ESCALATE

SPAIN – BASQUE COUNTRY

Evidence Base for a Skills Escalator (WP4)

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List of Abbreviations

ESCALATE	Coordinated Higher Institutions Responses to Digitalisation, Erasmus+ KA2 - Cooperation for innovation and the exchange of good practices, KA203 - Strategic Partnerships for higher education
EU	European Union
WP	Work Package

Useful Definitions[1]:

Digital Skills: Competences in and / or knowledge of IT tools including computer programs and programming languages.

Digitisation / Digitalisation of Jobs: Job automation by means of computer controlled equipment.

Baseline Digital Skills: Digital literacy skills that employers ask for in the vast majority of jobs across all sectors in the UK labour market. Includes spreadsheet and word processing tools like Microsoft Excel and Microsoft Word, as well as enterprise management software like Oracle or SAP. These proficiencies are increasingly becoming a basic skill requirement for a majority of occupations.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807830/No_Longer_Optional_Employer_Demand_for_Digital_Skills.pdf

Executive Summary

This report presents the main findings of the implementation of a Digital Skills Escalator model, focused on the **circular economy sector**, in the **Basque Country**, in the North of Spain. The Digital Skills Escalator here presented maps the **digital skills pipeline** of the region, directly linked to the circular economy, as a key transversal activity, prioritized by the **smart specialisation strategy** of the Basque Country.

The methodology followed to build this Escalator model has consisted of a combination of **desk and field research techniques**, combined with the involvement of **several stakeholders from public policy, higher education and VET, and business fields**. The involvement of these stakeholders during the creation process of the Escalator is important, as it guarantees the inclusion of first-hand experiences and insights, together with the views from decision making stakeholders and real needs from companies.

The **circular economy sector is a necessary transversal activity that contributes directly to a successful implementation of the Smart Specialisation Strategy** in the Basque region, especially, in relation to smart industry and eco-innovation. Therefore, mapping key digital skills needed and existing training provisions is critical, in order to identify existing gaps, and make recommendations that can tackle these gaps.

Through our work we have identified that the **main gaps with regard to digitalisation**, include the lack of digital strategies at university levels; poor digital skills and resistance, low cooperation between academia and business in general; the lack of workplace assessment models or the lack of adequate training materials on how to promote and improve digital skills.

Further, there are also **gaps related to circular economy skills**, including the lack of awareness about circular economy opportunities, and therefore, about related digital skills, within companies; there are existing difficulties perceiving the link between digitalisation and circular economy at the higher education level and/or difficulties within education organisations (VET and higher education) when it comes to identifying companies' needs related to digital skills in a circular economy. The main technical skill gaps are digital skills related to new business models and to Industry 4.0 and associated automatization requirements (sensors, monitoring, cloud computing…).

In order to tackle these gaps, this report presents a number of recommendations, and we highlight the following ones:

- Importance of prioritizing the identification of digital needs, as the starting point for further action
- Greater institutional strategic and operational support to develop digital strategies and action plans
- Updated and adapted training materials; theoretical and practical
- Awareness raising on opportunities within the circular economy
- Establish strong and specialized networks including, but not limited to,

Future iterations of the Escalator Model should integrate the means to promote collaborative networks, to implement specific thematic research or piloting projects or to facilitate the creation of social media and other communication channels to make communication among participating stakeholders easier.

Methodology

The methodology followed to design and develop this Escalator has consisted of the combination of different research techniques. Firstly, a desk research has been developed, in order to continue with the field research based on personal interviews.

- Desk research: the aim of the desk research carried out was to map and to identify the main training providers and provisions of the region, in relation circular economy, and especially, in relation to digital skills. This research was necessary as well to identify not only relevant stakeholders to be involved during the Escalator creation process, but to identify and analyse main policies, strategies and plans regarding digitalisation and circular economy skills and education (i.e. Basque Country Digital Agenda - AD@2020 - and the Circular Economy Strategy of the Basque Country).
- Field research: after having carried out the desk research, personal (virtual) interviews were carried out with 6 stakeholders from the VET and Higher Education, Public Administration and Business levels. The objective of these interviews was to know more in depth about the main policies and strategies of the region regarding circular economy and digitalisation training provisions, together with the identification of the main needs and gaps in the filed of circular economy and digital skills.

Stakeholders directly involved in this process, include both policy makers, VET and Higher Education organisations and companies:

- IHOBE: the Basque Environmental Basque Government Agency.
- IVAC-EEI: the Basque Institute for the Knowledge of the Vocational Training.
- The University of the Basque Country.
- Two industrial manufacturing companies.

The involvement of these stakeholders during the creation process of the Escalator is a key aspect, as it guarantees the inclusion of first-hand experiences and insights, together with the views from decision making stakeholders and real needs from companies.

This Escalator is built around the circular economy sector in the Basque Country. The selection of this sector is made on the conviction that the circular economy is a necessary transversal activity that contributes directly to a successful implementation of the Smart Specialisation Strategy in the Basque region, especially, regarding smart industry and eco-innovation. The Smart Specialisation Strategy of the Basque Country for the period covering 2014-2020, as approved in the "Estrategia RIS3 de Euskadi" and accordingly, in the Innovation, Technology and Science Plan 2030, establishes 3 main strategic priorities:

- Advanced Manufacturing and Industry 4.0
- Clean Energy
- Biosciences / Health

Both the circular economy sector (through the Circular Economy Strategy of the Basque Country) and digitalisation (through the Basque Country Digital Agenda) are very closely related to the Smart Specialisation Strategy priorities established by the Basque Country Government, as basic axis and enablers to support the achievement of the Smart Specialisation Strategy's aims.

In this context, the creation of the Escalator has consisted of the following main steps; which therefore are the basis to structure of this report.

- Defining the digital skills pipeline through the mapping and the identification of training provisions regarding digital skills and circular economy skills.
- Defining the policy context in the Basque Country, focusing on smart specialisation priorities and national priorities influencing circular economy in the region.
- Identifying aligned investments.
- Creating and depicting the Escalator model
- Identifying digital Skills Gaps and higher Level Smart Specialisation Sector skills gaps needing to be addressed.
- Proposing recommendations to tackle the identified skills gaps
- Proposing recommendations for how the Escalator Model can be improved if used again

Both the desk and field research has prioritised identifying current provision and existing gaps and needs, with the intention of proposing recommendations that can tackle those gaps.

Background to the ESCALATE Project

The ESCALATE project was the subject of a successful application to Key Action 2 – Cooperation for Innovation and the Exchange of Good Practices – of the Erasmus+ programme submitted by West University of Timisoara to the Romanian National Agency. The project has been developed by six partners from five EU countries, namely five universities and an independent company, which specializes on foresight and prospective - strategic studies for the public and private sector.

The official start of the ESCALATE project is 01.11.2019 and it is a 24-months project with the end date being 31.10.2021.

The aim of the project is to assist universities in implementing activities designed to increase the levels of digital competences for employability, upskilling, according with a growing range of employment generated by the digital economy, aligned with the needs of and opportunities offered by the labour market and linked to professional profiles.

The primary focus is to understand digital education disruption and to enable open-source technology and innovative solutions for both educators and students, leading to increased learning-outcomes that meet the learning needs of students whilst also being relevant to the labour market and societal needs (creating a 'better' digital future).

Our target groups are higher education institutions (HEI), education providers, teachers, learners for existing and new digital skills provision. Indirect target group consists primarily of those citizens with low levels of digital skills at risk from digitalization facing a keen need to acquire the digital knowledge and use of digital technologies, but also labour market (LM) forecasters such as labour market observatories.

The project has two linked objectives. Firstly, to help universities understand the scale and depths of the challenges they face from digitalisation - to enable them to formulate effective policy and education system governance - by developing and making freely available new methods and techniques in digital skills acquiring, foresighting and forecasting. We will explore the state-of-the-art before developing and testing the new materials across 6 major themes.

Secondly the project will trial the potential of a new innovative practice (a Digital Skills Escalator) across a selected region in each partner country to test its potential as a mechanism for both identifying where there is unmet demand and subsequent need for new digital skills provision and as a means of building a more holistic offer from education providers. <u>This report addresses this objective for our region.</u>

The University of Exeter has summarized existing practices and lessons learned from their work developing the Exeter Data Analytics Skills Escalator and has passed this onto partners who will then build policy and stakeholder relationships to enable testing of the model in their own region and policy landscape.

This report will be presented at Partner Meeting 3 where a methodology for utilising the findings with policymakers will be devised. This is likely to include meetings, regional reports, workshops, and events.

The Concept of a Skills Escalator

Escalators are relatively new developments that seek to achieve the following two related, but not identical, aims.

1. To ensure a region has sufficient citizens skilled in a particular field/sector critical to economic success.
2. To ensure that the skills and training needed to enter or progress in this field/sector are available locally, at all levels.

The former can be understood as a driver of economic success and the latter is more concerned with inclusive growth. As a project we are looking specifically to develop Digital Escalators where the skills at the 'lower end' of the qualifications can be quite generic but will link into a very specific key sectoral need at the higher end. Linked to a City or Region's 'smart specialisation'.

A good example of this is the existing Exeter Data Analytics Skills Escalator is relatively broadly defined. It encompasses topics such as:

- Statistical understanding
- Digital and programming skills
- Use of AI and high-end algorithm development for the analysis of 'big data'
- The translation of environmental intelligence into new products and services and local growth.

Put simply the Escalator is a pipeline of skills, or perhaps more accurately a 'funnel of skills', linked to a specific smart specialisation sector. The fact that a significant proportion of individuals may apply these skills usefully outside the prioritised smart specialisation sector is not problematic. Having a relatively broad, and some might say flexible focus (in which the 'environmental' focus can be picked up or dropped, as convenient) enables engagement across a wide range of educational and other partner organisations and access to a wider range of opportunities.

The Escalator Model is not intended to be a fixed journey from school to Higher Education and CPD but instead is designed for people to enter and leave when necessary. Its purpose is to promote discussion, engagement and coordinated partnership activity.

The digital skills pipeline in the Basque Country

This section presents an overview of the digital education provided in the Basque Country, examining both digital skills and skills related to the circular economy - as this is one of the priorities of the smart specialization strategy of the region.

Digital education provided and digital skills taught:

The Basque Country Digital Agenda (AD@2020) is the tool that provides the framework for the development of the Information Society in the Basque Country. Through the AD@2020, Basque Government has articulated a series of driving and support measures to be deployed during the 2016-2020 period addressed to public agents (coordination of different departments and levels involved) companies, organizations and the whole of society to benefit from the advantages and opportunities offered by digital economy.

The Basque Country already has a high level of digital positioning, if we take into account, the DESI (Digital Economy and Society Index) which compares the relative position of the Basque Country on connectivity, human capital, use of Internet, services, integration of digital technology and digital public services with other Member States of the European Union. Also, as part of the Smart Specialization Strategy, the challenges of digitalization in all areas take on a special importance in the Basque Country.

It is in this spirit that the AD@2020 is structured around 4 main issues, 11 strategic challenges and numerous Lines of Action and 62 Driving Initiatives. Related to education, the main issue of *Competitive and Active Society* must guarantee people have the necessary digital skills for a full performance within society, whether in their work and professional environment, their family life or their leisure activities or contribution to the social development from the digital point of view.

The issue *Competitive and Active Society* is developed through the 3 strategic challenges

1) "*Improve people's digital skills to increase their employability and proximity to learning*":

Background information:

Digital skills are one of the eight key competences defined by the European Commission for the modern citizen's curriculum. The Basque Government has been developing and adapting the European model of digital skills to the context of Basque Country taking into account the different educational plans (Heziberri 2020 Plan, IV Basque Vocational Training Plan, 2015-2018 University Plan), the priorities of the Smart Specialization Strategy (RIS3 Euskadi), as well as the employability needs associated with the current economic and social situation, as an example, addressing the matter of digitally illiterate to avoid social and economic exclusion.

Action Lines:

- To integrate digital skills the formal educational model: The *Heziberri 2020 Plan* is the framework of the pedagogical educational model at Basque Country based on an educational approach oriented to action. That means strengthening the digitally literate on students, they will be able to deal the information from digital sources, to turn it into knowledge, to create digital productions multimedia and to actively participate in social and digital networks. The *Heziberri 2020 Plan* must also ensure the teachers digital training and the provision of appropriate infrastructure and computer equipment for educational centers. Moreover, the plan takes into account the future integration of ICT in teaching and learning processes, through the *Sare Hezkuntza Program* which is focused on the development of Digital

Competence through the pedagogical integration of ICT from 3 complementary perspectives: as an area of knowledge, as a set of capacities that ensure interaction with multimedia didactic content on all the curricular areas and as an instrument of learning and construction of knowledge, where the physical resources available, collaborative learning through the internet and the role of a trained teacher with enough skills will be essential.

- To integrate digital skills on lifelong learning: All learning addressed to labour insertion and job updating must contemplate the adequate transmission of digital skills. In this sense, the AD@2020, makes proposals for actions for the Basque Vocational Training Centers (Initial Vocational Training) and for Lanbide, the Basque Employment Service (Occupational and Ongoing training). The IV Basque Vocational Training Plan considers the importance of providing students with digital skills focused on industry 4.0 (smart and connected factories). The Law 1/2013, of October 10, on Lifelong Learning, promote training initiatives aimed at the acquisition of digital skills. The Basque Institute for Distance Education has to play a fundamental role in this regard, being also essential to promote a global offer of learning for older people who wish to cultivate and expand their digital skills. Finally, initiatives aimed at socializing and universalizing digital skills in Basque society should be promoted, such as the *Ikanos project*, aimed at developing a society that is competent, highly participatory and co-responsible, as well as a user of advanced and high-quality digital services.
- To integrate groups with difficulties in the digital context: The aim is to integrate those groups with low levels of digital literacy and skills to avoid their socio-digital exclusion by training them on the development of digital autonomy (searching for public information, online procedures and requests for public services..), learning on privacy on the Internet and the risks associated (digital identity), training about the importance of the authorship of works on different media.., among others.

Key Initiatives:

- *Ikanos* project: The aim is to create a learning support infrastructure for the digital competence needs of citizens, enterprises, civil servants and others. Ikanos used DigComp to design a selfassessment test (linked to career and training guidance) and various tools and services to develop digital competence for employability, including industry 4.0 job profilesLine: integrating digital into the media mix in our Guide to Digital.
- *Digital Skills Accreditation:* It allows for accrediting knowledge, skills and attitudes in the digital field. The program will also allow citizens to be motivated to acquire skills that are more appropriate to their personal and professional profile and to advance at increasingly expert levels.
- *Mikro- empresa Digital@ Prestakuntza:* Training service for micro-companies and freelancers in any activity sector with the aim of familiarizing them with the various basic TEIC solutions on the market that can be implemented and adapted to improve the efficiency and competitiveness of their businesses. The service is provided through the KZgunea Center Network.
- *KZgunea Center Network:* KZgunea is a project created in 2001 to develop the digital competence of the citizens of the Basque Country. Today are essential platforms for the dissemination, training and experimentation of the new generation of digital technologies. Its great capillarity throughout the territory makes it an essential infrastructure to bring this type of technology to both citizens and small companies.

- *Sare Hezkuntza Gelan:* This project supports the Heziberri 2020 process and aims to promote the development of digital materials and resources in the teaching-learning process, their use in the classroom, as well as facilitating the technological and pedagogical training necessary to carry it out.
- *Denon Irekia:* It is an initiative aimed at raising awareness about the employability of people with intellectual disabilities, brain damage, mental disorders or autism in the Basque Country. The objective of the initiative is to reduce the digital gap and help these groups to integrate into the workplace.

2) "*Promote the generation and demand of professional profiles linked to ICT in all sectors of the economy.*":

Background information:

There is a difference between user digital skills refer, at different levels (basic or above basic), to digital skills related to information, communication, problem solving or the use of a "software" for the creation of contents, such as the use of word processors, spreadsheets, the creation of presentations or documents that integrate texts, drawings, tables or graphics, or programming language. The results shown are very different; while, in the case of general skills of basic or higher level, the position of the Basque Country is correct and the value is above the average of the EU-28, in those related to "software", for the same level, the value is noticeably lower than the average and the position, more backwards. In the case of higher level skills, the rank of the Basque Country is intermediate, for a value just below the EU-28 average. This uneven behaviour can also be seen in the indicators of advanced skills and development: with ICT graduates, the Basque Country holds the first place in the ranking, but this is not the case with the ICT specialist employees, who are below the average of the EU-28. In the case of female ICT specialists, the results are somewhat better in positional terms. Some of the factors that contribute to this situation are the relatively low perception of the need for ICT profiles, insufficient recognition of training and certification within the technology sector, and a worryingly high failure rate in ICT projects. If the lack of TEIC vocations is significant, the lack of female specialists is worrying. This phenomenon is not exclusive to the Basque Country, although it will break the trend towards equality in the labor market for the next few years.

Action Lines:

- To promote non-TEIC professional profiles with a high digital component: It is focused on achieving the leaders of organizations have the appropriate skills required in an increasingly digitized context. These leaders are what we call "e-Leaders". These skills, defined within the European Commission eLeadership Initiative, are those that can lead the leaders of the organization to design business models, taking advantage of innovation opportunities, making the best use of digital technologies and therefore adding value to their organizations. In this sense, the leaders of the future must be e-Leaders, the only way to face new challenges.
- Encourage and attract TEIC professional profiles in areas of incipient demand: The Basque Country needs to have a sufficient number of TEIC specialists available to be able to respond to the demand, but it is foreseeable that it will grow rapidly in short time, creating a bottleneck for growth. At present, there are already signs that the lack of certain technological profiles is limiting the growth of certain sectors with a strong technological component. In this sense, through this line of action it is intended to reduce the expected gap for the year 2020, between

the demand and generation of TEIC professional profiles in order to respond to the digital transformation of the economy.

- To transmit a technological, advanced and practical knowledge to people closed to its application: On many occasions, the use or practical and real application of technological solutions arises from people who, although they are not on decision-making process in an organization, are in a position to see its application to the solution of problems or needs. These solutions tend to have a pilot nature (due to their size or limitation of associated risks) and these are technical profiles closely linked to the business and, therefore, highly practical. This line of action is intended to address these key groups through initiatives with a strong component of practical training, experimentation and the application of new generation digital technologies linked to sectorial and technological priorities, especially advanced manufacturing.

Key Initiatives:

- *Basque EIT Coalition*: Initiative framed within the European Grand Coalition for Digital Jobs, which represents the commitment of the Basque Country at the regional level to promote the digital society, through the creation of a common platform for the evaluation, certification and accreditation of digital skills.
- *Observatory for occupations TEIC:* Observatory that provides both the Basque EIT Coalition and public and private agents with updated information about the degree of coverage of the demand for TEIC intensive professions, so as to facilitate the taking of decisions to adapt the offer.
- *Inclusion of digital specialization in non-technical training:* The objective is to incorporate digital specialization content in non-technical degrees and postgraduate degrees. The training actions will be of long duration (i.e. master's format) and taught by Universities or Technology Centers.
- *Basque e-Leader:* Network for decision makers to be in contact with other peers who have succeeded as e-Leaders in their respective companies.
- *Girls in Tech.* Platform whose objective is to generate a community that allows to promote and promote the role of women in the STEAM world (Science, Technology, Engineering, Art and Mathematics).
- *Enpresa Digitala:* Its objective is to promote the improvement of business competitiveness through awareness and training of emerging ICTs and, at the same time, contribute to the development of new digital businesses. The initiative is mainly aimed at the business and professional field, with special emphasis on small and medium-sized companies that wish to address the application of ICTs in their business processes.

All these initiatives under the umbrella of the AD@2020 are addressed to increase digital skills through the education provided from school age to the workplace, including academic and vocational qualifications at all levels as well as to raise young and adult peoples' awareness, interest and attainment in digital skills and careers. The AD@2020 also considers the need of reducing digital gap on people with intellectual disabilities, brain damage, mental disorders or autism in the Basque Country.

Besides that, the impression is that there is a lack of use of the models of workplace assessment for digital skills weaknesses and still this represents a challenge for the digital gap on adult workers and sectors

Education provided and digital skills taught in the field of circular economy:

Training provision in circular economy has been widened in the last years, in line with the development of the new Circular Economy Strategy approved recently by the Basque Government and consequently, with the implementation of several actions and initiatives that aim to push the sector and encourage companies to start applying circular economy practices.

Circular economy related training is mainly provided at VET, Higher Education and Further Education or Continuing Professional Development (CPD) levels. Therefore, skills taught at Initial Education or Compulsory Education (until 16 years old), mainly refer to education that covers broader areas related to sustainability, or more specific subjects as biology or applied sciences.

- Primary level (8-11 years old): Subjects "natural science" and social "science", together with specific initiatives as; "Ingurugela - environmental education and sustainability programme", "School Agenda 21" and "Aztertu programme".
- Compulsory secondary education (11-16 years old): Same initiatives as "Ingurugela", "School Agenda 21" and "Aztertu programme" are applied, with specific subjects including "scientific culture", "applied science to professional activity" and "biology".

Upper secondary education (Spanish Baccalaureate – from 16 to 18 years old) includes same subjects as in compulsory secondary education.

Specific training related to circular economy provided at VET, Higher Education and Further Education or Continuing Professional Development (CPD) levels is presented below:

Training provided at VET level (medium and high level):

Even there is not any specific full module focused on circular economy, circular economy related skills are taught transversally, as part of the "sustainability and environment" area, one of the five working fields prioritized by IVAC-EEI, the Basque Institute for the Knowledge of the Vocational Training, as the policy maker of the region on VET policies and curricula decisions. Together with this area, "digitalization" is prioritized too, to be taught transversally along the different modules and courses that integrate the official public VET provision.

At the moment, the Basque VET system is undergoing some transformations regarding a higher capacity to decide on curricula contents[2], together with the inclusion of new contents and subjects, due to changes in legislation. Indeed, more changes are expected in relation to sustainability and circular economy related training contents, as the new Law 7/2021 about Climate Change and Energy Transition approved by the Spanish Government in May 2021, states the following: "*The Government will review and update the National Catalogue of Professional Qualifications, as well as the catalogue of training provisions in the VET field that train in environmental sustainability and climate change and the energy transition related profiles*". As well as this, the need to adapt the current training offer to the new demands arising from the changing economy reality, as for instance, due to the needs related to Industry 4.0, is provoking changes both in qualifications and curricula.

[2] The Basque Country government will be able to decide on the 50% of the contents of the curricula once a new Law is approved shortly, instead of on the 45%. The other 50% of the curricula is defined by the Spanish Government.

In this context, two new subjects are expected to be included as part of the official VET curricula, as transversal subjects to be taught to all students, whatever the module[3]:

"Circular Economy and digitalization" transversal course (40 hours) for Medium Level Vocation Education. Focus:

- The transition from linear economy-based businesses to circular economy businesses.
- The importance of the 4th Industrial Revolution.
- The concept of "cloud" and its application to production environments.
- Digital technologies and their impact on the change of the production model.

"Applied digitalization" transversal course (40 hours) for High Level Vocation Education. Focus:

- Application of digitization in productive sectors as an element for transformation.
- Identification of the enabling technologies and its application in productive sectors.
- Understanding the cyber-physical world.
- The importance of data.
- Application of artificial intelligence.

In addition, one year specialisation programs are offered too, more focused on companies' reality. However, even if some of these courses include some contents related to circular economy, as for instance, food waste on the catering industry, no circular economy specific programs exist.

Some other specific initiatives include for instance, the development of specific projects that complement the existing curricula, focused on circular economy on the catering and agri-food sectors (i.e. to avoid food waste), where students apply knowledge through the learning by doing approach.

Training provided at University level

Training offer on circular economy at Higher Education level has been improved in the last years, as a response to the needs arising from sustainability related trends and the transition of the industry towards a 4.0 approach.

On the one hand, even no specific degrees focused only on circular economy exist in the Basque Country, specific subjects about circular economy are included in different degrees and Master's degrees. For instance:

The "Master in Project Management" of the University of the Basque Country, includes two circular economy related specific subjects: "Ecodesign and Circular Economy" and "Product life cycle management". In both cases, the addressed competences are the same:

- Apply the theories of product design and its life cycle
- Apply the tools and techniques used for the sustainable management of projects

The "Master in Industrial Engineering" of the University of the Basque Country, includes two circular economy related specific subjects:

- "Product Life cycle", addressing the following competences:
    - Knowledge and skills to project and design security installations

[3] Draft Decree: https://www.todofp.es/dam/jcr:d0143046-b655-4d1b-8691-47541f310679/prd-2-modulos-profesionales-digitalizacion-fp.pdf

    - Knowledge and skills to perform verification and control of facilities, processes and products
    - Knowledge and skills to perform certifications, audits, verifications, tests and reports
    - Knowledge and ability to project, calculate and design integrated manufacturing systems

- "Product design and development", addressing the following main competence:
    - Knowledge and ability to project, calculate and design integrated manufacturing systems

On the other hand, specialization masters and postgraduate studies on circular economy can be identified, as the one delivered by the University of the Basque Country: "Circular Economy: Application to the Company". This specialization master's degree includes the following competences as part of its learning outcomes.

General competences:

- Apply theoretical knowledge in those basic and advanced aspects in Design Engineering in Circular Economy, including those reflected in the academic bibliography and those exposed in recent scientific articles.
- Apply the theories of product design and its life cycle.
- Transmit, in written and oral form, to their professional environment and to scientific society in general, the new knowledge developed clearly and precisely.

Specific competences:

- Define the concepts Circular Economy, Sustainable Economy, Low Carbon Economy and Eco-innovation
- Understand and explain the modifications involved in the transition from a linear economy to a circular one, as well as recognize the opportunity they represent
- Identify the priority industrial sectors to implement Circular Economy initiatives in the Basque Autonomous Community
- List the differential characteristics of eco-innovation and provide advice for the design and implementation of actions to advance this type of innovation.
- Identify the current regulations applicable to the environment (air, water, waste and soil) in order to carry out correct environmental management in the company.
- Learn about good practices and technologies in terms of optimizing the use and consumption of resources (raw materials and energy) and minimizing pollutant emissions and discharges and the production of waste, as well as recognizing the benefits it represents.
- Apply environmental management tools and describe environmental indicators in the company.
- Define the concept of ecodesign and become aware of the environmental, economic and social implications derived from product design, in addition to determining the advantages it entails.
- Apply the ecodesign methodology and handle the tools available for ecodesign in the industrial field.
- Define the life cycle concept and identify the phases of the life cycle of a product, as well as list the Life Cycle Analysis regulations.

- Know and apply the evaluation methodologies and software tools for the analysis of the life cycle of products.
- Formulate guidelines for communication and marketing with a life cycle approach.
- Specify the key aspects to consider in the different design strategies for R: reuse, repair, remanufacturing and recycling.
- Define and understand corporate and competitive strategies to integrate the environmental variable in the company and select the most appropriate strategy for each particular case.
- Understand the particularities of organic marketing and identify the different agents and factors that affect the successful marketing of a product.
- Understand the purchasing behavior of the consumer demanding more environmentally sustainable products (eco-innovations)
- Design product, price, distribution and communication policies for the commercialization of the eco-innovation
- Identify business opportunities in the field of Circular Economy for different sectors and design proposals

It is important to highlight that one of the subjects included in this Master closely relates to digitalisation: "Circular Economy, Digital Transformation and Industry 4.0", addressing the following competencies:

- Describe the relevant strategies offered by industry 4.0 and digitization for the Circular Economy.
- Know the applicability, facilitators and barriers of Industry 4-0 in the field of Circular Economy
- Identify the key technologies of Industry 4.0 from a manufacturing, automation and telecommunications point of view.

Some other circular economy related university studies are closely related to ecodesign, as the following ones delivered by the University of Deusto and Mondragon University:

- Ecodesign and Lifecycle Assessment Program – University of Deusto (Link): This course, aimed at environmental technicians, engineers, quality managers of companies, entrepreneurs, graduates, professionals and students of the last course of Industrial Design degree, focuses on Life Cycle Analysis and Ecodesign. The learning outcomes of this course in terms of specific competencies are as follows:
    - Apply current regulations regarding sustainability in the field of innovation, creativity and project management and professional teams, in order to be able to apply them in industrial areas.
    - Carry out Life Cycle Analysis of the product and / or service designs carried out, to assess the environmental impact of any product / service.
    - Carry out an exhaustive Life Cycle Analysis, through the use of professional software, to quantify in a real way the environmental impact of any product / service.

- The Higher Polytechnic School of Mondragon University created in 2014 an ecodesign classroom ("Aula de Ecodiseño") and at least one subject related to sustainability was implemented in all engineering degrees. This initial work led, that same year, to the creation of the degree in Engineering in Ecotechnologies in Industrial Processes.

In all of these courses, there is a clear influence of industry 4.0, as a mainstream trend that is bringing new needs and requirements.

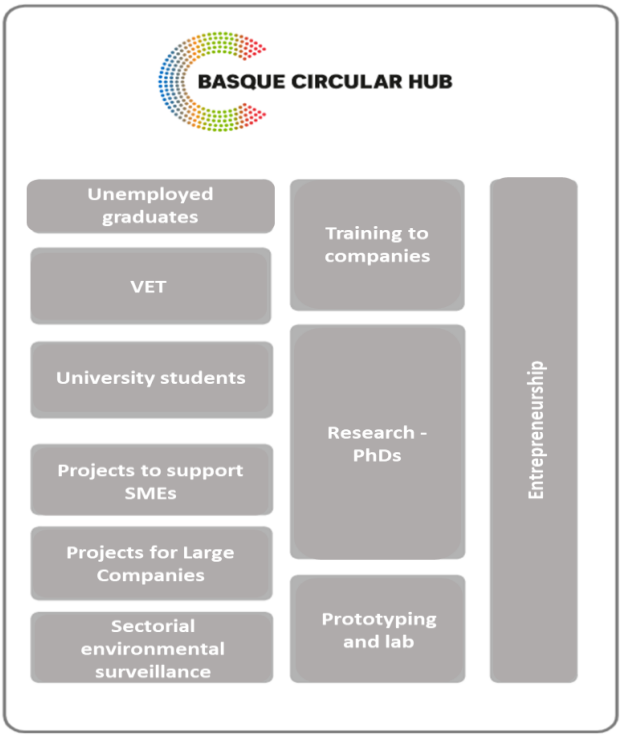
Training provided at Employer / Innovation led FE and HE level (CPD)

At employer and further education level, several circular economy related training courses and initiatives are available; some initiatives, promoted from Basque and provincial environmental public administrations and higher education are included below:

On the one hand, the Basque Environmental Basque Government Agency – IHOBE –, as the key reference and promoter of the circular economy strategy of the Basque Country, has developed different initiatives regarding circular economy related training, addressing mainly professionals and companies, last year students and graduates through specific internships in companies. Special attention has to be paid to the Ecodesing Classroom and the Basque Ecodesign Hub (Link), including training programs and internships focusing on ecodesign, and to the recently created Basque Circular Hub (Link) (as an evolution of the Basque Ecodesign Hub).

The Basque Circular Hub, promoted by IHOBE, the Basque Government and the Bilbao municipality, in collaboration with the three Basque Universities (the University of the Basque Country, Mondragon University and the University of Deusto), TKNIKA (Basque VET Applied Research Centre) and Novia Salcedo Foundation, is the centre for advanced circular economy services in the Basque Country.

It is the only centre of these characteristics that exists in Spain and in Southern Europe with market foresight services, advanced training, as well as trend analysis and generation of expert knowledge in the field of circular economy.



In this framework, digitalization is understood as an enabler for the implementation of the circular economy and promote the resource efficiency. Training provision promoted from the Basque Circular Hub, in coherence with the Circular Economy Strategy of the Basque Country, mainly focuses on digitalization related to big data, highlighting the following main areas:

- Sensors to obtain real time data in productive processes and operation facilities and equipment. For instance, to monitor machining centres with regard to emissions, waste and effluents….
- Sensors for remanufacturing; to analyse, diagnose and assess pieces and other elements for remanufacturing, especially for automatization sites and to enable reintegration of those elements in productive processes (ie. existing demand already in the automotive sector).
- Machinery management in the cloud, with preventive maintenance purposes, through the use of sensors.

- Other applications: sensors for waste management to improve route planning….

Other areas of digitalisation specified in the Circular Economy Strategy of the Basque Country more closely related to industry and manufacturing (and are mentioned in the next section of this report) are managed by SPRI, The Department of Economic Development, Sustainability and Environment of the Basque Government that focuses on promoting Basque industry.

In addition, internships are promoted through annual programs, with the aim of improving the competences of both recent graduates and employers. For example, in 2021 the "Circular Berrindartzea" program has been launched; this internship program, promoted by the Circular Basque Hub and that counts with the participation of 15 sectorial Basque clusters, will introduce 100 young people in Basque SMEs, in order to define their company roadmap towards circular economy.

Another interesting example is the Circular Economy Classroom launched by the Provincial Government of Gipuzkoa together with the University of the Basque Country, with the aim of initiating and developing collaborative projects among university, companies and other relevant stakeholders in the field of circular economy.

Finally, the University of the Basque Country is launching at the end of the year "Zirkulargunea", a knowledge hub in collaboration with Teknalia Research Centre.

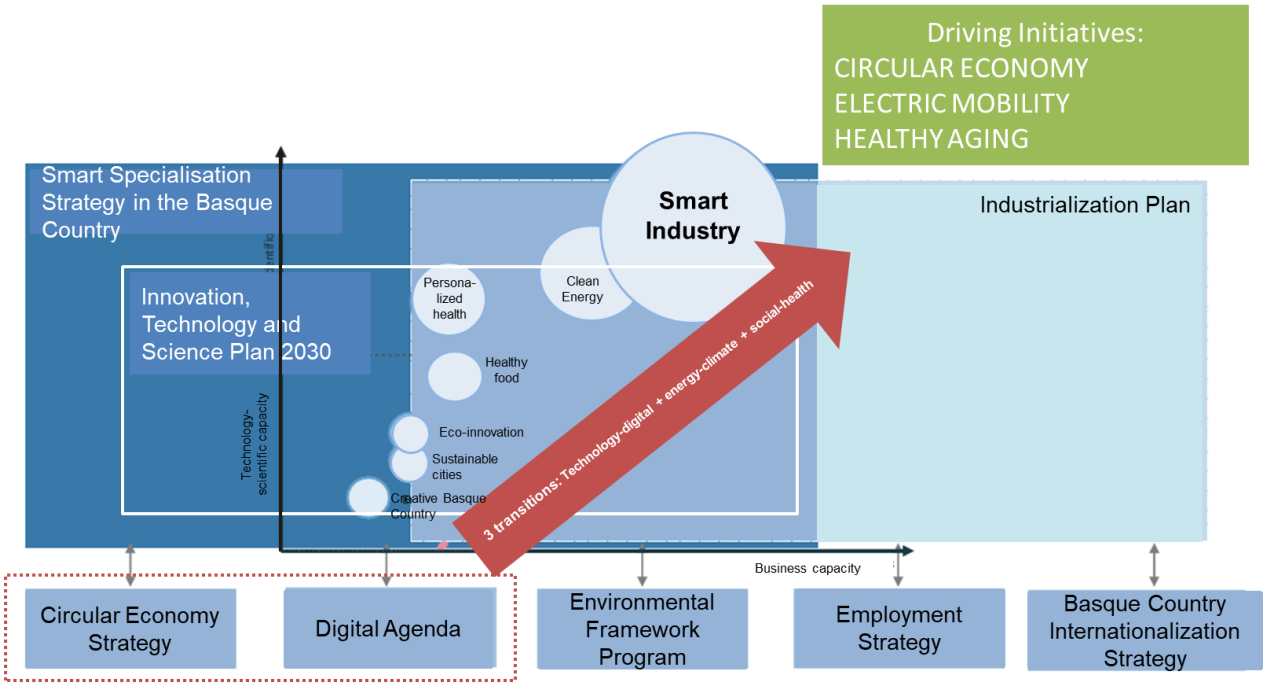
The Policy context in the Basque Country

Smart specialisation priorities in the Basque Country

The Smart Specialisation Strategy of the Basque Country for the period covering 2014-2020, as approved in the "Estrategia RIS3 de Euskadi" and accordingly, in the "Innovation, Technology and Science Plan 2030", establishes 3 strategic priorities:

- Advanced Manufacturing – Smart industry
- Clean Energy
- Biosciences / Health

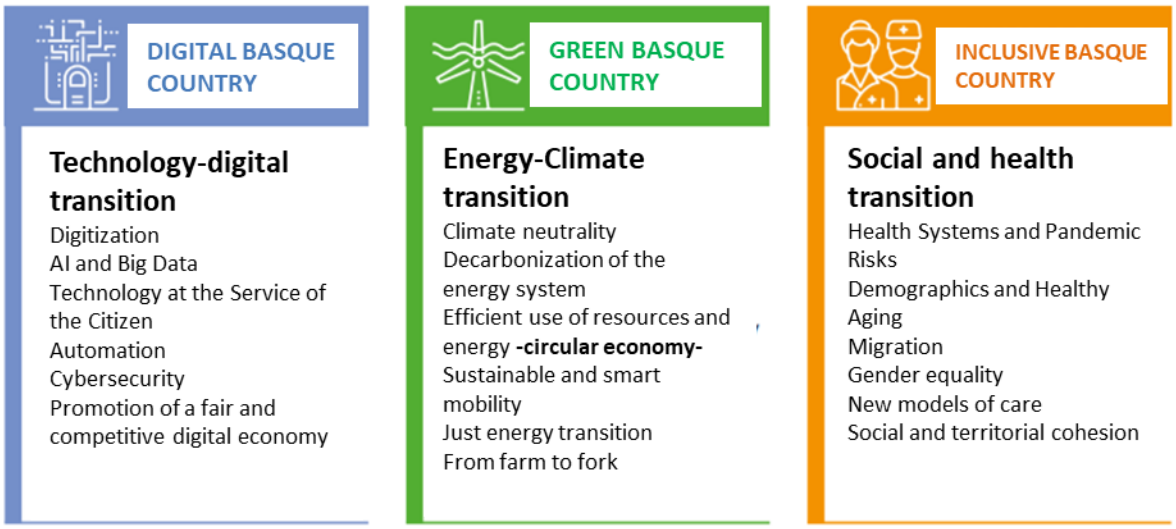
The priorities established for the new period, focus on 7 strategic areas, as presented below, focusing mainly on the 3 areas already mentioned.



Source: Presentation by SPRI, "The European Green Deal in the RIS3 Euskadi Strategy", adapted taking into account the "Innovation, Technology and Science Plan 2030".

As seen in the diagram, both the Circular Economy Strategy and the Digital Agenda Strategy are very closely related to the Smart Specialisation Strategy priorities established by the Basque Country Government, as basic axis and enablers to support the achievement of the strategy's aims. Indeed, Circular Economy is included as one of the three Driving Initiatives.

At the same time, these strategic areas are linked to some transversal sectors, as advanced professional services to companies and digitalisation and communication technologies, and are influenced by three main transitions:



Source: "Innovation, Technology and Science Plan 2030".

In this context, the Escalator presented here will focus on the "Circular Economy sector, as a necessary transversal activity that contributes directly to a successful implementation of the Smart Specialisation Strategy in the Basque region, especially, regarding smart industry and eco-innovation.

Education and skills strategic priorities aimed at the Circular Economy sector in the Basque Country

Digitisation is a key and necessary tool to accelerate the transition to a circular economy. Indeed, as defined in the "Circular Economy in the Industry of the Basque Country" diagnosis report, there are some key technologies from 4.0 industry that may facilitate the implementation of the circular economy in the region. These technologies include:

- IoT
- Cloud computing
- Smart factory
- Additive manufacturing or 3D printing
- KETS
- Digital business models

At the same time, the circular economy is a key enabler too to face main challenges of the industry in relation to digitisation and new business models and automatization and modernisation, as circular economy can improve the efficiency of productive processes, improve the maintenance of products and processes or increase the value of products and materials, among many other advantages.

The importance of digital technologies is also highlighted in the "Circular Economy Strategy of the Basque Country", as there is one specific working line - "2. Innovation and New Technologies"- focused on innovation and the integration of digital technologies.

- New digital technologies and data analysis allow better control and use of resources, as well as greater collaboration and knowledge exchange

- Digitization provides a great opportunity to integrate sustainability throughout the innovation process in new processes and products (ie. digitization in connection with 3D printing is expected to revolutionize the repair industry in the coming years, further reducing storage needs)
- The resource-efficient circular economy promises to be one of the most innovative areas in which to deploy the possibilities offered by digitization.
- A digitized value-added chain can be instrumental in achieving comprehensive resource management, complementing innovative technologies and business models.
- The interconnection of the main drivers of the efficient circular economy in the use of resources, with the advantages of smart facilities and products (the 'Internet of things") holds great potential for added value.
- The vast information that we have available today through the application of smart facilities and products can be used as feedback for the design of the facilities and products of the future. This allows optimization of maintenance, durability forecasts and cycle extension, as well as efficiency in the use of resources in useful life and recycling.
- There is a great pending potential for the development of technologies for the elaboration of status diagnoses and the implementation of means to control the material cycles.

This way, examples include; simulation and validation tools for components made of advanced materials, monitoring technologies embedded in components, developing technical-environmental information systems for the value chain, etc.

The Circular Economy Strategy of the Basque Country, aiming at promoting the transition of the region towards a more efficient economy in the use of resources through innovation oriented towards a new model of production and consumption, and through public-private collaboration that effectively involves citizens, companies and policy makers, will have a clear positive impact on employment generation. Indeed, the development of new businesses and the competitive improvement of current companies through the integration of circular economy principles will allow the creation of new jobs, both in existing companies and in new businesses emerged as a result of change of the linear economy model (the creation of new 3.000 jobs is expected).

New profiles and skills to drive the transition:

The achievement of this objective requires both research and innovation in new business models and the development of the necessary skills to drive the transition. Therefore, the Strategy defines specific actions related to training and education. It is necessary to reflect on the required professional profiles and skills in order to develop specific training modules in university and vocational training study programs, and to guarantee this way qualified professionals. This work must be carried out in close cooperation between universities, training institutions, companies and research centres. In this regard, the Basque Circular Hub has been created (http://www.circularbasque.eus/), as a benchmark in terms of knowledge and advanced training.

The educational and training offer takes a fundamental role in the transmission of knowledge and the development of new competences and a step forward must be taken by integrating the concepts of circular economy in the teaching of vocational and university training. The Strategy intends to promote specific training actions aiming at formal training, in both university and vocational training levels, as well as at non-formal education, through the creation of new certificates in the field of circular economy. It prioritises also the training of students through business internships and the promotion of entrepreneurship.

Important national priorities influencing circular economy in the Basque Country

ESPAÑA CIRCULAR 2030 Circular Economy Spanish Strategy

At National level, the Spanish Government approved in June 2020 the Circular Economy Spanish Strategy "España Circular 2030". This strategy establishes the bases to promote a new production and consumption model in which the value of products, materials and resources are maintained within the economy for as long as possible, with minimal waste and reusing as much as possible the waste that cannot be avoided. This Strategy contributes to Spain's efforts to achieve a sustainable, decarbonized economy, which uses resources efficiently and which is competitive. This strategy will be materialized in successive triennial action plans.

The Circular Economy Spanish Strategy is aligned with the objectives of the two circular economy action plans of the European Union, "Closing the circle: an EU action plan for the circular economy" (2015) and "A new Circular Economy Action Plan for a cleaner and more competitive Europe"(2020), as well as with the European Green Deal and the 2030 Sustainable Development Agenda. The Strategy has a long-term vision, which will be achieved through successive three-year action plans to be developed, in the 2030 horizon.

In this context, the Strategy establishes strategic guidelines as a 'decalogue' and sets a series of quantitative objectives to be achieved by 2030:

- Reduce national consumption of materials by 30% in relation to GDP, taking 2010 as the reference year.
- Reduce waste generation by 15% compared to what was generated in 2010.
- Reduce the generation of food waste in the entire food chain: 50% reduction per capita at the household and retail consumption level and 20% in the production and supply chains from 2020.
- Increase reuse and prepare for reuse to reach 10% of municipal waste generated.
- Improve water use efficiency by 10%.
- Reduce the emission of greenhouse gases below 10 million tons of CO2 equivalent.

The Strategy identifies six priority activity sectors: construction, agro-food, fishing and forestry, industry, consumer goods, tourism and textiles and clothing. It highlights as well some key policies related to employment, R+D+I and tax, as well as consumer, industrial, water and agrarian policies and development policies in rural areas. Finally, among the 8 action lines defined by the Strategy, employment and training appear together with some other transversal elements as awareness and participation, research, innovation and competitiveness. The five remaining action lines relate to closing the circle; production, consumption, waste management, secondary raw materials, and water reuse.

Law 7/2021 about Climate Change and Energy Transition

Tthe new Law 7/2021 about Climate Change and Energy Transition approved by the Spanish Government in May 2021, defines a new legislative framework that will have a direct impact on regional policies, especially regarding circular economy training. As stated by the Law:

- "The Government will review and update the National Catalogue of Professional Qualifications, as well as the catalogue of training provisions in the VET field that train in environmental sustainability and climate change and the energy transition related profiles".

- "The Government will promote that universities proceed to review the treatment of climate change in the curricula leading to the obtaining of official university degrees in which it is consistent in accordance with the competencies inherent to them, as well as the training of university teachers in this area".
- "The Government will review the treatment of climate change and sustainability in the basic curriculum of the teachings that are part of the Educational System in a transversal manner, including the elements necessary to make an education for sustainable development a reality. Likewise, the Government, within the scope of its competences, will promote the actions that guarantee the adequate training of teachers in this matter".

Escalator partners

Stakeholders participating in the development of this Escalator, include organizations from the policy, education and business fields, as it is key to count on the insights from these 3 areas in order to analyse and identify existing needs and gaps in the digital-circular axis.

Policy stakeholders participating in this study include IHOBE and IVAC:

- IHOBE: the Basque Environmental Basque Government Agency and main promoter of the Circular Economy Strategy of the Basque Country.
- IVAC-EEI: the Basque Institute for the Knowledge of the Vocational Training, as the policy maker of the region on VET policies and curricula decisions.

Regarding education stakeholders, besides IVAC-EEI, the University of the Basque Country has been the one participating, through the involvement of the person in charge of the "Circular Economy: Application to the Company" Master and the person in charge of the Digital Transformation area.

Finally, two industrial manufacturing companies have provided their views and needs regarding circular economy and digitalisation.

These stakeholders were contacted in order to arrange a virtual interview (in a COVID pandemic context) and collect this way their experiences, views, needs and recommendations, with regard to circular economy, and especially, in relation to digitalisation and digital skills.

Once the Escalator is completed, the objective is to continue keeping a continuous dialogue, over time (through periodic short interviews), in order to keep track of possible changes and requirement and needs evolution, so that recommendations can be adapted accordingly.

Aligned Investments

The Circular Economy Strategy of the Basque Country has a budget of approximately €19 million for the 2020-2025 period. €10 million out of this budget is designated for the "Competitive and Innovation" field of action, where specific actions related to training and innovation and new technologies are included.

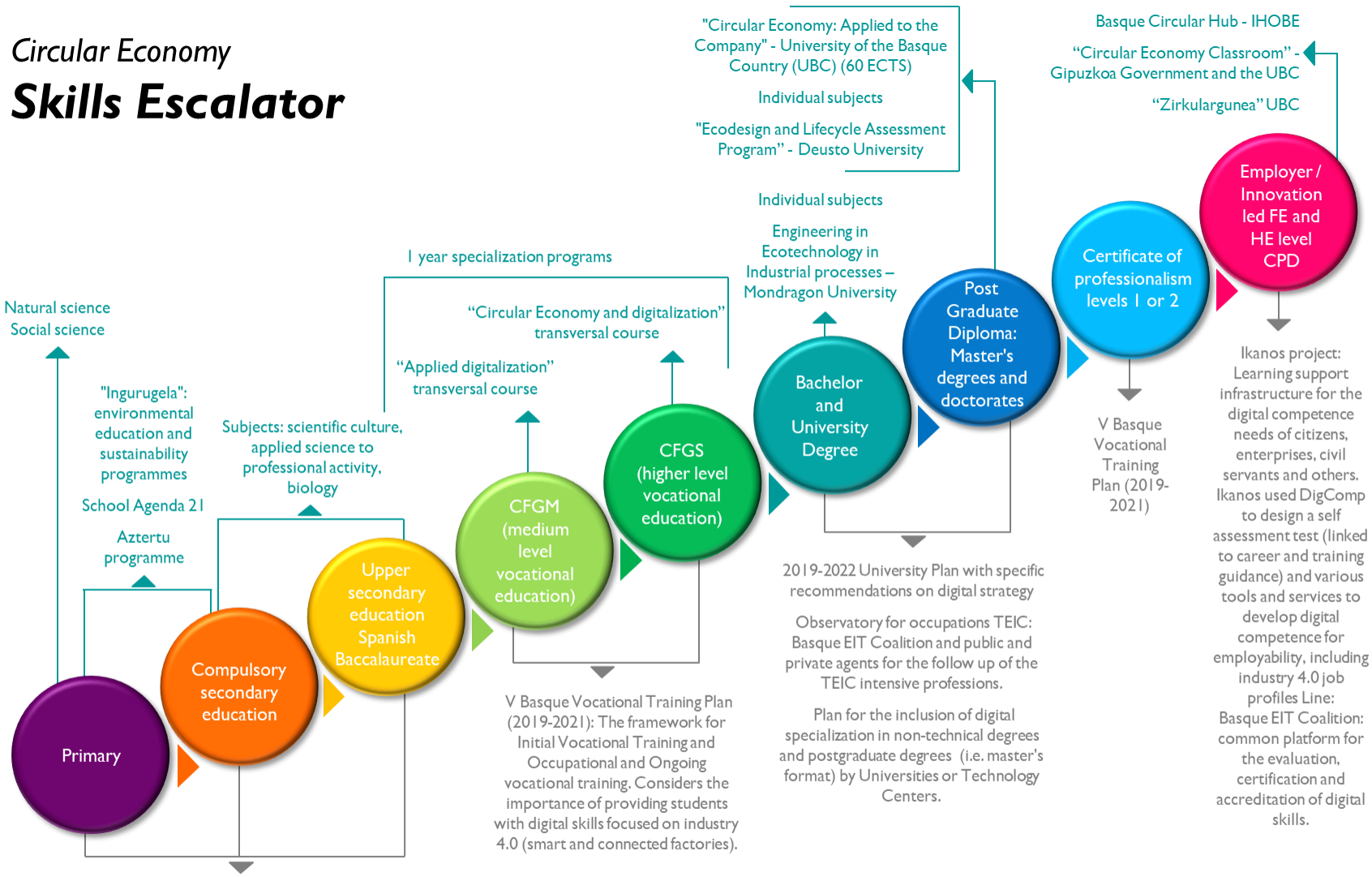
On the other hand, the research made in the region suggests that there are not similar innovations to the Escalator. Until now, main efforts have focused on developing training on circular economy and Industry 4.0, but the link between them is still very incipient. It is expected that further efforts will be made in the near future.

An interesting initiative that is under construction at the moment, is the one developed by Lanbide – the Basque Employment Public Service –. They are identifying the key skills in the circular economy field, in order to identify new training paths, to support digitalisation.

Model creation

Circular Economy

Skills Escalator



Resultant Skills Priorities and Recommendations

Digital Skills Gaps in the Basque Country needing to be addressed

This section includes the main digital gaps identified, according to the desk research and interviews carried out. These gaps relate to digital skills as a whole, without considering the link between digital skills and circular economy related skills.

- **Lack of digital strategy at universities. University leaders** are beginning to understand the potential of information technologies to contribute to the transformation of the University, but it is essential to acknowledge that investments in technology, by themselves, are not enough to achieve the desired objectives and that there is an important background of cultural change, of organisational processes and resources that it is necessary to promote and lead in order to realize all that potential. Today there are still many Spanish institutions that do not have a clear strategy regarding governance and the extraction of value from their data. In the Basque Country, this reflection is already made, and Universities are willing to work on a digital transformation strategy that can update not only the infrastructures, but the ways of working. Indeed, the University of the Basque Country departing from the definition of a transversal competences catalogue, is developing a reflection process to define a strategy that is able to promote digital skills, through new training provisions, that focuses on teachers, students and administration and general services staff.
- **Poor digital skills and resistance to the change**: Teachers and researchers at university often lack the required digital skills. The most technologically advanced departments are the ones leading the change but it usually depends on the efforts of individual figures, not on a university strategy. Many teachers often hold resistance to change and insecurity in their digital capacities. In addition there is a resistance to the change. As mentioned in the report "The digitalization of Spanish Society" by CEOE, Spanish Universities often base their systems and processes on historical solutions and that are sometimes difficult to adapt to the new digital environment.
- **Low cooperation between academia and business in general**. Academia and business cooperation remains weak in Spain, and similarly, in the Basque Country. As mentioned in the Education and Training Monitor 2019 by the European Commission 2019, higher education institutions tend to cooperate with large and medium-size companies located in their region. Cooperation is particularly low in aspects such as curriculum co-design, co-delivery and student entrepreneurship. This is particularly important where there is a need for greater communication between the new technological advances on sectors, as circular economy, and the training provider so they can adapt the training offer to the new digital skills demanded.
- **Lack of use of the models of workplace assessment for digital skills weaknesses**. In line with the above, the lifelong learning strategies on workplace still this represents a challenge for sectors and companies in Spain and in the Basque Country. There is a lack of participation on ongoing training actions by companies and workers in all economic sectors and this is particularly important considering that the major digital gap is situated on adult workers.
- **Lack of adequate training materials on how to promote digital skills**. Although universities are doing efforts on the identification or the mapping of needs regarding digitalisation, it is still an incipient concept. However, the interviews carried out confirm that the lack of training materials to teach digital skills is a clear gap.

Higher Level Smart Specialisation Sector skills gaps needing to be addressed

Similarly, this section includes the main circular economy skill gaps, paying special attention to the link with digital skills.

- **Lack of awareness about circular economy opportunities, and therefore, about related digital skills, from companies**. Even circular economy is becoming more well known in the recent years, it is still a novel concept for many companies, especially for the smaller ones. Companies that know about circular economy, may have more specific needs related particular technical issues or business model related issues; however, specific digital skills related to circular economy are still not mentioned by them, when asking about potential needs. When talking to companies that are not acquainted with circular economy and its opportunities, the lack of needs is still more prominent.
- **Difficulties to see the link between digitalisation and circular economy at higher education level**. As commented in the interviews carried out with university stakeholders, as a general basis, the link between digital and circular skills is not clear at university level.
- **Difficulties of education organisations (VET and higher education) to identify companies' needs related to digital skills in a circular economy**. As commented in the previous gap, many companies are not aware of their needs about these issues. Therefore, it is very difficult for universities and VET centres to get direct demands and needs from companies about digital skills and circular economy (companies have not a proactive attitude towards circular economy and digital related training). The provision of training related to digital and circular skills together come from the need to adapt to the coming Industry 4.0 scenario, and new sustainability trends, not from the companies demands.
- **Similarly, policy makers usually have difficulties to receive circular economy digital skills related needs directly from companies**. Policy makers that work more closely with companies, as for example IHOBE, may identify needs more easily, through direct contact during the training programs they organize, or internship programs they launch. However, VET or Higher education policy makers may have more difficulties for this identification, due to more reduced level of flexibility when developing curricula contents (ie. limited to what legislation establishes). Usually, the needs or requirements that policy makers try to address through their education and training policies and programs in the circular economy domain, come from other pressures and trends, as for instance, sustainability and environmental legislation and policies, or industry 4.0 requirements.
- **Main skills gaps** can be summarized then as these related to new circular business models and to Industry 4.0 and automatization requirements (sensors, monitoring, cloud…).

Recommendations to tackle the above Skills Gaps

In order to try to tackle the previously mentioned gaps, the following actions or recommendations would be helpful, according to the research carried out:

1. Universities, VET centres and policy makers should **prioritize the identification of digital needs**, as a whole and specially, with regard to circular economy activities. Mapping needs is essential to be aware of the current starting point, and therefore, to implement measures and actions that can tackle the identified needs.
2. **Policy makers should support higher education institutions and VET organisations** in the process of becoming digital, from a **double perspective**:
    - **Strategic** perspective, to guarantee that a clear digital transformation strategy is in place, to lead and guide the process with adequate, resources and responsibilities.

- **Operative** perspective, so that universities and VET organisations count on adapted technical resources and means, to bridge identified gaps and training needs.

3. **Updated and adapted training materials** that can bridge existing digital skills, both at general and circular economy level are needed. Universities are in need of new materials, on new contents, that may rapidly change. Research projects like ESCALATE are essential to try to address existing needs on this regard.
4. **Training materials with both a theoretical and practical approach are needed** ("dual training programs"). Practically oriented courses and "learning by doing" approaches are recommended in order to improve digital skills of professionals and companies that want to become circular, through the implementation of circular economy practices.
5. Specific **internships focused together on circular and digital skills**, **promoted by universities** would be recommended. University students participating in the internships would have the opportunity to apply acquired knowledge on real companies, supporting the transformation and digitalisation of companies' activities towards circularity. Besides, new employment opportunities would be created for young people.
6. Although Circular Economy has become a more known and widespread concept, there are still many companies that are quite far away from it, especially, the smallest ones. Therefore, **awareness raising is still needed**, so that companies can be more aware of the opportunities and benefits of the circular economy, and at the same time, of their needs, regarding knowledge and skill gaps. Knowing about own needs will make companies more proactive, in the sense that they could directly demand digital and circular economy training to universities or VET centres.
7. It would be recommended too to **create specialized networks of experts and relevant stakeholders** from the education domain and beyond, that can focus on promoting training or supportive services to bridge existing gaps and to address skills that bring together digitalisation and circular economy. Companies should be involved in these networks, to make sure that there is a real transfer between education and training entities and companies operating in the market (ie. see as an example, the Digital Skills Partnership of the Heart of the South West Local Enterprise Partnership in England, link).

Recommendations for how the Escalator Model can be improved if used again

Some recommendations to improve the Escalator Model if used again, include the following ones:

- To define a mechanism to establish a network or a collaboration scheme between the stakeholders involved ("all with all"), so experts in one specific sector can reach each other with the aim of sharing knowledge and experiences.
- To propose specific research or piloting collaborative projects on specific issues that are of interest of the involved stakeholders.
- To create social media and other communication channels to make communication among participating stakeholders easier.