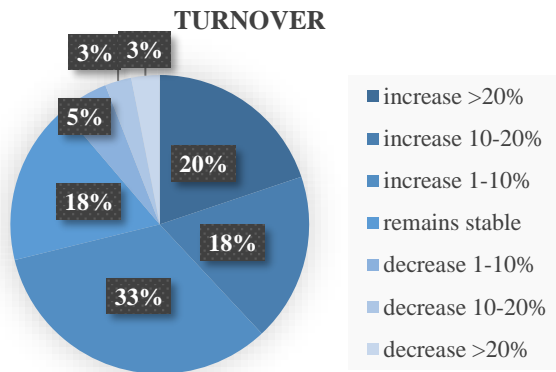
The main impact of the adoption of digital technologies by companies is observed in sales increases due to intelligent products or services sales, while an upsurge in competitiveness and new customer acquisition are also important impacts of the adoption of these technologies.

**Figure 20: Percentage of companies by area impacted by digital technologies uptake**

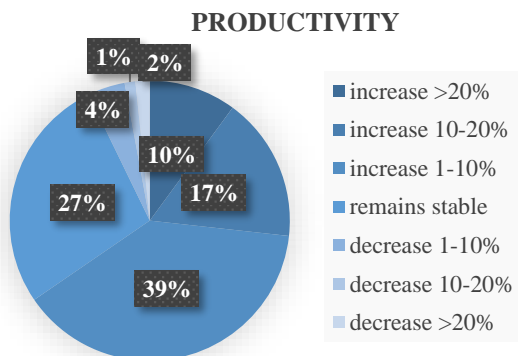


Analysing the sample's business development, we find that the turnover of 71 per cent of Basque firms increased, the productivity of 65 per cent of firms rose while the operation costs of 56 per cent of firms increased. This may be due to recent adoption of these digital technologies, which means that the return on investment has not yet materialized, thus increasing the firms' operating costs.

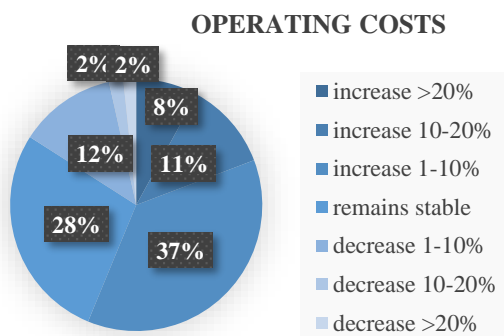
**Figure 21: Percentage of companies by turnover (percentage of growth/decrease)**



**Figure 22: Percentage of companies by productivity (percentage of growth/decrease)**



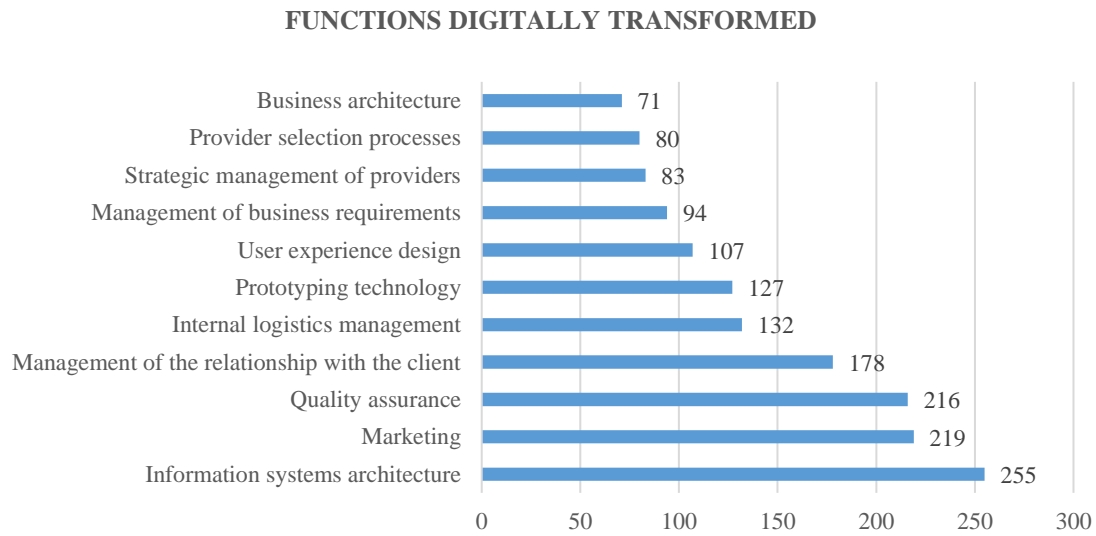
**Figure 23: Percentage of companies by operating costs (percentage of growth/decrease)**



In terms of the functions that have been digitally transformed by the adoption of digital technologies, i.e. information systems architecture, marketing and quality assurance, seem to be the most digitalized functions in the sample firms, while business architecture and provider selection processes are less digitalized functions.

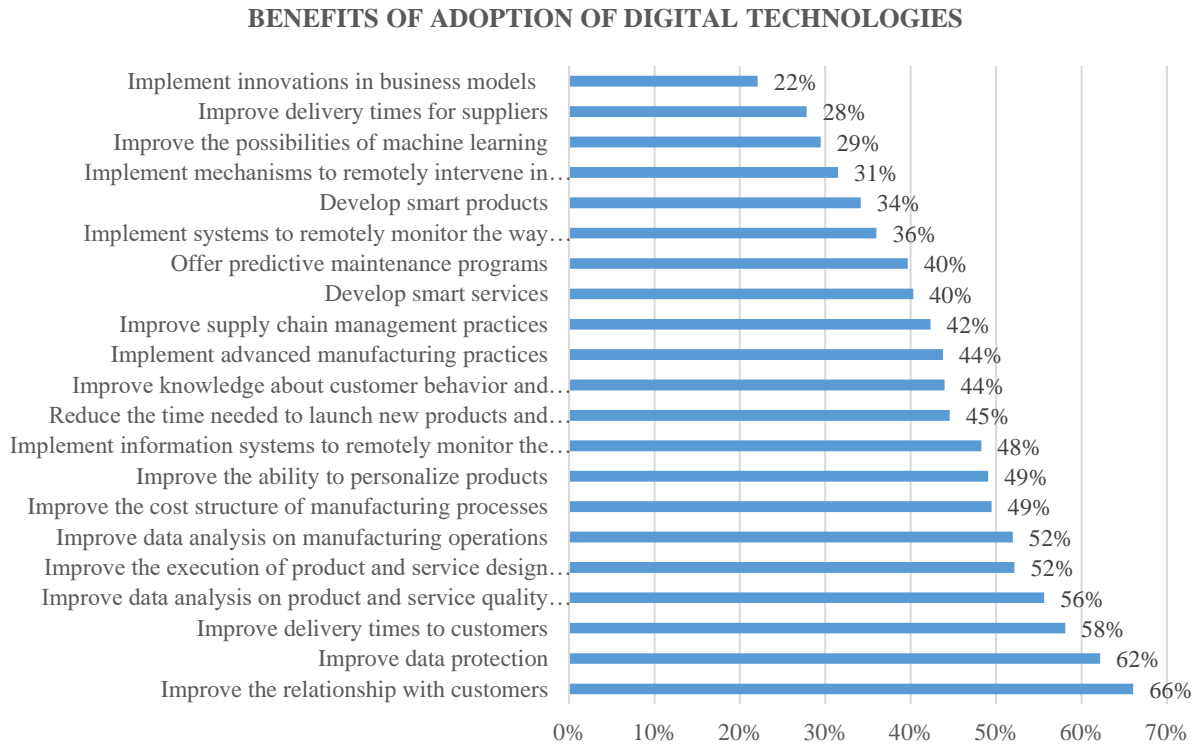


**Figure 24: Number of companies by digitally transformed business functions**



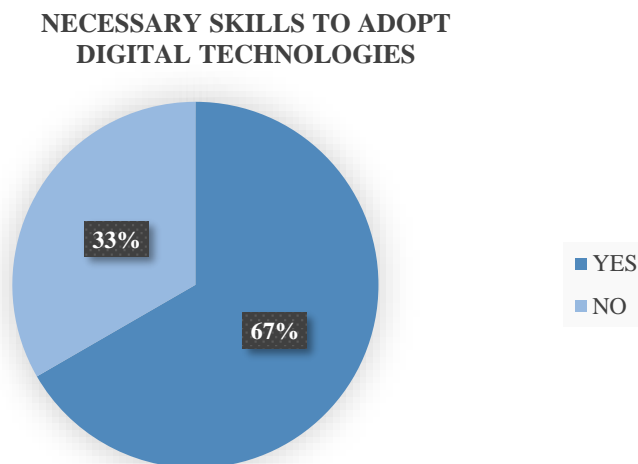
The main benefit according to 66 per cent of Basque firms of the use of digital technologies is the improvement in the relationships with clients. The improvements in data protection, delivery times to customers and data analysis of products/service quality have also been observed by over 55 per cent of the sample.

**Figure 25: Percentage of companies by benefits of digital technology adoption**



Sixty-seven per cent of the companies surveyed stated that their employees had the necessary skills to adopt digital technologies, while the remaining 33 per cent indicated skill shortages.

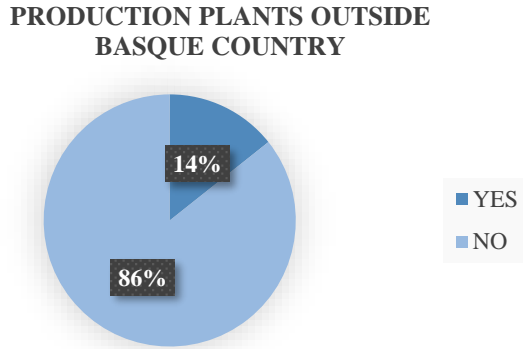
**Figure 26: Percentage of companies with internal skills for digital technology adoption**



### 3.2.2 Adoption of digital technologies in highly internationalized companies

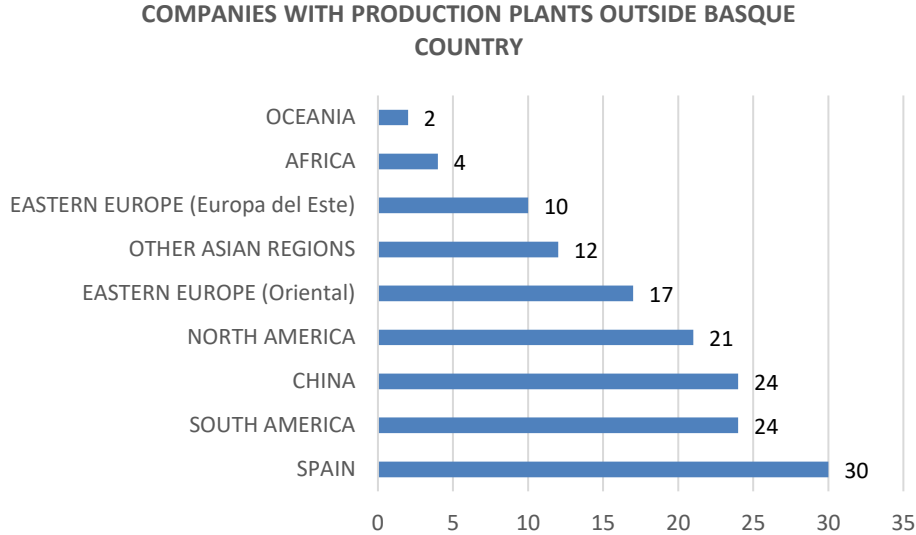
Almost 15 per cent of the sample have production plants outside the Basque Country.

**Figure 27: Percentage of companies with production plants outside Basque Country**



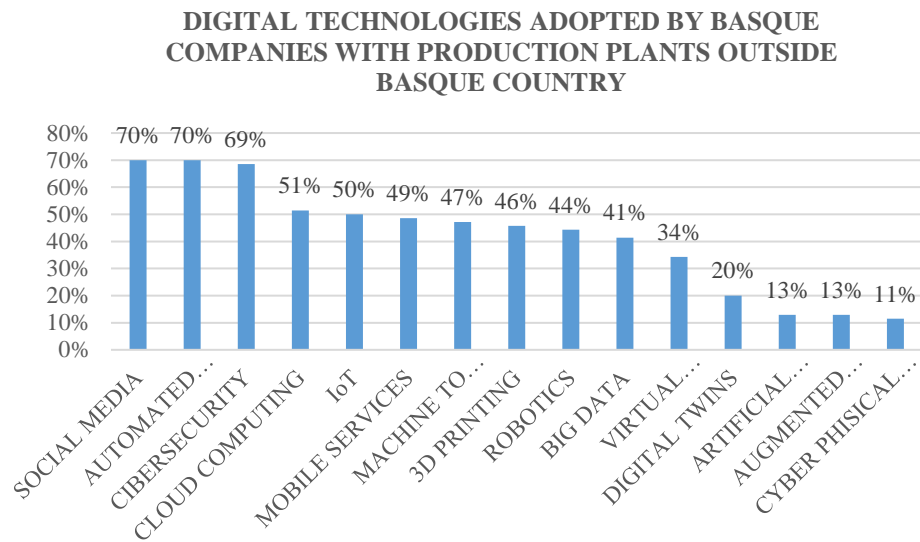
Most of the production plants are in Spain and in South America, China, North America and Eastern and Western Europe.

**Figure 28: Number of companies with production plants in each country**



Among these, the rate of digital technology adoption is illustrated in the following figure:

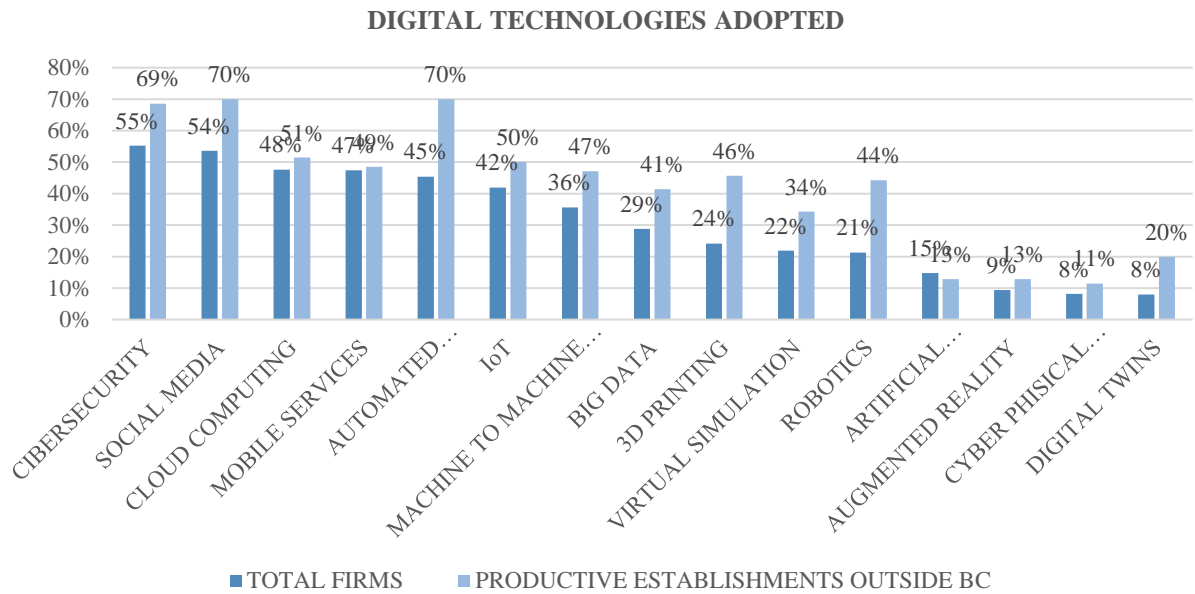
**Figure 29: Percentage of companies with production plants outside Basque Country by digital technologies adopted**



The rate of digital technology adoption is generally higher in firms that have production plants outside the Basque Country. The greatest differences in terms of implementation of digital technologies between all firms surveyed and those with production plants outside the Basque Country are found in digital twins, robotics and 3D printing, with an 8 per cent adoption rate as opposed to a 20 per cent adoption rate in the case of digital twins, 21 per cent and 44 per cent in the case of robotics, and 24 per cent and 46 per cent in the case of 3D printing.

By contrast, the adoption of artificial intelligence seems to be slightly higher in all firms (15 per cent) as opposed to those with production plants outside the Basque Country (13 per cent).

**Figure 30: Comparison by percentage of digital technologies adopted by total firms and firms with production plants outside Basque Country**



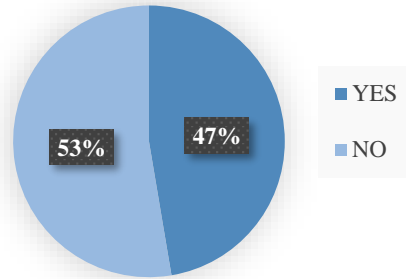
### 3.2.3 Uptake of digital technologies in firms associated with cluster organizations

In the 1990s, the Basque government initiated the development and support of cluster policy led by and based on public-private partnerships. The Basque Country now has a series of powerful industrial clusters, which are key in the internationalization processes of Basque companies. These clusters, which are the result of private-public partnerships, promote collaboration projects in different fields (research, internationalization, etc.) within the sectoral value chain and between clusters, generating a unique relational framework in the Basque industry.

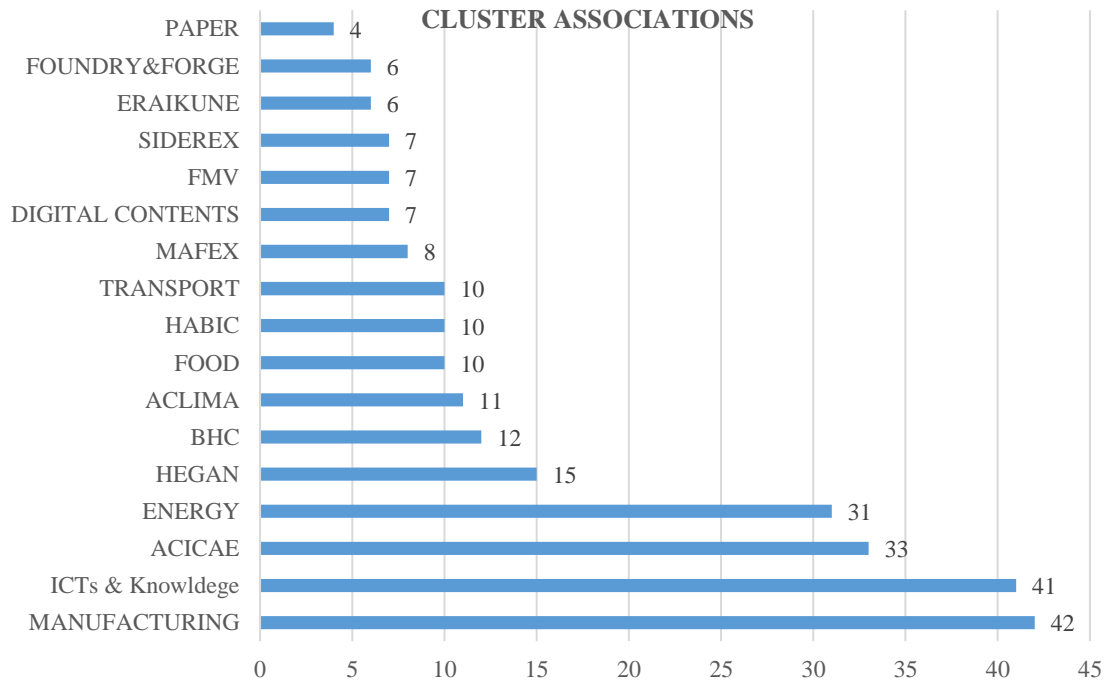
Forty-seven per cent of surveyed firms are members of the Basque Country’s cluster associations. Advanced manufacturing, ICTs and knowledge as well as automotive are the cluster associations with higher representativeness in the sample, which is a true reflection of the reality of the Basque Country’s clusters, since they have the greatest number of associates.

**Figure 31: Percentage of companies with a membership in Basque cluster associations**

**MEMBERS OF CLUSTER ASSOCIATIONS**

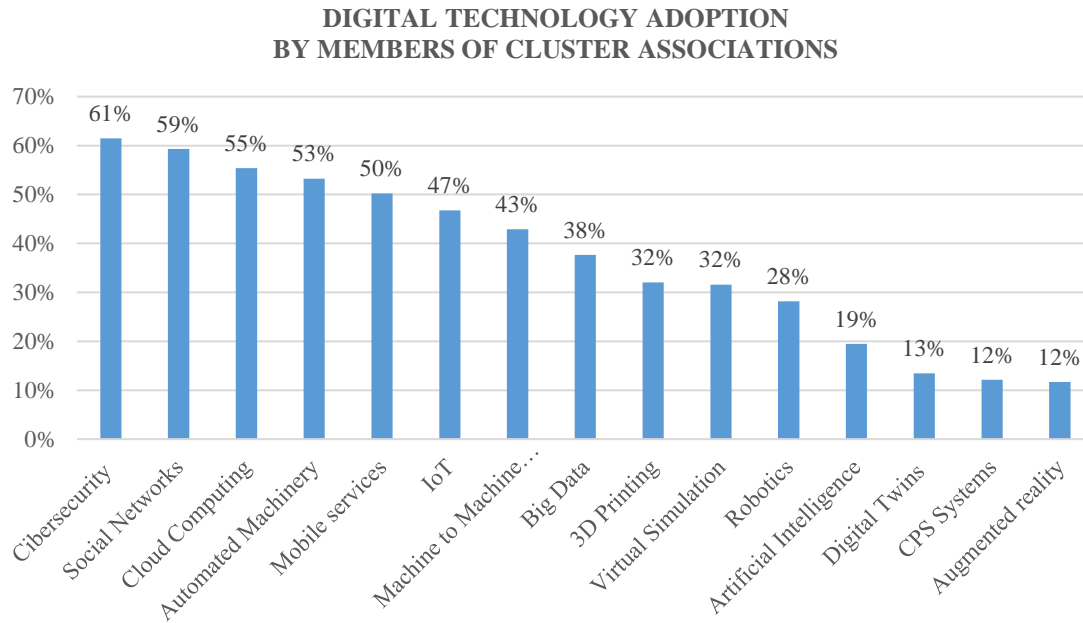


**Figure 32: Number of companies belonging to each cluster association**



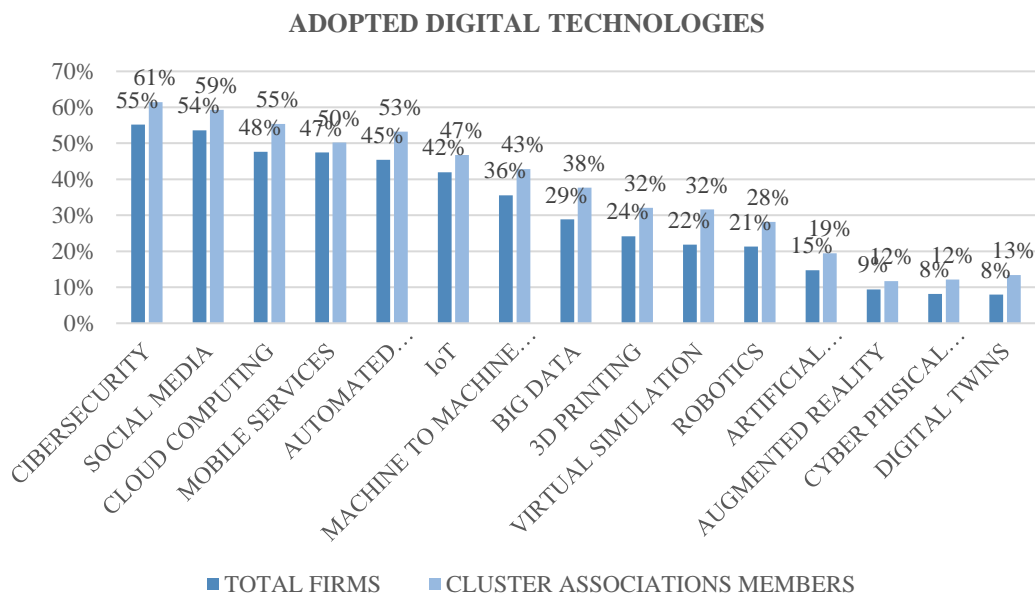
The rate of digital technology adoption is presented in the following figure.

**Figure 33: Percentage of companies that are members of cluster associations by digital technology adoption**



Comparing the rate of digital technology adoption by companies associated in clusters with that of all companies, we find that the adoption rate is also higher by clustered companies, although the difference is not as obvious as in internationalized companies.

**Figure 34: Comparison by percentage of digital technology adoption between total firms and members of cluster associations**



### **3.3 Results on the “adoption of digital technologies” - “offshoring/backshoring dynamics” relationship**

To analyse the relationship between the adoption of digital technologies, on the one hand, and offshoring/backshoring dynamics, on the other, we use two specific subsets among all respondents. First, and to frame the two subsets, we only considered companies that operate in B2B markets and are engaged in production, namely either a:

- “manufacturer of finished products for other industrial firms”,
- “supplier of parts or components to other industrial users”, or
- “system provider to other industrial users”.

Companies that stated that they are chiefly distributors of goods, engaged mainly in services or in B2C markets were thus excluded.

#### ***3.3.1 Characteristics of respective sub-groups***

Consequently, we framed the following two sub-groups:

- Sub-group 1: companies that have offshore manufacturing plants.
- Sub-group 2: companies without such plants, but who obtain over 50 per cent of their turnover from foreign trade and have outsourced the production of specific parts to overseas locations.

Sub-group 1 consists of 61 companies and sub-group 2 of 60 companies.

Accordingly, we were able to single out the firms that could take an active position on off-shoring and backshoring issues.

Figure 35 provides insights into the two sub-groups’ size characteristics.



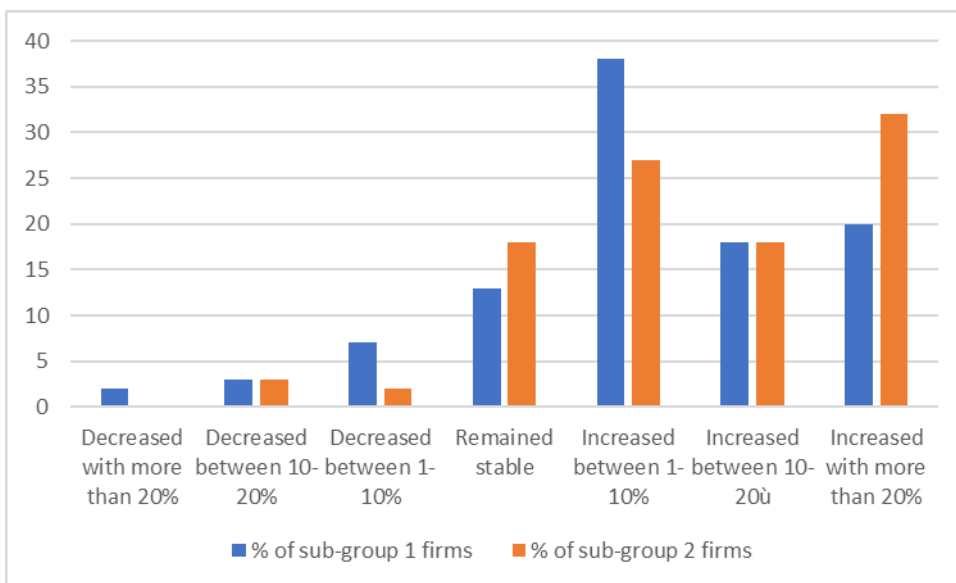
**Figure 35: Size distribution per sub-group**



N= 61 / 60

In addition, the next figure provides insights into the two sub-groups' growth dynamics:

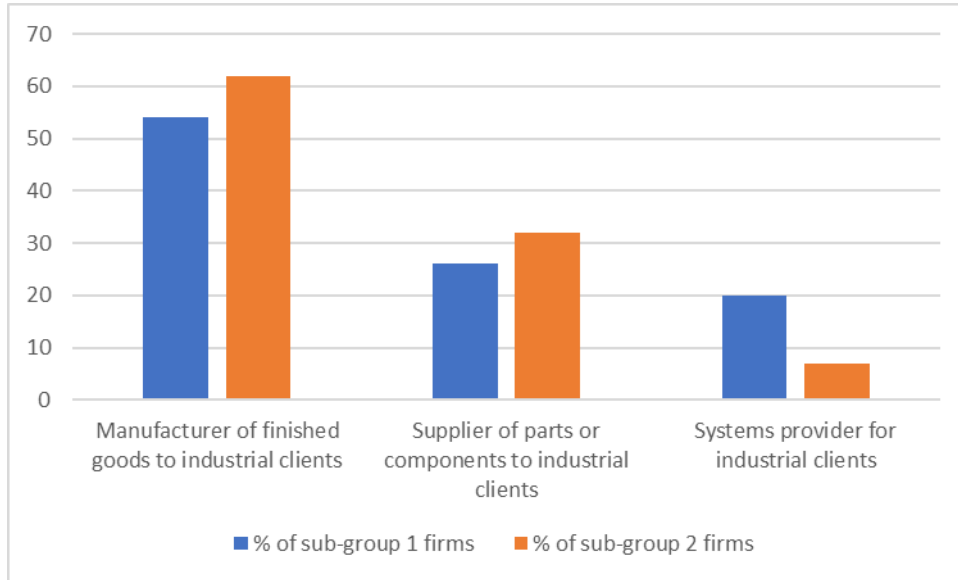
**Figure 36: Distribution of growth dynamics per sub-group**



N = 61 / 60

Finally, the following figure presents the sub-group members' "value chain position":

**Figure 37: Distribution of value chain positions per sub-group**

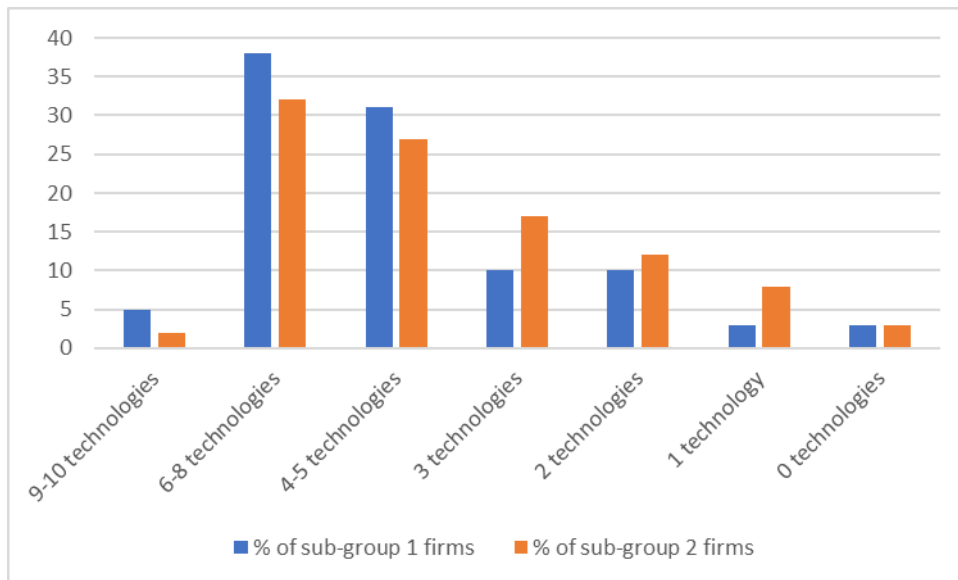


N = 61 / 60

### 3.3.2 Rate of digital technology adoption among the two sub-groups

As regards the adoption of digital technologies among the companies that belong to the respective sub-groups, we identify the digital technologies of the first sub-group (technology set A):<sup>11</sup>

**Figure 38: Distribution of adoption of technology set A by sub-group**

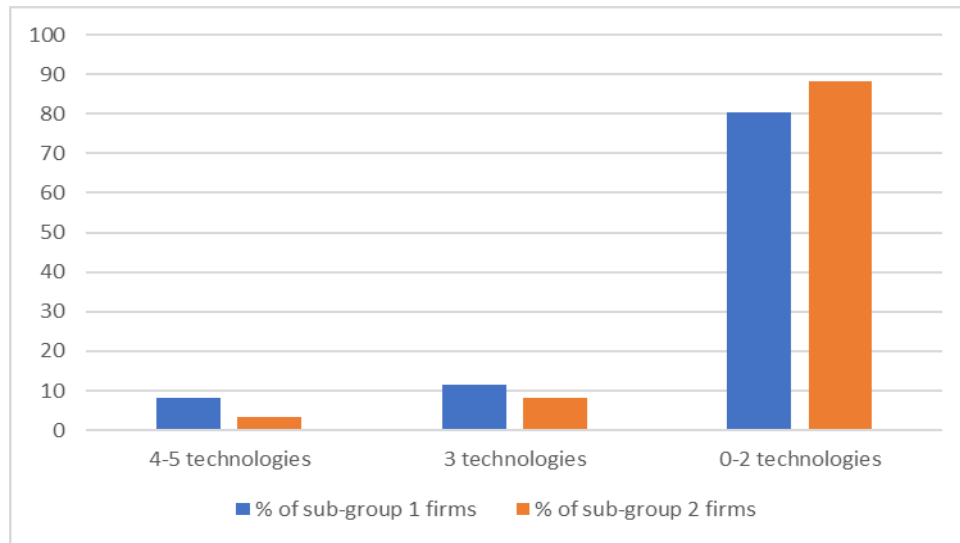


N = 61 / 60

<sup>11</sup> Big data / data analytics, cloud technologies, cybersecurity, Internet of Things, automated machinery, robotics, 3D printing, artificial intelligence, mobile services, social media.

As regards the first group of digital technologies (technology set B) we find:<sup>12</sup>

**Figure 39: Distribution of adoption of technology set B by sub-group**



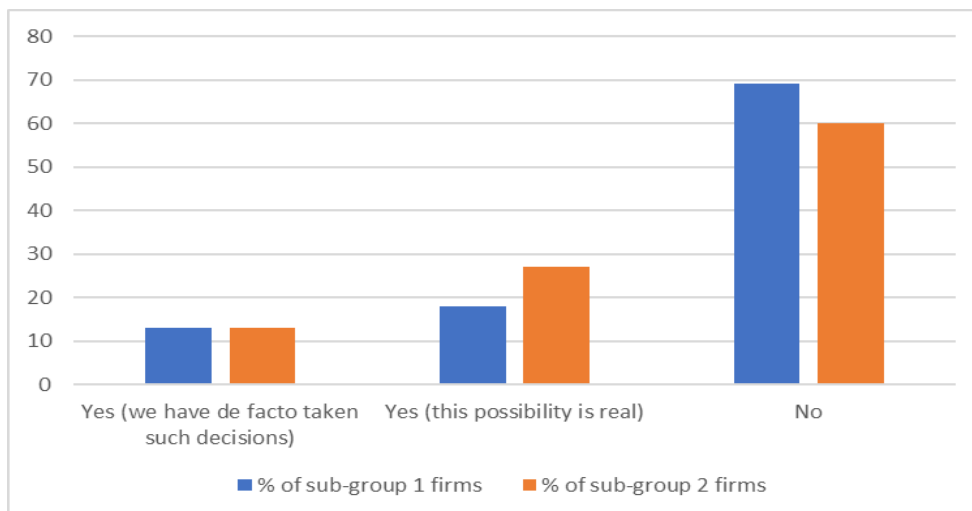
N = 61 / 60

### 3.3.3 *Link between digital technology adoption and decisions on production sites*

When we examine the influence the adoption of digital technologies has on decisions in relation to sites for manufacturing activities, the companies state the following:

The influence of digital technologies on backshoring production activities from abroad is illustrated in Figure 41:

**Figure 40: Distribution of opinions on the influence of digital technologies on production backshoring by sub-group<sup>13</sup>**



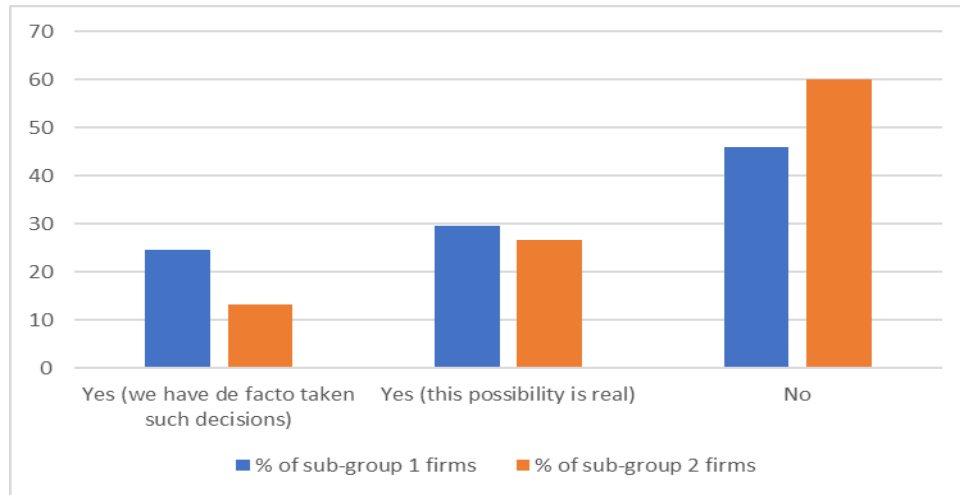
N = 61 / 60

<sup>12</sup> Machine-to-machine communication, cyber-physical systems, augmented reality, virtual simulation systems, digital twins.

<sup>13</sup> Opinions expressed by sub-group 2 on this matter refer to decisions on outsourcing production activities to either distant locations or in the home region.

The influence of digital technologies on avoiding offshoring of production activities:

**Figure 41: Distribution of opinions on the influence of digital technologies on avoiding production offshoring by sub-group**



N = 61 / 60

The following picture emerges on the mechanisms through which the adoption of digital technologies influences the location decisions of firms.

**Table 4: Distribution of opinions on the mechanisms through which digital technologies can influence decisions on production location**

<b>Mechanisms</b>	<b>% of sub-group 1 companies that attribute a strong to a very strong power to the given mechanism</b>	<b>% of sub-group 1 companies that attribute a strong to a very strong power to the given mechanism</b>
The use of digital technologies for manufacturing activities improves the production cost competitiveness of locations with high labour costs in comparison to countries with low production factor costs	70	74
The use of digital technologies for manufacturing activities improves the quality and agility of production processes and lowers the interest to relocate or fragment production steps across space	70	74
The use of digital technologies for manufacturing activities increases the interest of carrying out production close to where new product development and R&D take place (intra-organizational perspective)	74	71
The use of digital technologies for manufacturing activities increases the interest of carrying out production close to where the main providers of production technology are located and where R&D on production processes takes place (inter-organizational perspective)	82	55
The use of digital technologies for manufacturing activities increases the interest of carrying out production close to the end market	58	61
Others	48	32

N = Sub-group 1 (50 companies, 82 per cent responded yes in B.12.1); Sub-group 2 (38 companies, 63 per cent responded yes in B.12.1).

### **3.4 Findings on the “adoption of digital technologies” - “offshoring/backshoring dynamics”**

#### **3.4.1 On the adoption of digital technologies**

Overall, we observe a notable rate of digital technology adoption by the two sub-groups, particularly in sub-group 1. When looking at the range of digital technologies that make up technology set “A” (mostly representing the first wave of technologies from the fourth industrial revolution), we find that more than 75 per cent of firms have adopted at least 4 of the 10 technology types. For sub-group 2, this holds true for 60 per cent of companies. We also observe that only 3 per cent of both sub-groups have not implemented a single digital technology from the base list.

When we look at the adoption of technology set “B” (mostly representing the next wave of technologies from the fourth industrial revolution), we again find that sub-group 1 slightly outperforms sub-group 2. Some 20 per cent of firms of sub-group 1 have already implemented a minimum of 3 of the 5 technologies from this set of technologies. In the case of sub-group 2, this is the case for 11 per cent to 12 per cent of the companies.

#### **3.4.2 On backshoring**

A minority of the firms from both sub-groups state that the use of digital technologies has an influence on either production location decisions (31 per cent of sub-group 1) or cross-border outsourcing decisions (40 per cent of sub-group 2) in favour of home-based operations. In fact, at the level of both sub-groups, 13 per cent declare that they have taken decisions to backshore production activities and 18 per cent and 27 per cent of sub-group 1 and 2, respectively, declare that there is a real possibility that they will take decisions in this direction.

The 13 per cent figure implies that 1 out of 7 firms have taken a backshoring decision. This ratio is considerably lower than the findings from panel data by Kinkel (2015), demonstrating that every fourth to sixth offshoring activity is countered by a backshoring activity within two to five years. While we have provided a snapshot only and have not followed our respondents over several years (we also do not know for how many years the production activities subjected to backshoring have been pursued), we do know that many of our respondents have multiple plant locations abroad and while they may decide to bring back some foreign production operations, there are plants that will remain intact. At the level of “production activities”, the ratio must be lower than the 1:7 “companies that took backshoring decisions”.

Our results generally indicate that backshoring is (still) a rare phenomenon. Also, as far as the adoption of digital technologies trigger backshoring, it is likely that there is a time lag between the implementation of such technologies and actual backshoring (apart from the fact that such events are rarely purely technology-driven). The former is in line with findings from Dachs et al. (2017) or Chiarvesio et al. (2018), who state that: “In fact, we cannot identify a clear and direct relationship among investments in Industry 4.0 technologies and international activities, neither declared by the companies, nor indirectly identified during data collection.”<sup>14</sup>

The percentage of firms that has stated that they have already taken decisions to relocate production activities back to the Basque Country is not insignificant, i.e. even if the adoption of Industry 4.0 technologies does not entail a massive return of offshored manufacturing activities, it is certainly plausible to expect that some form of reshoring will take place.

### ***3.4.3 The likelihood of preventing offshoring***

The expectations on the ability of digital technologies to prevent offshoring are slightly more optimistic than those for backshoring in the case of sub-group 1 (companies with overseas production plants). In the case of sub-group 2 (strong exporters, but without own production plants abroad), these expectations are lower. Hence, while a majority of the members of sub-group 1 expects that the uptake of digital technologies will prevent offshoring, in the case of sub-group 2, only a minority supports this view. This difference can arguably be explained by the fact that the nature of offshoring is probably more equity-intensive for sub-group 1 firms (building up production capacity abroad through FDI or M&A) and less equity-intensive for sub-group 2 firms (outsourcing to third parties).

Similarly, when comparing the percentages of “backshoring and “preventing offshoring” for sub-group 1, the group that expects that the use of digital technologies will prevent offshoring is larger than the one that expects that new technologies will trigger backshoring. This implies that the effect of the respective digital technologies may have more of a “preventive” than a “corrective” effect. It also aligns with the notion that “decisions once taken” are not so easily reversible, but that the uptake of digital technologies can affect the level playing field between different locations and thus influence production allocation decisions in the (near) future.

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<sup>14</sup> Chiarvesio et al. (2018, p. 371)

#### ***3.4.4 What triggers backshoring***

With reference to Figure 43, both sub-groups express relatively similar opinions about the value of digital technologies for production costs, production process management and for the interaction between product innovation and serial fabrication of new products as mechanisms to retain or backshore production activities in/to high-cost home bases. Nearly 75 per cent of respondents from sub-groups 1 and 2 assert that digital technologies strongly or very strongly contribute to the location of production activities in the home base.

This seems to be consistent with the lower scores the respondents attribute to digital technologies' ability to shift the location of production activities closer to the final market place. Digital technologies enable firms to adapt and customize products swiftly to changing or varied market preferences and are thus viewed as trumps that do not need to be leveraged from close range.

Sub-group 1, in particular, confirms that the implementation of digital manufacturing technologies for production purposes is best carried out at (production) sites that likewise shelter pockets of technology suppliers and R&D activity in the realm of the respective digital technologies. Over 80 per cent of respondents attach a high to very high value to introducing digital technologies in production in areas where the main input providers of production process know-how and technologies are located. Given that the main suppliers of technology and know-how for advanced manufacturing for the lion's share of respondents originate from their home base (question B8), the use of digital technologies generates a further bonding effect in the companies' home bases. Evidently, this type of 'clustering' or 'embeddedness' effect presupposes that the firms' home base is well endowed with technological suppliers of relevance for Industry 4.0.

The fact that sub-group 2 reveals much lower scores in this regard may be attributable to the fact that these firms are not multi-localized across the globe and thus have less experience in looking in multiple places for expertise to assist them in upgrading their plants. Hence, whereas the sub-group 1 respondents have plants in several places (polycentric situation) which certainly raises their awareness of the relevance of being able to count on solid and localized advanced manufacturing know-how in different places, sub-group 2 members may have been less exposed to this aspect.<sup>15</sup>

Beyond the survey questions that intended to capture the respondents' viewpoints on individual mechanisms, the interviews elucidated that when backshoring takes place, it is often attributable

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<sup>15</sup> Therefore, the judgmental capacities of sub-group 1 firms regarding the value of location-based know-how for advanced manufacturing implementation is superior to those of sub-group 2.



to multiple factors rather than (digital) technology being the only explanatory factor. On occasion, it also appeared that (digital) technologies acted as a catalyser or accelerator of a backshoring decision that made sense all along. In several cases, we sensed that companies continued to cling to foreign production sites when they had lost their strategic importance for the mother company. These sites were, however, maintained out of either organizational inertia or for the sake of conserving global production capacity. This was the case until digital production technologies opened a window of opportunity to either relocate the production tasks of such foreign plants, sell them to third parties or simply to suppress them and serve the markets they catered for from other sites. Similarly, we have seen companies—particularly those that started building up an international production apparatus a long time ago—established or acquired sites in places that ‘once upon a time’ made sense, but which in the meantime have lost their purpose. Embracing Industry 4.0 technologies provides an opportunity for those companies to ‘clean up their inventory’ and rationalize their overseas assets and activities. Likewise, companies can build up a global presence through take-overs of local companies in different places and end up with a portfolio of plants whose sales destinations benefit from a weeding out and restructuring exercise. If such an origin (plant) destination (market) reshuffling takes place while the company also commits investments to the technological upgrading of plants in high labour cost locations; at face value, it is the implementation of digital technologies that triggers change, while at a deeper level, other considerations are at play.

#### ***3.4.5 Reasons for offshoring as an intervening variable on the plausibility of backshoring motives***

Motivations to offshore can be manifold. They can, however, be grouped into three general categories (Johansson et al., 2018):

- availability of superior production factors (access to sparse raw materials, cheap or more qualified labour, etc.) in a foreign location, resulting in firms to offshore their manufacturing activities out of a production orientation;
- market potential, primarily in quantitative terms, in a foreign location, resulting in firms to offshore their manufacturing activities out of a sales orientation;
- lead market conditions and/or favourable support (eco)systems in a foreign location, resulting in firms to offshore their manufacturing activities out of a development/innovation orientation.

While the advantage a foreign location holds over the firm's home base will continuously evolve (Ellram et al, 2013; Tate et al., 2014), when considering backshoring of manufacturing activities, it makes sense to expect that the "vulnerability" of overseas plants to this phenomenon depends on the initial mission they are meant to support. Hence, foreign plants that were established to capture production cost advantages and are witnessing the erosion of those cost advantages are arguably more prone to falling victim to backshoring than plants that were established for sales or development purposes, even if they are also faced with rising production costs.

Therefore, and while motivations to backshore are also pluriform, if an overseas location loses its original purpose and intention, backshoring becomes more likely. Consequently, we can hypothesize that:

- Overseas manufacturing activities with a mission to exploit a production cost differential will be particularly prone to backshoring if this cost differential weakens;
- Overseas manufacturing activities with a mission to exploit a market potential will be particularly prone to backshoring if this potential weakens;
- Overseas manufacturing activities with a mission to exploit particular lead market or ecosystem conditions will be particularly prone to backshoring if these conditions weaken.

While the survey did not explicitly ask about the actual reasons for offshoring, the interviews provided insights into the motivations behind the acquisition of foreign production plants by Basque companies. The interviews also revealed what had motivated companies to backshore. In the following table, we synthesize our interpretations of various cases:

**Table 5: Case-specific offshore and backshore motivations**

<b>Company and country where production was established</b>	<b>Why offshore</b>	<b>Why backshore</b>
<p><b>Orbea-China</b></p> <p><b>Fagor Industrial-China</b></p> <p><b>Irizar-China / India</b></p>	<p>Expectation that the Asian market for premium bicycles, kitchen equipment and buses would grow</p>	<p>Market did not develop as planned, loss of market argument</p> <p>Too specific assets to sell</p> <p>Behavioural uncertainty with regard to the market</p> <p>Plants ended up producing for export, whereas they had been intended to sell in local markets</p> <p>Mis-taxation of expectations followed by rectification (pull-out)</p>
<p><b>Arteche, Fagor Industrial, Ormazabal-Turkey</b></p>	<p>Sales potential on domestic (hotel) market</p> <p>Relatively well-skilled human resources and supply chain</p>	<p>Crisis in (tourism) market</p> <p>Behavioural uncertainty with regard to the market</p> <p>No appreciation for true quality: low willingness to pay and many customers settling for copycat products</p> <p>Growing environmental uncertainty from an institutional perspective as well</p> <p>Lack of strategic fit with core business/loss of market argument</p>
<p><b>Arteche, Ormazabal-Brazil</b></p>	<p>Perhaps not genuine offshore cases, but acquisitions/ JVs due to sales potential on domestic market and bargain</p>	<p>Market deterioration, Labour relations, levies on imports of parts</p> <p>Behavioural uncertainty (of market and of supply chain/inter-organizational network or value chain)</p> <p>Environmental uncertainty from an institutional perspective as well</p> <p>Lack of strategic fit with core business/ loss of market argument</p>

Company and country where production was established	Why offshore	Why backshore
<b>SNA Europe-China</b>	Started forming part of a consortium and ended up being surrounded with production plants in, among others, China and a sub-optimal distribution of production assignments across plants	Restructuring, rationalization of production apparatus and origin-destination relations
<b>NBI Bearings - China</b>	Premeditated choice: design in Europe, production in China (production cost rationale and “chopping up” the value chain principles)	<p>Financial crisis leading to lack of resources to keep the multinational structure the firm had created intact, and requiring NBI Bearings to reconsider its international strategy and multinational structures</p> <p>Decision to sell the Chinese unit, not because it was not functioning properly, but due to force majeure</p> <p>As the company opted for more R&amp;D-intensive and high-end products, it decided to focus on its home base and concentrate its activities in the Basque Country (later complemented by a nearshoring move of applied engineering activities to Romania): development and competences as drivers for backshoring and market orientation (focus on higher market ends implied selling to customers in Europe, in particular, which made production in Europe a rational choice)</p> <p>Endogenous (intra-firm) causes (as far as exogenous causes were concerned, they related to the financial system, not the market situation in China, for instance</p>

Source: Own elaboration based on interviews and desk research.

The main reasons for offshoring, in our view, were market-led ones and, consequently, a deterioration of the sales conditions on the markets the respective factories were supposed to supply have been more decisive for backshoring than changing production (cost) circumstances in situ. This is most apparent in the case of Ormazabal, which closed factories in Brazil and Turkey, but not in China. While the sales possibilities became bleak in Brazil and Turkey and the market segment in which Ormazabal tried to succeed came under increasing pressure due to customers resorting to lower price/quality products, leading to a pull-out of production from those

places. In China, the market dynamics were comparable, but the country's market was considered to be of more strategic importance in the long run, even if the high-end of the market only accounted for a small share of the entire market; however, it was much more sizeable than in the other two countries. Hence, the company maintained its production presence in China.

In some cases (cfr. Orbea and Irizar), it was not so much a question of a deterioration of sales perspectives, but rather of unrealistic sales expectations in the first place. This can be considered a way of correcting a company's international business strategy, as maintained by Kinkel and Maloca (2009) and Dachs and Kinkel (2013).

In other cases (e.g. Artech and SNA Europe), backshoring was more the outcome of deliberate strategic intent, as described, for instance, in Grandinetti et al. (2015) or Robinson et al. (2016). In the case of Artech, production was spread out across the world (particularly, South America) to comply with local content rules in different markets. Recently, they divested several of their earlier acquisitions to ensure that this does not result in products that are tradable across the globe, which is not particularly interesting from a strategic business perspective. These local-for-local plants were selected for sell-off (as was the case of their Brazilian subsidiary). Similarly, Ormazabal argued that they regularly evaluated their global production apparatus and sought to move to places that are of strategic importance and where a stable and sizeable market is available.

Additionally—as argued by Gylling et al. (2015) or Mugurusi and De Boer (2014)—there were cases where changing exogenous circumstances (institutional uncertainty, increasing bureaucracy) also played a role in backshoring decisions (see, for example, Artech and Ormazabal in Brazil). By extension, Ormazabal argued that plant closures tend to be related to moving out of unstable (commercial, political) markets rather than to production-related motives.

Finally, the backshored manufacturing activities were generally related to medium- to high-tech products intended for higher market segments (Orbea, Irizar, SNA Europe, NBI Bearings). Alternatively, backshoring included cases in which the activities were rather low-tech and the owner had decided that they no longer corresponded to its market position and thus lost interest in continuing the production activities in question (Artech, Ormazabal). In other words, if the products are too sophisticated for the markets in the vicinity of the production location or if they are too unsophisticated for the owner's portfolio, such a misalignment may also fuel the propensity to backshore (Di Mauro et al., 2018) or to divest.

## 3.5 Implications

### 3.5.1 *The impact of digital technologies on offshoring/backshoring*

Firms in locations associated with high labour costs have more incentives to adopt digital technologies than those in locations where the basic production factors, including (manual) labour, are less expensive. Thus, it makes more sense for firms in locations where high cost savings can be achieved to adopt such technologies.

In addition, it is likely that plant and company ownership is an intervening variable in these decisions. That is, the companies that participated in our survey and were interviewed were either Basque firms or companies owned by Western firms, which have systematically pioneered their digital technology implementation plans in Basque factories (or in other plants they have in the Western world). Consequently, the level of digitalization in the former plants tends to be higher than those they operate in emerging economies. As such, it is logical that digital technologies translate into competitive advantages for these plants and may hence lead to backshoring options. Such decisions can thus be associated with the absence of a technological level playing field.

Furthermore, and perhaps it is an idiosyncrasy of part of the Basque firms (certainly of the cooperatives), it may be worthwhile to point out the following: although internationalization is part of their business and of their growth intent, to act in a footloose manner is not a common practice among these firms. Instead, several firms state that their mission is to create wealth back home. If this needs to be secured via (production) activities abroad, that is what they will do. Yet firms tend to weigh the impact of offshoring against their “birth ground footprint” and internationalize in a moderate way.<sup>16</sup>

Therefore—and in analogy to the first Law of Newton—“mass is slow”, it seems more likely that the adoption of digital production technologies prevents offshoring<sup>17</sup> than that it triggers backshoring decisions. Investments made in overseas plants are typically for the long haul, and to downsize or close such plants is a measure that firms may recur to as a last resort.<sup>18</sup> Rather,

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<sup>16</sup> Or as a representative of an industrial cooperative asserted: “Whereas cooperatives and family-based businesses tend to internationalize with the purpose of making their home-based foundations more solid, there can also be full-fledged multinationals that do not take location-based interests into account. The latter are more tempted to develop their different business functions in the most suitable location. As a consequence, if it is rational (from the perspective of access to technology, networks, markets, production factors) to execute -say- 75% of business activities outside the location of where the company has its headquarters, they will probably do so. On the contrary, companies with a stronger sense of belonging to their place of origin will probably offshore a smaller part and at a slower pace, whatever is prone for offshoring according to financial-economic logics.”

Clearly, this attitude might be very different in other locations.

<sup>17</sup> See also Chiarvesio et al. (2018, p. 371): “... Industry 4.0 has the potential to further improve the local production system, which constitutes an alternative choice to outsourcing or creating subsidiaries in distant countries where the manufacturing costs are cheaper.”

<sup>18</sup> See also Chiarvesio et al. (2018, p. 371): “Despite the Industry 4.0 investments made in main factories in home countries, none of them have backshored or reshored yet and this does not seem part of their future plans.”

they may be tempted to try and give such plants another purpose and to look for alternative ways to make use of such production capacities. Backshoring, therefore, need not be a zero-sum game either. This interpretation is possibly applicable to the businesses we surveyed, as it contains very few lean and mean multinationals that adopt a calculated position towards ROI and may be quick to open and close plants across the globe or regularly restructure their production apparatus. In fact, Basque companies are characterized by a high degree of staying power. Or, as a representative of a Basque home appliances manufacturer expressed it: “If we open a plant somewhere, we tend to hold on to it. But people shouldn’t think it is forever. They should get accustomed to the idea that we close plants sometimes. In fact: we should learn to do that and have an exit strategy; not hold on to assets permanently.”

There may thus be some coherence in the way firms internationalize and may “de-internationalize”. When dealing with firms that are cautious about “go”/ “no go” decisions on offshoring, they will likewise be careful about “close”/ “continue” decisions regarding overseas plants. And business cultures can be distinct in this regard.

### ***3.5.2 The role of local ecosystems in explaining backshoring decisions***

It makes sense to allocate production in an environment where there is proximity and interaction with the developers of the digital technologies that make advanced manufacturing ‘tick’. This implies that backshoring is more likely to occur towards locations where an ecosystem of ICT and advanced machinery suppliers exists. Regions that want to foster backshoring of production activities should thus not focus on incentivizing the attraction of manufacturing activities as if it were a stand-alone affair. Creating or bolstering an environment in which such production operations can be embedded and invigorated seems to be equally important. The same goes for the availability of skilled employees and training centres that are up to par with the (technological) needs and progress of industrial production activities.

The relevance of ecosystem quality is also echoed by Tate et al. (2014), who emphasize the functioning of the local labour markets and the availability of a highly skilled and specialized workforce. Similarly, if home bases serve as the trial bases for utilizing new technology, it may provide expensive locations with a competitive advantage over offshore locations (Arlbjørn and Mikkelsen, 2014; Stentoft et al., 2015). In a similar vein, Johansson et al. (2018) find that the level of ‘development competences’ across localities is a dominant factor in backshoring.

As a counterpoint, however, Western economies should be wary of the advantage they can achieve over places like China (Venohr and Kamp, 2019). Because the Chinese economy (or others, for that matter) may also advance in the development and adoption of digital technologies. Consequently, it may also turn into the home of very competitive supply and value chain settings.<sup>19</sup>

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<sup>19</sup> <https://www.businessinsider.com/why-donald-trumps-plan-to-build-iphones-in-us-wont-work-2016-3?IR=T>  
<https://www.nytimes.com/2019/01/28/technology/iphones-apple-china-made.html>  
<https://www.heraldtribune.com/news/20120123/apples-jobs-to-obama-jobs-arent-coming-back-to-us>



## Bibliography

- Arlbjørn, J.S., Mikkelsen, O.S., 2014. Backshoring manufacturing: Notes on an important but under-researched theme. *J. Purch. Supply Manag.* 20 (1), 60–62.
- Bals, L., Daum, A., & Tate, W. (2015). From offshoring to rightshoring: Focus on the backshoring phenomenon. *AIB Insights*, 15(4), 3.
- Basque Digital Innovation Hub <https://basqueindustry.spri.eus/en/basque-digital-innovation-hub/#estrategia>
- Basque Government (2015) Estrategia de Fabricación Avanzada Basque Industry 4.0, <https://basqueindustry.spri.eus/en/#estrategia>
- Chiarvesio, M. and R. Romanello (2018), *Industry 4.0 Technologies and Internationalization: Insights from Italian Companies*, *International Business in the Information and Digital Age*, pp. 357-378.
- Dachs, B., Kinkel, S., 2013. Back-shoring of production activities in European manufacturing. Evidence from a large-scale survey. In: *Proceedings of the 20th European Operations Management Association Conference*, Dublin, Ireland.
- Dachs, B., Kinkel, S. and S. Jäger (2017). Bringing it all back home? Backshoring of manufacturing activities and the adoption of Industry 4.0 technologies, MPRA paper, München.
- Departamento de Desarrollo Económico e Infraestructuras. Viceconsejería de Industria (2017), Plan de Industrialización 2017-2020 “Basque Industry 4.0”, [https://www.irekia.euskadi.eus/uploads/attachments/10018/Plan\\_de\\_Industrializacion.pdf?1500453186](https://www.irekia.euskadi.eus/uploads/attachments/10018/Plan_de_Industrializacion.pdf?1500453186)
- Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (European Commission) (2017), *Regional Innovation Scoreboard 2017*, <https://publications.europa.eu/en/publication-detail/-/publication/ce38bc9d-5562-11e7-a5ca-01aa75ed71a1/language-en>
- Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (European Commission) (2017a), *Regional Innovation Scoreboard 2017*, <https://publications.europa.eu/en/publication-detail/-/publication/ce38bc9d-5562-11e7-a5ca-01aa75ed71a1>

- Ellram, L.M., 2013. Offshoring, Reshoring and the Manufacturing Location Decision. *J. Supply Chain Manag.* 49 (2), 3–5.
- Eusko Jarlauritza Gobierno Vasco (2020), Update of the 2020 Internationalisation Framework Strategy Euskadi Basque Country Strategy, [http://www.euskadi.eus/contenidos/informacion/accion\\_exterior\\_hemeroteca/es\\_def/adjuntos/ESTRATEGIA%20EUSKADI%20BASQUE%20COUNTRY%202020\\_en.pdf](http://www.euskadi.eus/contenidos/informacion/accion_exterior_hemeroteca/es_def/adjuntos/ESTRATEGIA%20EUSKADI%20BASQUE%20COUNTRY%202020_en.pdf)
- Fratocchi, L., Di Mauro, C., Barbieri, P., Nassimbeni, G., & Zanoni, A. (2014). When manufacturing moves back: Concepts and questions. *Journal of Purchasing and Supply Management*, 20(1), 54–59.
- Grandinetti, R., Tabacco, R., 2015. A return to spatial proximity: combining global suppliers with local subcontractors. *Int. J. Glob. Small Bus.* 7 (2), 139–161.
- Gylling, M., Heikkilä, J., Jussila, K., Saarinen, M., 2015. Making decisions on offshore outsourcing and backshoring: a case study in the bicycle industry. *Int. J. Prod. Econ.* 162, 92–100.
- Johansson, M., Olhager, J., Heikkilä, J. and J. Stentoft (2018). Offshoring versus backshoring: Empirically derived bundles of relocation drivers, and their relationship with benefits, *Journal of Purchasing and Supply Management*, <https://doi.org/10.1016/j.pursup.2018.07.003>
- Kinkel, S. 2015. Setting the scene: Global value chains, re-shoring activities, global innovation networks, and their impact on global innovation platforms. In: Van der Giessen, A., Stolwijk, C., & Leijten, J. (Eds.): *Can policy follow the dynamics of global innovation platforms?* 15-40. Papers from a 6CP conference, 14-15 April 2014, 's-Hertogenbosch.
- Kinkel, S., Maloca, S., 2009. Drivers and antecedents of manufacturing offshoring and backshoring - A German perspective. *J. Purch. Supply Manag.* 15, 154–165.
- Laplume, A. O., Petersen, B., & Pearce, J. M. (2016). Global value chains from a 3D printing perspective. *Journal of International Business Studies*, 47(5), 595–609.
- Mugurusi, G., Bals, L., 2017. A processual analysis of the purchasing and supply organization in transition: the impact of offshoring. *Oper. Manag. Res.* 10 (1), 64–83.

- OECD (2011), The Basque Country, Spain, Self-Evaluation Report, <http://www.oecd.org/education/skills-beyond-school/basque%20country%20self%20evaluation%20report.pdf>
- PCTI EUSKADI (2014) A smart specialisation strategy. Research & Innovation Smart Specialisation Strategy – RIS3, Basque Government, [https://www.irekia.euskadi.eus/uploads/attachments/6312/PCTI\\_Euskadi\\_2020\\_en.pdf?1429183477](https://www.irekia.euskadi.eus/uploads/attachments/6312/PCTI_Euskadi_2020_en.pdf?1429183477)
- Porter, M. E., Ketels, C. H.M. and Valdaliso, J. M. (2016), The Basque Country: Strategy for Economic Development, Harvard Business School Case 713-474, January 2013. (Revised June 2016), <https://www.hbs.edu/faculty/Pages/item.aspx?num=43962>
- Rehnberg, M., & Ponte, S. (2016). 3D printing and global value chains: How a new technology may restructure global production. GPN Working Paper Series. Singapore: Global Production Networks Centre.
- Rezk, R., Srari, J. S., & Williamson, P. J. (2016). The impact of product attributes and emerging technologies on firms' international configuration. *Journal of International Business Studies*, 47(5), 610–618.
- Robinson, P.K., Hsieh, L., 2016. Reshoring: a strategic renewal of luxury clothing supply chains. *Oper. Manag. Res.* 9 (3), 89–101. <http://dx.doi.org/10.1007/s12063-016-0116-x>.
- Stentoft, J., Mikkelsen, O.S., Johnsen, T.E., 2015. Going local: a trend towards insourcing of production? *Supply Chain Forum.: Int. J.* 16 (1), 2–13.
- Tate, W.L., 2014. Offshoring and reshoring: US insights and research challenges. *J. Purch. Supply Manag.* 20 (1), 66–68.
- Venohr, B. and B. Kamp (2019): «Global niche market leaders in emerging Asia and the necessity to become market insiders». *Revista Ekonomiaz* 95, 2019.
- Zubillaga Rego, A. and Peletier Espiga, C. (2019), Digital Economy and Society in the Basque Country 2018, Orkestra- Instituto Vasco de Competitividad, <https://www.orkestra.deusto.es/images/investigacion/publicaciones/informes/cuadernos-orkestra/digital-economy-society-2018.pdf>

## **Annex 1: Interview on backshoring with Basque companies**

### **1. General information**

Name of company

Name and function of contact person

Number of full-time employees of your company

Is your company a supplier of manufacturer of finished goods?

Sector?

Is the headquarter in the Basque country or are you member of an international group of firms?

### **2. Sources of competitiveness**

What do you regard as critical for the success of your business (price, quality, short delivery, flexible production, new products?)

What do you expect at the most important source of inspiration or knowledge for new products (own research, marketing and market research, industrial customers, suppliers, universities, etc.)

### **3. Current and expected use of digital technologies**

Technologies used for:

- Supplier management
- Product development
- Process management
- Customer relationship management
- Business management

### **4. Internationalisation of production**

In which countries outside Spain does your company produce?

Which parts or functions of the firms remain here at the headquarters or in Spain?

In your view, what criteria matter for producing abroad?

- Lower cost (personnel, raw materials, suppliers)
- Infrastructure

- Competitors are also abroad
- We need to be near our clients
- Better growth outlook than at home

## **5. Backshoring**

Tell me about your backshoring.

What parts of the production did you move back to the Basque country or Spain?

How did the backshoring take place?

- Sale of foreign company or parts of it
- Close-down of these foreign activities
- The backshoring is related to the production of a new generation of the product
- We brought back the high-value products which need a lot of customization. Mass production is still abroad
- Rescheduling of investment to another location

## **6. Reasons for backshoring**

- Lack of quality of the products produced abroad
- We were not able to customize the product or change production in short notice
- Transport and co-ordination took too much time and resources
- We had enough production capacity at home and did not need foreign production anymore
- Made in Spain/Basque Country is important for our customers and for us

Did any of these factors play a role for the backshoring decision?

- New production technologies that helped us to cut costs and allowed to produce in the Basque country again.
- Cost increases at the foreign location
- Other changes at the foreign location that let us to decide to come back to the Basque country?

## **7. Effects of backshoring**

Did you reach the goals we discussed above with backshoring?

What obstacles did you face?

Can you estimate the effects of backshoring on the activities here in the Basque country?

## **8. Outlook**

Does your company plan new backshoring projects?

If yes, what is the motive?

Do you think that backshoring will become a more general trend in your sector or the whole economy?

## **9. Policy**

Did you receive public support for your backshoring project?

If yes, what kind of support?

If no, how could policy support you in a future backshoring project?

## **Annex 2:** Definition of technologies in the company survey

**Big data / mass data analytics:** ‘Big data’ analysis is the process of examining large amounts of data from a variety of types to detect patterns, correlations and other useful information.

**Cloud computing:** computer techniques that make use of software that is not parked on the computers of the company itself, but in the cloud, with which the services or computer analyses developed with the computer are provided directly from the internet. This means that the programme a user wants to use will run directly from the software provider's server, without it having to be installed on the user’s own computer first. Likewise, the data and results of the analysis can be saved in the cloud.

**Cybersecurity:** the practice of defending computers and servers, mobile devices, electronic systems, networks and data from attacks (hacking) and computer viruses.

**Internet of Things:** various types of devices (from a domestic product to a machine in a manufacturing centre by means of sensors, transmitters and actuators) are connected via the internet to exchange information, which allows automation and multiplies the possibilities of use and the monitoring of connected devices.

**Automated machinery:** machinery equipped with control systems and information technologies (ICTs) to run different manufacturing processes. It is a step beyond mechanization in the field of industrialization. It can serve both to increase productivity, reduce the cost of production, and improve the quality, flexibility and customization of manufacturing processes.

**Robotics:** a machine or system that performs an activity on its own, i.e. without the need for a human to supervise its correct functioning.

**3D printing:** group of manufacturing technologies by addition, where a three-dimensional object is created by superimposing successive layers of material. That is why it is also called “additive manufacturing”.

**Artificial intelligence:** intelligence developed by machines (including so-called “machine learning”). It entails learning (the acquisition of information and rules for the use of information), reasoning (using the rules to reach approximate or final conclusions) and self-correction.

**Mobile services:** mobile services or applications and programmes that can be downloaded and accessed directly from your mobile phone, tablet or other mobile device.

**Social networks:** digital social networks or on the internet, such as Facebook and Twitter as generic social networks, and LinkedIn as an example of a social network with professional purposes.

**Communication from machine(s) to machine(s):** M2M communication refers to remote connections between machines for the purpose of management and coordination of processes between them.

**Cyber-physical systems:** assets or physical objects of the work / manufacturing environment (for example, machines) equipped with computing and communication capabilities to convert them into intelligent objects.

**Augmented reality:** technologies that allow a user to view part of the real world through a technological device with graphic information added by this device. It thereby increases the real or physical information with virtual information.

**Virtual simulation systems:** the use of equipment that allows a recreation of real situations in simulated worlds or virtual environments.

**Digital twins:** virtual replica of an object or system that simulates the behaviour of its real counterpart to monitor it and to analyse its behaviour in certain situations and improve its effectiveness. Among other advantages, it allows the development and testing of products more cheaply and more effectively than with a physical product. In addition, it allows creating infinite copies of the virtual model and testing it under a multitude of scenarios.





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