

Canaries4KT: White Paper for the promotion of Blue Knowledge Transfer and Innovation in the Canary Islands

EMPORIA4KT – Empower Academia for Knowledge Transfer for Value Creation in the Atlantic Area



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Executive Summary

The Blue Economy (BE) is a highly diversified economic sector with ample growth potential across all the subsectors (port activities, tourism, biotechnology, desalination, energy, extraction of living marine resources, etc.) relevant to the Canary Islands, located as they are in the Atlantic Ocean. The island of La Palma is particularly noteworthy as a place where the BE offers a fundamental opportunity for the strategic recovery of the island, especially after the recent destruction caused by the volcanic eruption of Tajogaite in 2021.

Knowledge transfer (KT) and the commercialization of technological innovations are a key driver of long-term economic growth. It is critical to ensure that Early-Stage Technologies (ESTs), developed through academic research, reach the market. Indeed, this is the primary objective of the European project EMPORIA4KT, funded by the Interreg Atlantic program. Historically, universities and companies have operated independently and at different speeds. However, it is necessary to create scenarios in which all actors can mutually benefit through Research, Development, and Innovation (RD&I), education and training and the development of policies aligned with a more sustainable economy.

The objective of this White Paper is to analyze the innovation and KT ecosystem in the Canary Islands, identify the main existing barriers to knowledge and technology transfer in this region affecting local BE sectors and valorize a series of opportunities and best practices to solve these challenges.

At a methodological level, the White Paper gathers data gathered, on the one hand, from the results of events and co-creation activities organized within the EMPORIA4KT project for more than 150 actors of the quadruple helix in the Canary Islands (surveys, bootcamps, BE forums, mentoring program...) and, on the other hand, a desk study of various sources.

The analysis has focused on the three main areas that influence KT in the Canary Islands: collaboration between the actors of the quadruple helix, funding and financing instruments and policies, as well as the blue skills and entrepreneurial culture needed for effective KT.

In summary, the White Paper identifies opportunities for fostering a culture of collaboration among actors of the quadruple helix. This in turn entails the need to establish permanent support services for innovation, promote and facilitate connection and mobility both between islands and abroad, the need to strengthen specific calls for R&D and transfer projects within the framework of BE to promote public-private collaboration and, lastly, promote interaction and the exchange of ideas and projects between universities, companies, policy makers and the Canarian society.



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List of Acronyms

AA	Atlantic Area
CDTI	Centro para el Desarrollo Tecnológico Industrial
CETECIMA	Centro Tecnológico de Ciencias Marinas
CPI	Compra Pública de Innovación
CTA	Corporación Tecnológica de Andalucía
BE	Blue Economy
ECEA	Estrategia Canaria de Economía Azul 2021-2030
RD&I	Research, Development and Innovation
LPRC	La Palma Research Centre
PYMES	Pequeñas y Medianas Empresas
OR	Outermost Region
KT	Knowledge Transfer
EST	Early Stage Technology
TRL	Technology Readiness Level
EU	European Union

Introduction

The EMPORIA4KT Project and the Blue Economy in the European Atlantic Area

This work has been carried out within the European Project EMPORIA4KT and funded by the INTERREG Atlantic Area Program through the European Regional Development Fund (ERDF). The EMPORIA4KT project was designed to promote the **Blue Economy (BE)** in the **Atlantic Area (AA)**. Its overall objective is to enhance transnational cooperation and synergies between government, industry, academia and civil society foster innovation and competitiveness in the **BE**. It focuses on improving **knowledge transfer (KT) and innovation**, from academia to markets, to drive innovation and the application of research results. Together, government, industry, academia and civil society comprise the quadruple helix (1)

According to the European Commission, the **BE** represents all economic activities related to oceans, seas and coastal regions and covers biological and non-biological marine resources, marine renewable energy, port activities, shipbuilding, maritime transport and coastal tourism (2). Currently, **BE** sectors provide direct employment to almost 4.5 million people in Europe and continue to grow. A sustainable **BE** is essential for achieving the objectives of the European Green Deal (3) and ensuring a green and inclusive recovery from the COVID-19 pandemic. However, a transition towards a sustainable **BE** requires investing in **innovation** (especially innovative technologies) to create new business opportunities and sustainably manage ocean and marine resources, as well as improved **links and synergies between civil society, academics, businesses, public administrators**, who often have different motivations.

The transfer and commercialization of technological innovations are key drivers of long-term economic growth as these actions are important to help **Early-Stage Technologies (ESTs)**, developed through academic research, reach the market. EMPORIA4KT has therefore focused on the transfer of relevant academic knowledge. Further to this end,

over the course of EMPORIA4KT, the project acquired a **transnational perspective** of the existing mechanisms to encouragement and promote of knowledge and technology transfer in the countries forming the consortium (Portugal, Spain, France, Ireland and the United Kingdom).

Throughout the project, data has been collected on the factors **preventing innovative technologies from entering the BE and hinder the progress of knowledge transfer in the AA**. This has been carried out through several methods, including capitalization events, workshops, surveys and training programs. Most notably, the project organised **bootcamps** with actors from the quadruple helix and conducted a **mentoring program for researchers** focused on promoting the transfer of academia-developed technologies to the market.

The results obtained during the original runtime of the project were analysed in a White Paper (4) published in January 2022, the focus of which was identifying the main barriers affecting knowledge and technology transfer in the AA as a whole. Parallel to the preparation of the white paper, EMPORIA4KT held two editions of **the Blue Economy Techno-**



logy Transfer Program (5), a mentoring program for early-career researchers, in which **54 young scientists in BE-relevant sectors** participated. The programme included an initial, theoretical phase delivered via an online platform, followed by a second phase in which the participants, in groups of three, determined the best routes to market for real-world early-stage technologies while receiving support and mentorship from project partners, and academic and industrial mentors.

Extension of the Project to the Canary Islands

In January 2022, an extension of the EMPORIA4KT project through June 2023 was approved and expand the project's activities to the Canary Islands. The aim was to improve technology transfer on the islands and to support the reconstruction of the **BE on La Palma**, in the wake of the eruption of the Tajogaite volcano at the end of 2021 (6). This project extension, which included the accession of new partners and corresponding actions, activities and events focused on obtaining a view of the Canary Islands in terms of KT and technology. It also included the preparation of this new **White Paper**.

In methodological terms, this White Paper brings together a series of data sourced, on the one hand, from the results of events and **activities organized within the project** (e.g. surveys, bootcamp, **BE** forums, mentoring program...) and on the other hand from a **desk study** involving the collection of information from various sources (i.e. sectoral studies or BE political strategies from regional and national levels).

With regards to the data extraction from events and activities, in the **Bootcamp** held in La Palma on May 26th, 2022 participants conducted co-creation activities to understand the perspectives of the different actors and stakeholders relevant to the **BE** in the Canary Islands.



Working groups with actors representing the quadruple helix in the Canary Islands during the Bootcamp (La Palma, 2022).



Participants of La Palma Bootcamp (Los Cancajos, 2022).

Objective of the White Paper::

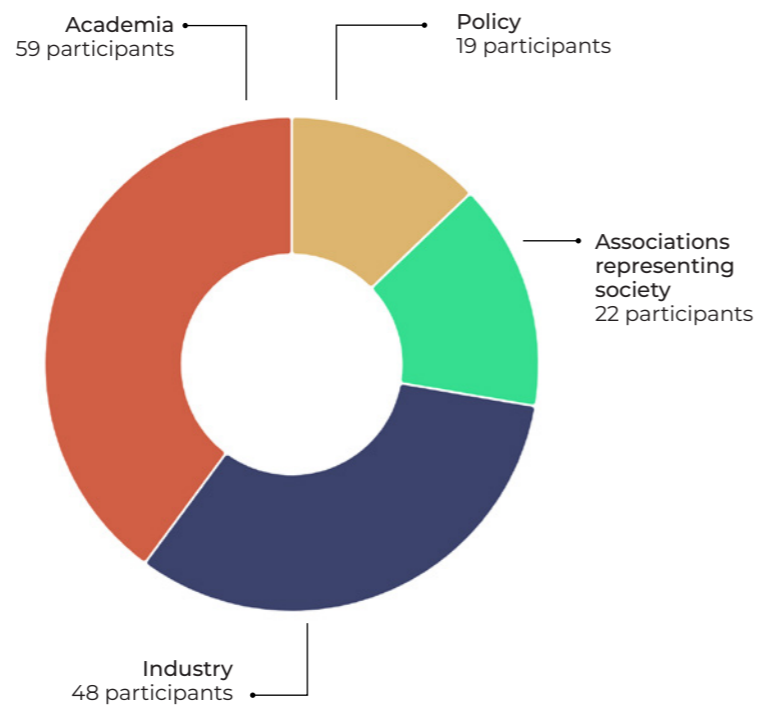
This White Paper has been developed within Emporia4KT's Work Package 8: **“Creating a positive influence on public policies of innovation and financing”** and focuses on describing the **economic and political context** of **BE** in the **Canary Islands**, identifying the **main existing barriers** in the Canary Islands for **KT** and technology in the Canary Islands that affect the local **BE** sectors and presenting a **list of opportunities and success stories** to address these gaps. The aim is for the White Paper aims to be consultative and serve as a practical tool for public administration, universities, technology centres, businesses and society in general. It is hoped that this document's guidelines and recommendations may be useful for the **promotion of innovation and the transfer of knowledge and technology in the Canary Islands** and help to promote the **competitiveness of the islands' BE sectors within the AA.**

Additionally, the results of a **survey on KT** in the **BE of the Canary Islands**, collected from key actors in the region, were analysed. Data and conclusions were also extracted from the last two **Blue Economy Forums** that took place in La Palma on December 12th, 2022 and March 15th, 2023.



Participants of the Blue Economy Forum La Palma (Port of Tazacorte, 2023).

The following **graph** shows a representation of the participants who attended the abovementioned activities organized within the framework of EMPORIA4KT on the island of La Palma between 2022 and 2023; this encompasses the Bootcamp (43 attendees) and the two forums (85 people in total), plus the surveys that garnered 20 responses from across the region. In total, it comprises 148 people belonging to the quadruple helix. The biggest groups represented were academia (40%) and industry (32%).



Representation of participants graph

It should be noted that the EMPORIA4KT team has participated in various regional and international events related to the **BE**, such as the **II International Meeting on Knowledge and Blue Economy**, InnovAzul the latter in which the project was awarded the 2022 Atlantic Project Award in the category **“Blue skills and ocean literacy”** (7, 8).

The analysis of the main barriers to KT and technology and the subsequent recommendations proposed in this White Paper are structured around three areas, allowing for a review of the current situation of transfer within the European sector and proposals for the adoption of strategic measures. The three areas are:

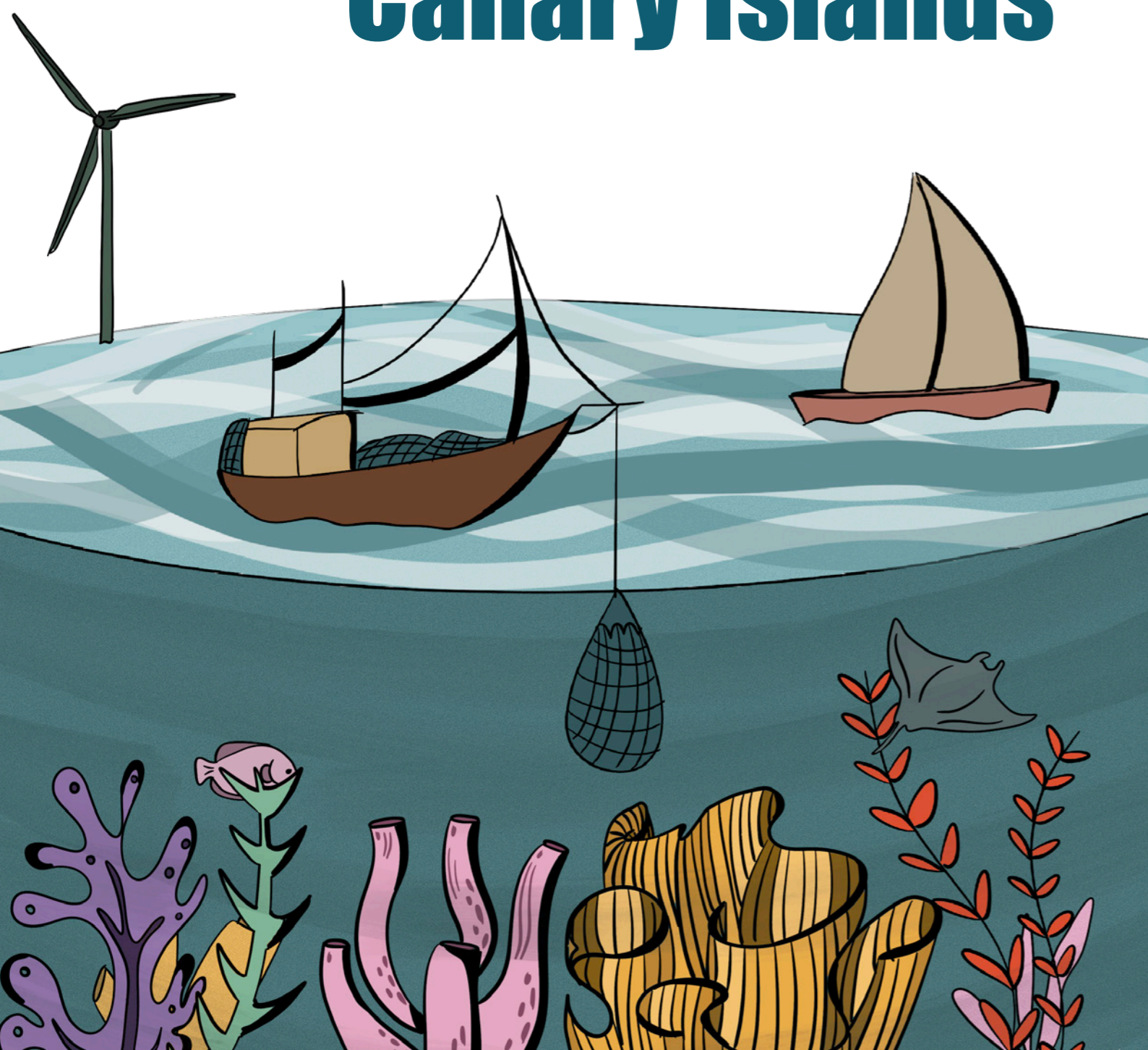
The key people for the collaboration within quadruple helix of the Canary Islands.

Policies and financing instruments that support knowledge transfer.

Blue Competencies for the **transfer of knowledge and technological entrepreneurship.**

The following chapter first outlines the geographical and socio-economic situation and context of the Canary Islands in terms of the **BE**. Next, the key elements directly influencing KT and technology are described for each of the three priority areas defined above, along with a summary of the main **barriers** and **opportunities** for KT identified in the archipelago. The final section presents a series of **success stories** and **recommendations for policy makers** on the mitigation and/or elimination of barriers, with the aim of **promoting innovation and the transfer of technology and knowledge in the BE of the Canary Islands.**

The Context of the Blue Economy in the Canary Islands



The Canary Islands, of volcanic origin and with a subtropical climate, are part of Macaronesia and are considered the **Outermost Region (OR) of the European Union** (9). They are located in the Atlantic Ocean, 100 km from the western coast of the African continent and 1,700 km from the Iberian Peninsula, the nearest coasts of the European continent, with a total coast length of approximately 1,300 km. This Mediterranean region has a great variety and abundance of marine species and is host to 24 marine **Special Areas of Conservation (SACs)**, sites of marine community importance whose corresponding conservation measures seek to halt the loss of marine biodiversity in the most threatened natural habitats in Europe, caused by the adverse impacts of human activities and climate change.



Location map of the Canary Archipelago with respect to the AA.

1. **The Guide of good practices in the SACs of the marine area of the Canary Islands** (17), prepared by the Ministry of Agriculture and Fisheries, Food and Environment (2011), compiles the knowledge and social involvement in the conservation of the SACs and offers information on the types of natural habitats and the species of community interest present in the SACs.

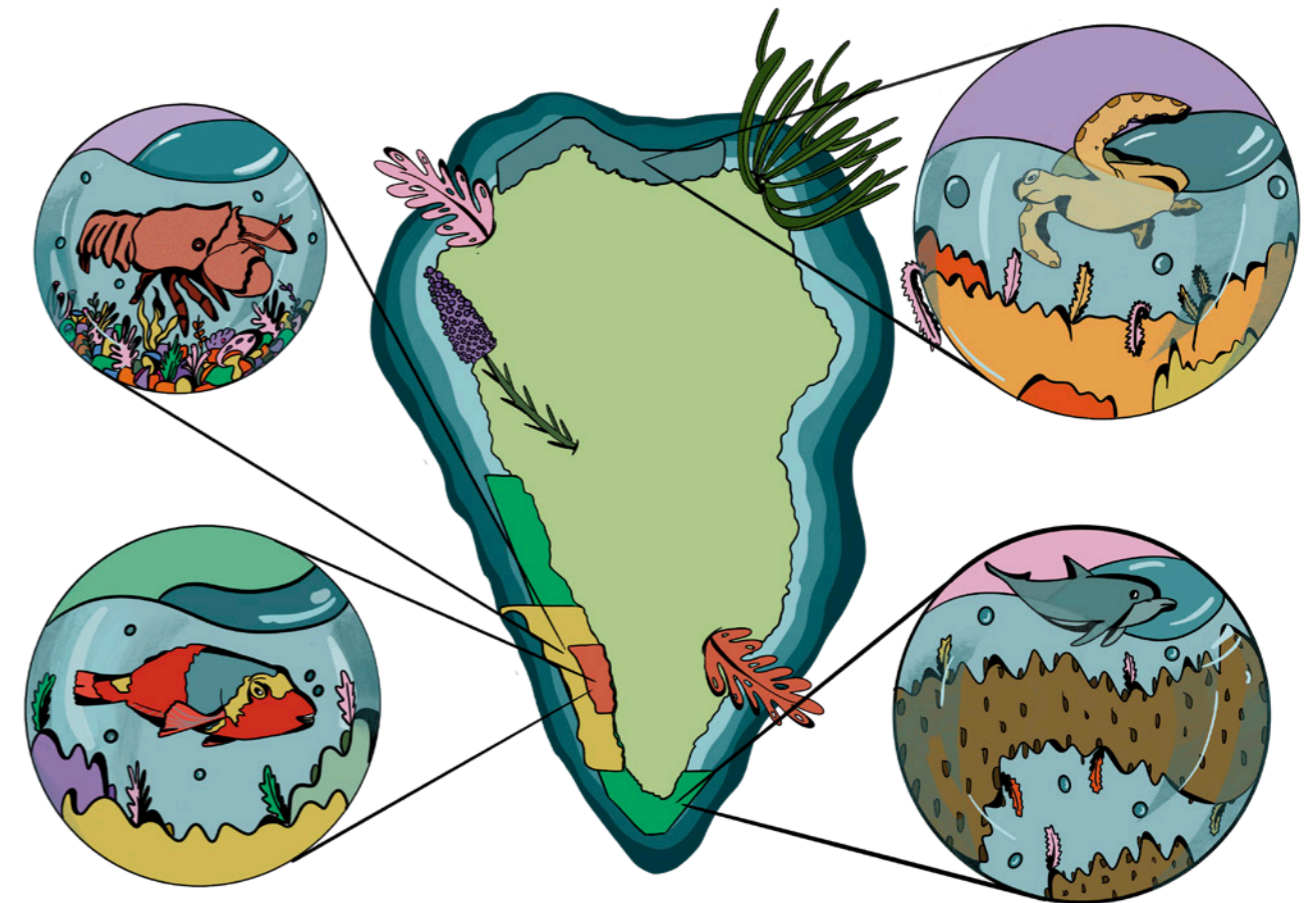
The Canary Islands are the first autonomous community of Spain that explicitly delimitates the **sea** within its borders, constituting the maritime area of the Autonomous Community of the Canary Islands as the denomination of ‘Canarian waters’ or ‘**Canarian sea**’. As established in the 2018 Statute of Autonomy: “the spatial scope of the Autonomous Community of the Canary Islands includes the Canary archipelago, integrated by the sea and the seven islands” (10). The oceanic platforms of the islands are the most productive areas of the Canarian Sea, extending up to 100-200 m deep and characterized by abrupt and narrow bottoms of enormous biological and aesthetic value due to the volcanic nature of the islands.

The island of **La Palma** is of particular note, featuring two **marine SACs**: the Fuencaliente Marine Strip (south and southwest) and the Garafia Coast (northern area) (11, 12), comprising reefs, sea caves, and a home to the loggerhead turtle (a species in danger of disappearing in Europe) and the bottlenose dolphin. The diversity of marine flora and fauna is very high, including fish species less easily observed in the other western islands of the Canary Archipelago. Similarly, the south-western coast of the island is covered by another protected marine area, the **Isla de La Palma Marine Reserve** (13) and it is also part of the **World Biosphere Reserve** (14), along with the rest of the island territory of La Palma.

The Canary Islands consist of 2 million people (15) and its **economy** is largely based on the activities of the Service Sector (75%), especially tourism, which brings 12.3 million tourists to the islands each year (16). This highlights **blue tourism** as one of the main activities of the Canary Islands’ BE and suggests there is great potential to diversify the economy with other sectors of the **BE**. Despite the benefits, opportunities and development that tourism has brought, it has also generated significant **environmental pressure** on the Canarian coast.

There are other **pressures of anthropogenic origin** (18) that come from different sectors of the **BE**, such as **fisheries pressure** on benthic ecosystems due to overfishing in Canarian waters, **marine litter** (considered a global environmental problem) together with **uncontrolled land-to-sea discharges** such as industrial effluents, brines, and wastewater, or **marine noise pollution** stemming from the intense international and inter-island maritime traffic that traverses the waters of the Canary Islands that can affect marine life.

Recognising the great ecological and economic value of the Archipelago and the need to reduce environmental pressure and promote more sustainable and inclusive development July 2021 saw the approval of the “Canarian Circular Economy Strategy 2021-2030” and the **Canary Islands Blue Economy Strategy 2021-2030 (ECEA)** (19). The ECEA includes the 2021-2023 workplan outlining the strategy for that period and defining long-term objectives targeting the year 2030, with the overall goal of achieving sustainable growth based on the opportunities of the Canary Islands’ coast and sea (20).



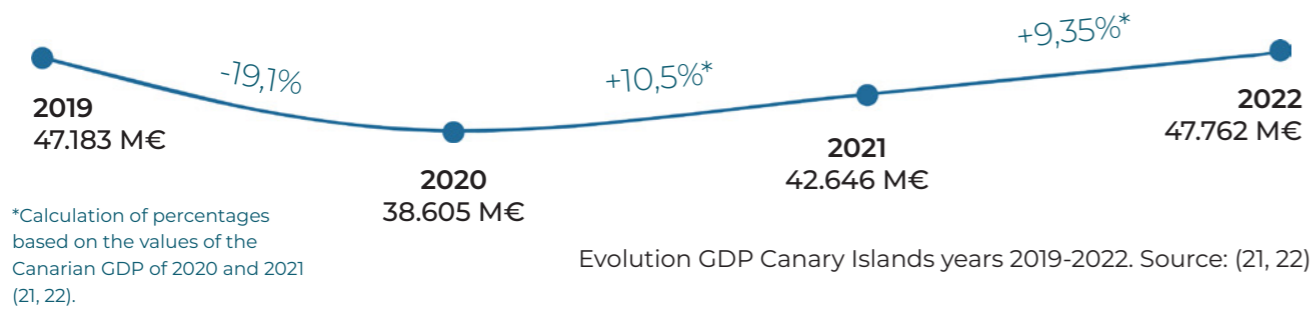
Own illustration on the marine biodiversity of the island of La Palma.

2. In 2005, the Marine Environment Protection Committee of the International Maritime Organization (IMO) designated the Canary Islands as a **Particularly Sensitive Sea Area (SSSA)**, a legal figure designed to protect their high environmental, scientific and economic values, since the islands are an obligatory passage for the great oceanic routes between Europe, Africa and Asia, as well as for ships bound for ports in Central and South America.

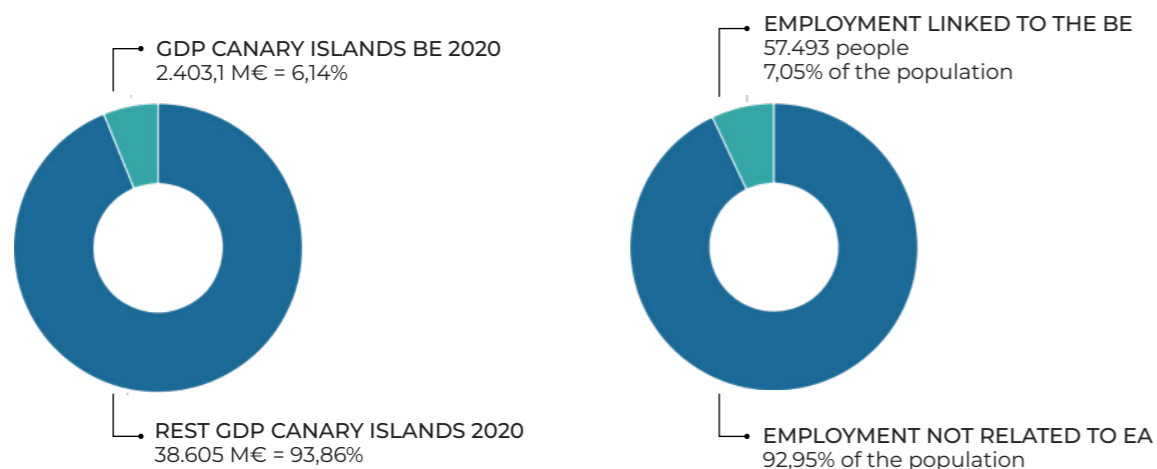
3. The “**Canarian Circular Economy Strategy 2021-2030**” is aligned with the sustainable development agenda of the Canary Islands, guided by the Smart Specialization Strategy specific to the Canary Islands and the Canarian Agenda for Sustainable Development 2030 to generate a circular socioeconomic model adapted to the factors of the outermost regions, insularity and territorial fragmentation, to reduce dependence on the outside, move towards a low-carbon society and diversify economic activity, taking advantage of the geostrategic situation of the Canary Islands as a nexus region between Europe and the central Atlantic area.

4. Strategy entrusted to the **Technological Institute of the Canary Islands (ITC)** by the Ministry of Economy, Knowledge and Employment.

According to data on the regional economy of Spain, the economy of the Canary Islands has suffered several fluctuations in the twenty-first century. As shown by in the following graph, in the last three years the **annual GDP** was severely impacted by the effects of the COVID19 **pandemic crisis**, most notably in 2020 when it decreased by 19.1% compared to 2019. In 2021, after the pandemic, the values indicate that the annual GDP rose slightly compared to 2020 and by 2022 the value was once again equivalent with pre-pandemic figures (referring to 2019). These figures place the Canarian economy 8th with respect to the whole of Spain (21, 22).



A closer examination of the regional data behind the graph showed that **BE-related activities** accounted for **6.14% of the Canarian GDP** in 2020, according to estimates by the Technological Centre for Marine Sciences (CETECIMA) (23) and employed 7.05% of the Canarian population. Thus it can be inferred that the **BE plays an important role in the regional economy** and will acquire an even greater role in accordance with future expectations.



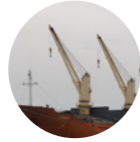

The sectors of the Blue Economy in the Canary Islands

The Canary Islands boast a **marine-maritime** area with a wide variety of activities, including **fishing, maritime transport, port activities and ship repair** and **offshore platforms** (floating or fixed to the sea floor), each of which in turn gives rise to infrastructure and employment with further opportunities for development (20). In terms of growth sectors, the **aquaculture, cruises, nautical tourism and desalination** sectors, and additional emerging areas such as **marine renewable energies** and **marine biotechnology**, facilitate maritime security and Canarian marine knowledge and can, in turn, incentivise sustainable use of the sea, environmental protection and maritime spatial planning (23).





According to the definition and methodology applied by the EU, the definition of **BE** in the Canary Islands includes the sectoral disaggregation that is included in the ECEA. There are six sectoral groupings with varying degrees of implementation, in addition to thirteen BE sectors with their own activities, such as **environmental and coastal protection** or **resource extraction** (minerals and sea salt) (20). This White Paper focuses on the ten main sectors collected from **CETECIMA's Blue Economy Activity Report in the Canary Islands 2021**, which represent the following approximate values for the **BE** in the regional economy of the Canary Islands (23):

PRIMARY SECTOR		G	D	P	EMPLOYMENT	
		VALUE	%	VALUE	%	





Thousands of €

FISHING		39.852	0,01	1.440	0,18	
AQUACULTURE		75.494	0,19	998	0,12	

SECONDARY SECTOR

SHIP REPAIR AND OFFSHORE PLATFORMS		397.068	1,01	10.120	1,24	
DESALINATION		n/d	n/d	n/d	n/d	
MARINE BIOTECHNOLOGY						
MARINE RENEWABLE ENERGIES						

TERTIARY SECTOR

HARBOURS		1.256.987	3,21	23.200	2,84	
SHIPPING		158.910	0,41	4.320	0,53	
CRUISES		61.457	0,16	2.158	0,26	
MARINE TOURISM		413.375	1,06	15.257	1,87	

TOTAL BLUE ECONOMY	G	D	P	EMPLOYMENT	
	VALUE	%	VALUE	%	

Thousands of €

TOTAL BLUE ECONOMY

2.403.145 6,14 57.493 7,05

Value of the blue economy in the regional economy of the Canary Islands, broken down by sector. Source: (23)

As can be seen in the table, the Tertiary Sector features the highest employment and GDP connected to the **BE**, followed by the Secondary Sector.

Clearly, the **BE** is a concept of huge relevance to the Canary Islands. The Blue Book of the European Maritime Policy (24) notes that “islands suffer considerable economic disadvantages, but have a high potential as regards maritime activities and marine research”. In fact, it maintains that “these large maritime areas provide ecosystem services of considerable interest to the Union”, so it is committed both to “the exploitation of its maritime potential and its cooperation with regional neighbours”.

The island of **La Palma** deserves special mention, as the recent destruction wrought by the eruption of Tajogaite in 2021 spotlights the need for urgent recovery on an island where **BE** sectors can assume great importance for the local economy, as well as presenting an opportunity to strategically reinvent the region. The report The Ocean Economy in 2030, published by the OECD (Organisation for Economic Co-operation and Development) (25), makes it clear that the **BE** can be the path to economic development in the coming decades, but this requires **encouraging scientific research, the development of new technologies and training.**

The economic activities related to the sea in the Canary Islands are driven by several common elements (23). These activities are developed in very competitive international markets, within a common legal framework and must consider the conservation of the marine environment. Activities are negatively conditioned by dependence on fuel prices, the use of high-cost, long-life assets, as well as the lack of specific support systems for entrepreneurship in the maritime sector that are found in other sectors. On the other hand, they benefit from positive conditioning of the **growth potential** and the **high multiplier effect.**

Key elements influencing Knowledge Transfer in the Canary Islands

As previously discussed, the EMPORIA4KT project analysed the current situation of the **Canary Islands** in terms of **knowledge and technology transfer** in the **BE** sectors across three areas: the **key actors of the quadruple helix**, **policies and financing mechanisms to support KT**, and **skills for KT (blue competencies) and technological entrepreneurship**.

The Canary Islands context for each of these areas is described below, including the **main barriers identified** for transfer and a series of **opportunities, recommendations and success stories** developed by the EMPORIA4KT consortium for barrier mitigation or elimination.

The key actors of the quadruple helix in the Canary Islands

The creation of synergies between the different actors and sectors of the **BE** is one of the pillars for **Blue Growth**. Collaboration between quadruple helix actors fosters shared knowledge and opportunities and enables economies of scale. The design of tools for collaboration within the quadruple helix must foster cooperation between blue industries, those generating knowledge and Canarian society. In fact, the ECEA states that “the **quadruple helix model offers multiple advantages for the creation of new knowledge, innovation and good practices in the region**”.

Within the business ecosystem, the **Canarian industry** is mainly made up of SMEs and microenterprises, which makes it difficult to carry out large RD&I projects. For this reason, the small size of the Canarian market and territorial fragmentation have been identified as the cause of the gaps in KT. This is compounded by, among other things, low financial capacity, the reluctance of entrepreneurs to cooperate, the deficit of relational capital and the lack of an entrepreneurial culture and innovation (20).

KEY ELEMENTS INFLUENCING KNOWLEDGE TRANSFER IN THE CANARY ISLANDS

In terms of knowledge generation, the Canary Islands is one of the three Spanish autonomous communities that allocates the fewest economic resources to research and development, both in absolute terms and in relation to its regional GDP⁵(21, 22). Even so, the Canary Islands features multiple RD&I centres with extensive experience in several fields of study related to the **BE**. Therefore, one of the main challenges is to take advantage of the knowledge generated in these RD&I centres by identifying lines of research directly applicable to the **BE** sectors and promoting their transfer to the market.

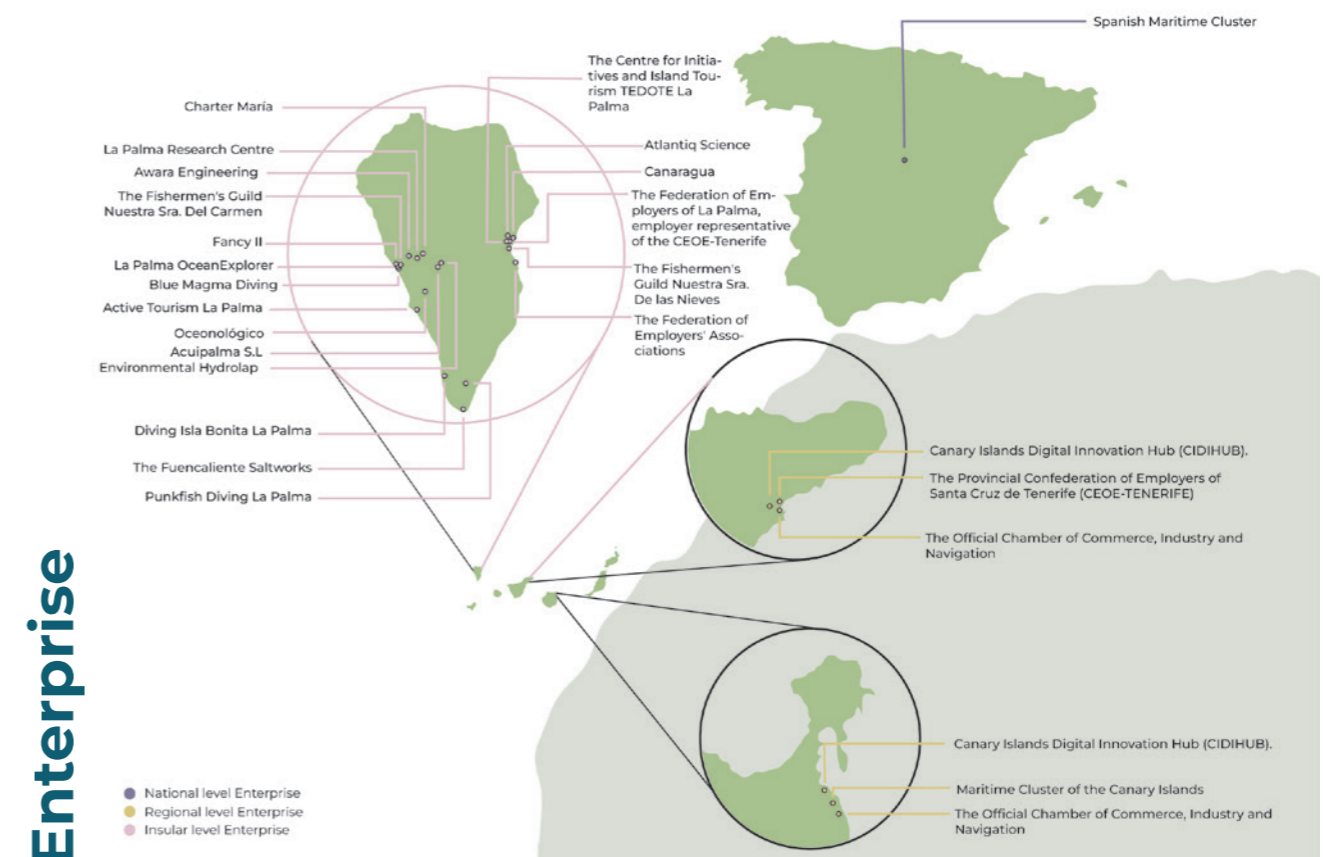
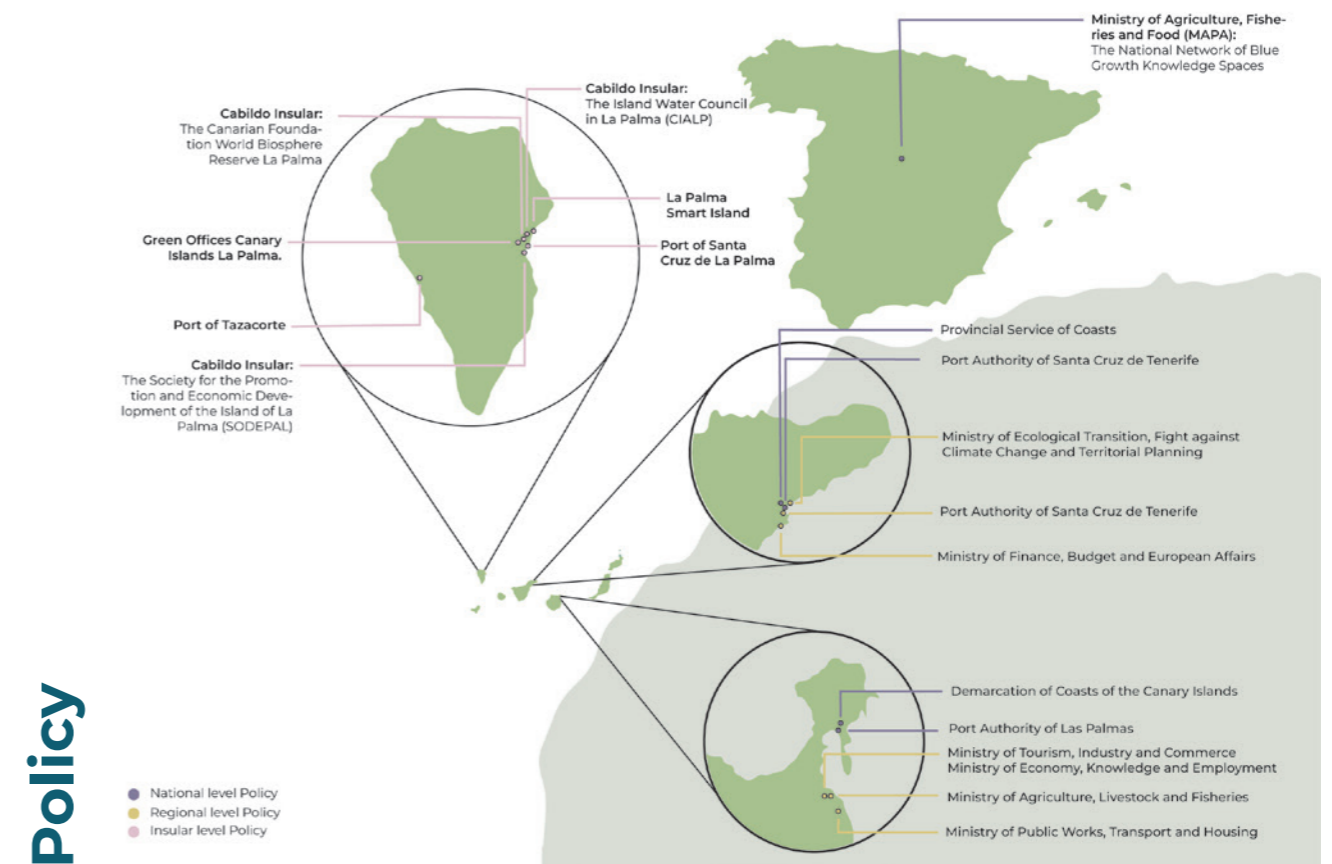
The successful management of the collaborative environment and efficient transfer is highly dependent on the work and profiles **of the transfer agents**. In the Canary Islands, there are many institutions, programs and companies within the quadruple helix that offer KT services, as will be outlined in the next section.

The following lists include a (non-exhaustive) guide to the actors of the **quadruple helix linked to the multiple sectors of the BE in the Canary Islands**, prioritizing those that have stronger connections with **KT and entrepreneurship** – key objectives of EMPORIA4KT. The ecosystem of the Canary Islands BE is, fortunately, very broad and complex and includes many more actors than those mentioned in this White Paper.

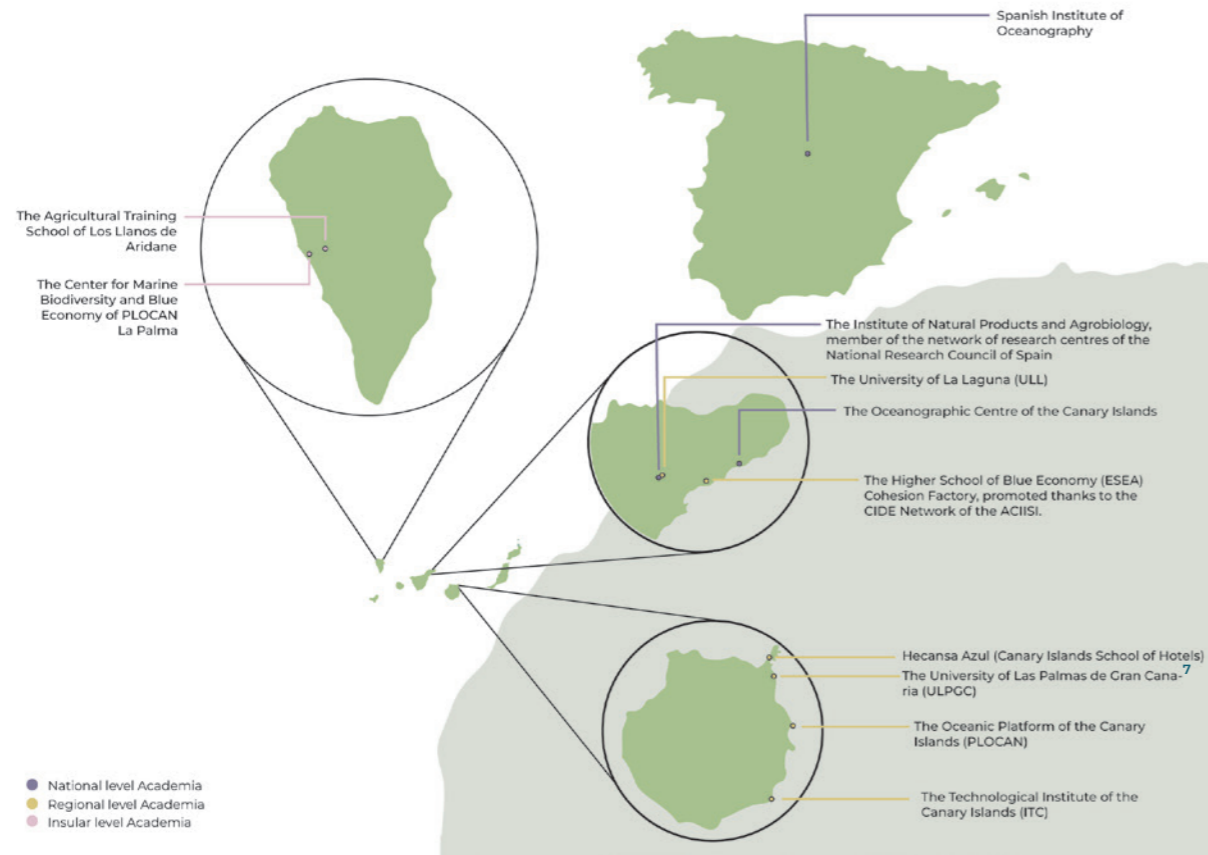
In order to identify the actors, we started from the **Map of resources to support innovative entrepreneurship⁶**, prepared by the **Canarian Network of Innovative Entrepreneurship in Blue Economy** (26, 27). This map was supplemented with other actors who have or may have a role in KT and the creation of innovative new companies within **BE**. Each **'Canarian blue actor'** is organised by **national, regional and insular** level, as well as their category within the quadruple helix. The island actors are actors from the island of La Palma.

5. **R&D expenditure as a proportion of GDP** in 2021 represents 0.56% of the GDP of the Canary Islands and 1.43% of the GDP of Spain (21, 22). In per capita terms, domestic R&D expenditure amounted to 363.66 euros per inhabitant nationwide in 2021. However, the Canary Islands recorded one of the lowest expenditures on internal R&D activities with 105.9 euros per inhabitant (21).

6. The **Map**, last updated at the end of 2021, shows 35 different entities from all over the archipelago, including RD&I agents, business support entities and resources available for entrepreneurs in the **BE** sector in the Canary Islands.



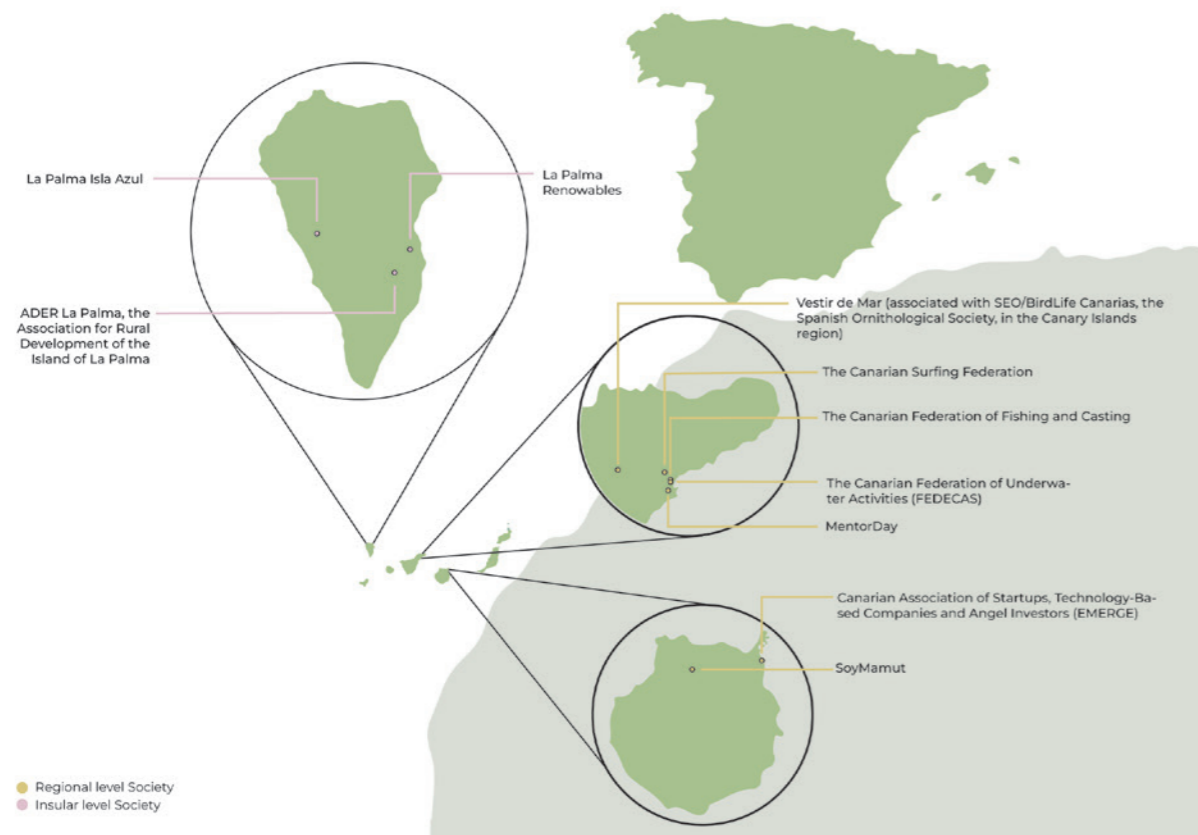
Academia



Main barriers and opportunities identified

The following pages identify the barriers, related to collaboration between actors, that slow down or hinder the transfer of knowledge and the development of joint technological projects. The opportunities generated in the region are also highlighted, as well as the examples of success stories to achieve a collaborative relationship in the Canary Islands population, linked to **BE**.

Society



7. In addition, the **ULPGC** has the University Institute of Tourism and Sustainable Economic Development (**TIDES**); University Institute for Research in Environmental Studies and Natural Resources (**i-UNAT**); University Institute of Animal Health and Food Safety (**IUSA**); University Institute of Intelligent Systems and Numerical Applications in Engineering (**SIANI**); University Institute of Cybernetic Sciences and Technologies (**IUCTC**); University Institute for Technological Development and Innovation in Communications (**IDeTIC**); University Institute of Applied Microelectronics (**IUMA**).

B A R R I E R

Complexity of the innovation ecosystem given the wide variety of entities and sectors/subsectors in the field of BE, as well as insularity.

Limited organization and collaboration:

Difficulty in organizing and prioritizing common objectives and interests among agents of the quadruple helix, which hinders effective collaboration.

Lack of capacity for collaborative and coordinated work between entities

Nature of being an Island OR:

Dependence on external agents and mechanisms that facilitate the exchange between the different agents, accentuated especially by the condition of ORs (extra transport costs, infrastructures, raw materials, etc.).

The insularity and condition of ORs can lead to isolating situations in geographical and socioeconomic terms.

Maritime planning and disconnection:

Lack of spatial maritime planning for the geographical areas in which each sector must be developed, generating greater disconnection between the sectors.

The disaggregation of competences is an obstacle to the evolution and growth of the maritime economy.

Disconnects and lack of awareness between agencies regarding growth potentials of different areas, in addition to excessive bureaucracy in marine and maritime activities.

Related success stories: Cooperation in Macaronesia and the ORs

There are multiple cooperation projects between the Azores, Cape Verde, the Canary Islands and Madeira, such as the **Oceanlit** Project, **SMART BLUE** or the **Integra** Project, within the INTERREG MAC 2014-2020 funding program (29, 30, 31); or the recently created **Canarian Association for the Progress of Macaronesia**. As an example of a cooperation project between the ORs of the EU is **FORWARD**, funded by the European HORIZON 2020 program (32).

O P P O R T U N I T Y

The multisectoriality is due to the transversal nature of the BE, which brings together a wide variety of entities and activities that enrich the development of the regional economy, thanks to its geographical conditions.

Collaborative relationship:

Promote KT through the collaborative relationship between actors of the quadruple helix to build a successful social, productive and environmental fabric.

Identifying similar objectives and compatibility between sectors and agents provides greater opportunity for collaboration and facilitates work.

Cooperation between the ORs and Macaronesia

Strengthen relations between the archipelagos of the Macaronesian region and the ORs, which have similar island particularities.

Advantageous geographical location between the major transcontinental maritime routes, with significant wealth and diversity of infrastructures, natural resources and trades related to the sea.

Take advantage of the economic and fiscal regime to boost economic activity in the islands (tax differential, investment incentives, free zones, Canary Islands Special Zone, aid for domestic production, etc.).

Synergy:

Consolidated institutions and instruments to serve as a point of support for intersectoral cooperation.

Participation by Canarian entities in BE projects that provide added value, diversification and competitiveness and reinforce sectoral and spatial complementarities.

Deep experience and familiar traditions of Canarians in general, a flexible maritime industry brought together with a strengthened network of port and scientific infrastructures and greater commercialization.

Potential in the development of new management techniques that reinforce the implementation of ECEA in policy, unifying standards and regulations, in addition to strengthening the regulatory framework.



B A R R I E R

Lack of alignment between the demand of industry and the technology focus of RD&I centres and between the public-private sector.

Unawareness of emerging technologies and real-world needs:

Industry is overlooking emerging technologies from the research sector and lacks awareness of the research results that are close to market.

Academia/research centres lack knowledge about the real-world needs of industry actors and market drivers.

Need for specific programs that promote KT and technology.

Visibility of new initiatives:

Low visibility of new business initiatives and their technological demands, which limits cooperation in funding calls.

Little digitalization and lack of agility in administrative information flows.

Related success stories: **ConneCTA**

The **Spanish** Open Innovation Platform, **conneCTA**(33), is an Open Innovation tool to find strategic allies in RD&I. It is a meeting point for all innovation generators from any field (industry, academia, society) where they can offer and learn about emerging technologies and demands. Its objective is to promote technology transfer, expanding the capabilities and ensuring results of the RD&I activity are beneficial and support profitable collaboration opportunities for all parties.

O P P O R T U N I T Y

The effective incorporation of knowledge into the production sector is one of the priorities for innovation in policies related to KT and technology.

Development of new technological tools:

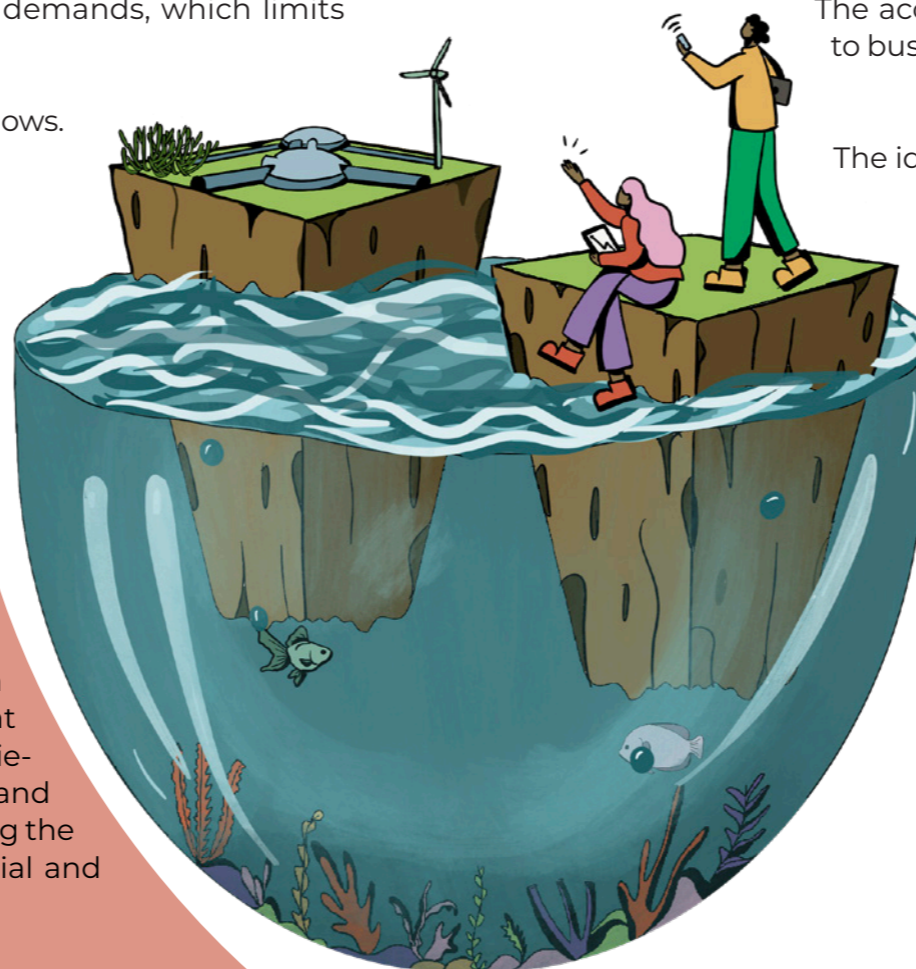
The search for common objectives and transfer opportunities is facilitated through the implementation of technological tools that can help manage the relationship between the public-private sector and the academia-industry relationship.

The creation and automation of databases has allowed better information management, offering a more efficient analysis of available supply and demand and providing compatible (FAIR) information search methods.

Identification of market needs:

The accumulation of skills and expertise among diverse actors, in relation to business development, market vision, knowledge exchange, persuasion and competitiveness, enhances the relationship between them.

The identification of the needs of companies increases shared knowledge and capacity to respond to challenges addressed by policies.



B A R R I E R

Poor connection and collaborative culture between the private sector and academia/research centres.

Lack of trust between actors:

Lack of communication, understanding, and organization together with the absence of a space to facilitate collaboration, visibility and KT generates a lack of trust between the different actors.

Lack of infrastructure and common spaces for innovation where the agents of the quadruple helix could intersect.

Resistance to cooperation:

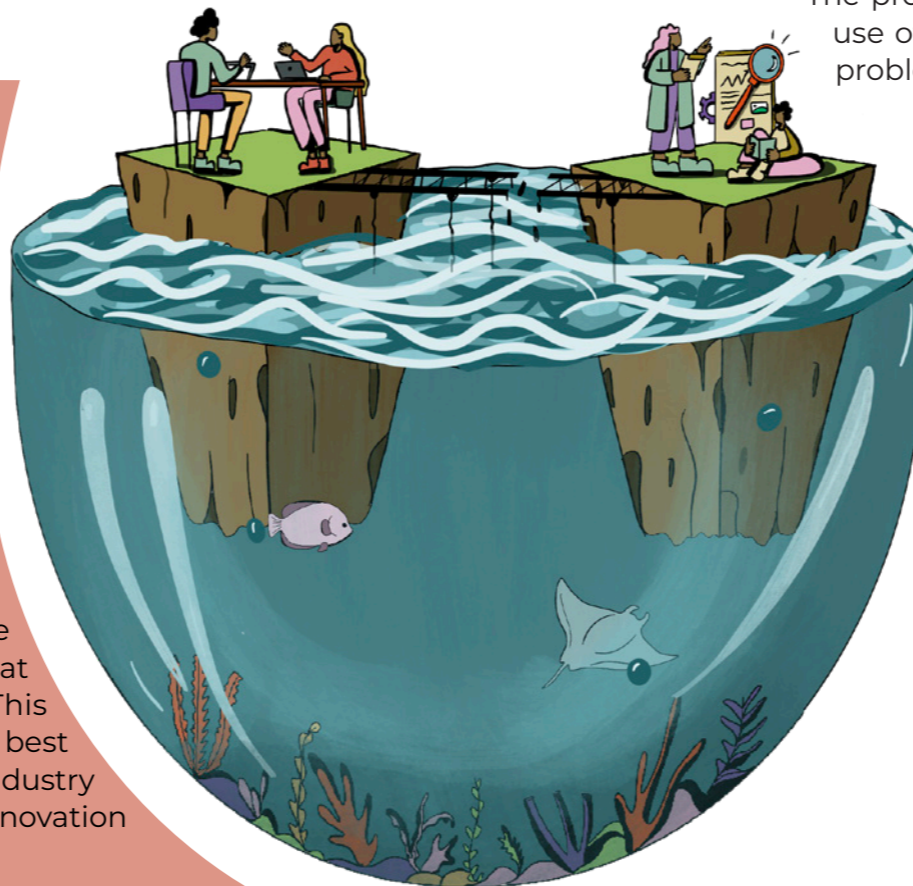
There is general resistance of researchers to interact with the private sector due to lack of trust or ignorance of the processes necessary for transfer, limiting communication and awareness of the needs and demands of industry.

Absence of a merit system and academic incentives that would encourage cooperation between public research centres and the private sector.

Related success stories: Spaces for collaboration and knowledge:

Through an open innovation platform (as seen in the previous example) (33), events and workshops (“**An entrepreneur in a laboratory**”) (34), or specific programs (such as **ITC’s Demola Canarias**) (35, 36), where the main objective is to exchange needs, ideas and knowledge, in order to move towards commercialization through collaboration.

InnovAzul, II International Meeting on Knowledge and Blue Economy, held in Cádiz (2022), is a meeting space for companies, research institutions, public policy makers and universities related to the traditional and emerging strategic sectors of **BE** to provide industry and society with innovative technologies and solutions that increase the competitiveness and economy of the regions (7). This international meeting promotes networking and the exchange of best practices in transformative innovation policies and helps align the industry and research sector, as well as define a new roadmap for the **BE** innovation ecosystem.



O P P O R T U N I T Y

The KT process between universities and companies is strengthened through spaces for collaboration and knowledge.

New knowledge spaces:

Promotion of platforms and knowledge spaces that enhance communication.

Cooperation between the public research sector and the private sector is the ultimate goal of any KT and technology process.

Collaborative culture:

The creation of “innovation managers” helps to direct and manage the promotion of joint projects, clarifying and simplifying roles. This also further empowers active Canarian actors with a predisposition to collaborate and fosters profitable relationships for academia/research centres and companies via productive results.

The promotion of open innovation initiatives, where entities promote the use of their RD&I processes to researchers in order to address a certain problem or technological challenge and encourage a collaborative culture and approach to island universities and companies.

Stable funding for technological research and access to research infrastructures, testing and demonstration of technologies, which cover the needs of researchers and research groups, promote RD&I and help achieve higher qualifications and capabilities.

B A R R I E R

Ineffective mechanisms for transfer and excessive bureaucracy.

Shortage of human and financial resources:

High number of interface entities (transfer offices, clusters, technology centres, etc.) duplicated roles and a lack of coordination and synergy between the different actors.

Scarce human and financial resources devoted to the management and communication instruments of interface entities, which hinders cooperation and transfer.

Bureaucratic procedures:

Excessive bureaucratic procedures hinder access to information on both technology supply/demand and financing opportunities.

Related success stories: Public-private collaboration with impact on the region

An exemplar model of multisectoral public-private collaboration is the **Corporación Tecnológica de Andalucía (CTA)**, which includes all the actors of the quadruple helix within its governance structure and maintains a focus on the promotion and private financing of RD&I and KT activities. This has proven to be a success story for the realization of projects, innovative products and services, as well as the internationalisation of micro, small and medium-sized enterprises, and has achieved measurable regional developmental impact at the socio-economic level through positive growth in GDP, employment and tax revenue (37).

A successful Canarian example is the **Canary Islands Maritime Cluster**, an important point of support for intersectoral cooperation due to its positioning as the focal point for dialogue and meetings of all the regional actors involved in maritime activities and the **BE**.

O P P O R T U N I T Y

Clusters and coordinated work between entities facilitate KT.

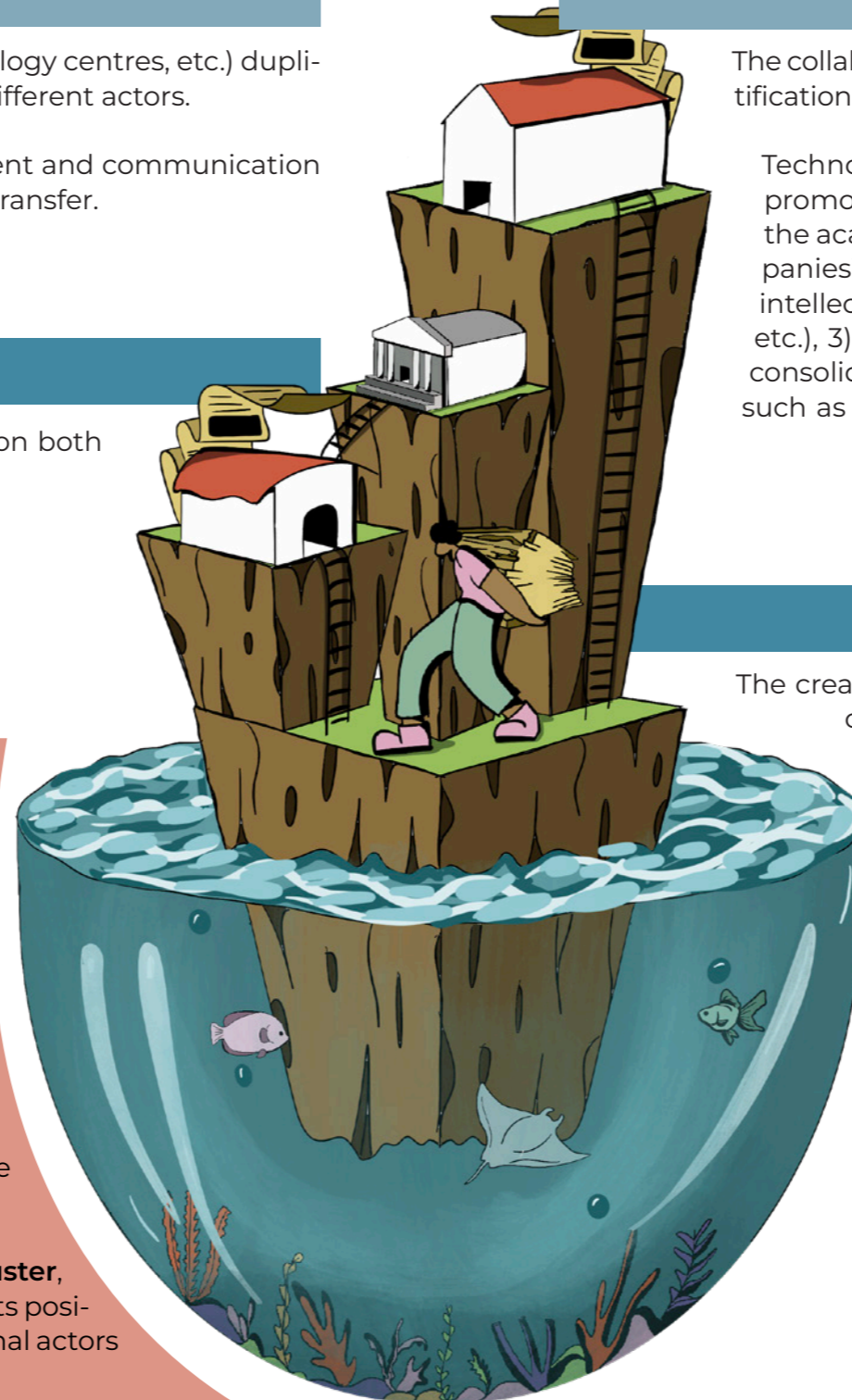
Technological cooperation and attraction of new investments:

The collaborative and coordinated work between entities allows a greater identification of actual industry needs and better promotion of knowledge transfer.

Technological cooperation and the attraction of strategic investments is promoted by recognising the needs of quadruple helix actors: 1) through the academic study of the environment and situation of **BE** and **KT** 2) companies' institutional knowledge (market knowledge, contacts in industry, intellectual protection services, interpretation of policies and bureaucracy, etc.), 3) the expertise of the Canarian population and associations, 4) the consolidation of policy instruments (integrated maritime policy, strategies such as the ECEA, sectoral and transversal policies, transnational territorial cooperation, smart specialization of the Canary Islands RIS3).

Public-private clusters as facilitators:

The creation of public-private clusters has proven to be a successful means of promoting **KT**, as well as facilitating and reducing bureaucracy in RD&I activities between different sectors and actors.



Financial policies and instruments

The **BE** in the Canary Islands is seen as a necessary pillar for boosting economic competitiveness and resilience in the region. On this basis, it is necessary to develop a political and financial ecosystem in the **BE** that encourages the transfer of knowledge and technology from academia to the market and provides corresponding benefits to society as a whole via economic development of the Canary Islands region.

To achieve the desired effect of the proposed strategic level initiatives in the ECEA, the Government of the Canary Islands needs **its own financial resources**, as well as to maximise the return on **external financing sources** aligned with the priorities and objectives of the proposed actions. These should promote entrepreneurship, synergies between the different actors and subsectors of **BE** and respond to the needs of the market and Canarian society. Normally, external funding is granted in the form of a grant, loan or a combination of the two and is usually conducted through competitive calls and conditional to the fulfilment of specifically defined requirements and targets (objectives, thematic priorities, schedule, bankable budget, type of beneficiary, type and intensity of financing, etc.).

As identified by the EMPORIA4KT project, the issue of access to public and private financing is transnational and in this the Canary Islands is no exception. The preparation of this White Paper involved a review of the policies and **public financing instruments at the European, national and regional level**, which entities of the Canary Islands are able to access through public-private collaboration for support and promotion of their RD&I and KT projects. Likewise, sources of **private financing** aimed at promoting new business initiatives in the region have been identified and collected. The challenges and opportunities linked to the policy and financing instruments are set out at the end of this section.

Public Funding

To expand the identification of public financing programs:

At the national level, the Spanish Government's MAPA provides the **"Map of blue financing aid"** tool – a hub for consulting updated calls for support in the financing of projects related to Blue Growth, at the international, national and regional levels (38).

At the regional level, the **CIDE Network** hosts a repository of aid for RD&I in the Canary Islands region for consultation (39), as well as an updated list of calls for support in the fields of innovation and technology from the Ministry of Economy, Knowledge and Employment that can be found in the **Canarian Observatory of Telecommunications and the Information Society** (40).

There is also a **Financing Map**, carried out by **CETECIMA** within the framework of the Macaronesian SMART BLUE project, which illustrates the scope for companies and actors in the marine-maritime sector (41).

Below are some **of the public funding programs of special relevance available to Canarian actors** linked to **BE**:



Example of the implementation of a **European fund in the Canary Islands**:

The **FEMPA Action Plan for the Canary Islands ORs 2021-2027** calls for investment to make the **fisheries and aquaculture** sector more competitive, thus achieving new markets and technologies. The main planned actions and financial means of the EMFAF prioritise contributing to sustainable **BE** in coastal, island and inland areas, and to promoting the development of fishing and aquaculture communities (allocating EUR 83 million to structural support for fisheries and aquaculture in the Canary Islands) (42). These initiatives are in harmony with the Actions of **AXIS 4 – Marine environment and climate change of the ECEA 2021-2030** (20).



NATIONAL FUNDING



Programs co-financed by the **Centre for Technological Development and Innovation (CDTI-Public Business Entity)** such as:

- Research and Development Projects (PID), either for individual or cooperative actions.
- The Innovation Hotline (LIC).
- The MISIONES program.
- Innovation and investment projects through FEMPA.



The **National RD&I Plan of the Ministry of Science and Innovation (PEICTI)** of the Government of Spain.

Examples of **national funding co-financed by European funds**:



Public Procurement of Innovation (CPI), co-financed by ERDF, is an instrument to promote innovation promoted by public policy to improve public services through the incorporation of innovative goods or services (43).

Others **national initiatives**



The **Ports 4.0** capital fund is a corporate open innovation model adopted by **Puertos del Estado** and the Spanish **Port Authorities** to attract, support and facilitate the application of talent and entrepreneurship to the Spanish public and private port-logistics sector in the context of the 4th industrial revolution (44).



REGIONAL FUNDING



SODECAN with the **Canary Islands Fund Financia 1** under European co-financing of **FEDER Funds**.



The **ACIISI**



The **SPEGC**



The Public company **PROEXCA - Sociedad Canaria de Fomento**

The **Island Councils**
The **Government of the Canary Islands**

Examples of regional grants:

El Gobierno de Canarias publica:

- **Subsidies aimed at the economic reactivation of SMEs in the Canary Islands** of the Ministry of Economy, Knowledge and Employment (45).
- **Subsidies for the modernisation and diversification of the industrial sector in the Canary Islands** (46).
- **Subsidies for the regeneration and revitalization of existing industrial areas in the Canary Islands**, from the Ministry of Tourism, Industry and Commerce (47).
- **Direct grants for the allocation of resources under the Canary Islands Development Fund (FDCAN)** for the period 2021-2027 (48).
- Also noteworthy is **PEPSTARS Canarias Stars**, a grant aimed at innovation projects carried out by emerging technology-based Canarian companies (49).

Other regional initiatives:

PROEXCA, a public company attached to the Ministry of Economy, Knowledge and Employment, attracts strategic investments in the Canarian industrial landscape. It is a member of the **Enterprise Europe Network (EEN)** - Canary Islands and, for example, through the **SMART BLUE** project, has collaborated in the financing of **BlueLab**, of Factoría de Cohesion (50).

Private Funding

For private financing, several initiatives promoted by financial institutions have been identified

The **La Caixa Foundation** and the **Caja de Canarias**, with the edition of the “**Canary Islands Sustainable Economy Awards**” that recognize outstanding initiatives in the fight against climate change, the defence of biodiversity or the implementation of the circular economy within the area of the Autonomous Community of the Canary Islands (51).

The alliance between **Bankinter** and the **Canary Islands Maritime Cluster** to support business projects in the field of **BE** to face the current challenges of automation/digitalization, the emergence of new technologies and the efficient use of natural resources as a transformative and sustainable element of industry on the Canary Islands (52).

AvalCanarias SGR also stands out, a non-profit financial institution that was conceived as a mechanism to improve the position of SMEs relative to banks. This enables access to privileged financing with low interest rates and long repayment terms through the contribution of guarantees by this entity with several avenues: support for entrepreneurship, investments in equipment, start of economic activities in La Palma, etc. (53).

Other noteworthy Canarian public initiatives that attract private funding:

RECABA (Red Canaria de Business Angels), which aims to promote alternative financing in the Canary Islands, putting private investors in the Network in contact with innovative investment initiatives, constituting a commitment to the creation of wealth, employment and the promotion of the culture of entrepreneurship in the Canary Islands (54).

Archipiélago Next, the first Canarian venture capital fund born from the union of the main Canarian business groups (55).



Main identified barriers and opportunities

The main problems related to financing instruments in the Canary Islands have been distinguished, as well as opportunities for improvement and relevant success stories.

B A R R I E R

Need for initial economic capital for the development of business activities close to the market.

Easy access to market financing and pre-commercial technologies:

There is a need to rethink funding models or programs so that calls are well-oriented to social demands and the reality of the market environment.

There are few calls that finance innovative initiatives close to market (high TRLs).

The financing mechanisms of RD&I focus on new developments associated with pre-commercial levels with low TRLs, especially if they include the cooperation of research organizations.

Relevant success stories: Manufacture of innovative marine technologies at pre-commercial TRL level:

The ITC and the SPEGC, under the financing of the **Cabildo de Gran Canaria** and using the formula of the **CPI Office of the CD-TI-Public Business Entity**, launched a **Pre-commercial Public Procurement (PPP)** in 2021 of disruptive technology in the desalination sector, through the initiative '**DESAL+ Startups**'(43, 56).

This initiative, within the framework of the **DESAL+ LIVING LAB Platform**, aims to attract and generate knowledge applicable to desalination processes. The two technological challenges identified were: brine valorisation and emerging desalination technologies. The CPP is the starting point to acquire RD&I services to develop solutions of emerging technologies in desalination from a TRL4 to TRL7 level in 20 months.

Another regional example that enhances the development of **cutting-edge** technologies is the **PLOCAN** sea test space, for demonstrations and testing prototypes of marine technologies, which accelerates the development of technologies and knowledge of the marine environment in the open ocean (57).

O P P O R T U N I T Y

The promotion of pre-commercial technologies increases regional strategic competitiveness.

Commercial deployment of technologies with high TRL:

Promote the co-creation and joint design of regional/national/European programmes to ensure alignment between market needs and funding opportunities.

Therefore, calls should include funding for initiatives with higher TRLs that are lower risk but with greater applicability in the market and which stand to enhance investment in strategic activities, thus increasing regional competitiveness.

There is a growing number of new instruments aimed at the early pre-commercial stages that facilitate the development, scaling, testing and validation of new technologies close to the market, oriented towards higher TRLs (above level 6) to boost commercial deployment.



B A R R I E R

Low awareness of financing instruments and taxation of RD&I.

Information on funding sources:

Need for adequate advice on access to public and private funding sources at European, national and regional level.

Lack of knowledge about the tax incentives associated with RD&I (tax relief, Technological Patronage, etc.) as well as the instruments of Public Procurement for Innovation

Insufficient information and training in this type of RD&I instruments at the public level, which, together with legislative changes, create insecurity when attempting to incentivise companies, which leads to the outsourcing of private experts with high costs.

Related success stories: Calls that facilitate funding

The projects of the call **“Proof of concept” of the State Research Agency of Spain** are aimed at accelerating KT and results generated in research projects. It finances activities for the development, valorisation, protection, transfer and exploitation of research results and ESTs (58).

For example, the RIC, Reserve for investments in the Canary Islands of the **Tax Agency**, constitutes a tax incentive for investment in the Canary Islands which, for companies, operates on their taxable base, which can facilitate the development of strategic and innovation activities (59). The RIC can serve as support in the private sector, enabling investment in things such as port infrastructure.

Another example of a financing program for the BE is the funds of the Institute for the Diversification and Saving of Energy (IDAE) for R&D at the national and regional level, since they often collaborate to promote emerging sectors for “Ocean Energy” (60).

O P P O R T U N I T Y

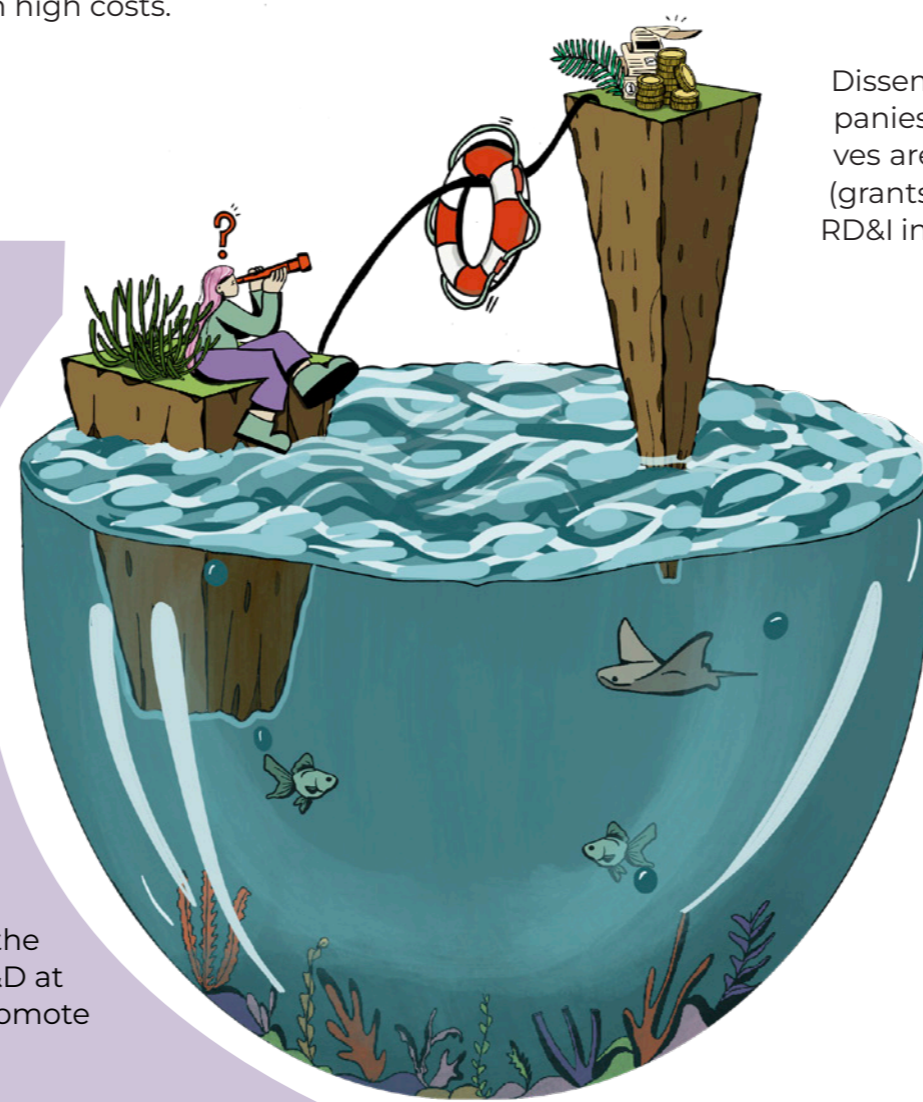
The Canarian fiscal and economic regime maximizes investments associated with RD&I.

Facilitators and tax incentive:

Take advantage of underused financing tools such as the CPI, both from the demand side, i.e., public bodies issuing tenders for innovative public procurement contracts, and from the supply side, i.e., companies, research groups, RD&I centres, etc. that compete in tenders, helping them compete, participate and present innovative offers in tendering procedures.

The Canary Islands is the Spanish region with the most beneficial tax and economic regime, which makes it an ideal territory for maximising RD&I investments by companies.

Disseminating the tax incentives associated with RD&I activities for companies poses advantages for the Canarian industry sector. These incentives are another type of aid aside from, but still compatible with financing (grants or loans). It is an incentive directly proportional to the amount of RD&I investments made by companies and is of free and direct application, without competition.



B A R R I E R

Excessive dependence on public funding. Scarce culture of financing and private investment in innovation projects.

Limited private financing opportunities:

Scarce culture of private investment in general. Private sources of financing are still considered emerging, even while it is becoming increasingly necessary to achieve this first financial seed for innovation projects.

Companies must assume a high level of risk which leads to a high dependence on public funding.

There's a need to promote a private financing ecosystem for startups and newly created companies related to BE, especially to assume the risks inherent to innovative technology projects.

Emergence of companies:

Need for specific legislation to support the creation and growth of technology companies associated with BE.

Related success stories: Business Angel networks in the Canary Islands and new market niches.

In the Canary Islands, **RECABA, the Canarian Network of Business Angels**, aims to promote alternative financing in the islands, by increasing the number of Business Angels and furthering the activity of those already existing, through the collection, analysis and informing of the entrepreneurial ecosystem (54).

RECABA trains private investors and offers advisory services to entrepreneurs of innovative projects in the Canary Islands, which has enabled the implementation of multiple projects in the Archipelago, with financing for sectors such as Information and Communication Technologies (ICT) and Renewable Energies.

O P P O R T U N I T Y

Potential in the private economic framework of the Canary Islands, promoting diversification towards new market niches.

Consolidation of Business Angels networks :

There is a growing involvement of financial institutions and networks of private investors interested in BE initiatives and projects in the Canary Islands, which enables the economic development of the region and the achievement of the objectives of the ECEA and other European strategies and agreements.

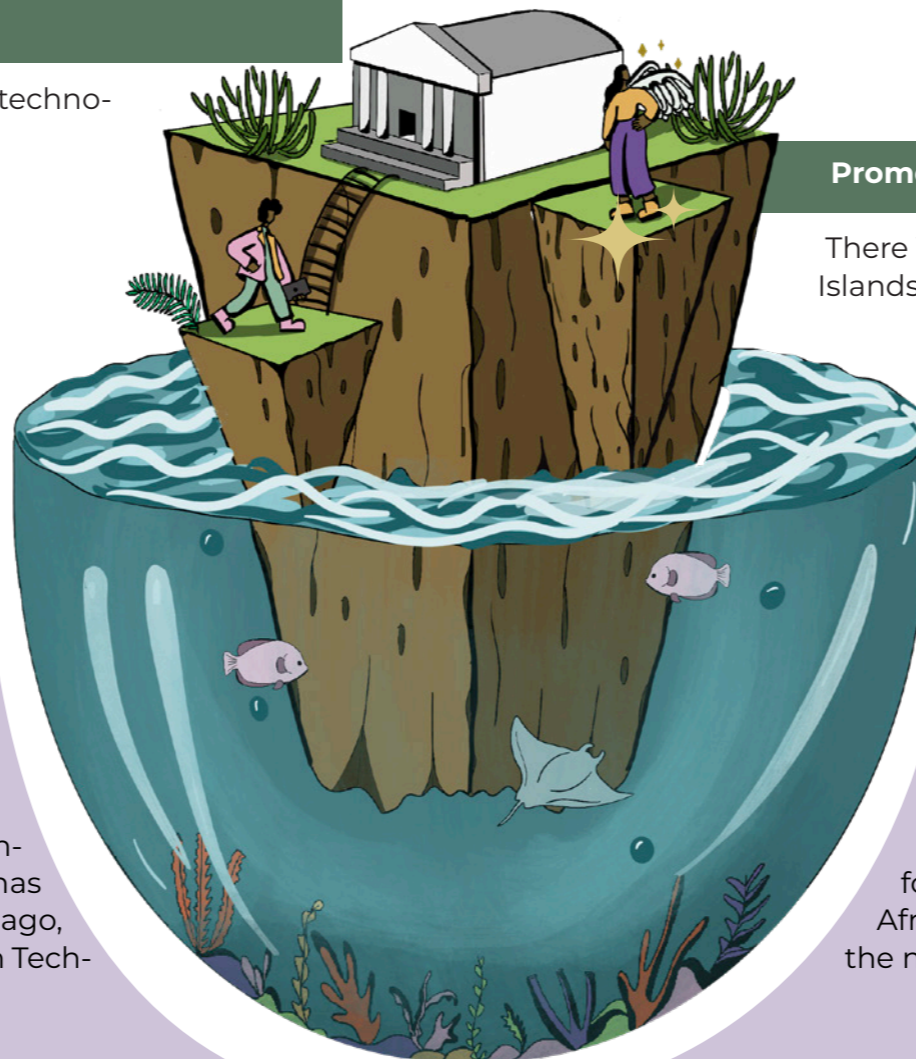
The role of "business angels" is expanded and understood to include private investment mechanisms for the support and collaboration of innovative projects and the promotion of an entrepreneurial culture focused on the exploitation of joint knowledge.

Existence of public instruments and institutions focused on supporting internationalization and attracting strategic investments with institutions such as Proexca or the promotion of similar societies of each island.

Promotion of innovation processes and generation of new companies:

There is increasing diversification towards new market niches in the Canary Islands, asserting its status as a "connecting bridge", thanks to its bilateral relations between Europe and Africa.

Regarding diversification into new market niches, the Strategy for the **Development of Relations between the Canary Islands and Africa** focuses on finding new market niches to increase their presence in African innovation networks, inviting investment and companies from the neighbouring continent to settle on the islands (63).



B A R R I E R

Intense bureaucracy and calls which diverge from the reality of industry.

Intense bureaucracy:

The current administrative procedures are not very agile, neither for the application nor the justification of aid, which limits the fluid relationship between the different actors.

Financial requirements are a barrier for start-ups.

Need for external advice to apply for funding applications given the lack of training for officials and policy actors on **BE** knowledge and cross-cutting subjects such as information technology or sectoral languages.

A complex regulatory/policy framework on the different uses of maritime space is a barrier to attracting investment.

Unattractive calls:

Calls are difficult to understand and access, highly competitive and overly homogenous.

Calls not aligned with the sectoral particularities and needs of Canarian business initiatives in **BE**

Related success stories: Funding with a 'bottom-up approach':

Cascading funding programmes (also known as third-party funding), promoted by the European Commission, aim to distribute smaller public funds more quickly. This method of financing simplifies administrative procedures for applicants, mostly SMEs and start-ups. The European Commission distributes public funds through ongoing projects in which there are collaborative procedures for designing calls together with the industry or innovation users that will benefit from these funds (61).

O P P O R T U N I T Y

Fluid collaboration between policies and companies that access funding calls

Administrative processes:

The ECEA states that one of its strategic objectives is to contribute to administrative simplification and modernization.

The objective SO1.2 of the ECEA seeks to improve the system of governance, governance structure and competences to facilitate the flexibility and administrative simplification of maritime affairs; SO1.4 aims to provide management instruments and tools to improve the planning and execution of policies promoting BE, while reducing bureaucratic administrative processes.

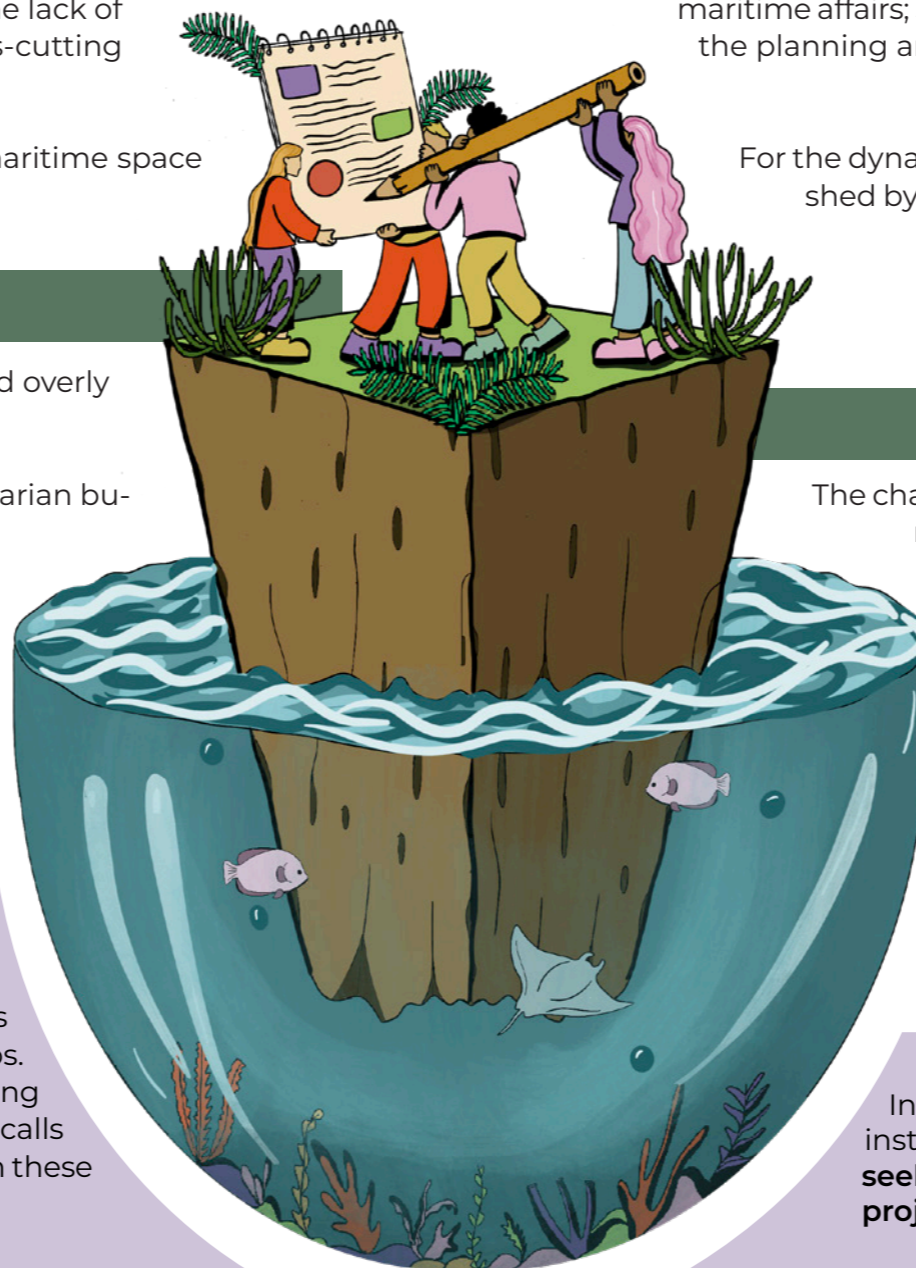
For the dynamic execution of the ECEA, a technical strategic office will be established by the appropriate ministry which will support the management team and the rest of the governance structure.

Redesign of calls:

The challenge of redesigning funding calls with a bottom-up approach, with more agile and clear application and justification procedures can be achieved through inclusive language that is more accessible to potential applicants, with resolution deadlines in line with the needs and timeframes of the market.

The creation of a one-stop shop would allow problems or questions to be solved both before and after applications are submitted and with financial requirements appropriate to the inherent situation of technology-based companies, startups, etc.

In practice, this means that applicants, mostly start-ups and SMEs, instead of going directly to the funding source (Horizon Europe) can **seek funding as third parties through an open call for an ongoing project**, managed by a more accessible local/regional/national entity.



Blue competences for knowledge transfer and entrepreneurship in the blue economy

According to the report “The EU Blue Economy 2022” (2), the **BE** sector holds great potential for growth and innovation, as well as positive social and environmental impacts. A **competitive, resilient and socially fair BE needs highly qualified and specialized professionals**. However, both in the Canary Islands and at European level, many sectors of the **BE currently have difficulty finding the right people to work on innovative technology projects**, which hinders the growth. For example, around 30% of companies in the offshore renewable energy sector say the necessary skills are not available or are in short supply.

This reality is evident in the Canary Islands, where there are **insufficient levels** of scientific-technical **specialization in maritime-marine careers**, which translates into limited employability in **BE** sectors and fewer investments. According to the **Canary Islands Maritime Cluster**, vocational training and the offer of university postgraduate courses in areas such as engineering should be reviewed and supplemented with specific content which will improve the employability of graduates from the Archipelago in the **BE** (64). For desalination, for example, there is a need for greater inclusion of sector-specific skills within the current curricula of Vocational Training (FP) and postgraduate engineering courses which feed into this field. In fact, the ECEA has eight key objectives related to the promotion of training and qualification programmes linked to the **BE**.

Examples of regional vocational training in maritime-marine fields:

Despite the limited scientific-technical specialization, new options are already beginning to be offered in the Canary Islands, such as the abovementioned recently established **Higher School of Blue Economy (ESEA), Hecansa Azul or the BE Chair of the ULL (65)**.

Undergraduate and postgraduate training in the new “university campus of La Palma”:

The Ministry of Universities announced in 2023 the creation of an **“Island university campus of La Palma”**, specialising in **BE** courses such as astronomy and volcanology (among others) as proposed by the **autonomous public universities** (ULPGC, ULL), as well as the **UNED** (National University of Distance Education) and scientific entities such as **Involcán** (Volcanological Institute of the Canary Islands), the **IAC** (Institute of Astrophysics of the Canary Islands) or the **CSIC** (Higher Center for Scientific Research). The aim of this short-term course scheme is “to help, from the training and research perspective, the reconstruction of La Palma” (66).

A training pipeline is necessary **for specialization** in key areas of the **BE**, as are mechanisms to promote the excellence of qualified human resources in companies, such as enhancing the **mobility of research staff and PhDs from academia to industry**. The training must be specialized, creating a differentiation factor that will favour employability and the creation of added value in industry, which together with the incorporation of other transversal competences and digital tools, will constitute the key elements for the improvement of competitiveness in the Canary Islands **BE** sector.

To achieve successful knowledge and technology transfer, it’s also imperative that the personnel in charge of this transfer (**transfer agents**), possess a **wide range of skills that allow them to develop the tasks in the most effective way**. However, continuous professional development is often inadequate in terms of cost and distribution, so more incentives are needed to attract talent and skills at the academic and business level, to **create and nurture a culture of collaboration and risk-taking that stimulates the entrepreneurial spirit**. For this to take place, there must be cooperation and communication between universities/academic centres and companies, built on the mutual effort of individuals from both sectors, to ensure there’s a joint understanding of the motives of all involved in the process (67).

Entrepreneurship programs in **universities as well as educational programs that encourage innovation to support entrepreneurship and startups** are still relatively new in the Canary region and is centralised around the capital islands. They range from general entrepreneurship training to advising entrepreneurs who have an initial idea or a project already underway.

Examples of regional entrepreneurship advice:

The Emprende Program, within the **University Foundation of Las Palmas (FULP)**, is based on the promotion of entrepreneurship through support and advice on the creation of innovative and knowledge-based companies, paying special attention to self-employment, social economy and collective entrepreneurship to boost local economic development (68).

The **ULL** through its **FGULL** offers free personalized advice and entrepreneurship support services for all those who want to develop business initiatives in the Canary Islands (69).

The High Technology **Incubator (IAT Marino-marítima) in Data Analytics and Artificial Intelligence** applies to the marine and maritime environment and is a centre serving entrepreneurs and SMEs that develop innovative projects in these technological fields with potential for local, national and international projection (70).

The IAT Bioasis Gran Canaria, a public incubation program that offers advice, training, technical support and access to R&D capabilities to validate, test and create new business projects throughout the value chain in the areas of **blue biotechnology and aquaculture (71)**.

The **CEOE-Tenerife** offers **advisory services for the implementation of business projects**. In April 2023 in La Palma, the employers' representative of the CEOE, **FEDEPALMA**, reactivated the project **"Vólcate con La Palma"** to strengthen the industries necessary for encouraging the economic growth of the island in response to the volcanic eruption of 2021 (72).

The **Canarian Network of Innovative Entrepreneurship in Blue Economy of Emprede Canarias**, promotes KT and the creation of new innovative companies through the concept of **'blue tutors'**, who come from RD&I or business support entities, such as SPEGC or **EMERGE**, and are available to advise innovative projects in the field (73, 74).

The main problems identified in relation to the deficit of blue skills in the Canary Islands region are summarised below, as are key needs that focus on the transformation and improvement of KT.

Main identified barriers and opportunities

Regarding the limiting factors of **KT**, three main barriers have been identified, in addition to existing opportunities and examples of success stories that allow the promotion of blue skills.

B A R R I E R

Skills gap between educational and research offerings and the needs of the labour market.

Lack of training:

A lack of specialized training for researchers in innovation management and technology commercialization strategies for existing market entry routes (licensing, collaboration, business creation...).

There is still little training in entrepreneurship, business creation and market needs for research staff.

Lack of communication between industry and academia, which means that curricula do not adapt to the changing needs of the market and society, and consequently results in scarce professional opportunities for researchers in the private sector.

The skills required for KT and ensuring the business success of BE become more complex as you progress through the development phases of the project, requiring not only specialized technical knowledge but also business knowledge.

o Financial resources, in addition to legal changes, are needed to resolve the precarious situation of many researchers, including doctoral or master's students.

Related success stories: Training of professionals in Blue Careers and management of innovation / entrepreneurship

A case study demonstrating local and university success is the **Programme for the promotion of self-employment and business initiatives "Create your innovative company in Blue Economy"**, a training, mentoring and pre-incubation programme taught at the **FCPCT** of the **ULPGC** and aimed at business initiatives in the **BE** (78). Another example is the **Chair for Young Entrepreneurs Fundación DISA-ULPGC**, which seeks to promote entrepreneurial vocations, support entrepreneurial initiatives and encourage the generation of new business projects (79).

Likewise, the role of regional technology centres such as the **ITC** is especially relevant for the training of professionals in blue fields such as with the **Marine Renewable Energy program** (2023) or the different activities, technical conferences and courses on **BE** or initiatives that promote qualified employment (such as the **Vocations Fair in the Blue Economy-FARO**) (80.81). Wi-

O P P O R T U N I T Y

Expansion and adaptation of educational offerings to the demands of the labour market, promoting investment in strategic activities, and improving regional employability.

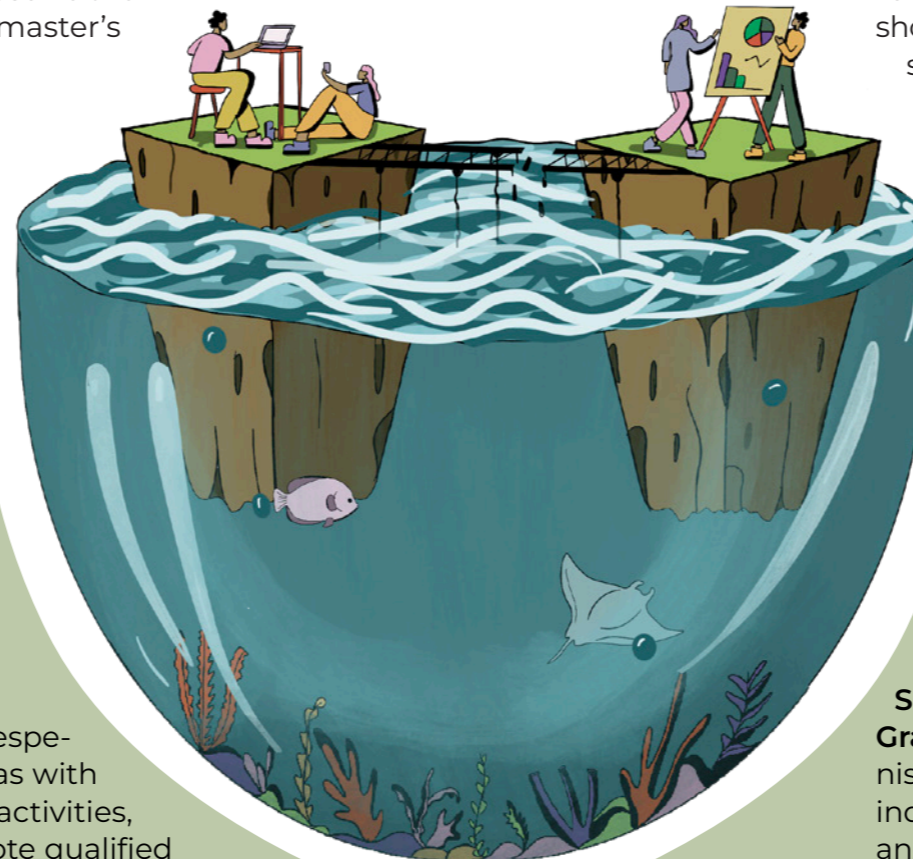
Blue careers and innovation management:

The creation of specific programs of "Blue Careers" that promote professions in maritime-marine areas, as well as the implementation of training initiatives in business innovation skills required by the BE sector, specifically in the sectors of marketing, sales, management, accounting and finance will reduce the gap between the educational and research offerings and the needs of the labour market.

Companies have a strategic and influential role in training, for example in doctoral programs they might provide experimental infrastructures in line with current business and academic interests, hiring personnel that are able to support the knowledge flow and collaboration between the actors of the quadruple helix.

It's advisable for entrepreneurs and new project managers to strengthen their entrepreneurial skills in order to grow small startups.

To establish greater synergy with the scientific sector, the Government should prioritize the financial support of entrepreneurs, start-ups, university spin-offs and business incubators linked to **BE** sectors and SMEs.



thin the **ITC**, several programs and services are also offered to support entrepreneurship, such as the **CIDE Network** or the **EEN Network** (82).

Another example is the creation of quality employment from the private sector, such as "**CALYPSO: Advanced Training and Quality Employment in Blue Tourism**", a blue tourism training program of **CARSA** (Automation and Robotics Consultants) in the Canary Islands and Andalusia, which enables the placement of unemployed people in tourism companies (83).

Additionally, the Ministry of Science and Innovation, through the **Spanish Research Agency (AEI)** offers annual calls for **Torres Quevedo Grants** and **Industrial Doctorates Grants**, which are efficient mechanisms for encouraging the movement of researchers and talent to the industry sector, and for transferring knowledge from within academia and research groups to the market (84, 85).

B A R R I E R

Low ocean literacy at both regionally and other scales.

Lack of information on the importance of seas and oceans to society:

Ocean literacy is a concept that encapsulates an understanding of the finite resources of the ocean and seas, how society influences them and how they influence society.

The scarcity of information on ocean culture is a barrier to making responsible decisions that protect the ocean and use the resources it offers in a sustainable way.

Related success stories: Tools for ocean literacy

At the European level, the European Commission's Directorate-General for Maritime Affairs and Fisheries in 2020 set up the **Ocean Literacy Coalition** (EU4Ocean) to connect diverse organisations, projects and individuals who share the common goal of contributing to the sustainable management of the oceans (86).

At the national level, the **General Secretariat of Fisheries of MAPA** each month issues a **bulletin** that covers news regarding Blue Growth, international, national, and regional updates, calls for project funding and other sections that are especially aimed at those who work in the fishing sector, aquaculture, or the processing and marketing of seafood products (87).

At the regional level, the **Ministry of Economy, Knowledge and Employment of the Government** of the Canary Islands has launched the **Canary Islands Observatory of Blue Economy**, an online tool that provides a single location for citizens and specialized actors to access existing information about the projects, events and progress made in this sector within the ECEA (88, 89).

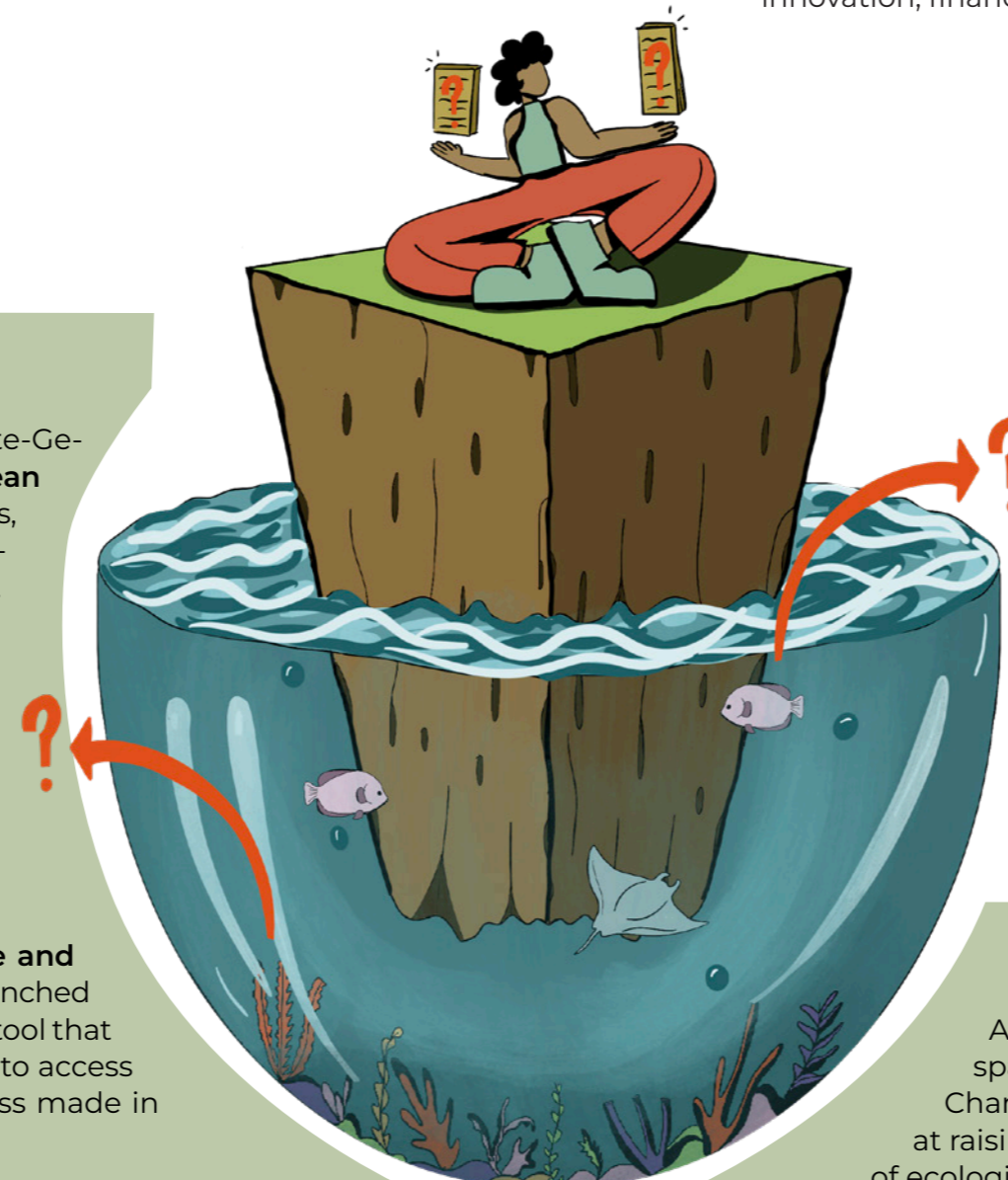
O P P O R T U N I T Y

Promote the use of informative tools available in all areas of BE.

Visibility and disclosure:

The culture of ocean literacy is promoted by highlighting **BE** projects that facilitate the exchange of knowledge and best practices among institutions and actors at the local level.

The creation of repositories or newsletters where all the resources for the promotion of innovation, financing of research and innovation, advances and technological offers, etc. are gathered.



At the island level is **Canarias Sostenible**, an informative and training space of the Ministry of Ecological Transition, Fight against Climate Change and Territorial Planning, produced by **Radio ECCA** and aimed at raising awareness among the island population about the importance of ecological transition and sustainability, with specific episodes on **BE** (90)..

B A R R I E R

Limited and fragmented entrepreneurial culture among the islands.

Territorial fragmentation and profile of actors:

The fragmentation of the territory in the region makes it difficult to create and maintain innovation support networks.

Entrepreneurial support programs are concentrated in the capital islands, which is a barrier for the rest of the islands that face higher transport and logistics costs to access these programs.

The size of entities, especially micro and medium-sized enterprises, which often lack investment in innovation, limits the competitive dynamics of the region.

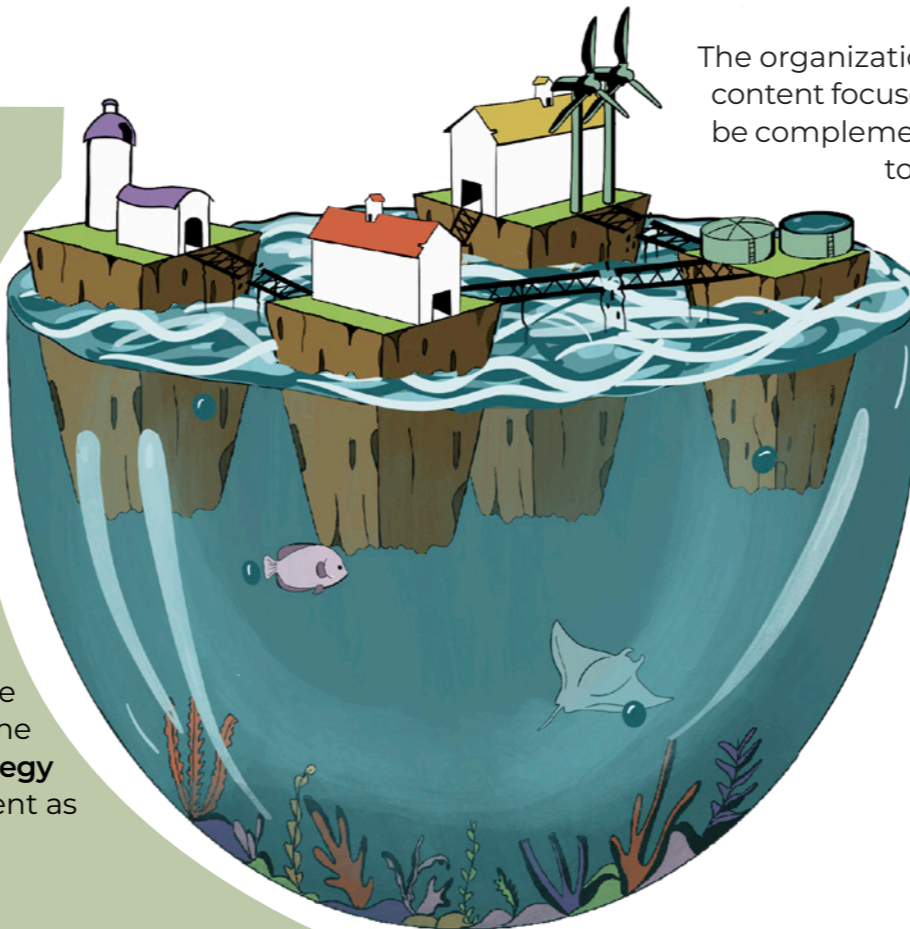
The existence of external companies that develop their products in the Canary Islands without involvement or interest in the socio-economic development of the Islands.

Related success stories: Initiatives to support entrepreneurship:

There's an initiative from Cádiz (Andalusia) called **Incubazul**, which is a project that aims to identify the best ideas regarding sustainability of the seas and accompany and develop them until they become a reality (93).

Another example is the actions of the **Canary Islands Maritime Cluster** to work as a link with policy makers to ensure innovation policies reflect the needs of the sector (94).

In addition, in the Canary Islands, **SODECAN** provides aid to promote the creation and development of innovative SMEs (95). This initiative is considered a success story to promote the transfer of research to the business world, particularly in the priority areas of the **RIS3-MAC strategy of the Canary Islands**, and the encouragement of private investment as a complement to public contributions (96).



O P P O R T U N I T Y

New business opportunities associated with the growing emergence of technology-based entrepreneurial projects

Business potential:

The mentoring, incubation and acceleration programs of technological business initiatives that are involved with BE sectors support entrepreneurship by generating new business opportunities in the region.

The growing existence of technology-based projects in the islands makes it possible to improve competitiveness in the sector through the creation of quality employment and economic development initiatives that include actions such as digital transformation, new business models, digitalization, or implementation of cutting-edge technologies in Canarian industries.

The promotion of an innovative culture requires a series of actions to define more practical and market-focused research pipelines, such as the creation or improvement of networks facilitating the flow of information and communication between islands.

The organization of innovation breakfasts, conferences, forums and meetings with content focused on the dissemination of practical examples, private clusters should be complemented by the encouraged participation of companies and researchers to identify important issues and problems that require scientific-technical support and support for their development.

B A R R I E R

Limited and fragmented entrepreneurial culture among the islands.

BlueUp, the program for startups in BE that has been carried out in different regions of Spain over five iterations, invites young people to develop innovative ideas to solve problems related to **BE** and the Sustainable Development Goals (SDGs) (97). Furthermore, the BlueUp project conducted the first and only **hackathon on BE** in the Canary Islands, **BlueLab**, which saw the participation of more than 20 young Canarian entrepreneurs from Tenerife, Gran Canaria, Lanzarote and La Palma (98).

Examples of innovative culture enhancers:

The **Caja Canaria Foundation** issues sustainable economy awards in the Canary Islands across several categories, one of which is the **Blue Economy Award**, which recognizes the initiatives of entrepreneurs in the maritime field that contribute to the fight against climate change, defend biodiversity or promote the circular economy in the region. (99).

The third edition of **the Climathon Gran Canaria** (2022), a concept proposed by EIT Climate-KIC, was organized by the SPEGC and hosted 80 Canarian participants (both students and innovation actors) who worked for 24 hours in teams to solve challenges related to the **elimination of plastics on coasts and seas** (100).

O P P O R T U N I T Y

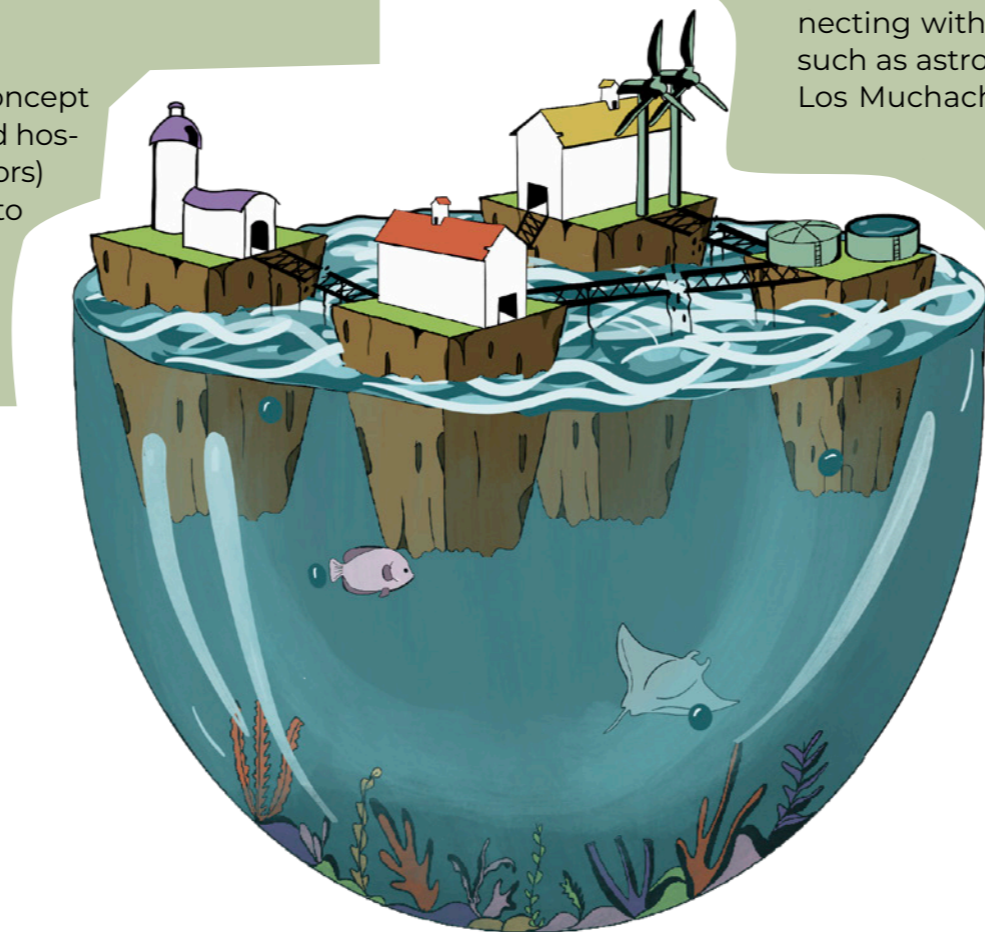
New business opportunities associated with the growing emergence of technology-based entrepreneurial projects

The **'Blue Campus'** (BC) allows students, academics and teachers to learn how to design and implement innovations and technologies using new business models based on BE. The BC offers access to cutting-edge technologies that have successfully operated at MS PORRIMA over the past decade, and demonstrates how to translate technology ideas to market (101).

The MS PORRIMA was the first ship to circumnavigate the world on solar power alone, converting wind power into baseload power and producing hydrogen from seawater with excess solar power (102).

The **first BC was held in El Hierro** in 2016, an island which has adopted the target of operating solely on renewable energies through **Corona del Viento** (103).

The **Institute of Astrophysics of the Canary Islands** is a notable example of connecting with **pre-established sectors** in La Palma, with activities for the public such as astronomical tourism hosted by observatories in La Palma (El Roque de Los Muchachos) and Tenerife (El Teide), and which can in turn, promote **blue tourism**, local RD&I and societal dissemination (104).



Conclusions

In the Canary Islands, the **BE** contributes 6.14% to the Canarian GDP in 2020 through a widely developed marine-maritime sector, with multiple economic activities directly or indirectly connected to the oceans, seas and coast. It is a highly diversified economic sector with a significant potential for growth across all its domains (energy, biotechnology, port activities, desalination, living marine resources, etc.).

The current economic and tourism model has exerted a great deal of pressure on coastal resources, necessitating a need to take planning measures as evidenced by the 'Canarian Blue Economy Strategy 2021-2030' (ECEA), which recognises the **quadruple helix model** offers many advantageous opportunities for the creation of new knowledge, innovation and best practice in the region. Of particular noteworthiness are the **BE** sectors on the island of La Palma, where the recent destruction caused by the eruption of Tajogaite in 2021 presents a need and opportunity to strategically reinvent and recover the island.

As demonstrated by the varying activities organized in La Palma within the framework of the EMPORIA4KT project, the positioning of the **BE** in Canarian society is based on the **four pillars** of the **quadruple helix**. Historically, universities and companies have operated at different speeds and independently, mainly due to divergent interests, objectives and target audiences. Understanding that knowledge is fundamental to the **sustaining the most advanced economies**. It is necessary to create scenarios in which all actors can mutually benefit through RD&I and education, while also ensuring the development of policies supporting a more sustainable economy, with the establishment of KT playing a key role, especially for accelerating the transfer of **ESTs** to market.

Therefore, this White Paper has focused on three main areas that influence KT and **BE** entrepreneurship in the Canary Islands: **Quadruple helix actors who act as an interface, financing policies and the blue skills and entrepreneurial culture necessary for effective** knowledge transfer. For each of these areas, this paper has identified major barriers preventing the efficient transfer of knowledge and has suggested certain opportunities, based on defined best practices, that can serve as a guide to overcoming these obstacles.

Regarding the actors who serve as interfaces in the quadruple helix, the majority of **entities** with links to KT and **BE** entrepreneurship in the Canary Islands have been identified. The industrial pillar covers the largest number of sectors in general, both in La Palma and in the rest of the islands, and is comprised largely of traditional small companies, mainly made up of fishermen's guilds, artisanal salt flats, diving companies and marine animal watching, most linked to blue tourism.



The complexity of the innovation framework in the diverse areas of the **BE**, as well as the great variety and number of agents involved, makes it difficult to coordinate and align approaches towards a common goal. To this end, it is essential to **use tools and databases** designed specifically to give visibility and connect technological supply with demand, facilitating intersectoral communication and positioning of the various regional **BE** actors. Likewise, the nature of the **fragmented territory** makes it even more difficult and costly for actors to collaborate in transfer projects between islands or outside the archipelago. Despite this, the archipelago is **strengthening inter-island relations and relations with the rest of the Macaronesian archipelagos and the ORs**, which share the unique island particularities related to the sea and the **BE**.

One of the widespread challenges observed in the deployment of activities in the marine environment is related to the difficulty of developing activities, both on an experimental scale and at the commercial level. In some cases, this is a consequence of a lack of maritime spatial planning while in other cases this arises from a **lack of collaboration between quadruple helix actors**.

The described opportunities for addressing the identified barriers are mainly aimed at strengthening **public-private cluster** initiatives that promote innovation activities, contribute to **improving communication and foster a collaborative culture** between different agents through events, forums or tools that serve to share information and reduce the bureaucratic burden. The usefulness of Open Innovation initiatives is highlighted, where entities can promote solutions to technological problems or challenges through internal or external ideas, thus advancing the knowledge and moving towards the commercialization of new products.

Regarding **financing**, a large portion of the growth potential of the **BE** sector in the Canary Islands involves improving the competitiveness of companies and the industry sector through innovation and transfer, as well as by improving efficiency in services. This will necessitate a **public financing policy** and a **legislative framework** aimed at promoting the creation and growth of value-added business initiatives and taking advantage of the knowledge generated in the archipelago's existing RD&I centres with research pipelines relevant to the **BE**, as well as the use of mechanisms for incorporating innovation, such as **the CPI**, by the Canarian policy makers with competences in **BE** where participation is still limited and below other Spanish regions.

Opportunities in this area are related to the redesign and/or co-creation of new programs and public **calls** aimed at the financial support of specific sectors, with reduced bureaucratic burden, and aligned with the needs and reality of the Canarian business ecosystem (for example, through cascade financing programs), which incorporate the movement of

knowledge and technology from academia to the market across all phases of technological maturity, from basic to pre-commercial research. At the same time, **agile transfer and communication tools and mechanisms** are necessary, **as well as advice on existing public-private financing options in the region** and the **tax incentives associated with RD&I initiatives**.

The lack of **private investment** in the Canarian business landscape and a strong dependence on public funding is historically justified by its uniqueness as an Outermost Region and by a greater number of business initiatives associated with the service sector. Networks of **specialised investors, mechanisms and private financing instruments are needed to support innovative initiatives** and attract technology companies and startups to the market in order to generate an innovative **BE** industry.

Finally, regarding **blue skills and innovation management**, a mismatch exists between academic outputs and industry demands, so there is potential for improvement via the generation of **new policies that encourage staff mobility** among the different sectors and actors active in the **BE**. This includes the incorporation of researchers in companies as well as allowing the private sector to collaborate in the promotion of new doctoral programs, so that universities are more aligned with their needs and can more effectively direct the flow of students into companies.

While scientific and technological capacities and ocean literacy are fundamental for facing the current challenges, it is also important to incorporate new **organizational and business management capacities** that allow collaborative work between diverse actors and services, so that investment in strategic activities is enhanced, and regional employability improves.

There is a growing ecosystem of initiatives in the Canary Islands **supporting entrepreneurial ideas**, strongly concentrated in the capital islands. This is proposed as a main mechanism for the extension of initiatives to all the islands which encourage, mentor and accelerate ideas created from the academic world, either through central or local governments, technology centres or private initiatives.

Thus, it is our conclusion that in order to pursue all the proposed and identified improvements which are required for constituting a key role for **BE** in the Canary Islands, an **open collaboration** is necessary. This must involve the establishment of permanent **services** that support innovation, promote and facilitate the connection and mobility between and beyond the islands, promote synergistic interaction and encourage the exchange of ideas and projects between universities, companies, policy makers and Canarian society.

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