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THE CONTRIBUTION OF THE EUSKADI 2030 SCIENCE, TECHNOLOGY AND INNOVATION PLAN TO THE SDGs

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Ane Izulain
Edurne Magro

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Abstract

The document aims to measure the contribution of the Basque Country Science, Technology and Innovation Plan 2030 (STIP 2030) to the Sustainable Development Goals (SDGs). To this end, an analysis of the best practices regarding the measurement of the contribution of R&D&I to the SDGs is carried out, and on this basis, the report presents a methodological proposal for measurement and a first diagnosis of the current level of contribution of the plan to the SDGs included in the STIP, sorted by social challenges.

Specifically, the social challenges and related SDGs that structure the report are as follows:

- Social challenge: health (SDG 3. Good Health and Well-being).
- Social challenge: gender equality (SDG 5. Gender Equality).
- Social challenge: energy and climate change (SDG 7. Affordable and Clean Energy. SDG 11. Sustainable Cities and Communities. SDG 13. Climate Action).
- Social challenge: quality employment (SDG 8. Decent Work and Economic Growth).
- Social challenge: digital transformation (SDG 9. Industry, Innovation and Infrastructure).

Laburpena

Dokumentuaren helburua Zientzia, Teknologia eta Berrikuntzarako Euskadi 2030 Planak (ZTBP Euskadi 2030) Garapen Jasangarrirako Helburuei (GJH) egiten dien ekarpena neurtzea da. Horretarako, artearen egoeraren azterketa bat egiten da, I+G+b-k GJHei egiten dien ekarpenaren neurketari dagokionez, eta, horretan oinarrituta, txostenak neurketa-proposamen metodologiko bat eta planak ZTBPn jasotako GJHei egiten dien ekarpenaren egungo mailaren lehen diagnostiko bat aurkezten ditu, erronka sozialen arabera antolatuta.

Zehazki, honako hauek dira txostena egituratzen duten erronka sozialak eta erlazionatutako GJHak:

- Erronka soziala: osasuna (3. GJHa. Osasuna eta ongizatea).
- Erronka soziala: genero-berdintasuna (5. GJHa. Genero-berdintasuna).
- Gizarte-erronka: energia eta klima-aldaketa (7. GJH. Energia eskuragarria eta ez-kutsatzailea. 11. GJHa. Hiri eta komunitate jasangarriak. 13. GJH. Klimaren aldeko ekintza).
- Erronka soziala: kalitatezko enplegua (8. GJHa. Lan duina eta hazkunde ekonomikoa).
- Erronka soziala: eraldaketa digitala (9. GJHa. Industria, berrikuntza eta azpiegiturak).

Abstract

The aim of the document is to measure the contribution of the Euskadi 2030 Science, Technology, and Innovation Plan (STIP Euskadi 2030) to the Sustainable Development Goals (SDGs). To this end, an analysis is made of the state of the art regarding the measurement of the contribution of R&D&I to the SDGs, and on this basis, the report presents a methodological proposal for measurement and a first diagnosis of the current level of contribution of the plan to the SDGs included in the STIP 2030, ordered by social challenges.

Specifically, the social challenges and related SDGs that structure the report are as follows:

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- Social challenge: digital transformation (SDG 9. Industry, innovation and infrastructure).

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List of abbreviations and acronyms

CAPV	Autonomous Community of the Basque Country
EC	European Commission
STI	Science, Technology and Innovation
R&D&I	Research, Development and Innovation
JRC	Joint Research Centre of the European Commission
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goals
UN	United Nations
STIP	Science, Technology and Innovation Plan
GDP	Gross Domestic Product
PRI	Partnerships for Regional Innovation
RVCTI	Basque Science, Technology and Innovation Network
S3	Smart specialisation strategies
EU	European Union
WoS	Web of Science

Executive summary

Sustainability has become a priority for most government agendas internationally. Innovation plays a key role in the transition toward sustainable development. As a result, the European Commission is helping regions embrace this perspective of innovation for sustainability through the reorientation of Smart Specialisation Strategies (S3) and their alignment with the Sustainable Development Goals (SDGs).

Along these lines, one of the main new features of the Basque Country Science, Technology and Innovation Plan 2030 (PCTI 2030) with respect to the previous plan is the specification of five Social Challenges aligned with the SDGs as part of the 2030 Vision.

Social challenge	SDG
ENERGY AND CLIMATE CHANGE	7. Affordable and clean energy
	13. Climate action
	11. Sustainable cities and communities
HEALTH	3. Health and wellbeing
EMPLOYMENT	8. Decent work and economic growth
DIGITAL TRANSFORMATION	9. Industry, innovation and infrastructure
GENDER EQUALITY	5. Gender equality

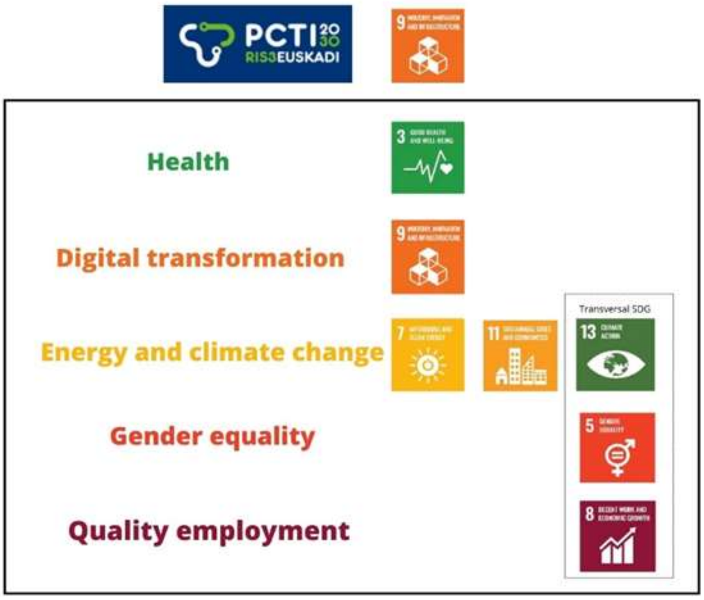
This report proposes a new methodological approach to measure the contribution of the Science, Technology, and Innovation Plan (STIP) 2030 to the Sustainable Development Goals (SDGs). Using the developed methodology, the report evaluates the plan's current contribution to the SDGs, which are organised around social challenges.

Proposed methodological framework

The literature review enables us to distinguish between two types of SDGs:

- Those related to systems for providing essential goods and services, such as health; clean and affordable energy; sustainable cities and communities; and industry, innovation, and infrastructure.
- Those that guide the direction of R&D and innovation and act as cross-sectional elements, including gender equality, decent work and economic growth, and climate action.

Furthermore, the developed framework places greater emphasis on SDG 9 (industry, innovation and infrastructure), as it broadly covers the goals and objectives related to innovation.



There are two principal methodological approaches for assessing the contribution of R&D&I to the SDGs:

1. Linking smart specialisation areas to specific SDGs,
2. Developing a scorecard of standardised R&D&I indicators based on international statistics and correlating them with the SDGs.

We have opted to prioritise the second approach using R&D&I indicators because it enables an analysis of the contribution of science, technology, and innovation to the SDGs—not limited solely to the domains associated with S3—and allows for comparative analysis with other regions. Therefore, we have selected indicators for both R&D&I investment and efforts (input) as well as outputs to measure the contribution of the STIP 2030 to each social challenge and SDG, while considering a number of limitations:

- The complexity of assigning indicators to SDGs when they often apply to multiple goals because of their inherent interconnectedness.
- The absence of a one-to-one correspondence between the social challenges addressed by the STIP 2030 and the SDGs.
- The scarcity of specific references to R&D&I within the UN SDGs' framework of goals and indicators.
- The difficulty of mapping scientific disciplines (a parameter by which some potential indicators are broken down) to the SDGs.

Key findings

Overall, the **contribution of R&D&I to the SDGs** is positive in terms of both input and output measures. However, there are areas that require improvement, such as patent performance per million inhabitants, business investments in innovation, and the proportion of women in STEM fields.

Regarding the social challenges outlined in the STIP 2030, a positive impact is evident across all domains. The contribution is **particularly notable in the area of energy and climate change**, which demonstrates combined strengths across the most pertinent indicators.

- *Health social challenge:* Output indicators are prominent in this domain. Noteworthy are the positive trends in business R&D spending (although it is less than the spending dedicated to other social challenges), scientific output as measured by publications within this field, and health-related patents.

- *Digital transformation social challenge:* The Basque Country exhibits strengths in business R&D investment and the returns from European funding programs. However, the performance in obtaining patents in this domain represents an area for improvement.

- *Energy and climate change social challenge:* The findings indicate substantial investment in R&D and strong output measures, particularly regarding specialisation compared to Europe in both scientific publications and green patents, as well as active participation in the Horizon Europe programme. Notable successes and progress are primarily concentrated in the energy sector.

- *Gender equality social challenge*: Strengths include the positive trend in the representation of women among R&D personnel, gender parity achieved in the university system, and a proportion of women in STEM subjects that exceeds the European average. However, a gender gap persists in both the representation within R&D personnel and STEM participation, as well as in female leadership of European projects.

- *Quality employment social challenge:* The report highlights the evolution and positioning of the Basque Country in knowledge-intensive employment as a significant contribution to SDG 8, which focuses on economic growth and quality employment. However, the areas identified for improvement include high and medium-tech product exports and trademark applications.

Given that this study is experimental and represents an initial effort to measure the contribution to the SDGs, it also sheds light on the applied methodology:

- There is a **need to enhance the measurement of contributions in certain areas**, and it is essential to investigate strategies for collecting such data over the medium to long term. For instance, regarding public funding applications for R&D&I, we can work towards a more comprehensive measurement system as we improve the collection of information about the specific social challenges or SDGs that these funds address.

- The study focuses on measuring the social challenges addressed by the STIP 2030. However, the plan also highlights talent as a critical element, emerging as a vital challenge for the region's future competitiveness. Thus, subsequent iterations of this assessment could consider **talent as a sixth social challenge** addressed by the STIP 2030, allowing for an exploration of its contribution to SDG 4 Quality Education, given its direct links to talent training and development.

- Finally, it is noteworthy that stakeholders within the Basque Science, Technology, and Innovation Network are progressing in designing methodologies to measure their contributions to the SDGs. This effort is both positive and complementary to the methodological groundwork laid by this study. Moving forward, it will be crucial to **develop shared measurement standards** to enable more cohesive data integration in the future.

Introduction

Sustainability has become a priority on most agendas at the local, regional, national levels, and of course, within the European Union. In the European context, notable examples of this strategic direction include the European Green Deal, the Mission-oriented approach that guides the Horizon Europe framework programme, and more recently, the EU Taxonomy for Sustainable Activities.

Innovation plays a crucial role in the transition toward sustainable development. Accordingly, the European Commission is facilitating this shift by endorsing the alignment of Smart Specialisation Strategies (S3) with the Sustainable Development Goals (SDGs), particularly for long-term orientation toward sustainable development (Miedzinski et al., 2021; Nakicenovic et al., 2021).

This alignment is also highlighted in the Playbook for the 2022 *Partnerships for Regional Innovation* (PRI) initiative, which was launched by the Commission to promote long-term social welfare as the “guiding star” for PRI activities, thereby steering regional innovation toward this aim The Basque Country is one of the regions that has participated in this pilot initiative, alongside 73 other European regions and territories.

The Basque Country's Science, Technology, and Innovation Plan 2030 (hereinafter referred to as STIP 2030) embodies the strategic commitment of the Basque Country to Research and Innovation. It aims to position the Basque Country among the leading European regions in innovation by 2030 to enhance the standard of living and the quality of employment. This is a collective strategy among public institutions, companies, universities, research centres, technology centres, and stakeholders in the Basque Country[1].

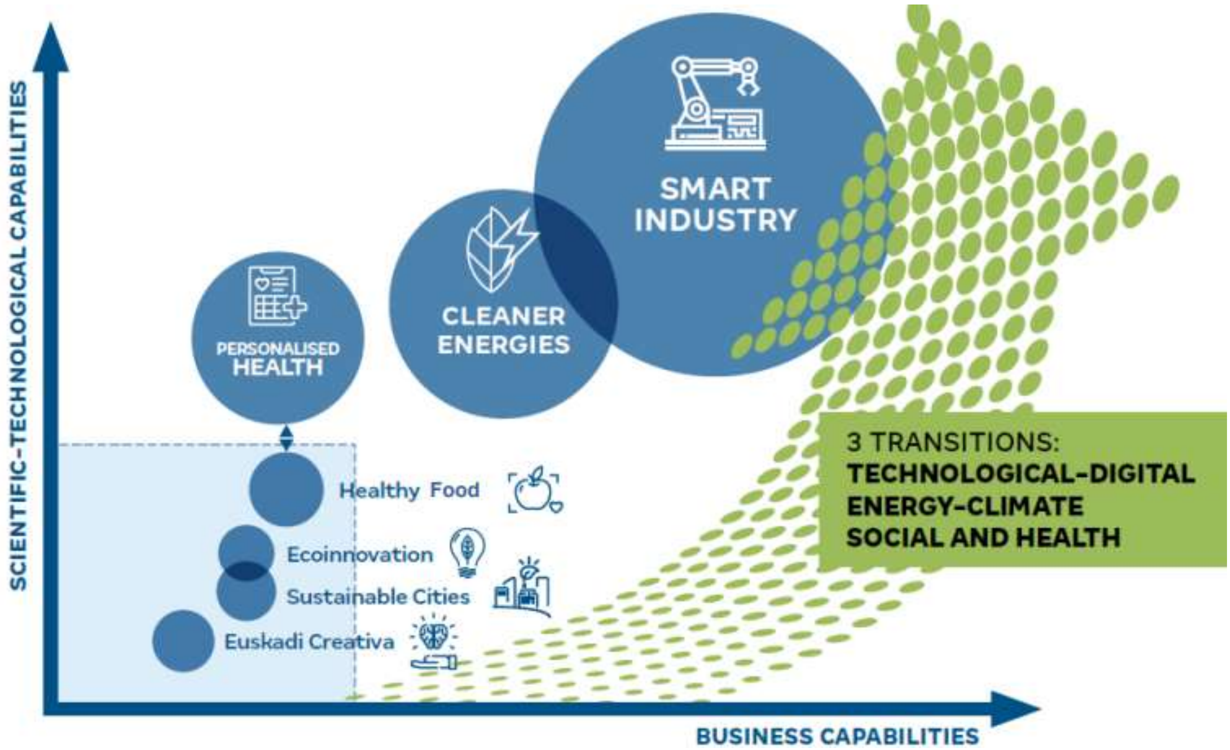
The STIP 2030 is founded on three strategic pillars: scientific excellence, technological and industrial leadership, and open innovation, with talent being the central element that is the backbone of the plan.

Furthermore, the strategy builds upon and broadens the STIP 2020, which was approved in 2014. That marked the first time the Basque Country—and indeed many other European regions—implemented a research and innovation strategy for smart specialisation (RIS3). This represented an innovative yet aligned evolution with the Basque Country's preceding science and technology policies, including former science, technology, and innovation strategies and the industrial strategy that had been in place for over thirty years (Aranguren et al., 2019).

The smart specialisation areas in the Basque Country recognized by the STIP 2030 are as follows: on the one hand, the three strategic priorities of smart industry, cleaner energies, and personalised healthcare; and, on the other hand, four opportunity areas in healthy food, eco-innovation, sustainable cities, and creative Basque Country. These areas have been reassessed in light of the three major transitions: technological-digital, energy-climate, and social-health.

[1] https://www.euskadi.eus/contenidos/informacion/pcti_euskadi_2030/es_def/adjuntos/EUSKADI-2030-STIP.pdf

Figure 1: RIS3 Basque Country 2030



Source: STIP 2030

In line with the EU's recommendations for more targeted action toward sustainability, the STIP 2030 is dedicated to hastening the transitions towards a greener, more inclusive, and digitally advanced Basque Country while promoting Sustainable Human Development. Therefore, one of the main innovations in the STIP 2030, compared to the previous plan, is the definition of five Social Challenges that are aligned with seven Sustainable Development Goals (SDGs) as part of the Vision for 2030.

Figure 2: Social challenges for SDGs in the STIP 2030

Social challenge	SDG
ENERGY AND CLIMATE CHANGE	7. Affordable and clean energy
	13. Climate action
	11. Sustainable cities and communities
HEALTH	3. Health and wellbeing
EMPLOYMENT	8. Decent work and economic growth
DIGITAL TRANSFORMATION	9. Industry, innovation and infrastructure
GENDER EQUALITY	5. Gender equality

Although the STIP 2030 explicitly recognises its alignment with the Sustainable Development Goals (SDGs), the plan's monitoring and evaluation system is exclusively designed to follow objectives and targets as defined within the plan itself, focusing on traditional indicators of research and innovation. Consequently, this report aims to suggest a methodological framework for assessing the STIP 2030's contribution to the SDGs. It also seeks to apply this framework by conducting an initial assessment of the plan's present contributions to the prioritised SDGs, which are organised around social challenges.

To achieve this, the report begins with a review of state of the art in the field. Secondly, the report describes the methodological proposal and the process of its development, detailing the conceptual framework and the chosen indicators. Third, the implementation of the suggested methodology and the current findings on the level of SDG contribution are presented, categorised by indicator type and accompanied by a summary of key insights for each challenge. Fourth, the report discusses other pertinent examples, both from the Basque Country and international contexts. Lastly, the report concludes with a summary of its findings and offers some methodological recommendations.

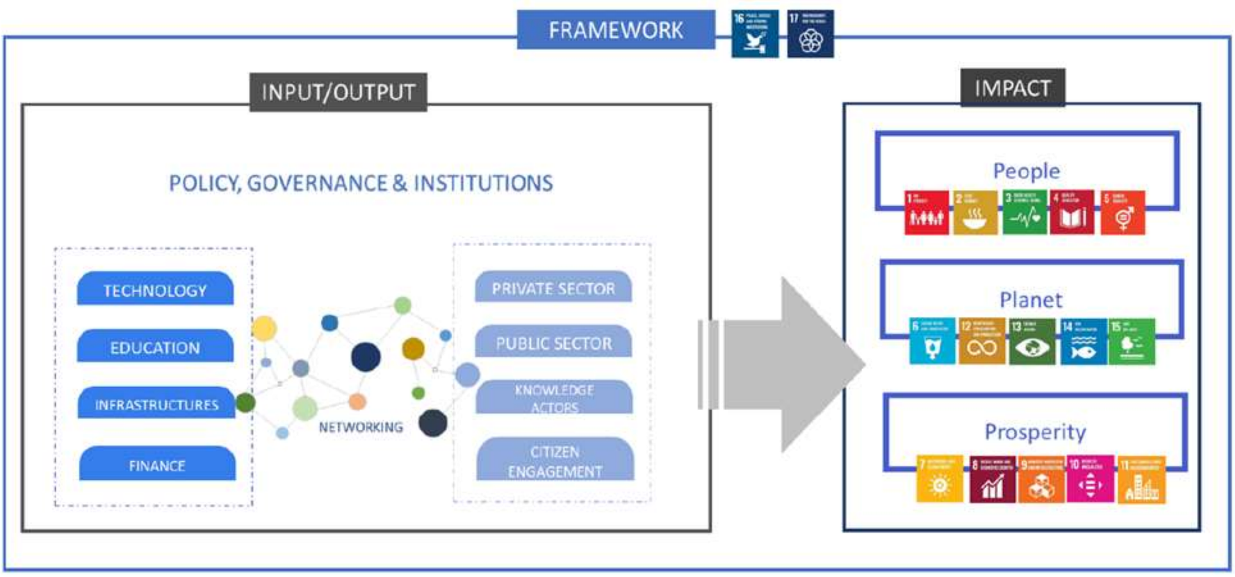
1. State of the art

The purpose of this section is to outline the most significant conceptual frameworks identified as key in representing the interplay between Science, Technology, and Innovation (STI) and the Sustainable Development Goals (SDGs).

It is important to acknowledge the scarcity of extensive literature dedicated to quantifying the contribution of STI towards each individual SDG. However, recent literature from academic sources and various international bodies (European Commission, United Nations, World Bank, OECD) has pointed to the imperative of infusing innovation policies (broadly referred to as science, technology, and innovation policies) with a stronger orientation towards economic, social, and environmental sustainability, hence fostering a closer alignment with the SDGs.

Recently, an exploratory study funded by the European Commission (4Front et al., 2023) proposed a set of scorecards designed to measure the contribution of R&D to the SDGs, categorised under the "three Ps" (Planet, Prosperity, and People). This study establishes a conceptual framework through a systematic review of existing literature, along with various documents and reports[2]. This framework identifies two major blocks. The first pertains to the R&D&I system and its constituent elements, which supply the necessary inputs and outputs for the innovation process to influence the SDGs. The second component illustrates the anticipated effects of R&D&I processes on the 15 SDGs, structured according to the 3 Ps of People, Planet, and Prosperity. Furthermore, SDGs 16 and 17 underscore the significance of encouraging framework conditions that facilitate this transformative process (refer to Figure 3).

Figure 3: Conceptual framework for the contribution of R&D& I to the 3Ps



[2] Orkestra was responsible for the literature review of this study, in which more than 300 documents were reviewed.

Source: European Commission et al. (2023)

Within the R&D&I system, the study identifies the following elements as essential, which can also be measured with input and output indicators:

1. Technology: It plays a significant role in achieving the SDGs, yet merely considering technology from its traditional perspective is not adequate to progress toward the targets set forth in the sustainable development agenda. It is essential to move beyond the prevailing focus that is exclusively on widespread economic growth, which is common in most STI policies (OECD, 2018).
2. Education: The integration of new technologies is inseparable from the requirement for a workforce with the necessary skills. Accordingly, education and reskilling initiatives are crucial for making a transformational shift towards the SDGs.
3. Infrastructure: Technology in isolation is insufficient, as it requires complementary assets to make an impact on the various SDGs. In this context, for instance, both energy infrastructure and ICT infrastructure must evolve to accommodate new technological advancements (UN & EC, 2021).
4. Financing: Funding for STI plays a pivotal role in fostering innovation that is aligned with the SDGs. Sustainable financing — which aims to promote economic growth while simultaneously reducing environmental impact and addressing social considerations — ought to emerge as a central area of policy focus.

These components are influenced by a range of stakeholders who collaborate and interact within the R&D&I ecosystem. These stakeholders can be categorised into businesses, public institutions, academia and research institutions, and civil society organisations.

The study proposes a series of input and output indicators for each dimension presented that affect the SDGs, categorised under the 3Ps framework.

Furthermore, especially significant within the recent body of academic work is the literature on sustainable transitions. This research relies on the concept of socio-technical systems[3] (Geels, 2002, 2004) and underpins the transformative innovation policy framework (Schot and Steinmueller, 2018). This perspective acknowledges the critical importance of science, technology, and innovation in realising the SDGs and considers innovation policy as a transformative process aimed at steering socio-technical systems and application sectors towards greater sustainability.

This approach contends that traditional methods of innovation, including those based on innovation systems, result in negative externalities within social and environmental domains, and it underscores the need for directionality, involving diverse participants in the innovation process, and fostering experimentation and learning. When considering the SDGs, transformative innovation policy differentiates among three categories of goals (Penna et al., 2023; Schot & Steinmueller, 2018):

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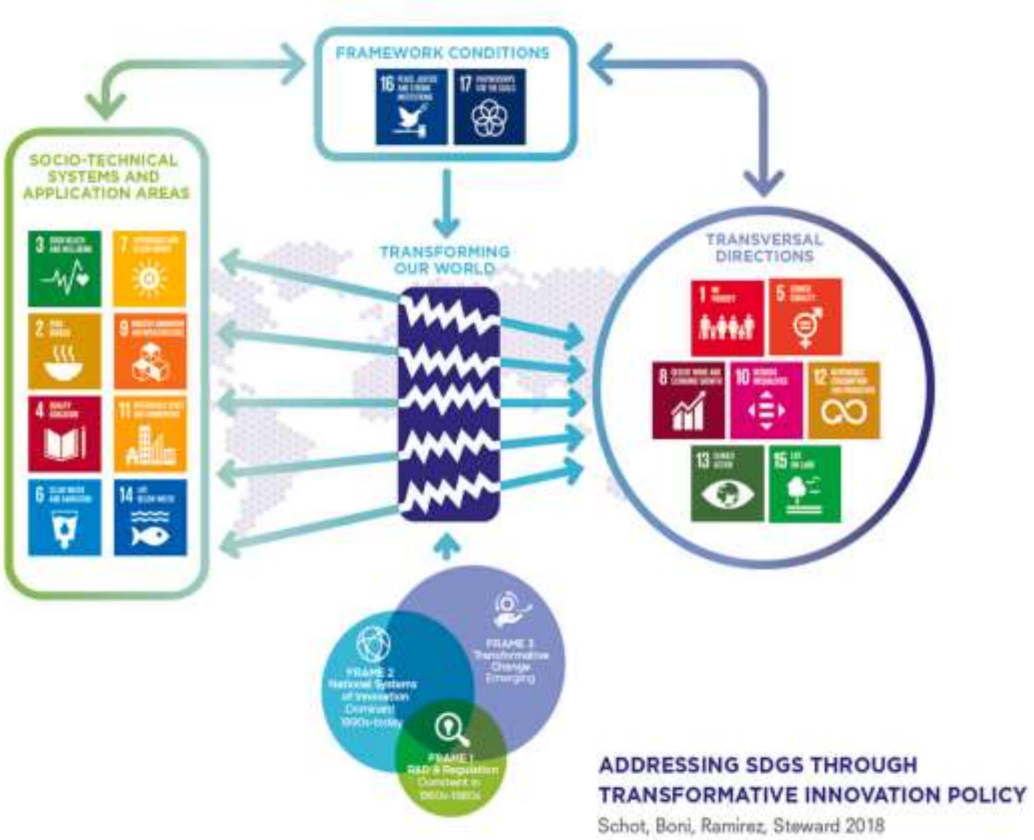
[3] Systems where technology interacts with people, reflecting a concept of technological development systems and their demand, such as mobility and energy systems.

1) those encompassing a range of socio-technical systems connected to the delivery of basic needs such as food, health, energy, education, etc. (SDG 2, 3, 4, 6, 7, 9, 11, 14);
2) those highlighting horizontal objectives or targets within socio-technical systems, for instance, gender equality and climate action (SDGs 1, 5, 8, 10, 12, 13, and 15);
3) and those forming the essential structural/framework conditions for transformation (SDGs 16 and 17).

Therefore, this framework posits that the SDGs are interconnected, and to effectuate the necessary shifts for transitions, direction must be imparted to the systems that provide basic needs—such as energy that addresses climate change (SDGs 7 and 13) or education that promotes gender equality (SDGs 4 and 5)—considering the underlying framework conditions. This categorisation and the interrelationships are depicted in Figure 4.

Figure 4: Grouping of the SDGs according to the transformative innovation policy framework



Source: Schot et. al. 2018

2. Methodological proposal

2.1. Proposed methodological framework

The main objective of the proposed methodological measurement framework is to draw conclusions on the contribution of science, technology and innovation to the SDGs, applied to the Basque context of the STIP 2030. It should be noted that the STIP 2030 represents the comprehensive strategy for science, technology, and innovation in the Basque Country, and that the focus of this study is to assess its contribution to the SDGs, with the understanding that the progress in research and development cannot be solely ascribed to this policy. Additionally, the framework aims to promote and convey the significance of science, technology, and innovation with regard to their impact on the SDGs. The measurements presented in this report are conducted separately from the STIP 2030 monitoring dashboard, though some indicators from the dashboard are incorporated due to their significance for the SDGs.

The STIP 2030 itself emphasises its approach to five social challenges that correspond to various SDGs, specifically:

- SDG 3 – Good health and well-being
- SDG 5 – Gender equality
- SDG 7 – Affordable and clean energy
- SDG 8 – Decent work and economic growth
- SDG 9 – Industry, innovation and infrastructure
- SDG 11 – Sustainable cities and communities
- SDG 13 – Climate action

Before examining the indicator level, it is important to contemplate a conceptual framework that, based on the analysed literature and the reality of STIP 2030, enhances the interpretation of the methodology implementation results and the understanding of the interrelations among the specified SDGs.

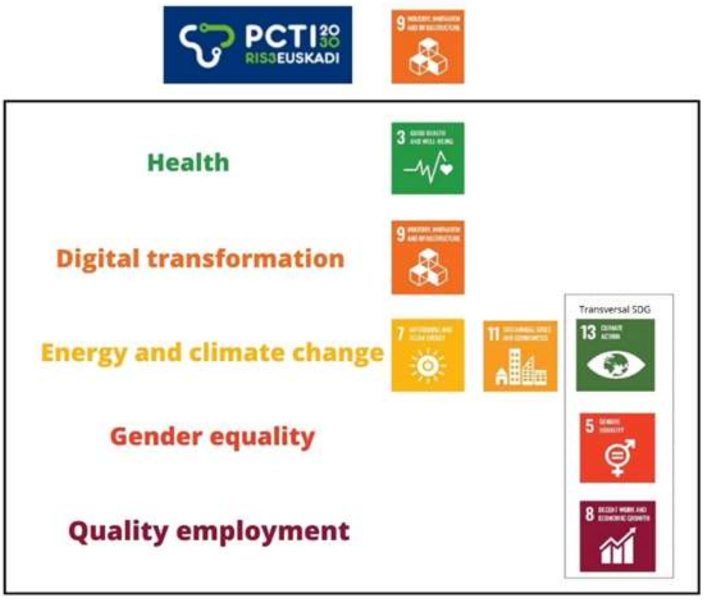
According to the conceptual framework proposed by Schot et al. (2018), of the prioritised SDGs, four of them address the systems providing essential goods and services (health; affordable and clean energy; sustainable cities and communities; industry, innovation, and infrastructure), while three impart directionality and act as horizontal elements (gender equality, decent work and economic growth, and climate action). Additionally, SDG 9 is underlined for its centrality within STIP 2030, as it broadly covers goals and targets related to innovation. Consequently, the plan is to apply the measurement framework to the SDGs, categorised by social challenges, while recognising that STIP 2030's contribution to these SDGs might extend beyond the specific social challenge, and to define a measurement framework that includes general indicators for a broad assessment of contributions to SDG 9. In addition, in tracking the legislative goals, the STIP 2030 is primarily aligned with SDG 9[4].

[4] https://bideoak2.euskadi.eus/paginas/page_63860/Programa2020_2024_en.pdf

Therefore, the proposed measurement framework would function as follows in interpreting the indicators: the aggregate results of the indicators are initially considered to contribute to SDG 9 (e.g., total business R&D expenditure). However, when the data is broken down by thematic areas or sectors, a more detailed analysis can be performed, such as allocating health-related spending to SDG 3 and investment in infrastructure and industrial technology to SDG 9 (in a secondary level of disaggregation). Moreover, the results are organised based on the social challenges outlined in the STIP 2030.

The following figure reflects this logic:

Figure 5: Proposed framework for measuring the contribution of the STIP 2030 to the SDG



Source: Compiled by the authors based on Schot et. al. 2018

2.2. Development process of the methodological proposal

The process of developing the methodological proposal regarding the Science, Technology, Innovation, and Policy (STIP) 2030 contribution to the Sustainable Development Goals (SDGs) has been structured in several phases and workspaces. Below is the sequence of tasks undertaken by the research team:

1. State-of-the-Art analysis of measuring Science, Technology, and Innovation (STI) contributions to the SDGs

2. Examination of the STIP 2030 and its alignment with specific SDGs (3, 5, 7, 8, 9, 11, and 13)
3. Development of a measurement framework for assessing the STIP 2030's contribution on the SDGs
4. Compilation of a comprehensive list of indicators available for the Basque Country
5. Pilot implementation focusing on SDG 7 (affordable and clean energy)
6. Methodological refinement and comprehensive implementation.

The principal working group has been comprised of representatives from the Basque Government (Lehendakaritza, specifically the Commissioner for Science, Technology, and Innovation, and her team) and researchers from Orkestra.

However, throughout the process, and particularly in the phase before the pilot implementation focused on SDG 7 regarding energy, it has been deemed highly important to conduct consultations on the matter with various stakeholders from the Basque Science, Technology, and Innovation Network. Consultations have been held with the following stakeholders: BRTA, SPRI, Ikerbasque, the Basque Government's Department of Education, AZTI, Tecnalia, and the Basque Government's Department of Health. The purpose of the sessions was twofold: firstly, to garner insights from the various stakeholders regarding the proposed approach, and secondly, to understand how these stakeholders were appraising their contribution to the SDGs in practice, for those who were doing so.

Below are some key contributions from the aforementioned stakeholders, which have been integrated into the formulation of the measurement methodology:

- There was a keen interest in defining a set of uniform indicators that would enable aligned assessment of contributions to the SDGs across the entire network. Recognising the current limitations, they found it worthwhile to establish indicators that could be implemented in the future.
- AZTI and Tecnalia incorporate their contributions to the SDGs into their strategic plans; this trend is on the rise, and it is anticipated that others will soon integrate it into their new strategic plans as well.
- It is important to clarify the objectives of the measurement, whether to assess impact, prioritise certain activities over others, etc.
- In practice, there are various *approaches*, including both direct measurement (using tangible evidence) and intermediate tools.
- There is a challenge in attributing the impact of specific R&D&I outcomes to particular SDGs, as often the SDGs are not mutually exclusive. Certain thematic areas or disciplines may simultaneously contribute to multiple SDGs. While there are specific tools for categorising publications by SDGs, they do not address the issue of overlaps. For instance, publications in the scientific discipline of biological sciences may contribute to SDG 3 (good health and well-being) as well as SDG 13 (climate action)[5]. Additionally, some of these tools have a relatively high margin of error when assigning publications to SDGs.

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[5] See classification of Dimensions. https://app.dimensions.ai/browse/categories/publication/sdg

2.3. Proposed indicators

In the literature, there are two main approaches to measuring the contribution of STI to the SDGs: through the lens of RIS3 strategies (Fuster et al., 2021), and from the broader context of R&D&I (4Front et al., 2023). The first approach involves linking the RIS3 areas prioritised by the region to one (or more) SDGs, thereby measuring their impact indirectly. The second approach uses traditional R&D&I indicators (staff, expenditure, publications, patents, etc.), categorising them by thematic area or discipline, and mapping them to the corresponding SDG[6].

The proposed methodology for measuring STIP 2030's contribution to the SDGs takes a hybrid approach, emphasising the second method but supplementing it with the first when it is not possible to disaggregate data by areas that can be directly linked to SDGs. For certain indicators where data are accessible through both approaches, both are employed to provide a comprehensive interpretation (e.g., R&D expenditure).

There are various classifications of indicators. **Input or resource indicators** are those that contribute to or support an R&D&I process (for example, business R&D expenditure). **Output indicators** reflect a specific STI result (for example, number of publications or patents, the volume of projects in a particular field, or the count of female researchers involved in projects). The criterion used in this report is whether an indicator represents an input or output of the R&D&I process, irrespective of being a resource or an output of the corresponding SDG. For instance, the number or proportion of women in R&D may be seen as an output in the context of SDG 5 on gender equality. However, in this study, it is considered an input, as personnel represents a resource in the R&D&I process.

For some indicators, it is possible to consider them as both an input and output in the R&D&I process. For instance, indicators related to projects (both regional and European) constitute an input in terms of financing, but also represent the focus of research outputs toward social challenges. In this study, with its focus on social challenges and SDGs, we have opted to classify them as outputs.

Additionally, each indicator is categorised based on whether it has a direct or indirect impact on the SDGs. This depends on whether it is a measure or result captured by the UN's own formulation and breakdown of SDG targets or whether it contributes indirectly to those targets.

The principal types of indicators used are outlined below, focusing on the elements that are crucial for their interpretation. In general, three points should be underlined:

- Whenever possible, the progression of the indicator is presented from the time STIP 2020 was approved (in 2014) up to the most recent data available.

[6] Both approaches can be seen in action in the *Pilot Methodology for measuring the SDGs within the context of Smart Specialisation Strategies*, developed by the JRC for the case of Serbia. On one hand, there is an analysis of the distribution of four STI activities (publications, Horizon 2020 projects, innovation funding, and patents) across various SDGs (Fuster et al., 2021, p. 6). On the other hand, there is an acknowledgment of a taxonomic alignment between Serbia's prioritised RIS3 areas and specific SDGs (Fuster et al., 2021, p. 8). For instance, its Food for Future priority corresponds to SDG 2 Zero Hunger, and the Energy Efficient and Eco-Smart Solutions priority aligns with SDG 7 Affordable and Clean Energy. (See Section 4 of this report).

- In instances where data are available, comparisons are made with Spain and with the average of the 27 European Union countries[7].
- The indicators are predominantly presented as relative values (percentage of GDP, turnover, total expenditure, etc.) to enhance comparability both across regions and among SDGs.
- For data pertaining to the Basque Country, Eustat is the preferred source, while data for Spain and the EU average are sourced from Eurostat.

Input indicators

- Personnel:
    - "Full-Time Equivalent (FTE) R&D personnel", and their percentage of total employment. Assessed for the general level (SDG 9) as well as for the gender equality challenge (SDG 5).
    - "Proportion of FTE staff with doctorates relative to the total", as a general contribution to SDG 9.
    - Percentage of "new enrolments in STEM degrees relative to total new university enrolments": for both the general level (SDG 9) and the gender equality challenge (SDG 5).
    - "University teaching and research staff (UTRS)" by gender: to analyse the contribution to gender equality (SDG 5).

- Expenditure:
    - For the general contribution to SDG 9, included indicators are R&D investment (as a percentage of GDP), business R&D investment (as a percentage of GDP), and international R&D funding (as a percentage of total R&D expenditure).
    - To analyse spending on specific SDGs, public sector R&D expenditure by socio-economic objective is used. The indicator shows the proportion of the total R&D expenditure reported by companies and private not-for-profit institutions (PNPIs) that is allocated to the area related to the SDG. As this data is unavailable for public and higher education institutions, the analysis is solely conducted for the private sector.

- Other inputs:
    - "Investment in innovation (relative to turnover)" accounts for spending on innovation activities (excluding both internal and external R&D) by companies with 10 or more employees in the industrial and advanced services sectors, as a percentage of their total turnover. The core sectors are covered by the following National Classification of Economic Activities (CNAE-2009) codes: 05-09, 10-33, 35, 36-39, 46, 49-53, 58, 61-63, 64-66, 71-73. This broadly supports SDG 9.

[7] The 27 Member States are, in order of accession, Germany, Belgium, France, Italy, Luxembourg, Netherlands, Denmark, Ireland, Greece, Spain, Portugal, Austria, Finland, Sweden, Czechia, Cyprus, Slovakia, Slovenia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Bulgaria, Romania and Croatia.

- “Employment in knowledge-intensive sectors” addresses the objective of quality employment (SDG 8). The indicator represents the percentage of the workforce engaged in high and medium-high technology manufacturing industries, knowledge-intensive market services (excluding financial services), and high-tech knowledge-intensive services relative to total employment.

Output indicators

- Publications:
    - For developing this indicator, data were sourced from the Web of Science database (which only includes JCR-listed publications). The database itself categorises published academic articles according to the SDGs, following the methodology by Traag et al. (2019). (2019).
    - Three-year average to smooth out annual fluctuations.
    - A specialisation index is also incorporated into the analysis. Using the EU-27 as the baseline (index value of 1), the index indicates whether there is specialisation in the field (index greater than 1) or sub-specialisation (index less than 1). This index provides valuable insights since the volume of publications can vary significantly across disciplines or fields. For instance, a substantial portion of publications may be in health, accounting for more than one-third of all publications; however, one might be considered sub-specialised if the proportion of publications is less than the EU average.

- Patents and intellectual property:
    - For patents, which measure the output of the R&D process, the EPO (European Patent Office) patent indicator is used. Both patent applications and grants are analysed.
    - In this case, it is feasible to measure the aggregate number of EPO patents per million inhabitants, aligning with SDG9. Additionally, an examination of green patents influencing SDGs 7, 11, and 13 is performed, alongside an evaluation of health-related patents pertinent to SDG 3 for medical technology, pharmaceutical products, and biotechnology. For this latter analysis, the methodology employed is derived from the PCT (Patent Cooperation Treaty) database rather than the EPO.
    - Regarding industrial designs, filings with the European Union Intellectual Property Office (EUIPO) are scrutinised, scaled per billion euros of GDP.

- Regional projects:
    - For the strategic business R&D support programme (Hazitek strategic) and Elkartek (Collaborative Research Grants), data are available only for the number of projects and funding received within RIS3 strategic areas.
    - Regarding the support programmes from the Department of Education, the existing data are categorised by scientific disciplines, which complicates the task of attributing their contribution to the SDGs.

  - Additionally, data regarding health research funding from the Department of Health have been incorporated.

- European projects:
  - Within the Horizon Europe programme, thematic priorities are not always clearly defined. For instance, there is available data on the number of projects and the net EU contribution to Basque organisations in the thematic area of climate, energy, and mobility, contributing to several SDGs (7, 11, and 13).
  - Conversely, there exists a thematic priority focused on health, corresponding to SDG 3.
  - Additionally, statistics on the percentage of female project coordinators in the Horizon 2020 programme are accessible, an indicator supporting SDG 5.
- Other outputs:
  - Indicators from the STI Policy 2030 Scorecard are gathered, illustrating outputs from the innovation process that contribute to the challenge of quality employment (SDG 8), such as the exports of high and medium-high technology products, and the sales of new products (as a percentage of total sales).
  - Also included are the percentages of SMEs that are innovative in products and processes, as well as EU trademark applications (per billion of GDP).

The complete list of indicators used is added below.

Indicator name	Description	Data source	SDG	Indicator type	Impact on SDG
Private sector R&D expenditure related to SDG 3	Percentage of the socio-economic objective of non-profit institutions serving households (NPISH), dedicated to "protection and improvement of human health".	R&D Survey. Eustat (Basque Statistics Office)	3	Input	Direct
Publications related to SDG 3	Number of publications assigned to SDG 3 by WoS	Web of Science /Incites	3	Output	Direct
PCT patents by technological fields health (% total patents)	Patents in technology fields: medical technology, pharmaceuticals and biotechnology	OECD-Regpat and Eurostat	3	Output	Direct
No. / Funding for Hazitek and Elkartek SDG 3 projects	Number of projects or funding out of the total in the area of "personalised health".	Basque Government. Department of Economic Development, Sustainability and Environment	3	Output	Direct
Public funding for health research	Health research funding. Includes funding from the health department and the innovation fund.	Basque Government. Department of Health	3	Output	Direct
No. / Funding European SDG 3 projects	Number of projects or funding out of total in the health pillar	European Commission Platform	3	Output	Direct
Publications related to SDG 5	Number of publications assigned to SDG 5 by WoS	Web of Science /Incites	5	Output	Direct
FTE staff (% women)	Number of female R&D staff (full-time equivalent) and percentage of total FTE staff	Eustat (Basque Statistics Office).	5	Input	Direct
Teaching and research staff (TRS) in the university system (% women)	Percentage of women among teaching and research staff (TRS) at the university level	Ministry of Education and Vocational Training	5	Input	Direct
New enrolments to STEM degrees (% women)	Number of new female students entering STEM degree programmes as a percentage of the total. STEM fields of study are Science, Technology, Engineering, and Mathematics.	Eustat (Basque Statistics Office).	5	Input	Direct
Percentage of women coordinators of H2020 projects/total coordinators	Percentage of female participants in H2020 projects	EU Commission	5	Input	Direct

Indicator name	Description	Data source	SDG	Indicator type	Impact on SDG
Private sector R&D expenditure related to SDG 7	Percentage of the socio-economic objective of enterprises and non-profit institutions serving households (NPISH), dedicated to "production, distribution and rational use of energy".	R&D Survey. Eustat (Basque Statistics Office)	7	Input	Direct
Publications related to SDG 7	Number of publications assigned to SDG7 by WoS	Web of Science /Incites	7	Output	Direct
EPO green patents and patents by SDG7 technology field	Green patents in the field of technology related to SDG 7 "2: Climate change mitigation technologies related to energy generation, transmission and distribution"	OECD-Regpat and Eurostat	7	Output	Direct
No. / Funding for Hazitek and Elkartek SDG 7 projects	Number of projects or funding out of total in the area of "cleaner energy"	Basque Government. Department of Economic Development, Sustainability and Environment	7	Output	Direct
No. / Funding European SDG 7 projects	Number of projects or funding out of the total in the pillar "Climate, Energy and Mobility".	European Commission Platform	7	Output	Direct
Publications related to SDG 8	Number of publications assigned to SDG 8 by WoS	Web of Science /Incites	8	Output	Direct
Knowledge-intensive employment	Number of persons employed in the high and medium-high technology manufacturing industries, knowledge-intensive market services (exteccluding financial services), and high-tech knowledge-intensive services relative to the total employment These sectors correspond to the following NACE Rev. 2. codes respectively: 21, 26; 20, 27-30; 50-51, 69-71, 73-74, 78, 80; 59-63, 72.	Eurostat Statistics on high-tech industry and knowledge-intensive services	8	Input	Direct
Exports of high and medium-high technology products	Monetary value of gross exports by sectoral groups depending on their technological intensity, which correspond to the following CNAE-2009 codes (NACE Rev. 2): High technology level: manufacture of pharmaceuticals (21), manufacture of computer, electronic and optical products (26), aircraft and space construction (30.3). Medium-high technology level: chemical industry (20), manufacture of arms and ammunition (25.4), manufacture of electrical material and equipment (27), manufacture of machinery and equipment (28), manufacture of motor vehicles (29), manufacture of other transport equipment [except marine and aerospace] (30 except 30.1 and 30.3), manufacture of medical and dental instruments and supplies (32.5).	Eustat (Basque Statistics Office). Foreign Trade Statistics (ECOMEX)	8	Output	Indirect

Indicator name	Description	Data source	SDG	Indicator type	Impact on SDG
Sales of new products over total turnover	Percentage of sales of new products as a percentage of turnover of companies with 10 or more employees in knowledge-intensive sectors in the Basque Country (percentage)	Eustat (Basque Statistics Office). Innovation Survey	8	Output	Indirect
Product innovative SMEs	Number of enterprises with 10 or more employees in the advanced manufacturing and service sectors that have introduced a product innovation out of the total. Include enterprises with ongoing and/or abandoned innovation activities (EIN). The industrial and advanced services sectors correspond to what is known as the core that includes the following CNAE-2009 codes: 05-09, 10-33, 35, 36-39, 46, 49-53, 58,61-63, 64-66, 71-73.	Eustat Innovation Survey	8	Output	Indirect
Innovative SMEs in business processes	Number of enterprises with 10 or more employees in the industrial and advanced services sectors that have introduced a business process innovation out of the total. Include enterprises with ongoing and/or abandoned innovation activities (EIN). The industrial and advanced services sectors correspond to what is known as the core that includes the following CNAE-2009 codes: 05-09, 10-33, 35, 36-39, 46, 49-53, 58, 61-63, 64-66, 71-73.	Eustat Innovation Survey	8	Output	Indirect
No. of EU industrial design applications (per billion GDP)	Number of individual industrial designs filed with the European Union Intellectual Property Office (EUIPO).	Eustat (Basque Statistics Office). EIS Innovation Scoreboard	8	Output	Indirect
No. of EU trademark applications (per billion inhabitants)	Number of trademarks applied for at the European Union Intellectual Property Office (EUIPO). Includes applications to the World Intellectual Property Organisation (WIPO) under the "Madrid System".	Eustat EIS Innovation Scorecard	8	Output	Indirect
Scientific publications in the top 10% most cited internationally	Number of scientific publications indexed in Scopus among the 10% of the world's most cited scientific publications indexed in Scopus out of the total.	Ikerbasque with Scopus data	9	Output	Direct
International scientific co-publications per million inhabitants	Number of scientific publications indexed in Scopus with at least one co-author abroad. Calculated on the basis of the total population (in million inhabitants).	Eustat and EIS.	9	Output	Indirect
Scholarly publications in the Web of Science per million inhabitants	Number of Web of Science publications (includes JCR only) per population in million inhabitants	Incites	9	Output	Direct
Publications related to SDG 9	Publications assigned to SDG 9 according to WoS methodology	Web of Science /Incites	9	Output	Direct

Indicator name	Description	Data source	SDG	Indicator type	Impact on SDG
R&D investment (% GDP)	Internal R&D expenditure in the Basque Country, relative to GDP.	Eustat (Basque Statistics Office). R&D Statistics	9	Input	Direct
Business-financed R&D investment (% GDP)	Internal R&D expenditure executed in the Basque Country financed by companies. Includes funding from private and public companies and private for non-profit institutions of a business nature, i.e. Technology Centres (multi-focalised and sectoral), Cooperative Research Centres (CICs) and Business R&D Units of the Basque Science, Technology and Innovation Network (BSTIN).	Eustat (Basque Statistics Office). R&D Statistics	9	Input	Direct
Private sector R&D expenditure related to SDG 9	Percentage of the socio-economic objective of private for non-profit institutions, dedicated to "industrial production and technology".	R&D Survey. Eustat (Basque Statistics Office)	9	Input	Direct
Investments in innovation (over turnover)	Expenditure on innovation activities, excluding internal and external R&D, of enterprises with 10 or more employees in the industrial and advanced services sectors, over total turnover of enterprises. The industrial and advanced services sectors correspond to what is known as the core that includes the following CNAE-2009 codes: 05-09, 10-33, 35, 36-39, 46, 49-53, 58, 61-63, 64-66, 71-73.	Eustat (Basque Statistics Office). Innovation Survey	9	Output	Direct
No. of EPO patent applications	Number of EPO patent applications per GDP	European Patent Index	9	Output	Direct
EPO patents (registered) (per million inhabitants)	Number of patents registered EPO (European Patent Office) per million inhabitants	OECD-Regpat and Eurostat	9	Output	Direct
EPO green patents and patents by SDG9 technology field	Number of green patents in technology fields "7: Climate change mitigation technologies in the production and processing of goods and 8: Climate change mitigation technologies in ICTs"	OECD-Regpat and Eurostat	9	Output	Direct
International R&D funding (% of total expenditure)	Internal R&D expenditure executed in the Basque Country financed by foreign sources. Includes both public funding from abroad (e.g. grants from the Horizon Europe Framework Programme) and private funding from abroad (e.g. the amount a subsidiary receives for R&D). The percentage of expenditure over total investment is given.	Eustat R&D Statistics	9	Input	Direct
Leadership of Horizon Europe projects	Number of Basque participations with a leading (coordinating) role in the Horizon Europe Framework Programme // Total number of Basque participations in the Horizon Europe Framework Programme	Innobasque Observatory for Basque Participation in European R&D&I Projects	9	Output	Direct
Basque companies participating in Horizon Europe	Number of business agents participating in European projects of the Horizon Europe Framework Programme. Business actors include business associations, RVCTI Business R&D Units, SMEs and large companies.	Innobasque Observatory for Basque Participation in European R&D&I Projects	9	Output	Indirect

Indicator name	Description	Data source	SDG	Indicator type	Impact on SDG
FTE staff dedicated to R&D (over employment)	Full Time Equivalent (FTE) personnel dedicated to R&D. The sum of full-time personnel and the fractions of time that part-time personnel (between 10% and 90% of their working day, also including persons who have dedicated themselves to R&D in periods of less than one year) have dedicated to R&D activities. Relativised by employment	Eustat (Basque Statistics Office). R&D Statistics	9	Input	Direct
Doctoral research staff	Research personnel with doctorate degree in Full Time Equivalence (FTE) over Research personnel in FTE	Eustat (Basque Statistics Office). R&D Statistics	9	Input	Direct
New enrolments to STEM undergraduate degrees (out of total)	New students entering university degree courses linked to science, technology, engineering and mathematics (STEM) (over total number of new students)	Ministry of Universities Integrated University Information	9	Input	Indirect
No. / Funding European SDG 9 projects	Number of projects or funding out of the total in the pillar "digital world, industry and space"	European Commission Platform	9	Output	Direct
No. / Funding for Hazitek and Elkartek SDG 9 projects	Number of projects or funding out of the total in the area of "smart industry"	Basque Government. Department of Economic Development, Sustainability and Environment	9	Output	Direct
Publications related to SDG 11	Publications assigned to SDG 11 according to WoS methodology	Web of Science /Incites	11	Output	Direct
Private sector R&D expenditure related to SDG 11	Percentage of the socio-economic objective of private for non profit institutions, dedicated to "infrastructure, transport and telecommunications"	R&D Survey. Eustat (Basque Statistics Office)	11	Input	Direct
EPO green patents and patents by SDG11 technology field	Green patents in the field of technology related to SDG 11 "4: Transport-related climate change mitigation technologies and 5: Building-related climate change mitigation technologies".	OECD-Regpat and Eurostat	11	Output	Direct
No. / Funding European SDG 11 projects	Number of projects or funding out of the total in the pillar "Climate, Energy and Mobility".	European Commission Platform	11	Output	Direct
Publications related to SDG 13	Publications assigned to SDG 13 according to WoS methodology	Web of Science /Incites	13	Output	Direct
Private sector R&D expenditure related to SDG 13	Percentage of the socio-economic objective of enterprises and non-profit institutions, dedicated to "Environmental monitoring and protection".	R&D Survey. Eustat (Basque Statistics Office)	13	Input	Direct
Green patents EPO and patents by technological field	All green patents	OECD-Regpat and Eurostat	13	Output	Direct
No. / Funding European SDG 13 projects	Number of projects or funding out of the total in the pillar "Food, Bioeconomy and Natural Resources, Agriculture and Environment"	European Commission Platform	13	Output	Direct

3. Application of the proposed methodology

In the following section, an analysis is conducted on the results of implementing the proposed methodology categorised by type of indicator (input or output) and by the specific social challenge addressed. The timeframe of the analysis begins with the approval of the STIP 2020 (in 2014) and concludes with the most recent available year. The limited time since the adoption of the STIP 2030 restricts the practical application of the developed methodology.

3.1. Input indicators

This section presents the indicators classified as R&D&I input indicators (regardless of their potential categorisation as input or output concerning the social challenge they address). The analysis of these indicators is structured based on each indicator's contribution to the various SDGs, focusing on social challenges on one hand and their overarching contribution to innovation (SDG9) on the other.

3.1.1. R&D personnel

Regarding the various indicators related to R&D personnel, an analysis is conducted focusing first on the general contribution to SDG 9, and subsequently on the contribution to the social challenge of gender equality (SDG 5).

Overall contribution to SDG 9 (Industry, innovation and infrastructure)

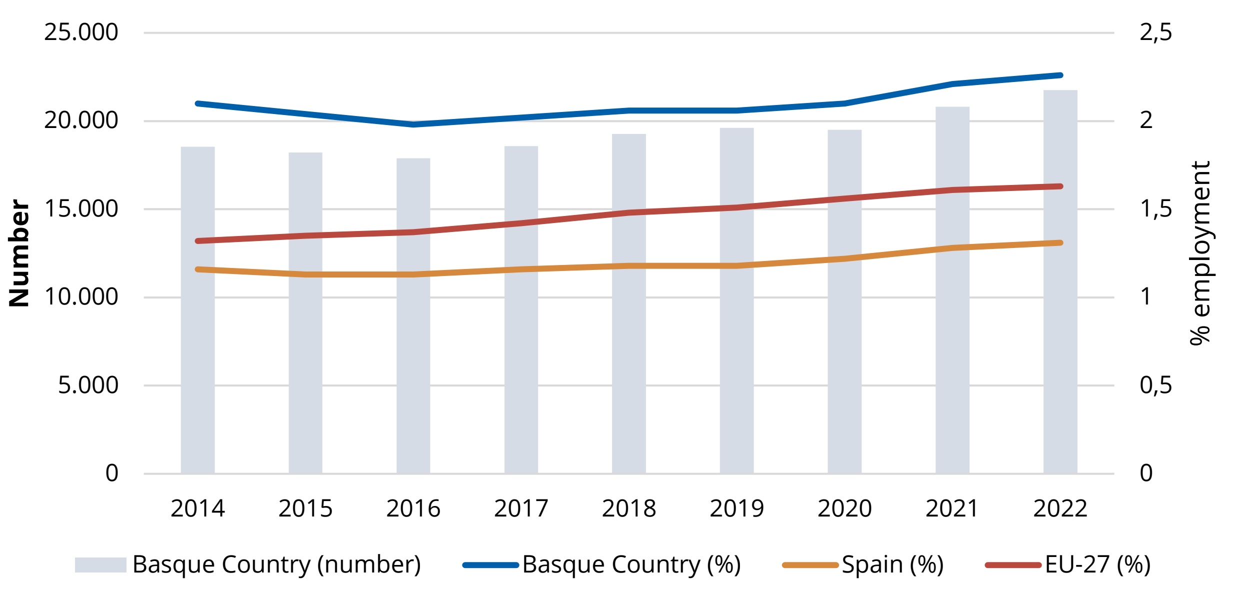
FTP personnel engaged on R&D (% employment)

Source: R&D Statistics. Eustat (Basque Statistics Office)

The following indicator captures the number of personnel in Full-Time Equivalents (FTE) engaged in R&D activities in the Basque Country. That is the total of full-time staff and the proportional time committed by part-time staff to R&D activities (ranging from 10% to 90% of their work schedule, including individuals who have worked on R&D for less than a year).[8] The data are presented without distinction of scientific discipline (exact and natural sciences, engineering and technology, medical sciences, agricultural sciences, and social sciences and humanities) or role (research, technical, and support staff).

[8] Definition available on EUSTAT: https://en.eustat.eus/documentos/elem_1701/definicion.html

Graph 1: FTP personnel engaged on R&D in Basque Country, Spain and EU-27 (% employment)



Source: Eustat (Basque Statistics Office) and Eurostat. Compiled by authors.

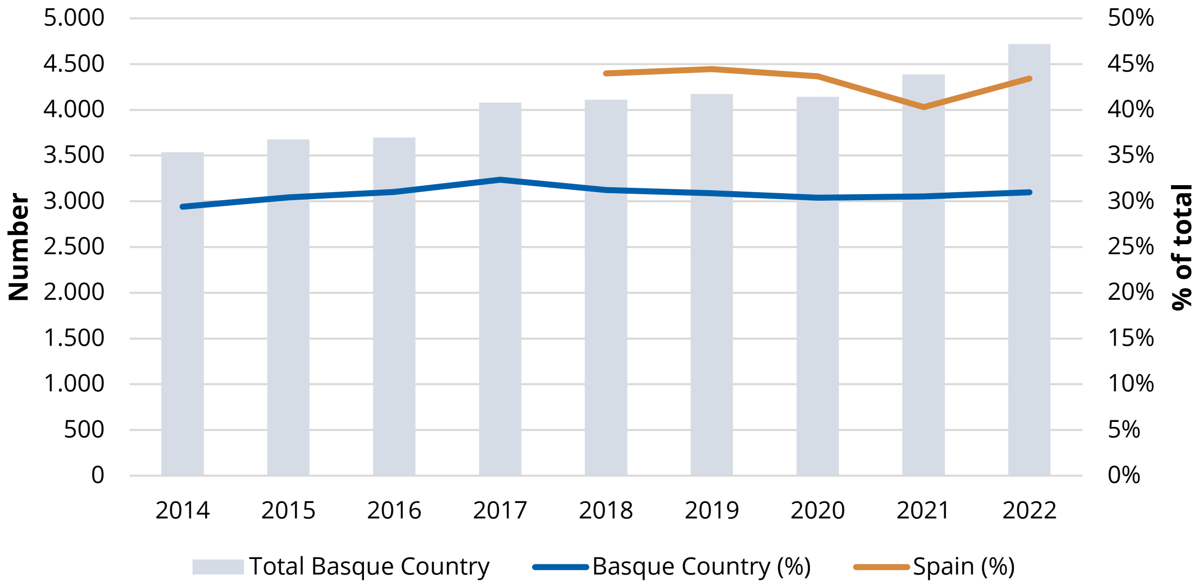
The total number of Full-Time Equivalent (FTE) personnel dedicated to R&D is 21,746 in 2022. Observing the trend over time, there has been a 14% increase since 2014. Despite a slight decrease in 2020 compared to the previous year, the number of R&D personnel has risen over the last two years for which data are available. In terms of its percentage of overall employment, the Basque Country has consistently stayed above 2% throughout the analysed period, showing an upward trajectory, and is significantly higher than both the Spanish and European averages.

FTE personnel engaged on R&D, doctorate holder researchers (% of total)

Source: R&D Statistics. Eustat (Basque Statistics Office).

Of the total Full-Time Equivalent (FTE) personnel dedicated to R&D, a significant majority are researchers (13,714 out of the total of 21,746 personnel in 2022), with the remainder being technical and support staff. Among the research personnel, roughly one-third have earned doctoral degrees, specifically 31% in 2022, a figure that has stayed relatively stable over the period reviewed. According to data from the INE (National Statistics Institute of Spain), Spain displays a higher percentage of doctorate holders across all sectors for the entire period analysed.

Graph 2: FTE personnel doctorate holder researcher (% of total FTE personnel engaged on R&D)



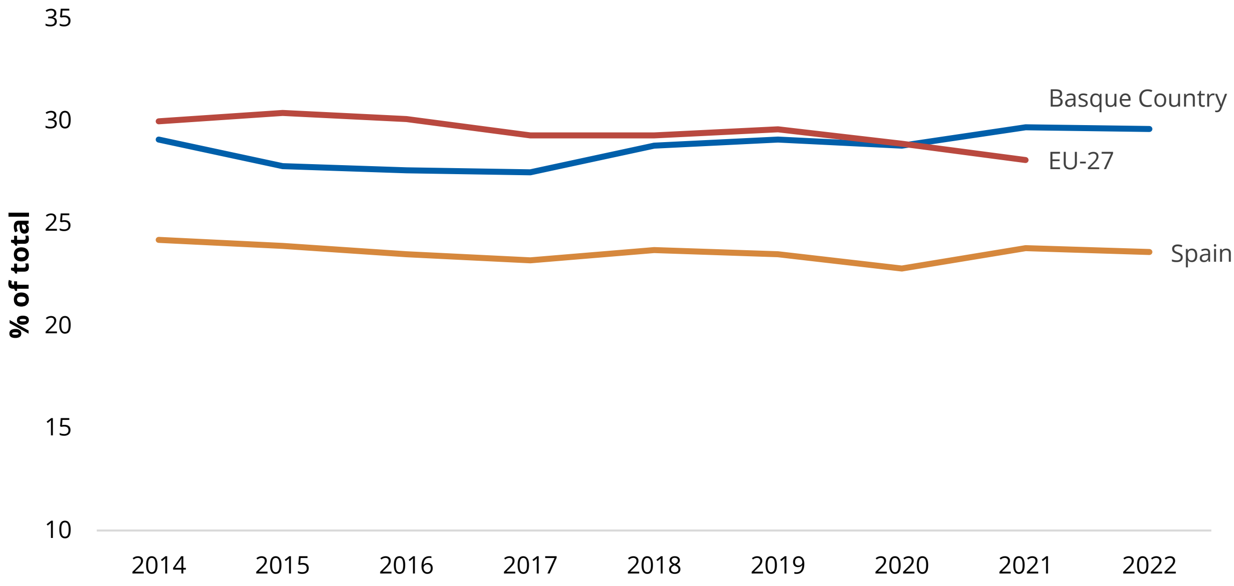
Source: Eurostat and INE (Spanish National Statistics Institute). Compiled by authors.

Percentage of new enrolments in STEM degrees relative to new university degree enrolments.

Source: Spanish Government. Ministry of Universities. Integrated University Information System (SIIU).

This indicator is included in the STIP 2030 Scorecard and relates to the proportion of new enrolments in STEM degrees out of the total new degree enrolments. STEM stands for Science, Technology, Engineering, and Mathematics.

Graph 3: STEM enrolments in the Basque Country, Spain and EU-27 (% of total)



Source: SIIU. Compiled by authors.

In 2022, 29.6% of new enrolments were into STEM degrees, meaning approximately one-third of the student body enrolled in a STEM programme. As illustrated in Graph 3, the proportion of new STEM enrolments relative to total degree enrolments has shown a slight upward trend since 2017, with minimal variation throughout the period.

Comparatively, the Basque Country has consistently outperformed Spain over the analysed period (2014-2022). When compared to the European average, although it was lower from 2014 to 2019, the Basque Country surpassed the European average in the most recent year for which data is available for both regions (2021).

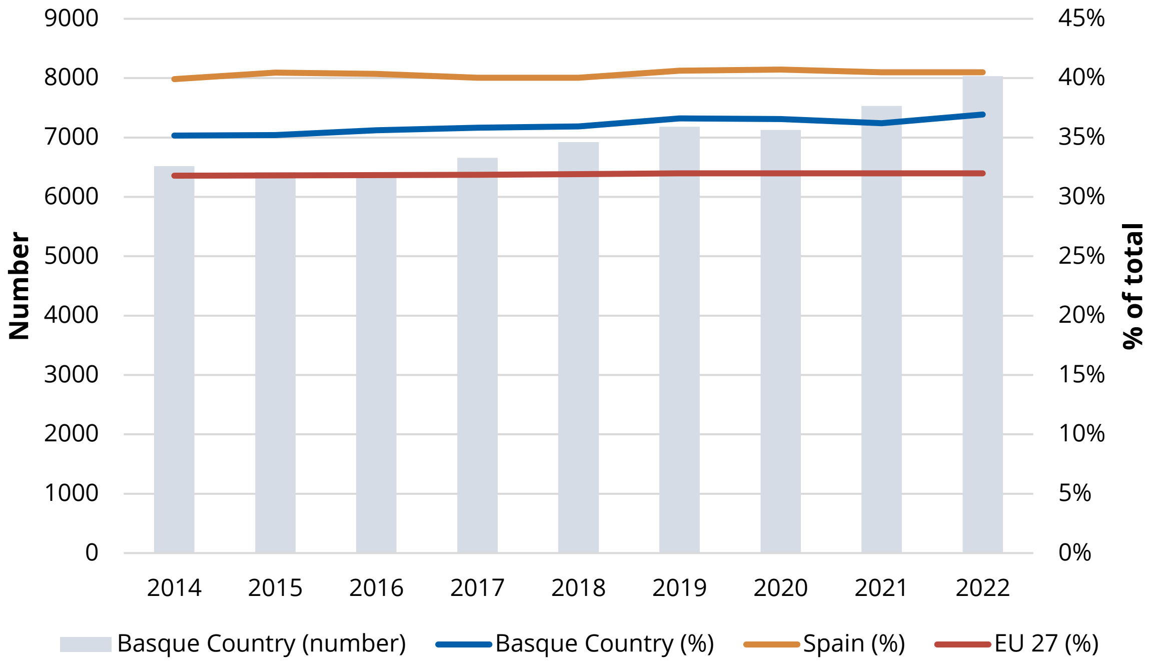
Social challenge: gender equality (SDG 5)

Percentage of FTE women engaged on R&D (% of total)

Source: R&D Statistics. Eustat (Basque Statistics Office)

Regarding **FTE personnel, by gender**, the trend in the number of women engaged in R&D has been positive, although a gender gap persists. Specifically, in the most recent year for which data is available, 2022, women constitute 36.9% of the FTE personnel in R&D, as depicted in Graph 4. In comparison, the Basque Country exceeds the European average for this indicator. However, it has a lower percentage of women in FTE roles compared to the overall numbers in Spain for the entire period examined.

Graph 4 FTE female personnel in the Basque Country, Spain and EU-27 (% of total)



Source: Eustat (Basque Statistics Office) and Eurostat. Compiled by authors.

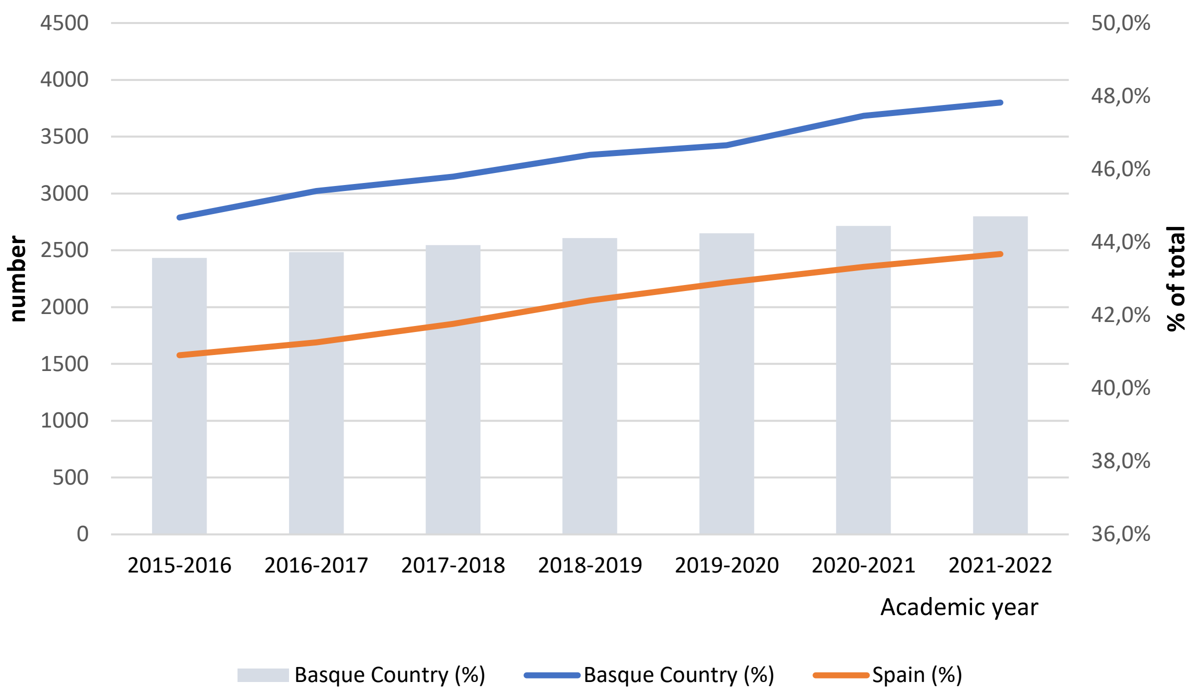
Female teaching and research staff (TRS) in the university system (% of total)

Source: University Personnel Statistics (EPU). Integrated University Information System (SIIU). Ministry of Universities.

The indicator details the gender-based distribution of the total number of teaching and research staff (TRS) in the Basque university system for each academic year.

While the number of men has remained relatively stable over the last seven academic years, the number of women has significantly increased to represent 48% of positions in the latest available academic year (2021-2022). As illustrated in Graph 5, the Basque university system exhibits greater gender parity throughout the entire period analysed compared to the Spanish university system, both showing a very similar upward trend. This positive trajectory signifies a contribution towards SDG 5.

Graph 5: Women teaching and research staff (TRS) in the university system in the Basque Country and Spain (% and number)



Source: SIIU. Compiled by authors.

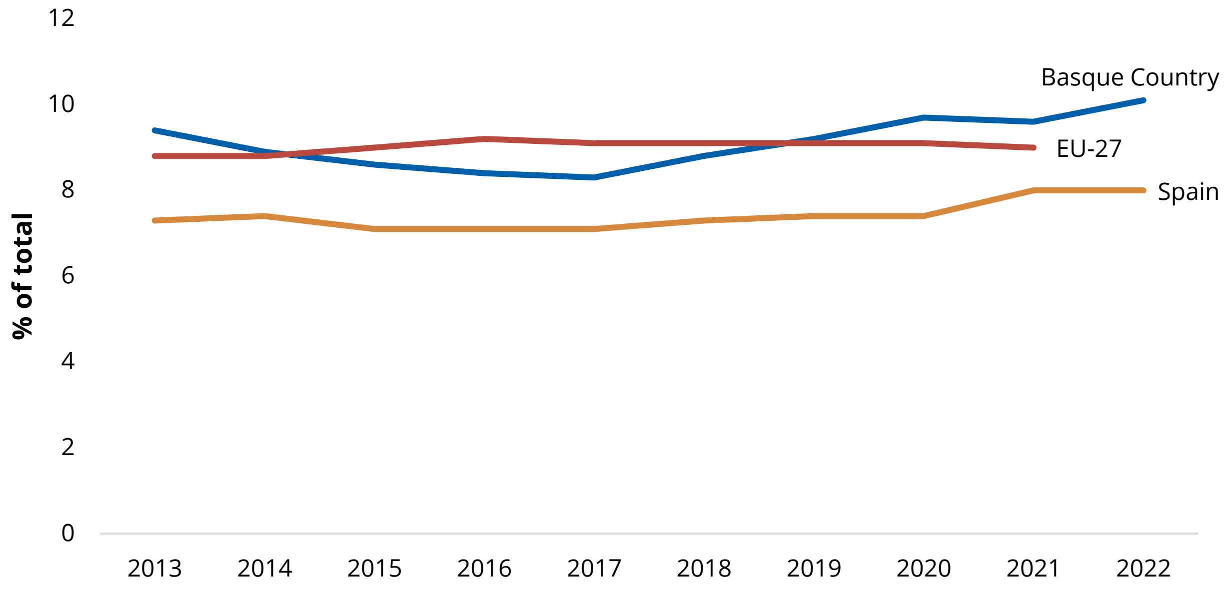
New enrolments in STEM degrees relative to new university degree enrolments (% women)

Source: Eustat (Basque Statistics Office). Socio-demographic statistics; Eurostat. Education and training; Spanish Government. Ministry of Universities. Integrated University Information System (SIIU).

As indicated in Graph 6, although **the percentage of women enrolling in STEM degrees** has seen an increase, particularly from 2017 onwards, it still remains low, not reaching even half the percentage of their male counterparts. In 2022, women made up 10.1% of enrollees in STEM fields, whereas men accounted for 19.5%, equating to one woman for every two men enrolled.

In a European context, the Basque Country fell below the EU-27 average from 2014 to 2019. However, in 2020 and 2021, the Basque Country registered slightly higher than the EU-27 average for the percentage of women enrolling in STEM degrees, at 9.6% in the Basque Country (of the total new enrollments) compared to 9% for the European average. Moreover, it surpasses the percentage of women enrolling in STEM degrees in Spain for the entire period analysed.

Graph 6: STEM enrolments in the Basque Country, Spain and EU-27 (%)



Source: Eustat and SIIU. Compiled by authors.

NB: 2022 data not available for EU-27

3.1.2. R&D expenditure

Next, an analysis is conducted on research and development (R&D) investments broadly, as well as on private sector R&D expenditure by specific social challenges (energy and climate change, digital transition, and health).

Overall contribution to SDG 9 (Industry, innovation and infrastructure)

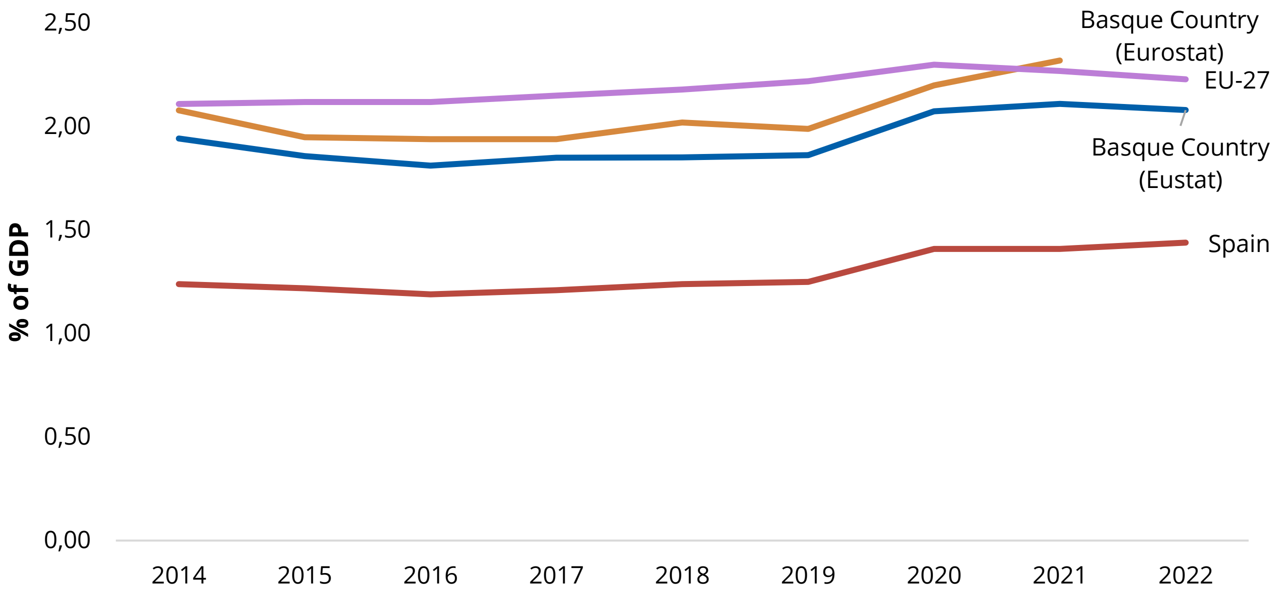
Total R&D investment (% GDP)

R&D investment financed by the private sector (% GDP)

Source: R&D Statistics. Eustat (Basque Statistics Office).

The total R&D investment indicators and those for the private sector reflect the commitment to research and experimental development (R&D). Investment relative to GDP has risen during the time frame covered, with particular growth in the last three years for which data are available (2020, 2021, and 2022). Throughout the entire period reviewed, the Basque Country has invested more than Spain, and in recent years it has achieved convergence with Europe (being slightly above according to Eurostat data in 2021, and slightly below according to Eustat data in 2022).

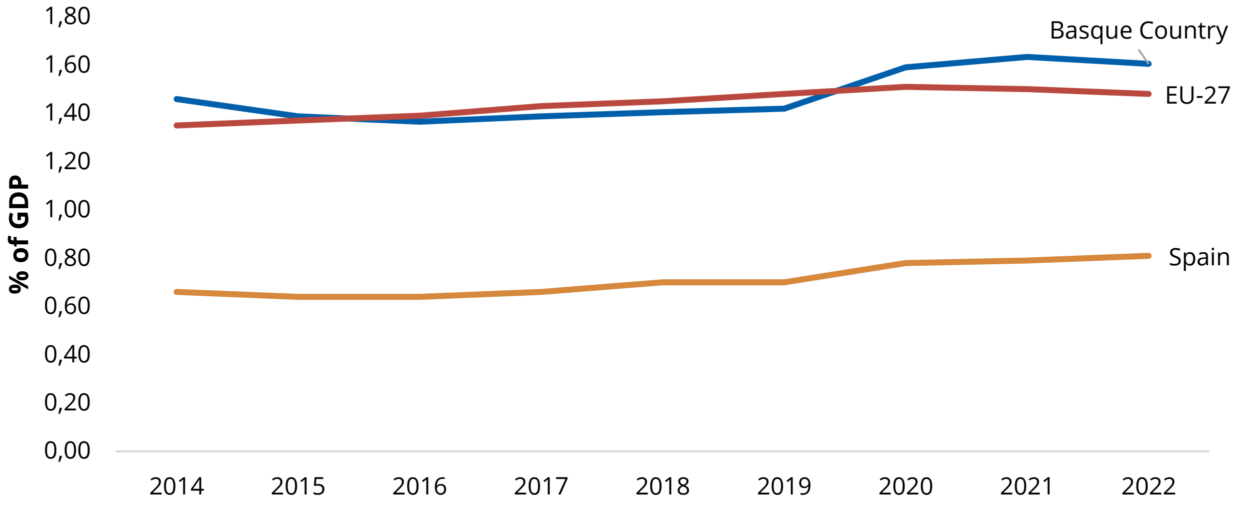
Graph 7: Total R&D investment (% GDP)



Source: Eustat (Basque Statistics Office) and Eurostat. Compiled by authors.

Regarding private sector investment, which includes both businesses and private not-for-profit institutions (PNPIs), it more closely approaches the European average compared to the total, even exceeding the EU-27 in the last three years (2020, 2021, and 2022). Furthermore, it is substantially ahead of the private sector investment in Spain for the entire period analysed (2014-2022).

Graph 8: Private sector R&D investment (% GDP)



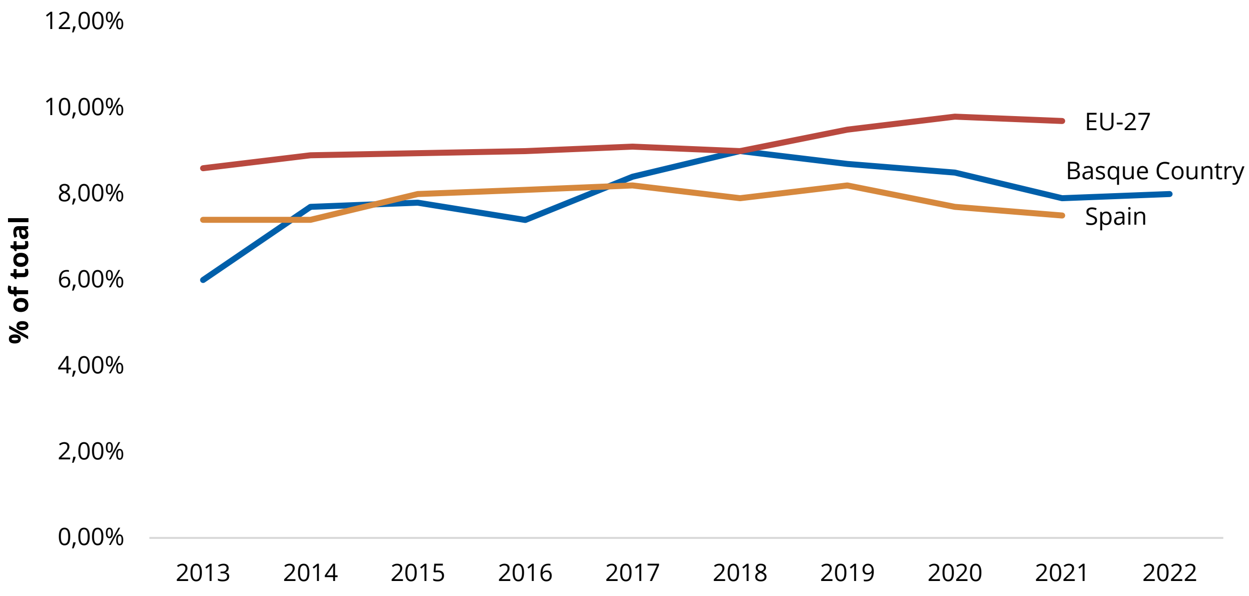
Source: Eustat (Basque Statistics Office) and Eurostat. Compiled by authors.

International R&D funding (% of total expenditure)

Source: R&D Statistics. Eustat (Basque Statistics Office).

The indicator pertains to R&D expenditure funded from foreign sources. The proportion of international funding has increased in the period analysed, from 6% in 2013 to 8% in 2022, with a peak at 9% in 2018. Since 2017, the Basque Country has exceeded Spain in terms of international funding, yet remains below the European average.

Graph 9: International R&D funding (% of total expenditure)



Source: Eustat (Basque Statistics Office) and Eurostat. Compiled by authors.

After analysing the overarching indicators that impact SDG 9, we can further determine the specific SDGs and corresponding social challenges that are being addressed by examining the socio-economic objectives of R&D spending. This analysis is conducted solely for the expenditures of businesses and private not-for-profit institutions (PNPIs), due to the lack of available information for public administration and higher education expenditures.

Private sector R&D expenditure (companies and PNPIs) by socio-economic objective.

Source: R&D Survey. Eustat (Basque Statistics Office)

The indicator captures private sector expenditure, namely that carried out by corporations and private not-for-profit institutions (PNPIs), based on the socio-economic objective of the research conducted[9]. We focus exclusively on the private sector spending, as there is no available data on the socio-economic objectives from public bodies or Higher Education in the Eustat R&D Survey.

The following table presents the potential purposes identified in the survey for the private sector and their corresponding alignment for taxonomy purposes with the SDGs outlined in the STIP 2030 (and the associated social challenge of the STIP 2030), wherever applicable:

Table 1: Socio-economic objective of private sector R&D expenditure by SDG

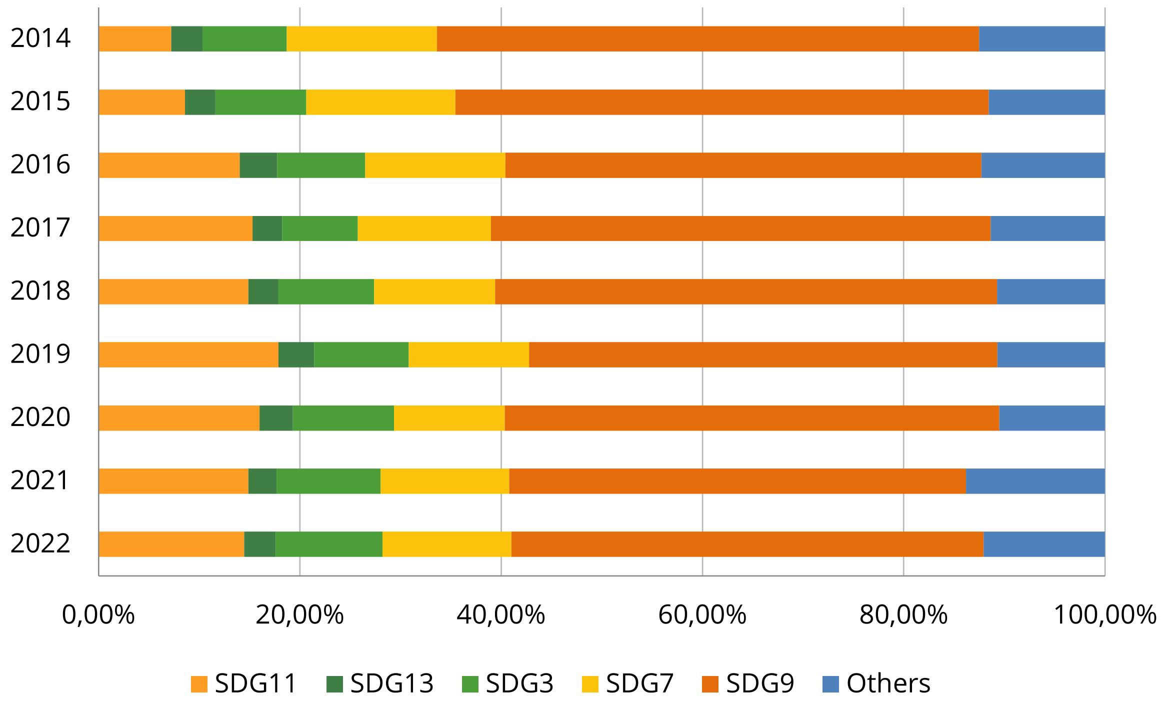
Purpose	Related main SDG	Associated social challenge of the STIP
Exploration and exploitation of the terrestrial environment and the atmosphere	-	
Infrastructure, transport and telecommunications	**SDG 11**	Energy and climate change
Environmental control and protection	**SDG 13**	Energy and climate change
Protection and improvement of human health	**SDG 3**	Good health and well-being
Production, distribution and rational use of energy	**SDG 7**	Energy and climate change
Agriculture, livestock, forestry and fisheries development	-	
Industrial production and technology	**SDG 9**	Digital transformation
Social structures and relations	-	
Space exploration and exploitation	-	
Non-oriented research	-	
Education, culture, leisure, religion and media	-	
Defense	-	

Source: Compiled by authors

The change over time in private sector R&D expenditure as a percentage of the total, broken down by the SDGs in the STIP 2030, is illustrated below. The purposes specified in the previous table that are not linked to any SDG are included in the Other category in the chart. The temporal change in percentages from 2014 to 2022 is depicted.

[9] For the comparison with Spain, there are variations in how the socio-economic objectives are described in the R&D Statistics of the INE (National Statistics Institute of Spain). This report applies the following criteria to associate these objectives with SDGs for Spain: Environmental control and care (SDG 13), Transport and telecommunications systems and Other infrastructure (SDG 11), Production, distribution, and rational use of energy (SDG 7), Industrial production and technology (SDG 9), and Protection and improvement of human health (SDG 3).

Graph 10: Change over time in private sector R&D expenditure as a share of total R&D expenditure by SDG (2014-2022)



Source: Eustat (Basque Statistics Office). Compiled by authors.

Nearly half of the R&D spending in the private sector is allocated to industrial production and technology, meaning it contributes to the digital transition challenge (SDG 9). This expenditure has remained steady over time, though its relative significance has somewhat diminished in recent years, declining from 53.9% of total spending in 2014 to 46.9% in 2022.

The next priority is energy and climate change, representing 30.4% of R&D expenditure in 2022. A significant portion of this figure originates from investment in Infrastructure, transport, and telecommunications, which has increased its weight from 7.2% in 2014 to 14.5% in 2022, and from spending on energy, comprising 12.8% in 2022. Thirdly, expenditure directed toward the health challenge stands at 10.6% in 2022, having stayed relatively constant throughout the period under review.

Box 1: Distribution of R&D expenditure by RIS3 areas

The STIP 2030 monitoring report provides another perspective on the distribution of internal R&D expenditure by smart specialisation areas, based on economic activity codes, as shown in Table 2.

Table 2: Distribution of domestic R&D expenditure by smart specialisation areas and SDGs

Scope		2022	Related main SDG	Associated social challenge of the STIP
Horizontal Priorities	Smart Industry	48.5%	**SDG 9**	Digital Transformation
	Cleaner Energies	13.3%	**SDG 7**	Energy and Climate change
	Personalised Health	9.9%	**SDG 3**	Good health and Well-being
Opportunity Territories	Healthy Food	3.1%	**SDG 3**	Good health and Well-being
	Sustainable Cities	3.5%	**SDG 11**	Energy and Climate change
	Basque Country Creative	0.7%	**---**	
	Eco-innovation	1.7%	**SDG 13**	Energy and Climate change

Source: Lehendakari (Prime Minister's Office) Basque Government.

Although the percentages vary slightly, the interpretation of the data is consistent, with the 'Smart Industry' sector related to SDG 9 accounting for the highest percentage of spending (48.5% in 2022). This is followed by the challenges of energy and environment, represented by 'Cleaner Energy', 'Sustainable Cities', and 'Eco-innovation', which pertain to SDGs 7, 11, and 13 respectively (18.5% in 2022), and the health challenge, featuring 'Personalised Health' and 'Healthy Food', at approximately 13% in 2022.

Subsequently, the report analyses the evolution of the private sector's R&D expenditure in detail, with a focus on the spending associated with each social challenge and the respective SDGs, using the R&D expenditure indicator provided by Eustat. The analysis also includes a comparison with Spain, using National Statistics Institute of Spain (INE) data, with available records commencing in 2018.

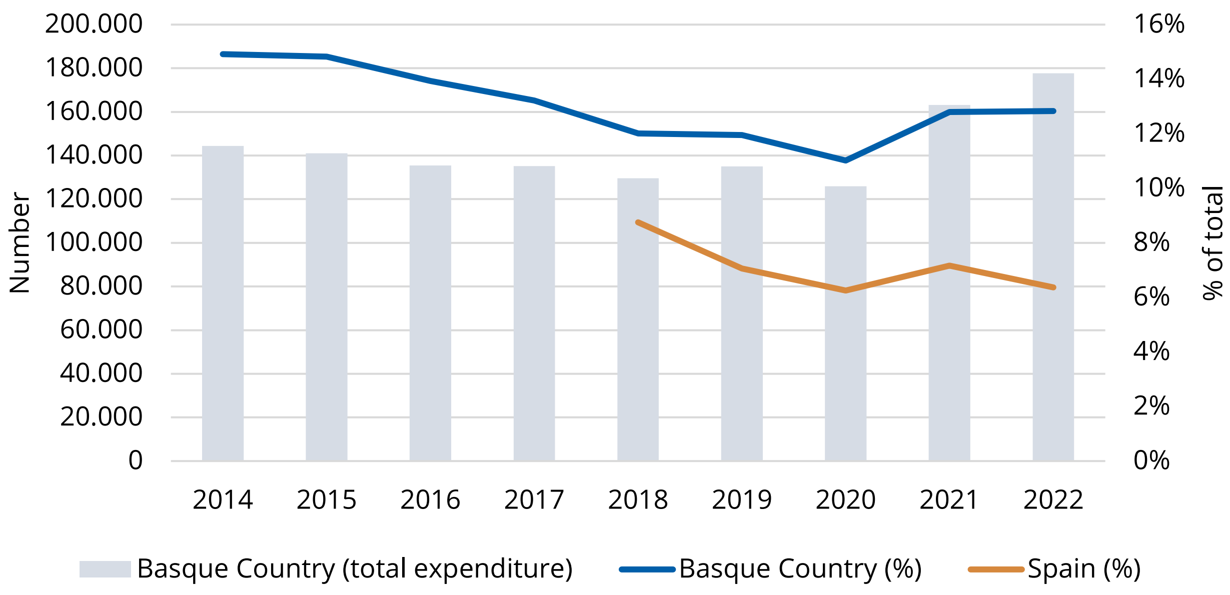
Social challenge: energy and climate change (SDG 7, 11 and 13)

SDG 7 "Affordable and clean energy"

The chart below displays the amount of private expenditure allocated to Production, distribution, and rational use of energy, which corresponds to SDG 7. Although the percentage of total spending has decreased in 2022 compared to 2014, the private sector has significantly increased its investment in R&D related to SDG 7 over the past two years.

Furthermore, when compared with the rest of Spain, the Basque Country's private sector energy expenditure (12.83%) is nearly double that of Spain as a whole (6.37%) for the latest available year (2022).

Graph 11: Private sector R&D expenditure related to SDG7 (2014-2022)



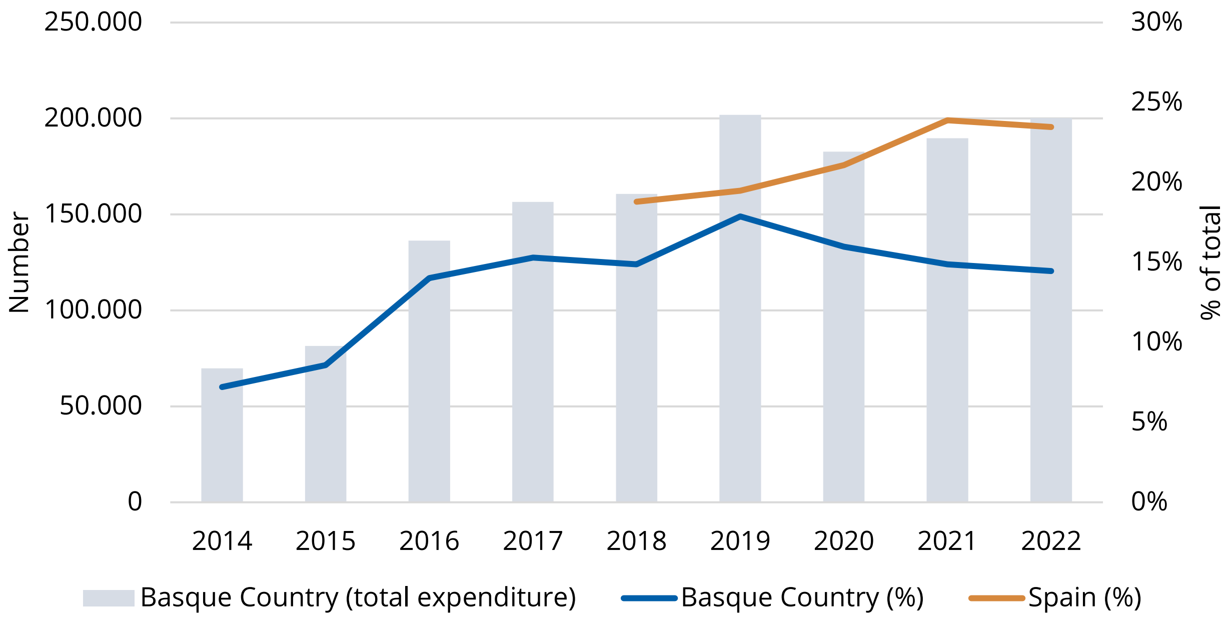
Source: Eurostat and INE (Spanish National Statistics Institute). Compiled by authors.
NB: Data is not available for Spain in the period 2014-2017

SDG 11 "Sustainable cities and communities"

There is a clear upward trend in private sector R&D spending on infrastructure and spatial planning, related to the Sustainable Cities SDG, up to 2019, both in actual amounts and as a percentage of total spending (from 7.2% in 2014 to 17.9% in 2019). In the pandemic year of 2020, spending declined (and the percentage dropped to 16%), and while there has been a partial recovery, spending has not yet returned to the pre-pandemic levels of 2019.

In comparative terms, while in 2019 the private sector in both the Basque Country and Spain allocated approximately 18-19% of its R&D expenditure to SDG 11, the trends have diverged significantly since then. In Spain, the trend has continued to rise, reaching 23% in 2022, whereas in the Basque Country, the proportion has decreased to 14% in the same year.

Graph 12: Private sector R&D expenditure related to SDG11 (2014-2022)



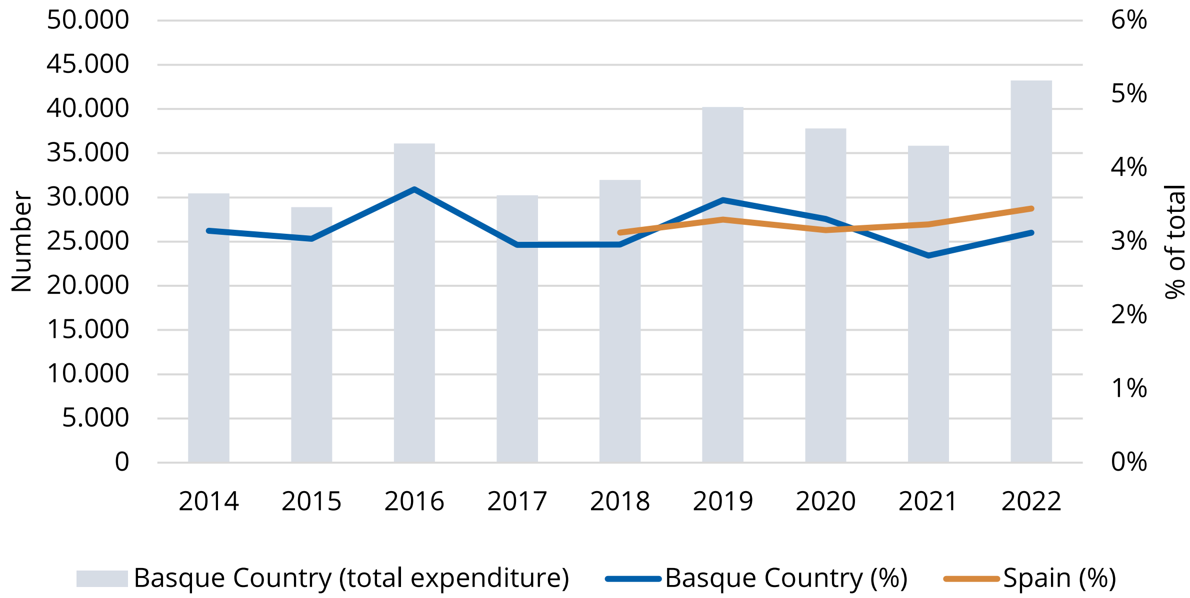
Source: Eurostat and INE (Spanish National Statistics Institute). Compiled by authors.
NB: Data is not available for Spain in the period 2014-2017

SDG 13 "Climate action"

Private sector spending on "environmental control and protection" represents the smallest allocation among the SDGs covered in this report, accounting for about 3% of the private sector's expenditure over the period analysed (2014-2022). In 2019, there was an increase in expenditure to 40,236 thousand euros, or 3.6% of total expenditure, followed by a decrease in both indicators until 2021, and then a rise again in 2022 to 43,227 thousand euros, which equated to 3.1% of total expenditure.

Also, in Spain, spending on the environment carries the lowest percentage weight among the SDGs examined and is positioned at figures very similar to those of the Basque Country for the entire period analysed where data are available.

Graph 13: Private sector R&D expenditure related to SDG13 (2014-2022)



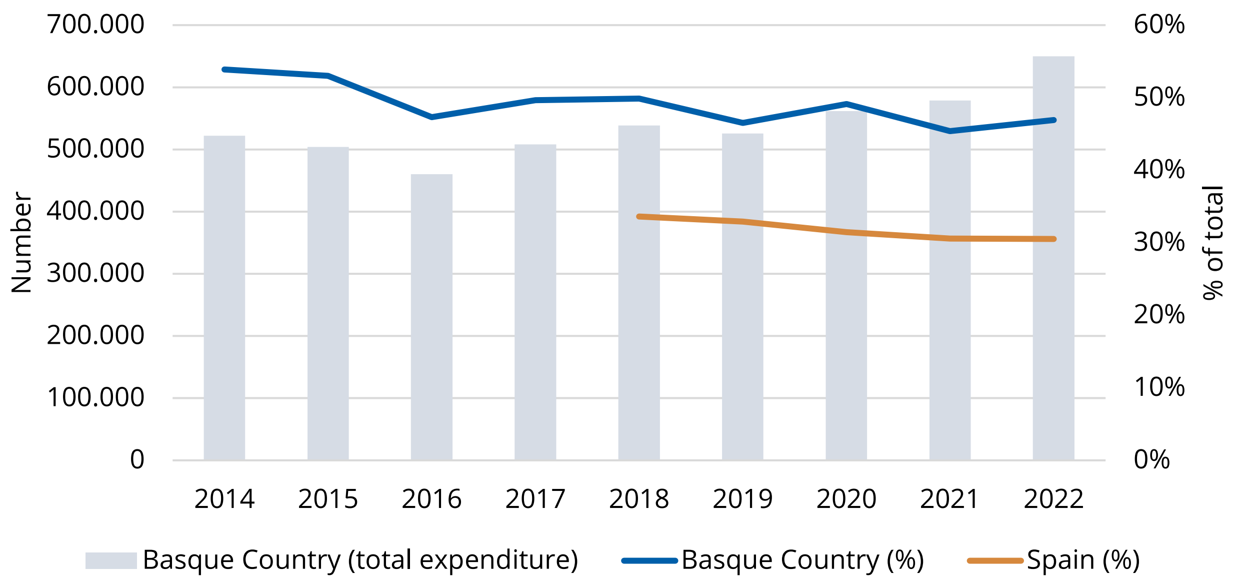
Source: Eurostat and INE (Spanish National Statistics Institute). Compiled by authors.
NB: Data is not available for Spain in the period 2014-2017

Social challenge: digital transition (SDG 9 Industry, Innovation and Infrastructure)

Spending on "industrial production and technology", i.e., related to the digital transition (SDG 9), accounts for nearly half of the total private sector R&D expenditure (46.9% in 2022). Yet, it has decreased in relative terms since 2014, when spending linked to SDG 9 constituted 53.9% of expenditure. This does not mean that companies and private not-for-profit institutions (PNPIs) are investing less. In fact, expenditure has risen (from 521,872 thousand euros in 2014 to 649,639 thousand euros in 2022), but not as much as R&D spending associated with other SDGs.

According to Graph 14, when comparing with the rest of Spain, there is a marked commitment to industrial production and technology in the Basque private sector, at 46.9% in 2022 versus 30.5% in Spain.

Graph 14: Private sector R&D expenditure related to SDG9 (2014-2022)



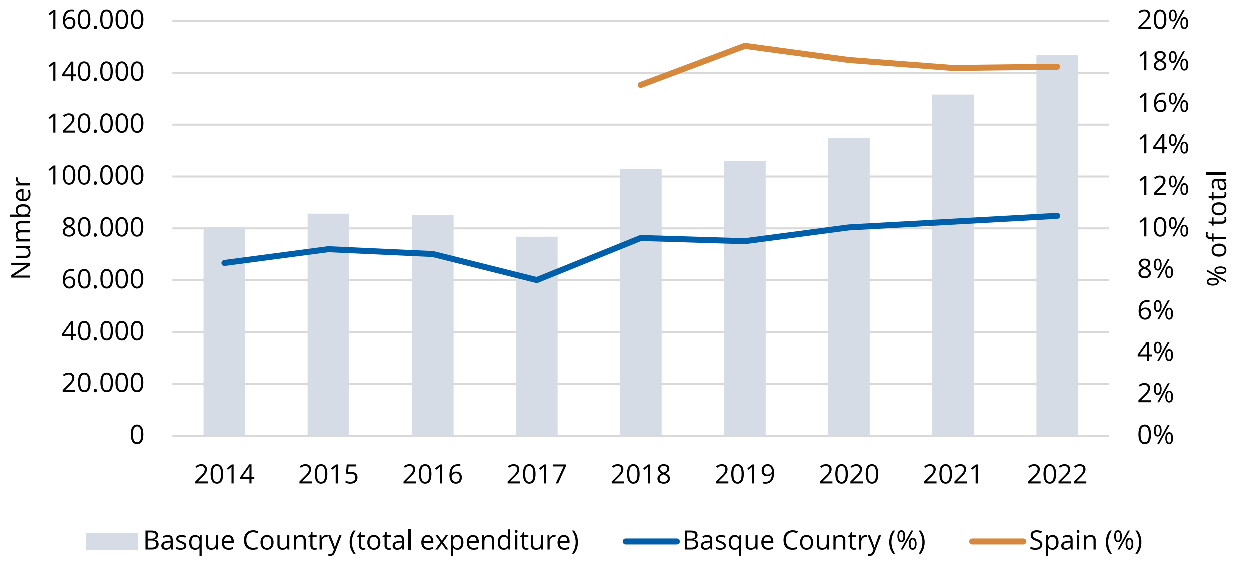
Source: Eurostat and INE (Spanish National Statistics Institute). Compiled by authors.
NB: Data is not available for Spain in the period 2014-2017

Social challenge: health (SDG 3: Good-health and Well-being)

There has been an upward trend in R&D spending for improvement and protection of human health since 2017, with an 11.5% increase in the last year (2022). The share of private sector spending linked to SDG 3 has remained at about 10% throughout the period analysed, except for the figure in 2017, which was 7.5% of the total expenditure.

The Basque Country significantly lags behind Spain in terms of the percentage of private sector spending dedicated to health, which accounts for approximately 18% in the period analysed.

Graph 15: Private sector R&D expenditure related to SDG3 (2014-2022)



Source: Eurostat and INE (Spanish National Statistics Institute). Compiled by authors.
NB: Data is not available for Spain in the period 2014-2017

3.1.3. Other inputs

This section examines R&D input indicators other than the personnel and expenditure previously discussed. Specifically, we analyse innovation investments as a percentage of turnover, which broadly contribute to SDG 9, and knowledge-intensive employment, which supports the social challenge of quality employment linked to SDG 8.

Overall contribution to SDG 9 (Industry, innovation and infrastructure)

Investments in innovation (over turnover)

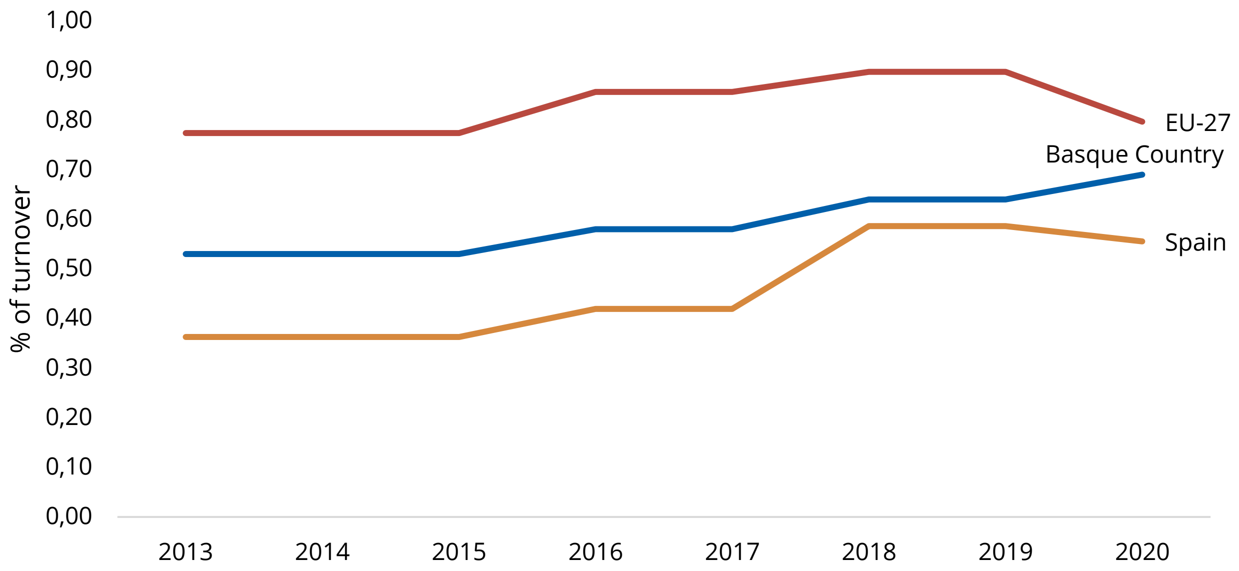
Source: Eustat (Basque Statistics Office). Innovation Survey.

This indicator, included in the STIP 2030 Scorecard, accounts for spending on innovation activities (excluding both internal and external R&D) by companies with 10 or more employees in the industrial and advanced services sectors as a percentage of[10] their total sales. The Basque Country has demonstrated an upward trend over the analyzed period, yet it still falls short of the 0.80% goal established in STIP 2030 for the year 2023. The Basque Country is above the

[10] The industrial and advanced services sectors correspond to what is known as the core that includes the following CNAE-2009 codes: 05-09, 10-33, 35, 36-39, 46, 49-53, 58, 61-63, 64-66, 71-73.

percentage observed in Spain but remains below the European average throughout the analysed period.

Graph 16: Investments in innovation of turnover (2013-2020, %)



Source: Eustat and EIS. Compiled by authors.

Social challenge: quality employment (SDG 8 Decent work and economic growth)

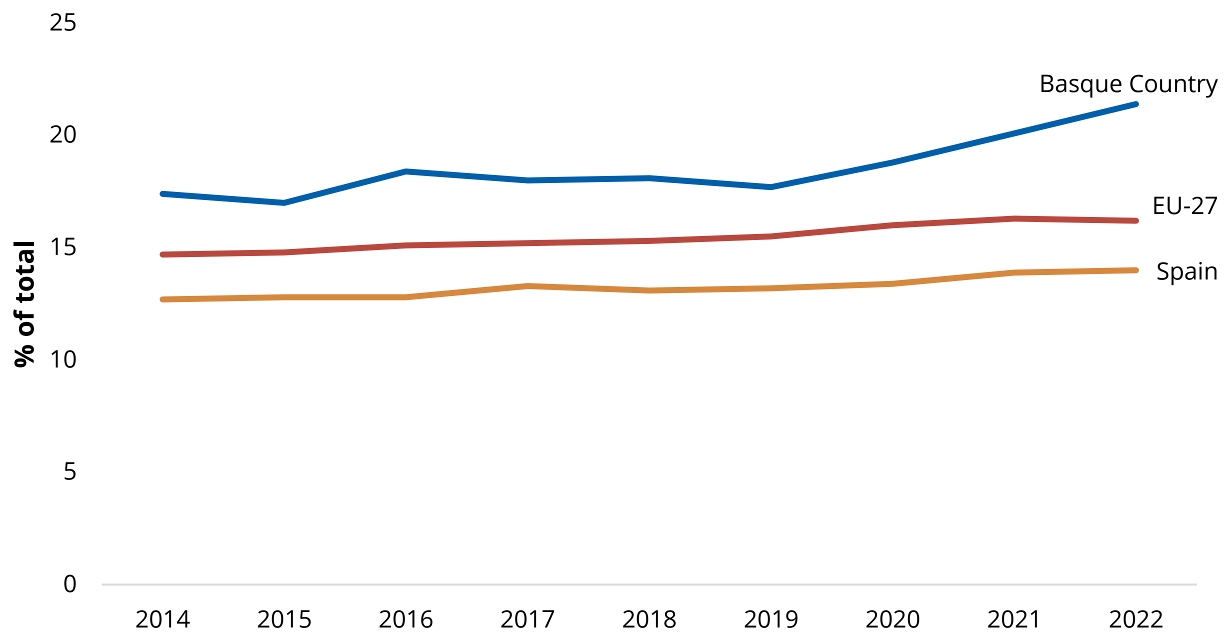
Knowledge-intensive employment

Source: Eurostat.

This indicator, featured in the STIP 2030 Scorecard, measures the percentage of people employed in high- and medium-high-tech manufacturing industries and knowledge-intensive market services (excluding financial services) and high-tech knowledge-intensive services out of the total employment, as defined by Eurostat.

The latest data indicate a positive trend for the Basque Country, whose percentage of the total stood at 21.4% in 2022, above both the EU-27 average (16.3%) and that of Spain (14%).

Graph 17: Knowledge-intensive employment (%)



Source: Eurostat. Compiled by the authors (data available as of 2018)

3.2. Output indicators

This section analyses the main R&D&I output indicators and their contribution to the social challenges defined in the STIP 2030. These indicators include scientific publications, patents and funding for R&D (regional and European).

3.2.1. Publications

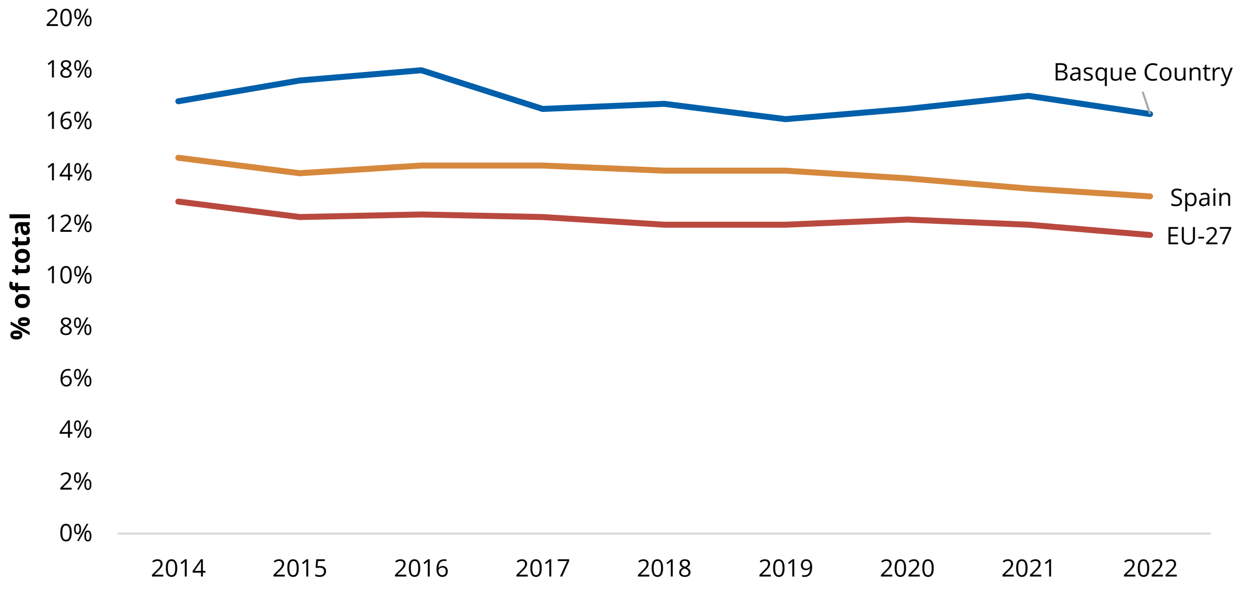
Overall contribution to SDG 9 (Industry, innovation and infrastructure)

Scientific publications in the top 10% most cited internationally

Source: Ikerbasque with Scopus data

Compared to the Spanish and EU-27 averages, the Basque Country is well-positioned in the percentage of scientific publications in the top 10% most-cited internationally, consistently exceeding both regions throughout the analysed period (16.3% in 2022, versus 13.1% and 11.6% for the Spanish and EU-27 averages, respectively). In contrast to the slight downward trend observed in both regions, the Basque Country has held a more stable trajectory in this field, keeping above 16% across all recorded data points.

Graph 18: Publications in the top 10% most cited internationally



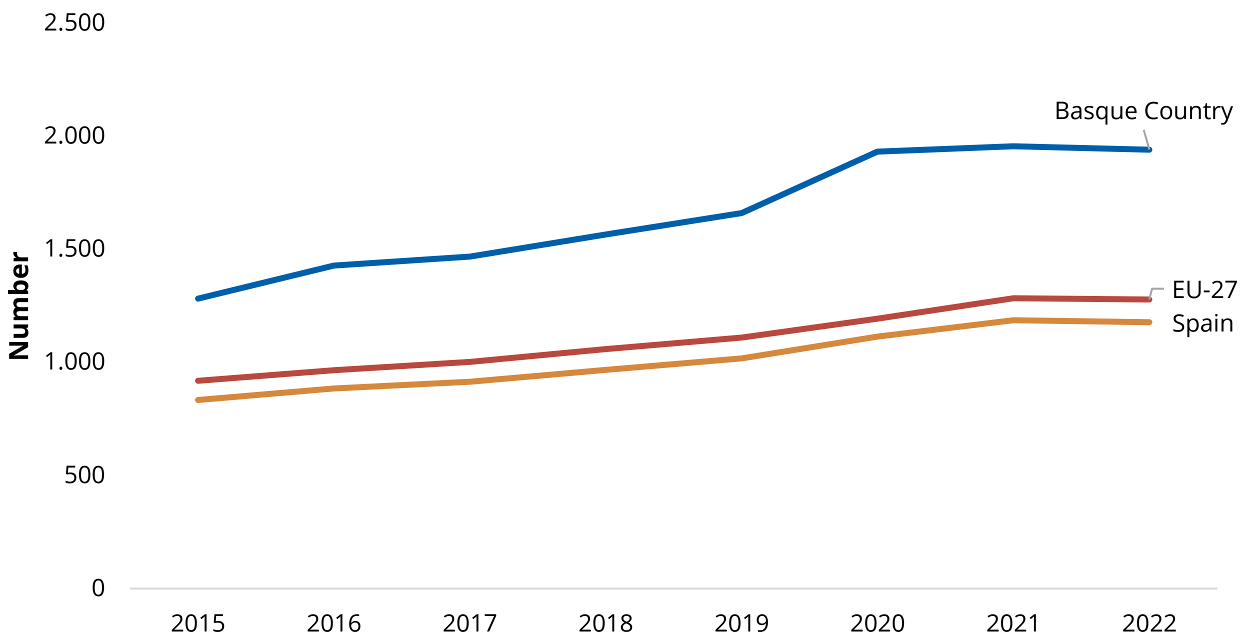
Source: Ikerbasque with Scopus data. Compiled by authors.

International scientific co-publications per million inhabitants

Source: Eustat and EIS.

International collaboration in scientific publications per million inhabitants in the Basque Country has exhibited a positive trend, with 1,941 co-publications achieved in 2022. Furthermore, the Basque Country's standing in this regard stands out, as it surpasses both the European and Spanish averages.

Graph 19: International scientific co-publications per million inhabitants



Source: Eustat and EIS. Compiled by authors.

Academic publications in the Web of Science, by SDG

Source: InCites

The following table ranks academic publications in the Basque Country from highest to lowest by SDG[11]. Firstly, the percentage of each SDG's publications is calculated in relation to the overall number of publications, using a triennial average to reduce variability. SDGs highlighted by the STIP 2030 are emphasised in bold with their respective corporate colours. Additionally, the table indicates the Basque Country's specialisation index compared to the EU-27, showing that a specialisation index greater than 1 signifies the Basque Country's specialisation in those particular SDGs.

[11] Note that the source of this indicator is the Web of Science, not Scopus as with previous indicators, because the former database provides an assignment of publications to SDGs. Methodological details are available in section 2.2 of this document.

Table 3: SDG ranking by number of publications in average 2020- 2022

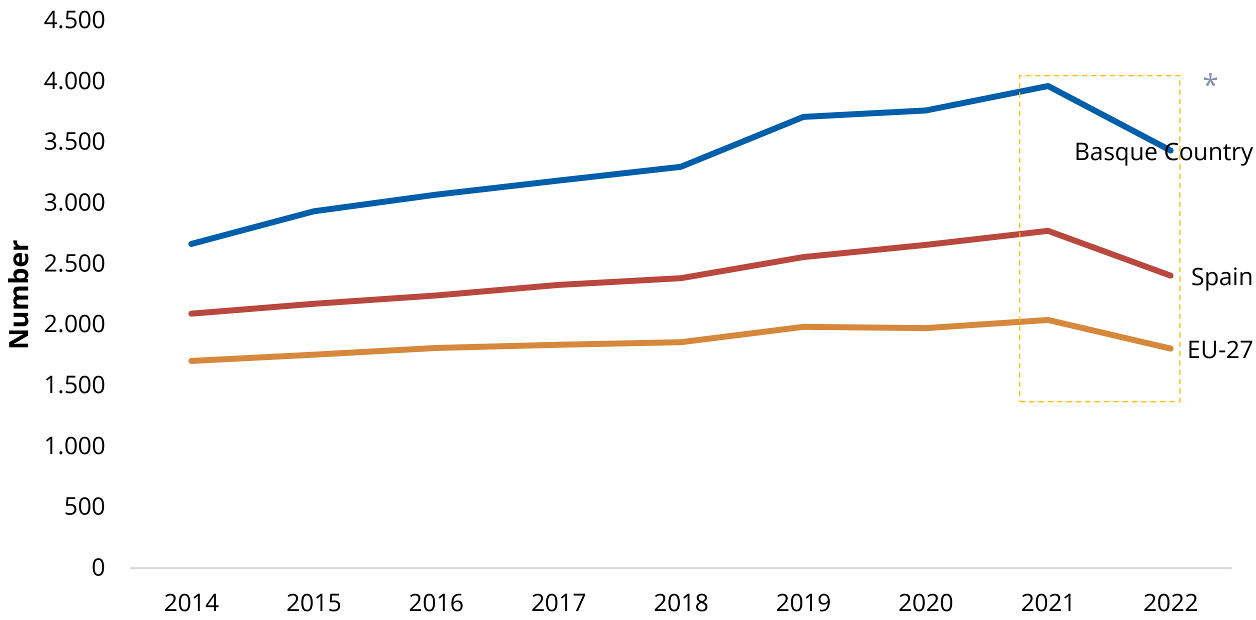
Order (high-low)	Percentage of total (2020-2022)	Specialisation index (2020-2022)
SDG 3	37.42%	1.18
SDG 13	5.87%	1.10
SDG 11	5.47%	1.19
SDG 7	5.34%	**2.14**
SDG 5	3.46%	**1.33**
SDG 4	3.00%	**1.48**
SDG 12	2.92%	**1.90**
SDG 15	2.92%	1.06
SDG 9	2.41%	**1.33**
SDG 14	1.93%	**1.47**
SDG 2	1.64%	0.90
SDG 1	1.19%	1.13
SDG 10	1.08%	1.10
SDG 6	1.05%	0.71
SDG 8	0.71%	0.89
SDG 16	0.55%	**1.51**

Source: Compiled by authors

As can be seen in the table, the top five positions in terms of the percentage of total publications are occupied by SDGs identified by the STIP 2030. Moreover, more than a third of the publications contribute to only one of the goals: SDG 3 on health. SDG 9 ranks tenth, and the most lacking in terms of the percentage of publications is SDG 8 on "decent work and economic growth". However, if we consider the specialisation index compared to Europe, the Basque Country excels in publications contributing to SDG 7 (Energy), more so than any other region.

Looking at the **number of publications** from the Web of Science (WoS) **per million inhabitants**, as shown in the following graph, The Basque Country has demonstrated a very positive trend over the last decade. It is significantly outperforming both Spain and the EU-27 in recent years, and the gap is widening (with 3,964 publications per million people in the Basque Country, compared to 2,041 and 2,773 for the EU-27 and Spain respectively, in 2021).[12]).

Graph 20: Publications on the Web of Science per million inhabitants



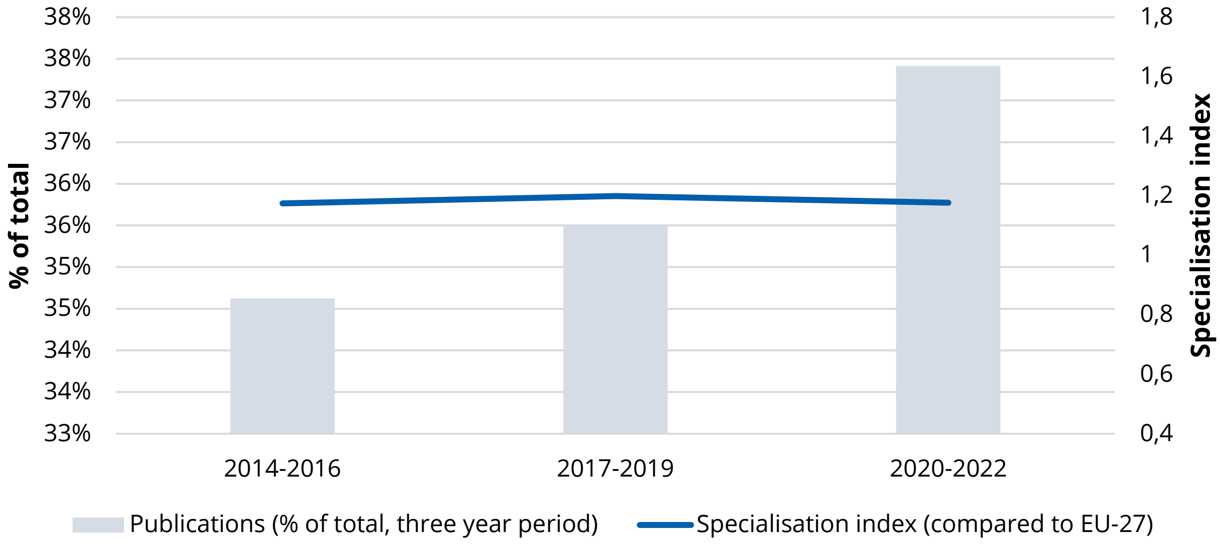
Source: Web of Science. Compiled by authors (*) 2022 data not consolidated

Social challenge: health (SDG 3: Good-health and Well-being)

In relation to the publications that contribute to SDG 3, there has been a positive evolution in relative terms regarding the total number of publications from the three-year period 2014-2016 to the most recent three-year period (2020-2022). Similarly, in terms of specialisation with respect to Europe, the Basque Country is specialised in this sector, demonstrating a stable trend since the 2014-2016 triennium.

[12] The data for 2022 are not yet consolidated, so an assessment cannot currently be made in this regard.

Graph 21: Percentage of publications and specialisation index relating to SDG 3 (2014-2022)

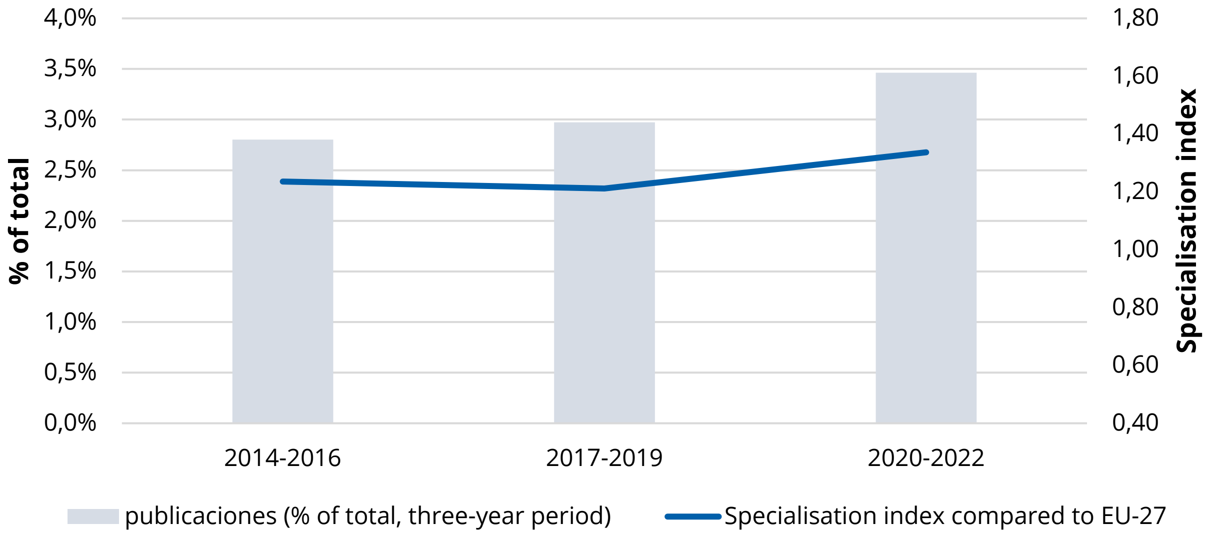


Source: Wos. Compiled by authors.

Social challenge: gender equality (SDG 5 Gender equality)

The weight of publications in this field has increased since 2013-2016. The Basque Country is also specialised in scientific publications compared to the EU-27, with a specialisation index of 1.34 (1 being the EU-27 average).

Graph 22: Percentage of publications and specialisation index relating to SDG5 (2014-2022)



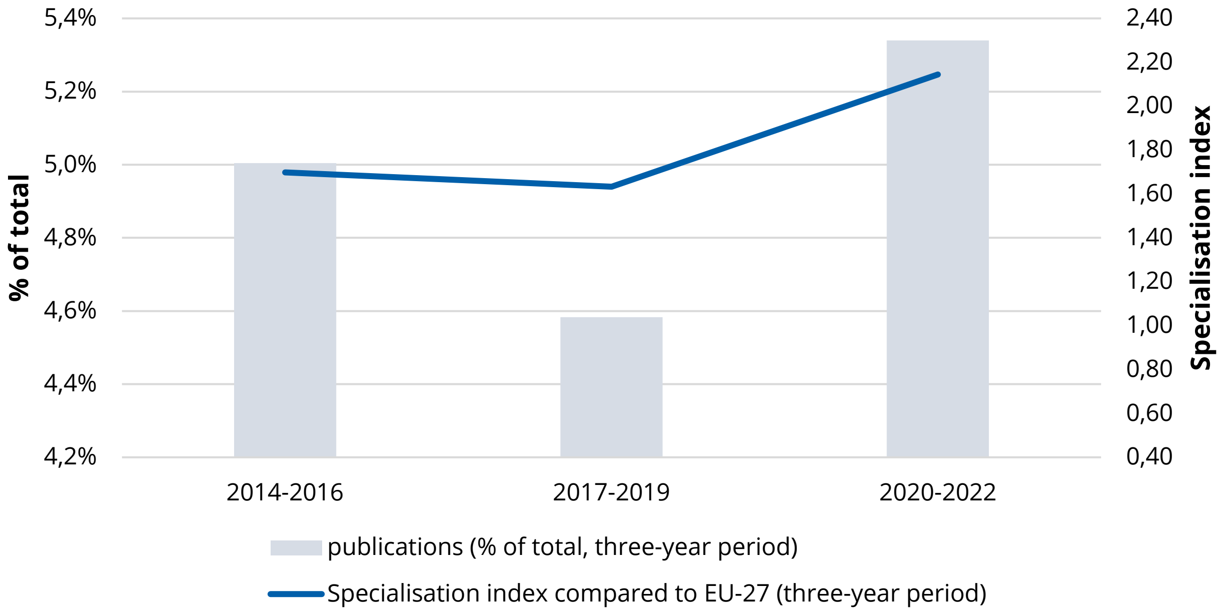
Source: Wos. Compiled by authors.

Social challenge: energy and climate change (SDG 7, 11 and 13)

SDG 7 "Affordable and clean energy"

The Basque Country specialised in publications related to energy, and in the three-year period 2013-2016, the specialisation index with respect to Europe was 1.7, and in the last three-year period (2020-2022), this index stands at 2.14. Energy-related publications account for between 4.6 and 5.3 % of the total between 2014 and 2022.

Graph 23: Percentage of publications and specialisation index relating to SDG7 (2014-2022)

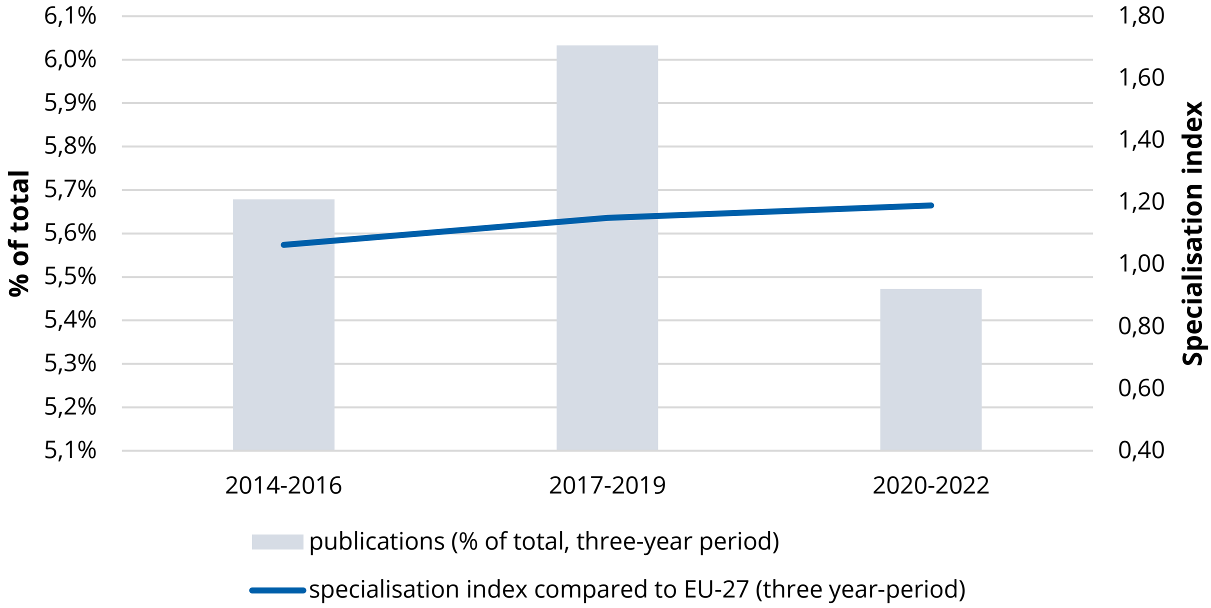


Source: WoS. Compiled by authors.

SDG 11 "Sustainable cities and communities"

SDG 11 is notable for the positive trend in its specialisation index when compared to the EU-27, which stood at 1.2 in the last triennium (2020-2022). Regarding the proportion of publications that contribute to this SDG out of the total, there was a slight decrease in the last triennium compared to the previous one (2017-2019), moving from 6% to 5.5%.

Graph 24: Percentage of publications and specialisation index relating to SDG 11 (2014-2022)

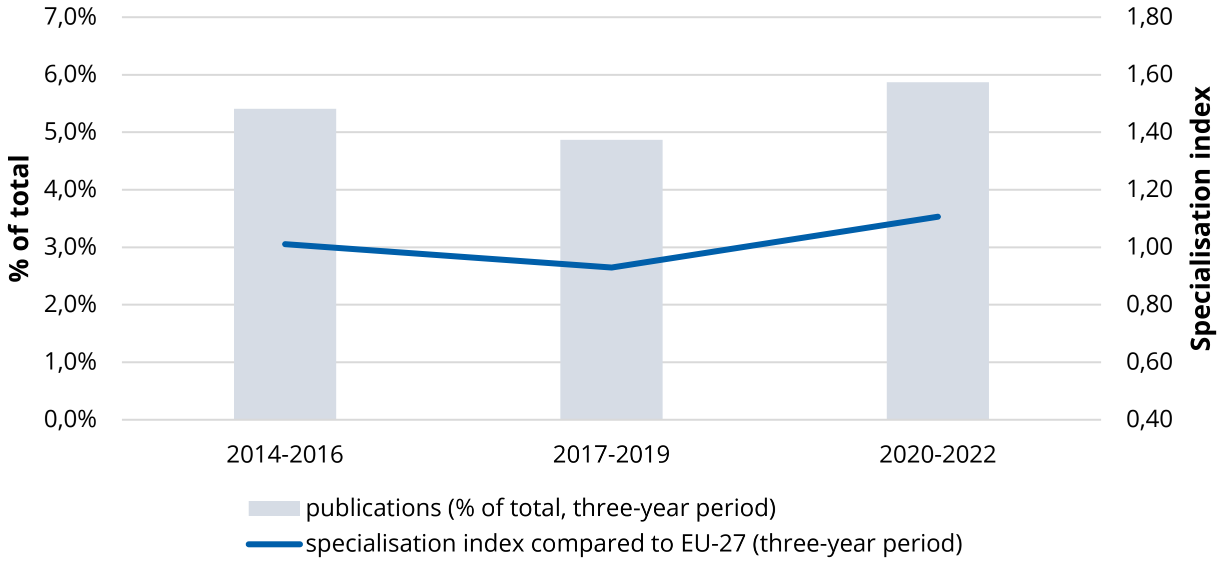


Source: WoS. Compiled by authors.

SDG 13 "Climate action"

Regarding publications contributing to SDG 13, in relative terms, there has been a mixed evolution, with an increase in the last triennium to account for 5.9% of the total. Additionally, the Basque Country demonstrates an evolution and level of specialisation in this area comparable to that of the EU-27.

Graph 25: Percentage of publications and specialisation index relating to SDG 13 (2014-2022)

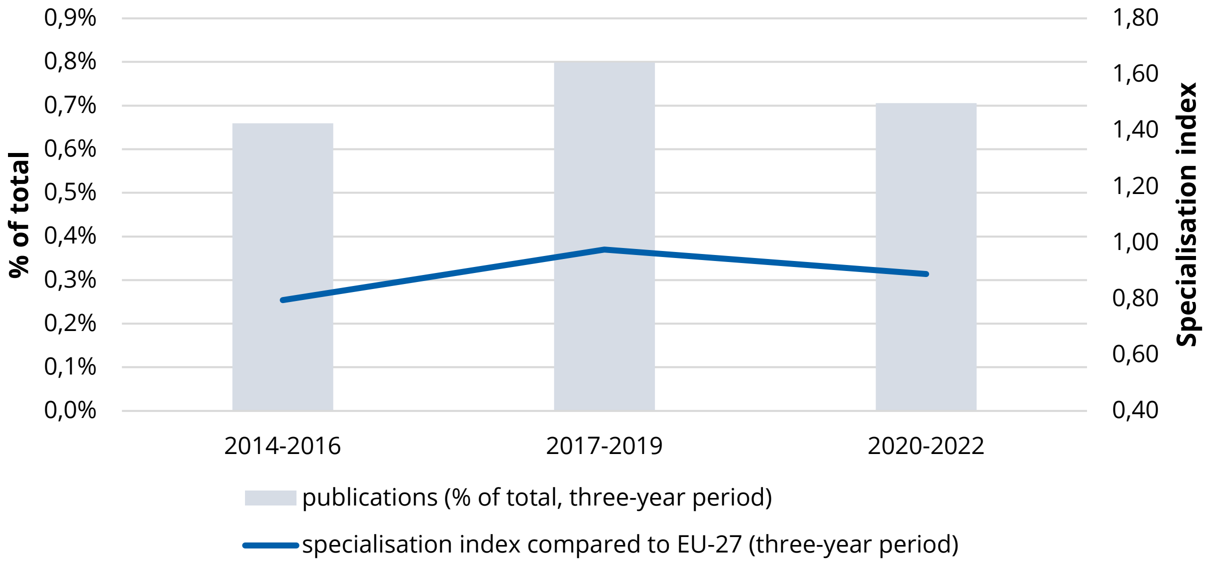


Source: WoS. Compiled by authors.

Social challenge: quality employment (SDG 8 Decent work and economic growth)

Regarding SDG 8, an uptrend is noted in the share of publications aimed at this goal through the 2017-2019 triennium, while in the most recent triennium there is a decline in their relative share. It is also worth mentioning that these publications constitute a relatively small fraction of the total (0.7% in the 2020-2022 period). In addition, the Basque Country is slightly under-specialised in comparison to the EU, with a specialisation index of 0.9 for 2020-2022.

Graph 26: Percentage of publications and specialisation index relating to SDG 8 (2014-2022)

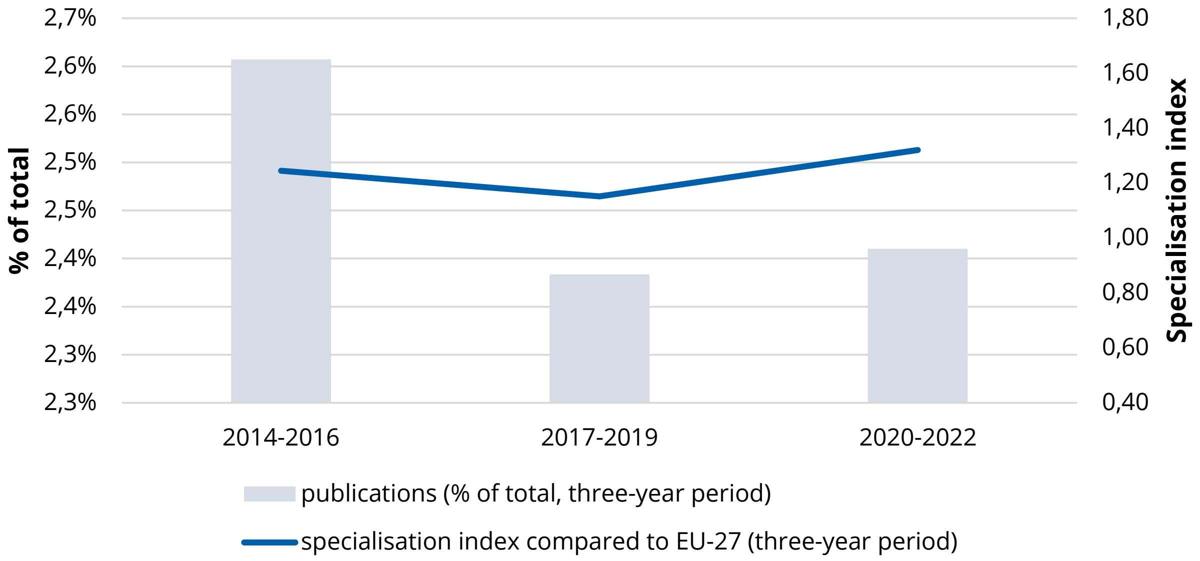


Source: WoS. Compiled by authors.

Social challenge: digital transition (SDG 9 Industry, Innovation and Infrastructure)

Regarding the data from the Web of Science on publications that directly contribute to SDG 9, a relatively consistent trend is noted up to 2022, representing 2.4% of the Basque Country's total publications in the most recent three-year period. Furthermore, the Basque Country is specialised in this area relative to the EU-27, with a specialisation index of 1.32 for the last triennium.

Graph 27: Percentage of publications and specialisation index relating to SDG 9 (2014-2022)



Source: WoS. Compiled by authors.

3.2.2. Patents and intellectual property

EPO patents (registered)

Source: OECD-Regpat and Eurostat

For patents, which measure the output of the R&D process, the indicator used is that of patents registered with the EPO (European Patent Office).[13] It is feasible to assess the total EPO patents per million inhabitants linked to SDG 9 and to evaluate green patents[14] that foster the social objective of energy and climate change (SDGs 7, 11, and 13). These analyses can extend to additional SDGs not prioritised by the STIP 2030, such as SDG 14 (life below water).

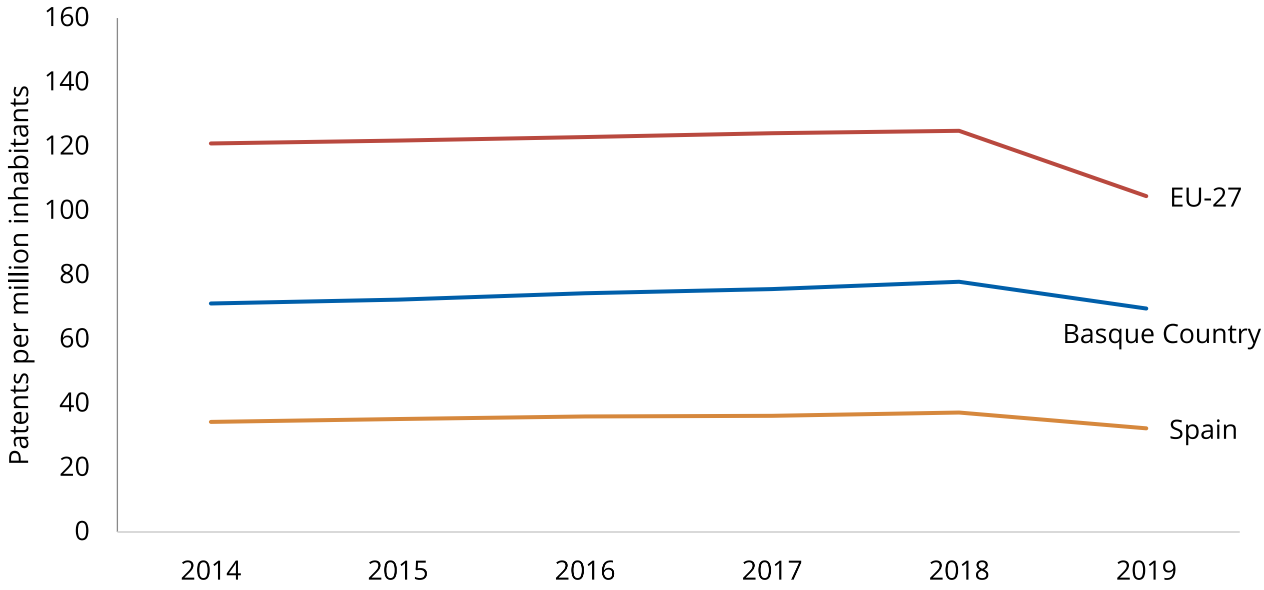
[13] Fractional counting per inventor

[14] According to OECD classification of environmental technology groups: Haščič, I. and M. Migotto (2015), "Measuring environmental innovation using patent data", *OECD Environment Working Papers*, No. 89, OECD Publishing, Paris, https://doi.org/10.1787/5js009kf48xw-en.

Overall contribution to SDG 9 (Industry, innovation and infrastructure)

The analysis of the total EPO patents per million inhabitants[15] contributing to SDG 9 indicates that the patenting performance of the Autonomous Community of the Basque Country[16] exceeds the Spanish average, exhibiting an upward trend (with the exception of the latest year, for which data are not yet consolidated), yet remains below the European Union average.

Graph 28: Registered EPO patents per million inhabitants



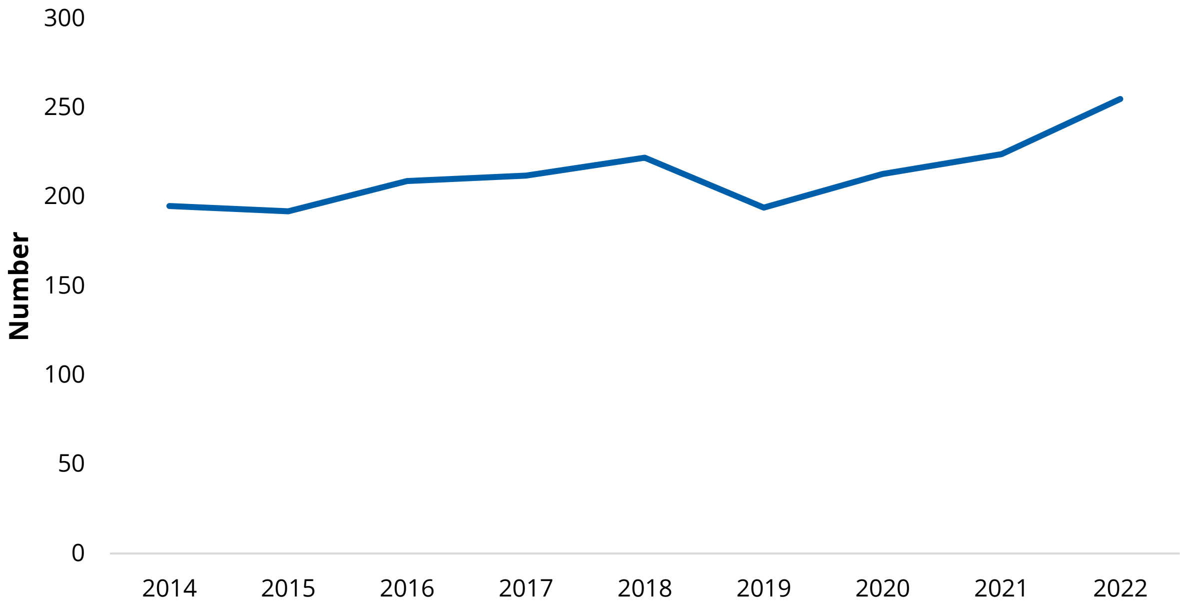
Source: OECD-Regpat and Eurostat. Compiled by authors

Given the trends in EPO patent applications, there is a positive trajectory since 2019, suggesting a likely increase in registered patents in the coming years.

[15] The figures for 2021 are preliminary (as the complete tally of registered patents has not yet been recorded in the OECD database)

[16] The attribution of patents to the Basque Autonomous Community is determined considering the fractional counting of inventors.

Graph 29: Number of EPO applications



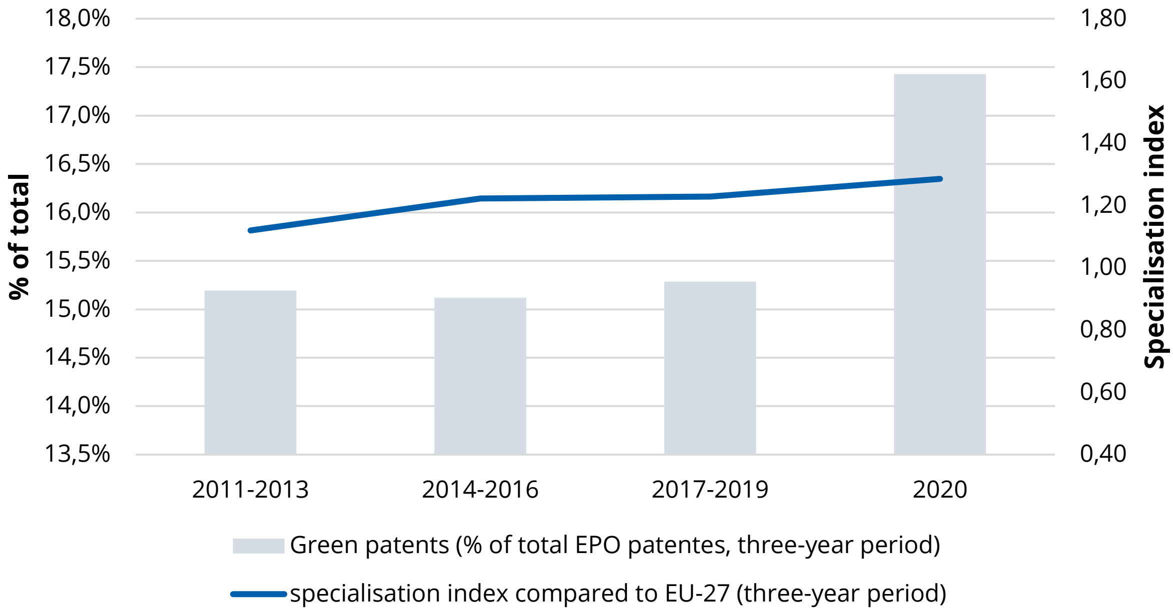
Source: EPO Patent Index. Compiled by authors

Social challenge: energy and climate change (SDG 7, 11 and 13)

SDG 13 "Climate action"

With regard to green patents (EPO-registered patents), there has also been a positive trend from 2013 to the most recent year available in their share of the total number of patents in the Basque Autonomous Community, with a significant increase in the last three years. Additionally, the Basque Country's specialisation index with respect to the EU-27 in the most recent available three-year period (2018-2020) is 1.29, an index that has risen since the three-year period 2011-2013, when it was at 1.1 (with 1 being the EU-27 average).

Graph 30: Green patents, change over time



Source: OECD-Regpat and Eurostat. Compiled by authors

The classification of green patents (all of which contribute to SDG 13) can be disaggregated into technological fields, some of which directly correspond with the SDGs prioritised by the STIP 2030, as indicated below:

Table 4: Green patent classification

Technological domain	SDGs prioritised by the related STIP (first order)	SDGs prioritised by the related STIP (second order)
1: Environmental management	**SDG 13**	
2: Climate change mitigation technologies related to energy generation transmission and distribution	**SDG 13**	**SDG 7**
3: Capture, storage, sequestration or disposal of greenhouse gases	**SDG 13**	
4: Transport-related climate change mitigation technologies	**SDG 13**	**SDG 11**
5: Building-related climate change mitigation technologies	**SDG 13**	**SDG 11**
6: Climate change mitigation technologies related to water treatment/management	**SDG 13**	

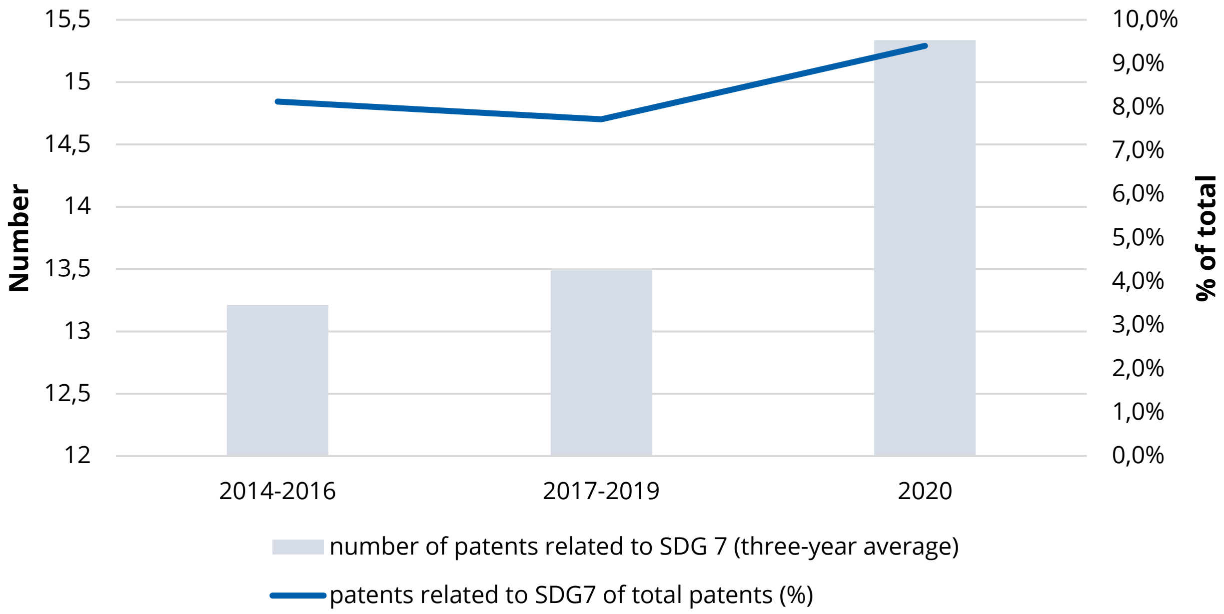
7: Climate change mitigation technologies in goods production and processing	**SDG 13**	**SDG 9**
8: Climate change mitigation technologies in ICTs	**SDG 13**	**SDG 9**
9: Climate change adaptation technologies	**SDG 13**	
10: Economics of sustainable oceans	**SDG 13**	

Source: Compiled by authors

SDG 7 "Affordable and clean energy"

The distribution across technological fields enables an estimation of the patents' contribution to SDG 7 by determining the number and significance of patents associated with climate change mitigation technologies in energy generation, transmission, and distribution. As such, there has been an increase in the proportion of patents related to SDG 7 during the last three-year period (2018-2020), accounting for 9.4% of Basque patents and over half of the green patents. Moreover, the Basque Country has specialised in patents of these technologies relative to the EU-27 average, with a specialisation index of 2.1 for the latest available three-year period (2018-2020).

Graph 31: Patents in technologies related to SDG7

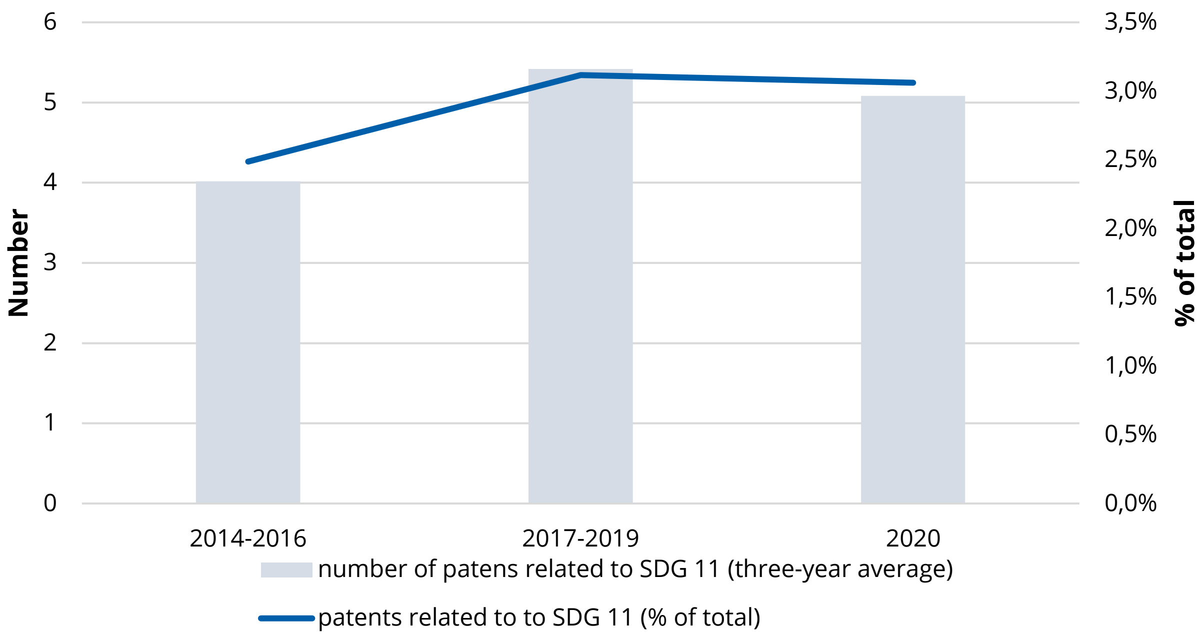


Source: OECD-Regpat and Eurostat. Compiled by authors

SDG 11 “Sustainable cities and communities”

The technology domains that contribute most directly to SDG 11 are domain 4: Climate change mitigation technologies related to transport and the countryside 5: Building-related climate change mitigation technologies. The Basque Country is specialised in domain 5, related to building, whose specialisation index for the last three years (2018-2020) with respect to Europe is 1.54, while it is underspecialized in field 4 (index with respect to Europe 0.44). Patents contributing to SDG 11 represent approximately 20% of the green patents in the last period examined and 3% of the total Basque patents.

Graph 32: Patents in technologies related to SDG11

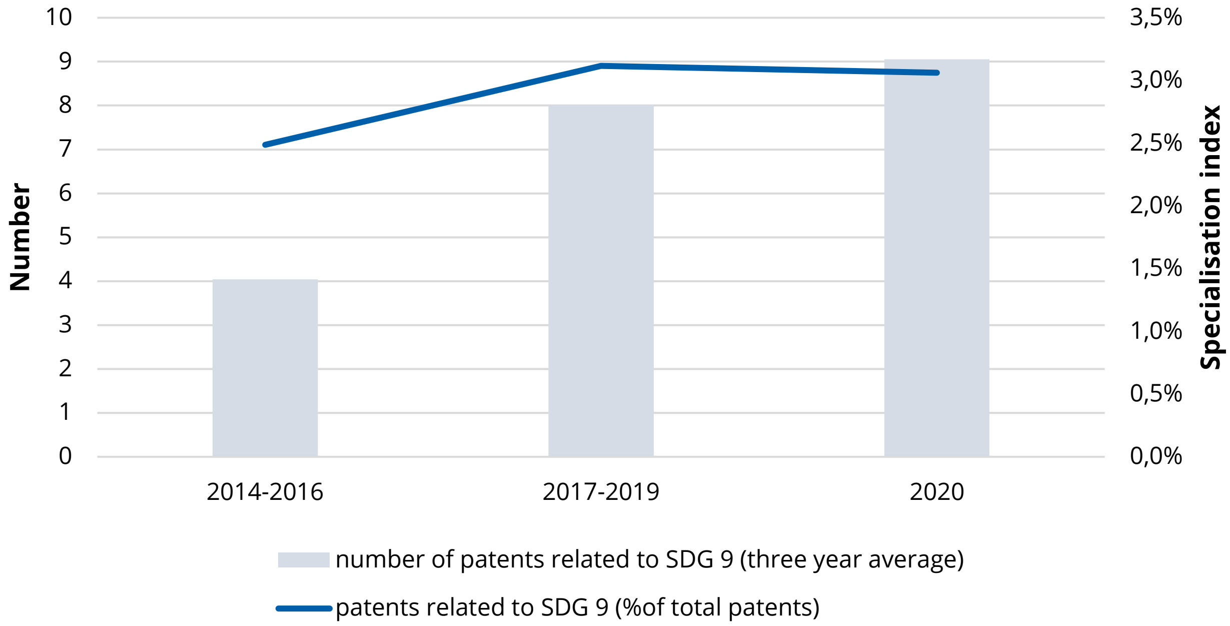


Source: OECD-Regpat and Eurostat. Compiled by authors

Social challenge: digital transition (SDG 9 Industry, Innovation and Infrastructure)

The breakdown into technological domains enables an analysis of two areas intimately connected with industry and digital transformation, and consequently with SDG 9: technological domain 7: Climate change mitigation technologies in the production and processing of goods and 8: Climate change mitigation technologies in ICTs. In the former, the Basque Country is highly specialised relative to Europe (with a specialisation index of 1.83), while in the latter, associated with ICTs, it is underspecialised (with a specialisation index of 0.44). Reviewing data from recent years reveals an increase in the number of patents in these fields, constituting 33% of green patents and 3% of the total Basque patents for the last triennium (2018-2020).

Graph 33: Patents in technologies related to the SDG9



Source: OECD-Regpat and Eurostat. Compiled by authors

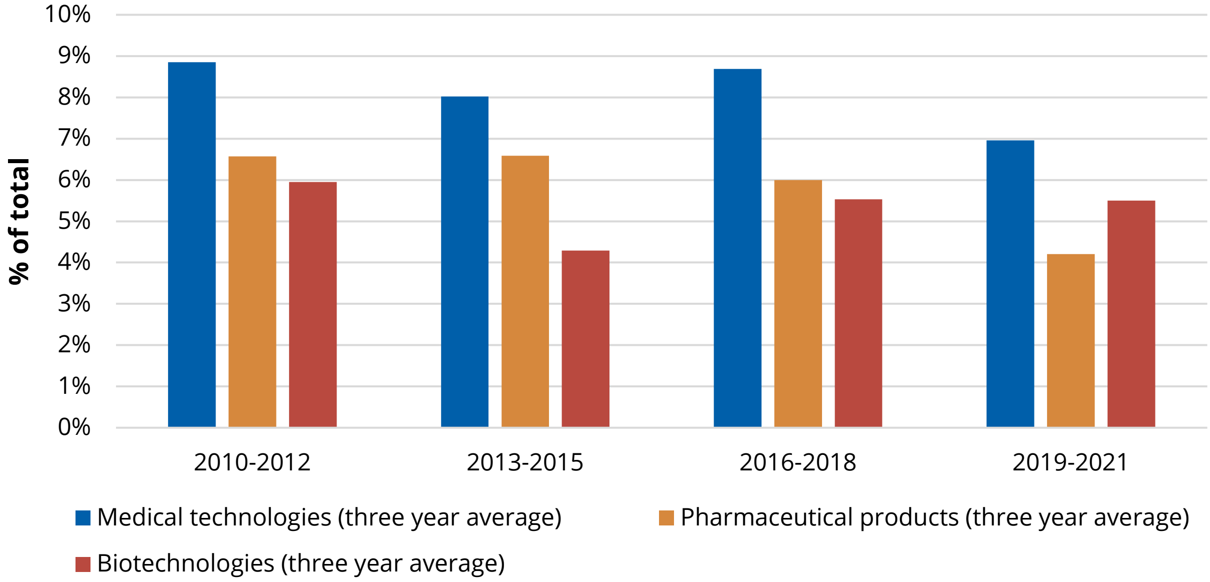
Social challenge: health (SDG 3: Good-health and Well-being)

Similar to the approach with green patents, an assessment of patents contributing to the social challenge of health may be conducted by examining the progression of registered patents (PCT patents) in the following technological domains:

- Medical technology
- Pharmaceutical products
- Biotechnology

From this perspective, it is evident that medical technology patents carry the most significant proportion of the Basque Country's PCT patents (three-year average), and patents in biotechnology have been gaining an increased share in recent years. Regarding temporal trends, no substantial fluctuations are observed for the period under review.

Graph 34 PCT patents by technological domains health (% total patents)



Source: OECD-Regpat and Eurostat. Compiled by authors

Social challenge: quality employment (SDG 8 Decent work and economic growth)

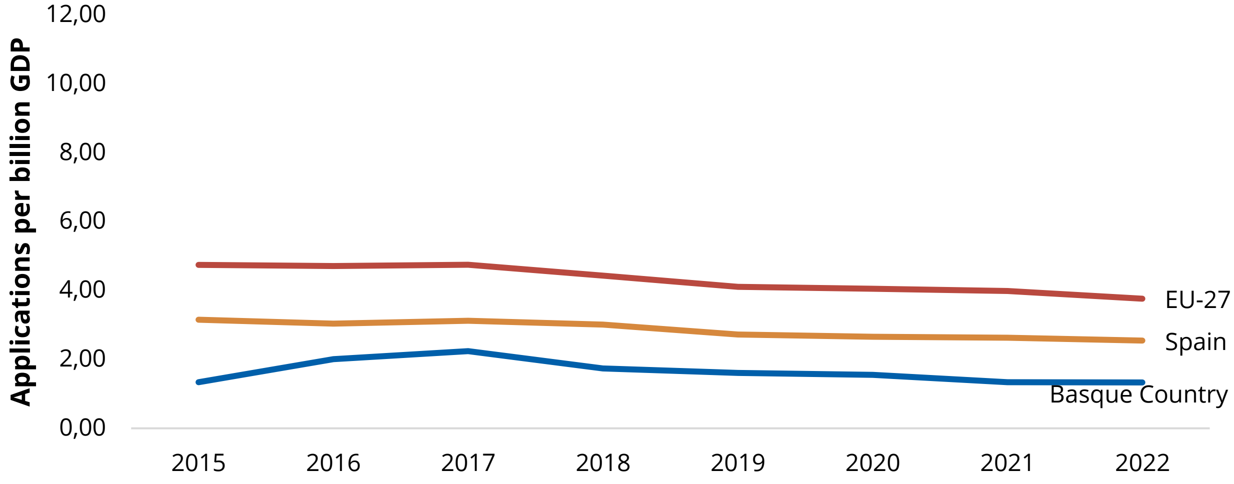
Beyond employment, SDG 8 also pertains to factors linked to economic growth. Therefore, following the analysis of patents, we will proceed with a concise examination of industrial property via EU industrial design applications and EU trademark applications, which tie in with the region's potential for economic expansion.

Number of EU industrial design applications (per billion GDP)

Source: Eustat (Basque Statistics Office). European Innovation Scoreboard-EIS

This indicator reflects the number of individual industrial design applications submitted to the European Union Intellectual Property Office (EUIPO) standardised per billion euros of GDP. As illustrated in the graph, there has been a slight decline in the number of applications in recent years. Comparatively speaking, the three territories demonstrate a very similar pattern throughout the period under study. Nonetheless, the Basque Country registers fewer EU industrial design applications than Spain and is significantly below the European Union (EU-27) average in terms of applications.

Graph 35: EU industrial design applications (per billion GDP)



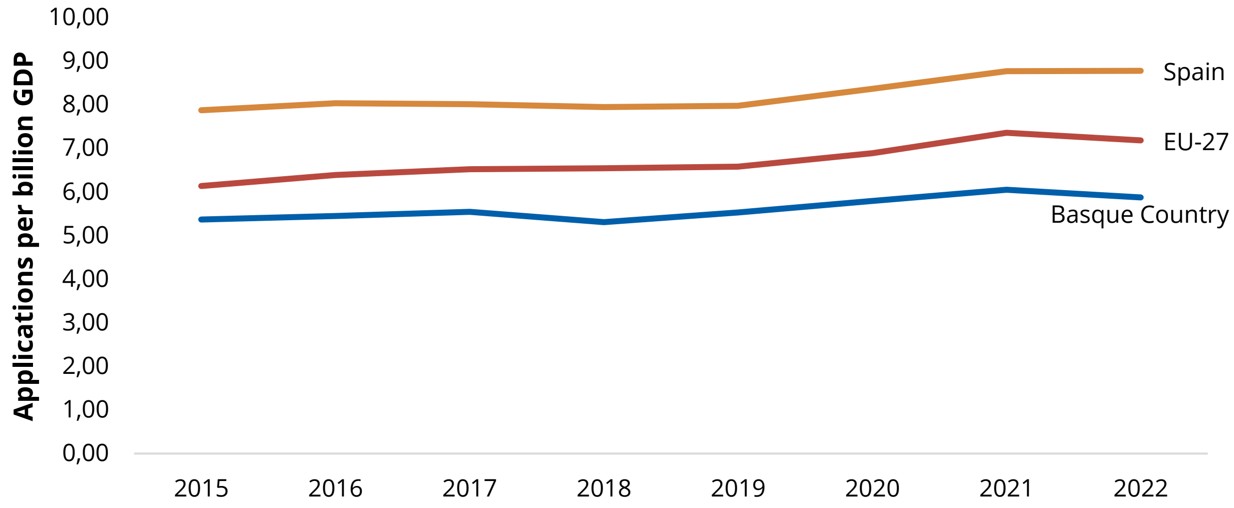
Source: Eustat and EIS. Compiled by authors.

EU trademark applications (per billion GDP)

Source: Eustat (Basque Statistics Office). EIS 2023

Trademark registrations (per billion euros of GDP in PPP) experienced a modest decline in 2022, interrupting the rising trajectory of the preceding years. Additionally, the volume of filings consistently trails that of both Spain and the European average over the entire period reviewed, as depicted in the subsequent chart.

Graph 36: Change over time in EU trademark applications (per billion GDP)



Source: Eustat (Basque Statistics Office). Compiled by authors

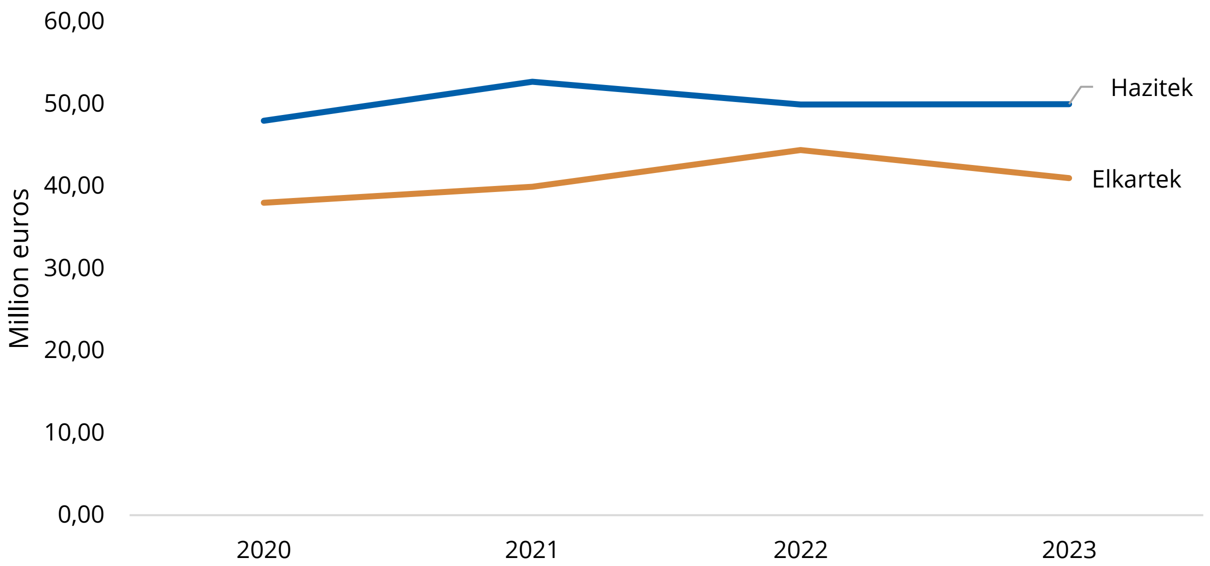
3.2.3. Regional R&D funding

Support for strategic business R&D and collaborative research programmes

Source: SPRI-Basque Government

The funding of the Basque Government for strategic business R&D and collaborative research through the Hazitek strategic programme[17] and the Elkartek programme[18] serves as a measure of R&D's contribution to the SDGs. Overall, the sum of grants from both programmes has exhibited an upward trend within the time frame studied, reaching a high in 2022 with a total of 94.4 million euros. Therefore, it can be inferred that since the implementation of the STIP 2030, there has been an increase in funding, which positively impacts the progress towards the SDGs.

Graph 37: Change over time in total regional funding granting (million euros)



Source: SPRI. Basque Government. Compiled by authors

For these two programs, the submitted and approved projects are categorised according to the STIP 2030 priority areas. Consequently, a correlation between these areas and the SDGs could

[17] Programme to support the implementation of strategic R&D business projects with a high potential for results and impact, in the intelligent STIP specialisation area (RIS3 areas).

[18] Programme to support the implementation of Collaborative Fundamental Research and Research with High Industrial Potential projects, carried out by the RVCTI (Basque Science, Technology and Innovation Network) stakeholders, in the RIS3 smart specialisation areas of the STIP.

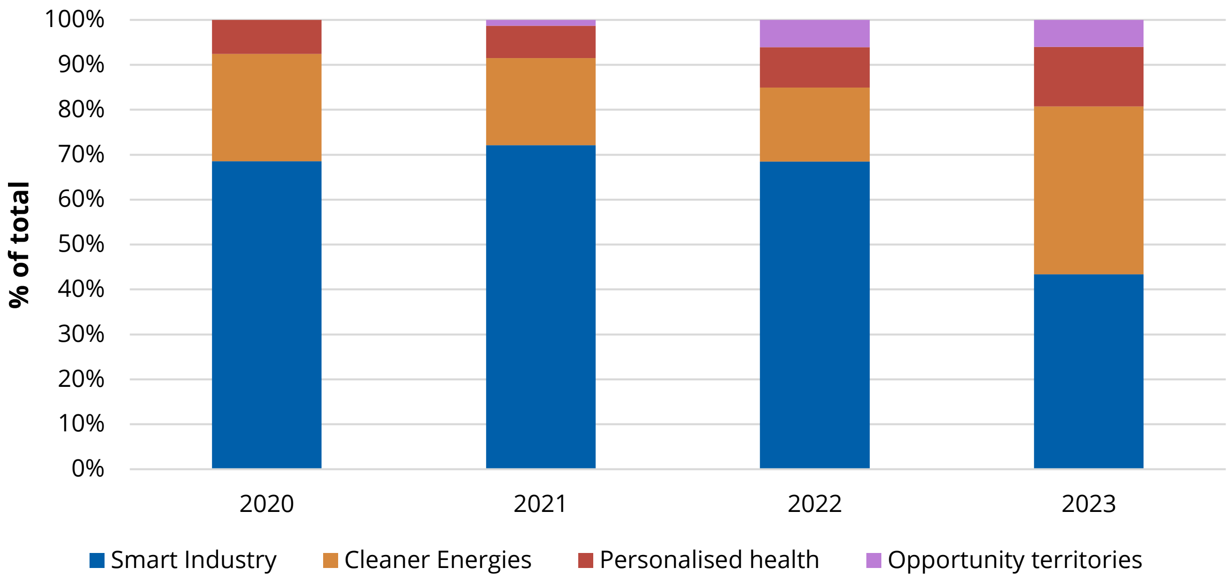
be established, keeping in mind that due to the interdisciplinary nature of many areas, there might be an inherent bias. Therefore, the following correspondence is suggested:

Table 5: Equivalence of RIS3 areas with SDGs

RIS3 area	SDG mentioned by related STIP
Personalised health	SDG 3
Cleaner energies	SDG 7
Smart industry	SDG 9

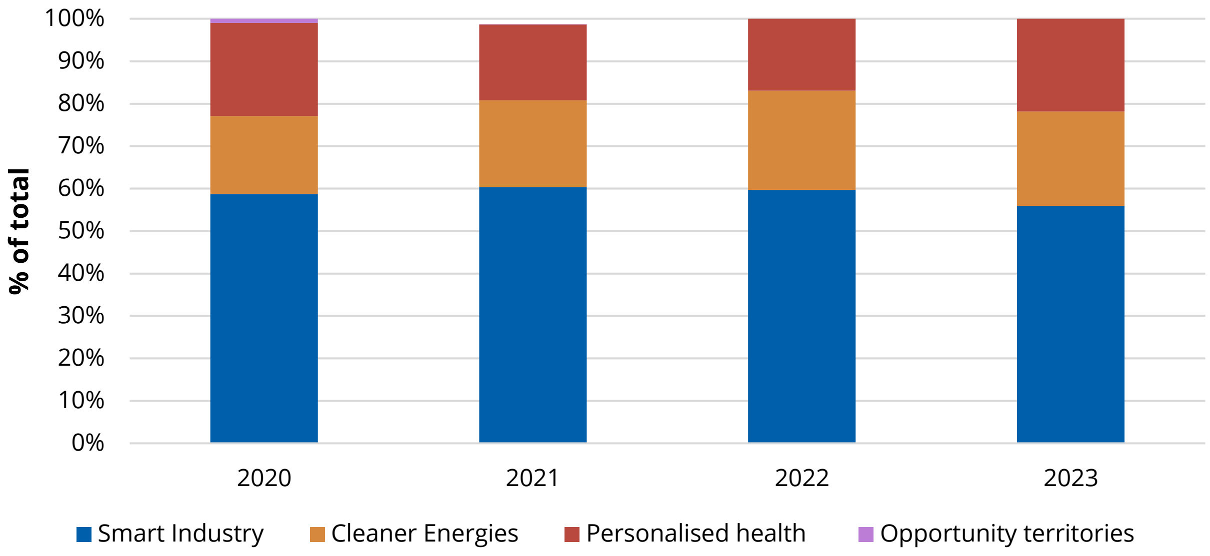
Generally, the data indicates that most of the funding allocated through the strategic Hazitek program is directed towards smart industry (SDG9), followed by cleaner energy (SDG7) and personalised health (SDG3). While this allocation pattern persists in the Elkartek program, there is an increased focus on the cleaner energy sector, indicating a heightened commitment to fundamental research in this area. Furthermore, the allocation across areas within Elkartek has been relatively consistent throughout the assessed period.

Graph 38: Distribution of strategic Hazitek grants by RIS3 area (% of total)



Source: SPRI. Basque Government. Compiled by authors

Graph 39: Distribution of Elkartek subsidies by RIS3 area (% of total)

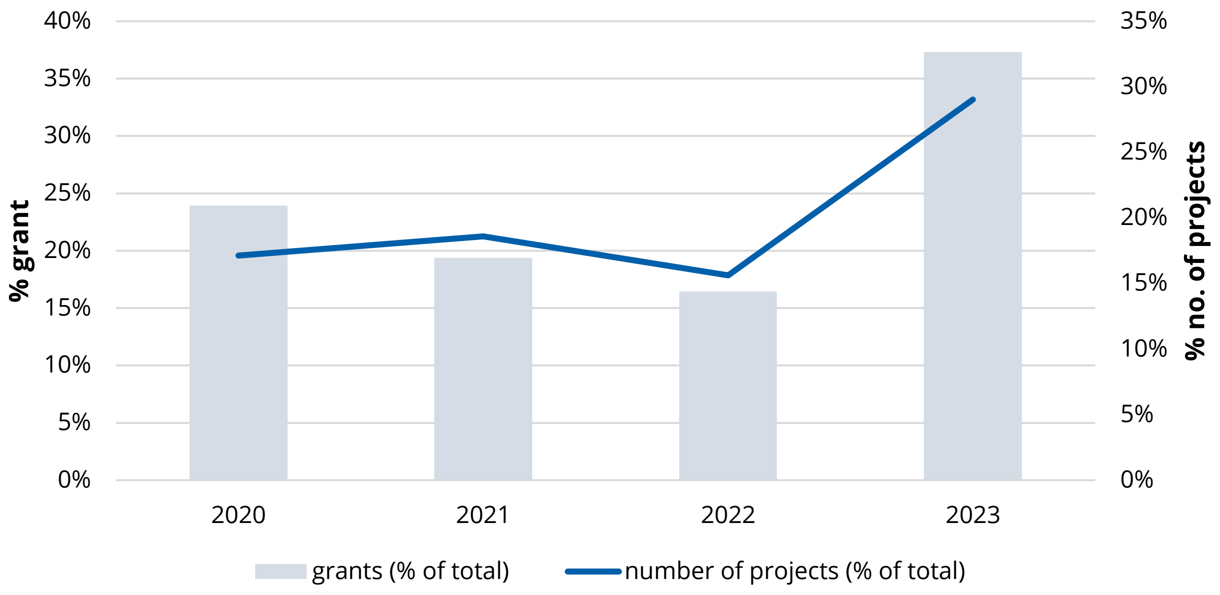


Source: SPRI. Basque Government. Compiled by authors

Social challenge: energy and climate change (SDG 7, 11 and 13)

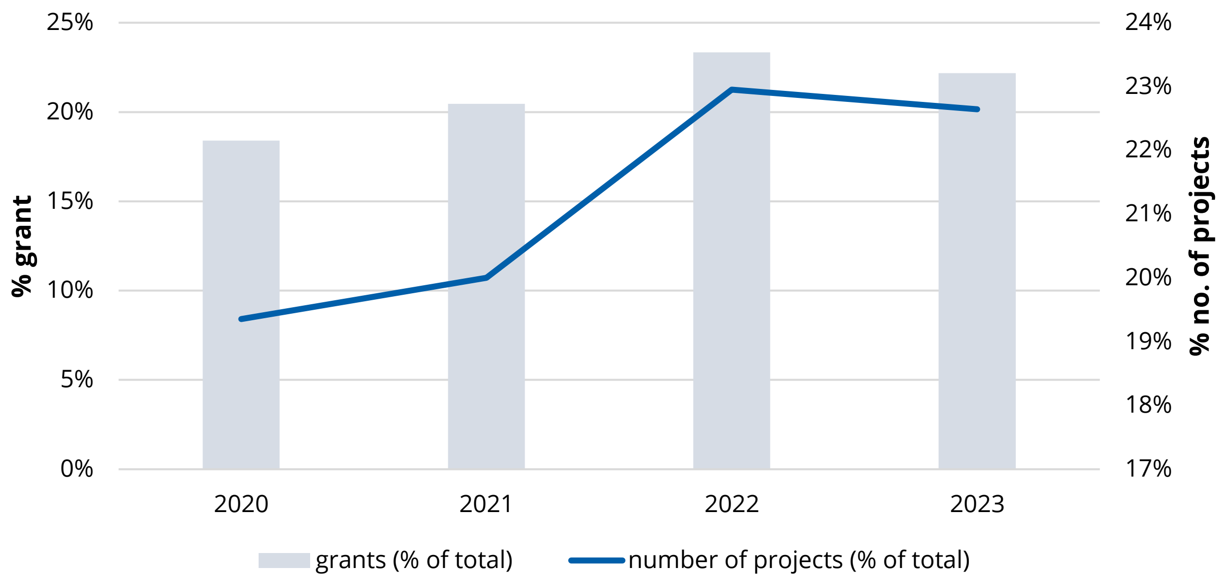
Specifically, regarding the cleaner energy priority, there has been a reduction in both the number of projects and the grant funding between 2021 and 2022 within the strategic Hazitek programme. Nevertheless, in 2023, the energy sector has significantly bolstered its proportion by 20 percentage points. The Elkartek programme has shown a positive trend between 2021 and 2022, though there was a slight decrease in 2023. Since 2020, the percentage of the grant relative to the overall programme has surpassed 20%.

Graph 40: Strategic Hazitek funding in Cleaner energies



Source: SPRI. Basque Government. Compiled by authors

Graph 41: Elkartek Funding in Cleaner energies

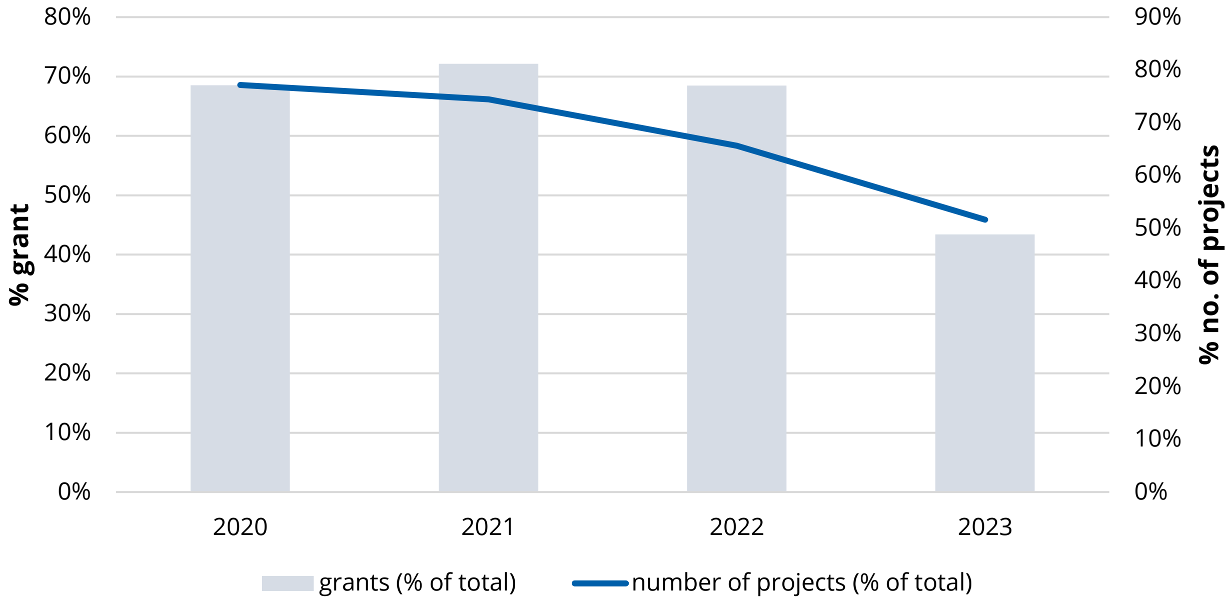


Source: SPRI. Basque Government. Compiled by authors

Social challenge: digital transition (SDG 9 Industry, Innovation and Infrastructure)

With respect to SDG9, concerning the grants awarded and the number of projects in the strategic Hazitek programme, there is certain stability in the proportion of grants awarded, maintaining at around 70% of the total programme funding for all years examined. Nevertheless, the share of approved projects in relation to the total, as well as the grant amount, has seen a marked decrease in 2023, dropping from 68% in 2022 to 43% in the most recent year.

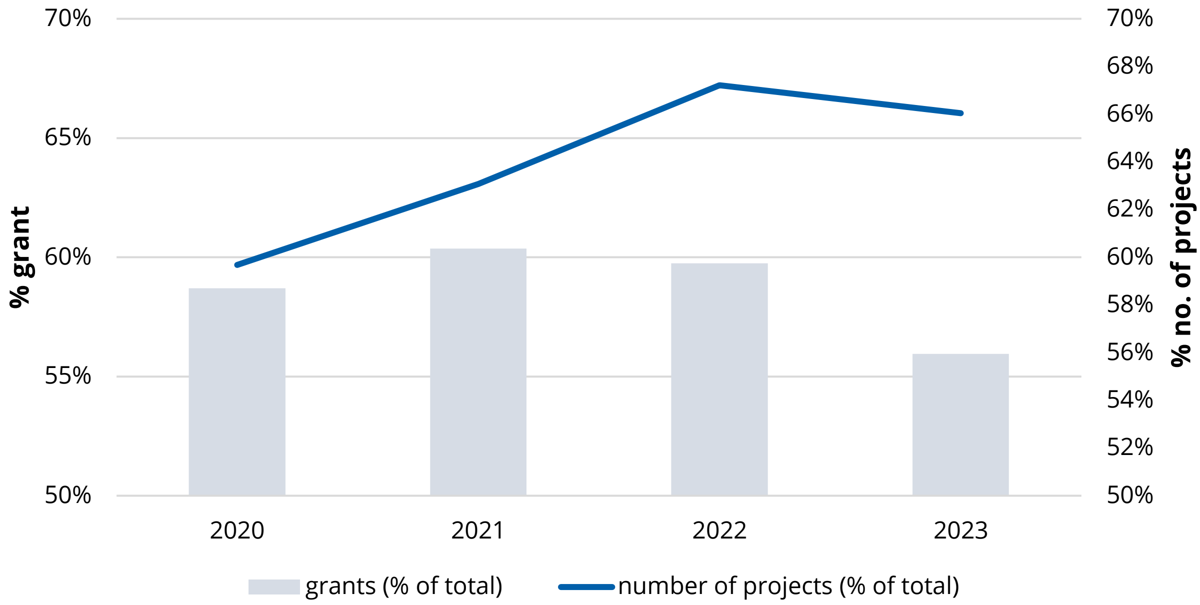
Graph 42: Strategic Hazitek funding in Smart industry



Source: SPRI. Basque Government. Compiled by authors

The figures and trend in smart industry financing under the Elkartek programme parallel those of the Hazitek programme. The subsidy percentage in this field has consistently hovered around 60% annually, with a minor decrease to 56% in 2023. The proportion of approved projects has been on the rise (63% in 2021 and 67% in 2022), though it experienced a slight dip in 2023 to 66%.

Graph 43: Elkartek Funding in Smart industry



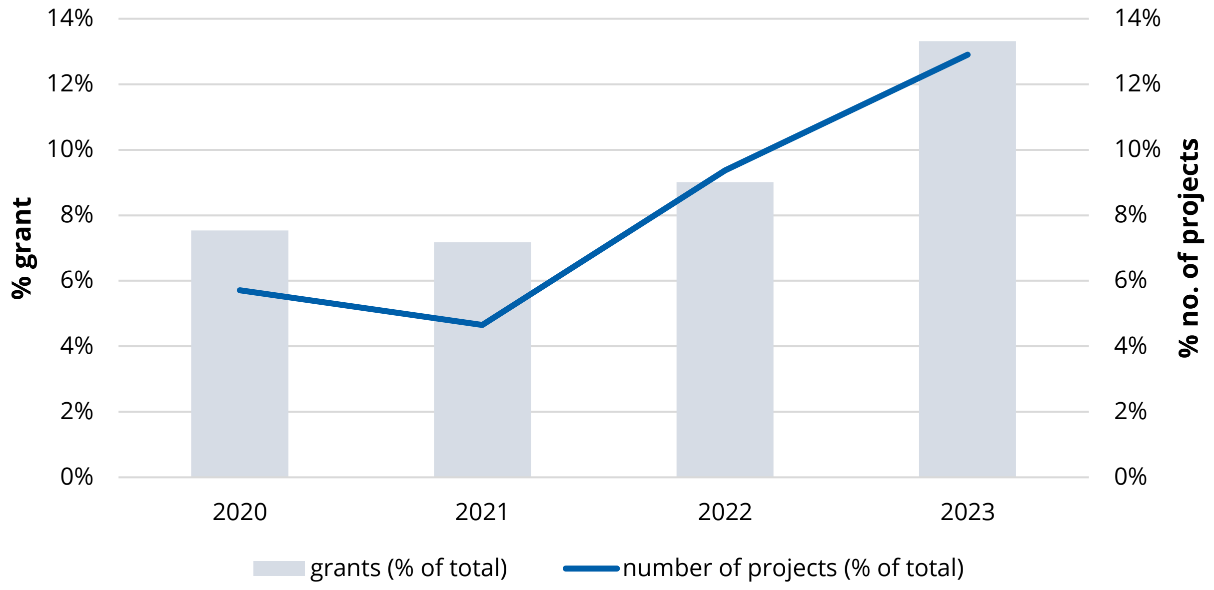
Source: SPRI. Basque Government. Compiled by authors

Social challenge: health (SDG 3: Good-health and Well-being)

In the personalised health sector, there has been an upward trend since 2021 in both the proportion of grants allocated and the percentage of projects approved, signifying a development in strategic business R&D. This area has nearly doubled its share of grant funding, rising from 7.18% in 2021 to 13.32% in 2023.

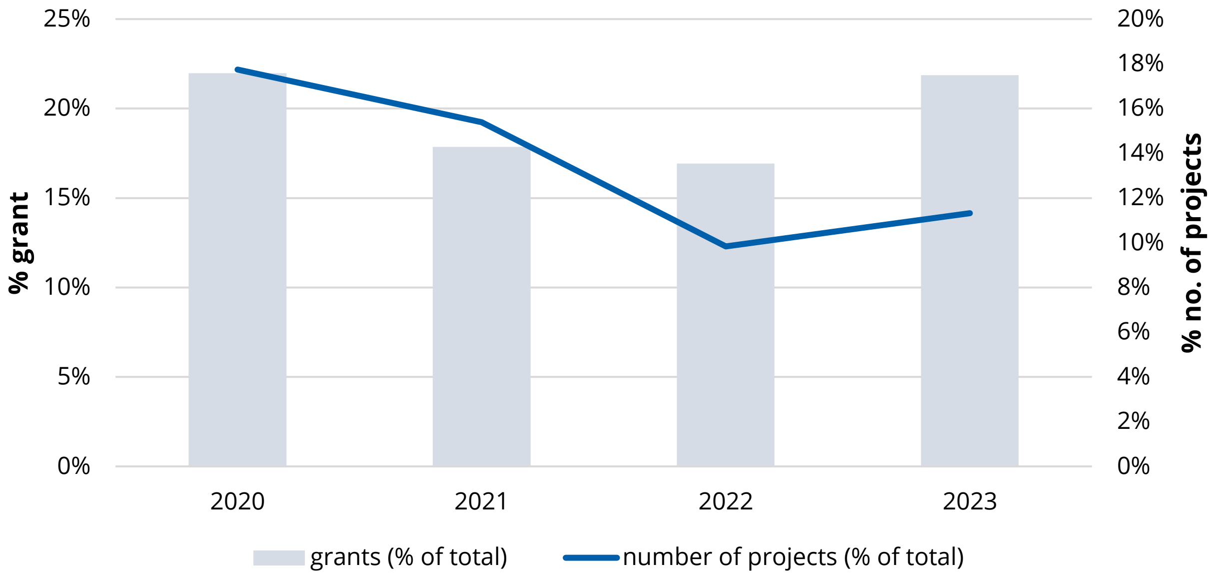
Within the Elkartek programme, which leans more towards generating scientific knowledge, grant allocation in this area has remained relatively stable at about 20%. However, there was a declining trend in the share of approved projects from 2020 to 2022, which then reversed in 2023.

Graph 44: Strategic Hazitek financing in Personalised health



Source: SPRI. Basque Government. Compiled by authors

Graph 45: Elkartek Funding in Personalised health



Source: SPRI. Basque Government. Compiled by authors

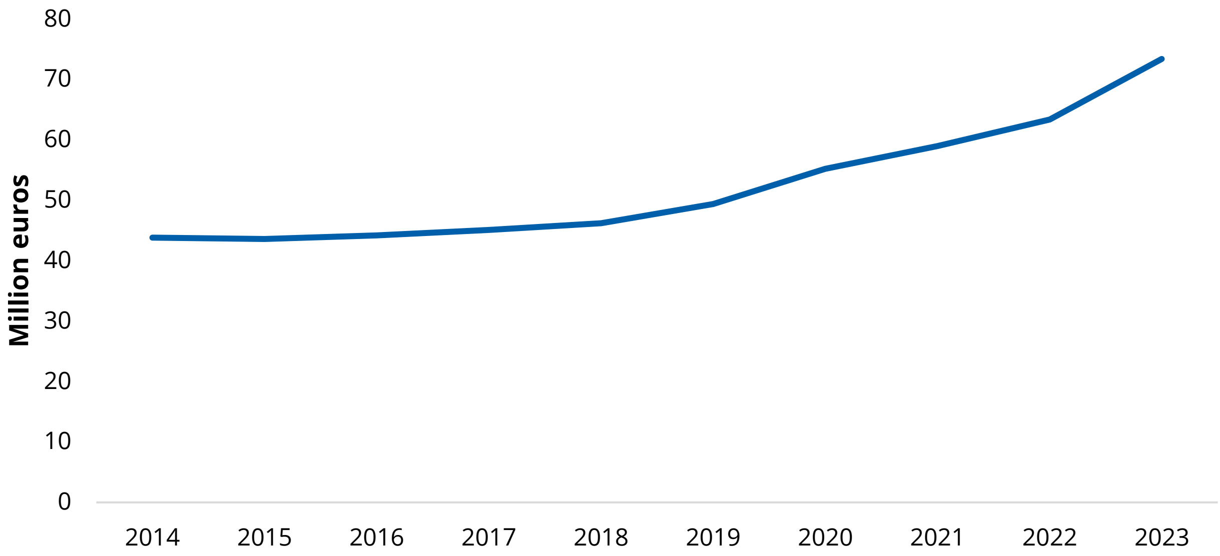
Public funding for health research

Source: Basque Government. Department of Health.

This indicator refers to the public budget allocated by the Basque Government's Department of Health and the Innovation Fund for health research. Graph 46 illustrates the trend in public investment in health research (in millions of euros) from 2014 to 2023.

As depicted in the graph, funding has increased by 167% over the last decade, rising from €43.8 million to €73.4 million. Notable increases occurred in the pandemic year (with a €6 million rise in 2020 compared to the previous year) and in the most recent year recorded (with an increase of €10 million in 2023).

Graph 46: Public funding for health research (million euros) (2014-2023)



Source: Basque Government. Compiled by authors.

3.2.4. European R&D funding

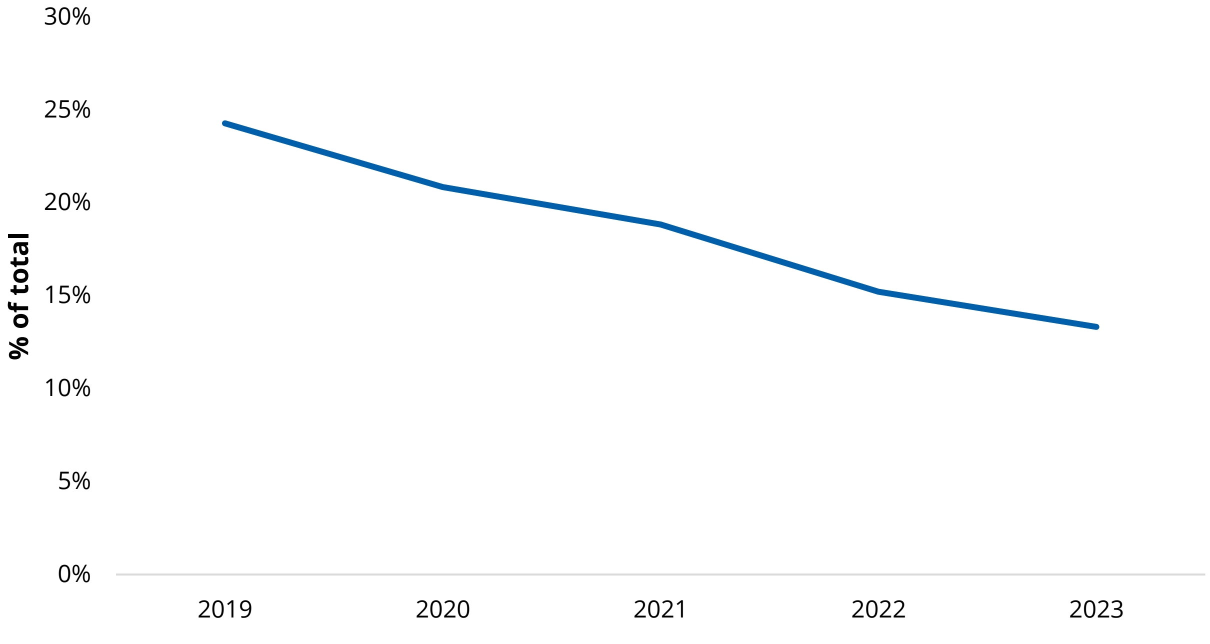
Overall contribution to SDG9 (Industry, innovation and infrastructure)

Leadership of Horizon Europe projects

Source: Horizon Dashboard. European Commission

Regarding the coordination of projects in the Horizon Europe programme[19], an indicator contributing to SDG 9, the data indicate a decline in the percentage of projects coordinated by Basque organisations (collaborative projects). Among the Autonomous Communities, the Basque Country is ranked third in the total number of projects led (following Madrid and Catalonia). In 2022, the Basque Country's share of project coordination in Spain stood at 3.7%, a figure that fell to 2.4% in 2023.

Graph 47: Leadership of European projects



Source: Horizon Dashboard. Compiled by authors.

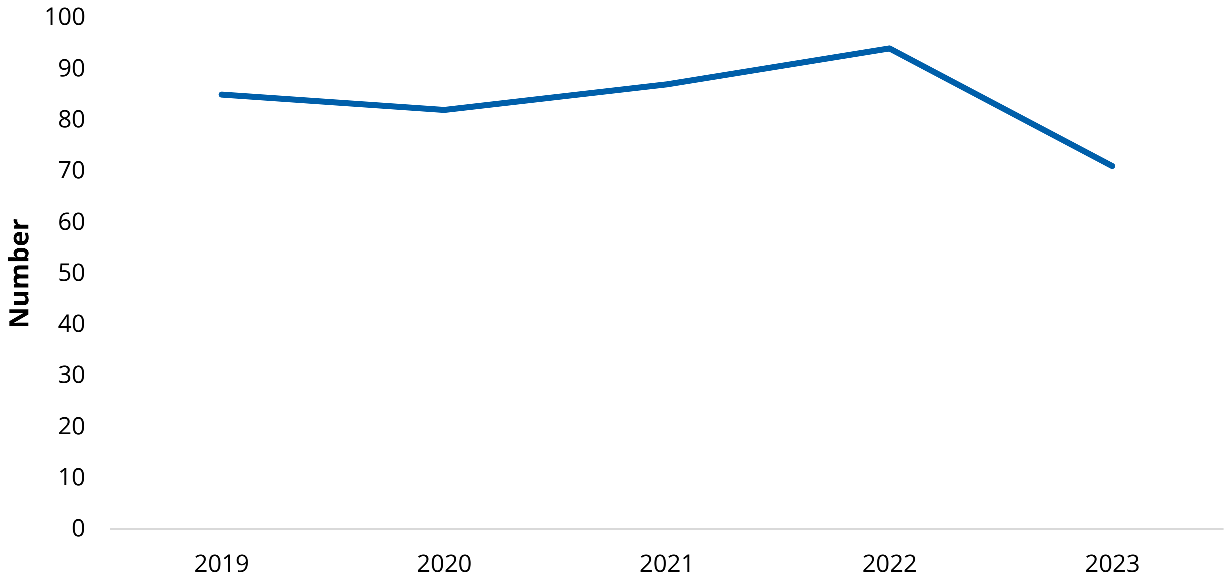
[19] Data extracted in February 2024

Basque companies participating in European projects

Source: Horizon Dashboard, European Union.

This indicator shows the number of business stakeholders/companies that have participated in European projects of the Horizon Europe[20] programme. For the purposes of this indicator, companies are considered to be all business stakeholders (business associations, RVCTI enterprise R&D units, SMEs and large companies). The number of participating companies has increased between 2020 and 2022, falling in 2023.

Graph 48: Basque companies participating in European projects



Source: Horizon Dashboard. Compiled by authors.

Support from Horizon Europe R&D programmes to Basque organisations (net EU contribution)

Source: Horizon Dashboard. European Commission

During the 2022-2023 period of the European Framework Programme (Horizon Europe), 600 projects[21] with Basque participation have been signed (181 unique participants in 352 projects in 2022 and 136 participants in 248 projects in 2023), resulting in a net contribution of 390

[20] The years 2019 and 2020 correspond to the Horizon 2020 Programme.

[21] They include all types of projects with Basque participation, not only collaborative projects. Data extracted in February 2024

million euros (61% in 2022 and 39% in 2023). This represents 1.29% of Horizon Europe's total contributions, compared to the Basque Country's share in Europe, which is 0.5% when measured both by population and GDP.

In the current European Framework Programme (Horizon Europe), the thematic priorities that align most closely with the SDGs are detailed in the following table. The health priority can be associated with SDG3; the Climate, Energy, and Mobility priority with SDGs 7, 11, and 13; the Food, Bioeconomy, Natural Resources, Agriculture, and Environment priority with SDG 13; and the Digital World, Industry, and Space priority with SDG 9.

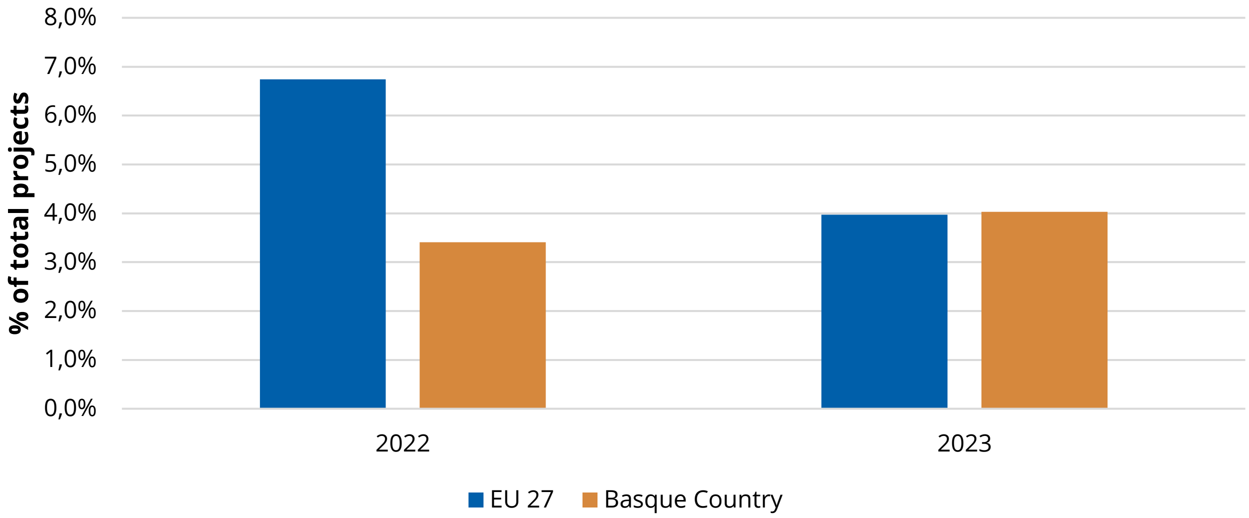
Table 6: European thematic priorities and SDG

Thematic priorities	SDGs prioritised by the related STIP
European Research Council (ERC)	-
Marie Skłodowska-Curie Actions (MSCA)	-
Research infrastructures	-
Health	**SDG 3**
Culture, creativity and inclusive society	-
Civil security for society	-
Digital world, industry and space	**SDG 9**
Climate, energy and mobility	**SDGs 7, 11 and 13**
Food, bioeconomy, natural resources, agriculture and the environment	**SDG 13**
Joint Research Centre (JRC)	-
European Innovation Council (EIC)	-
European innovation ecosystems	-
European Institute of Innovation and Technology (EIT)	-
Broadening participation and spreading excellence	-
Reforming and improving the European R&I system	-

Social challenge: health (SDG 3: Good-health and Well-being)

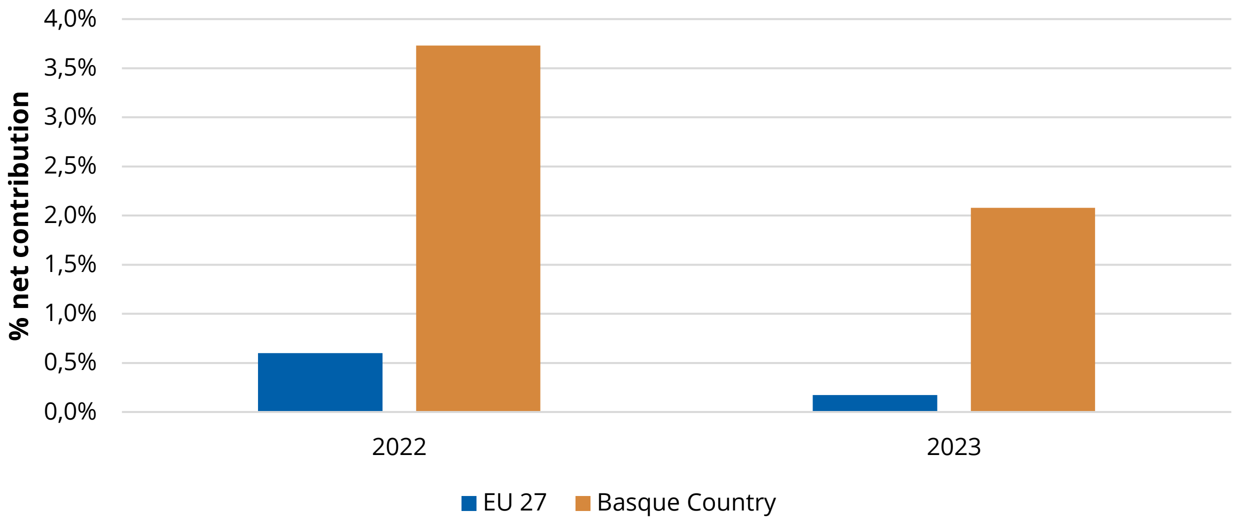
The thematic priority of Health contributes directly to SDG 3. Basque participation in this area accounted for 4% of EU projects signed in 2023 (6.7% in 2022) and just 0.2% of the total European contribution (0.6% in 2022), slightly above the Basque Country's share of the EU-27's GDP (0.49%). In terms of all Basque projects, only 4% of the agreements signed in 2023 were focused on the health priority, representing 2.41% of Basque organisations' total net contributions for that year.

Graph 49: Basque Participation in Health. Projects.



Source: Horizon Dashboard. Compiled by authors.

Graph 50: Basque Participation in Health. Net contribution.

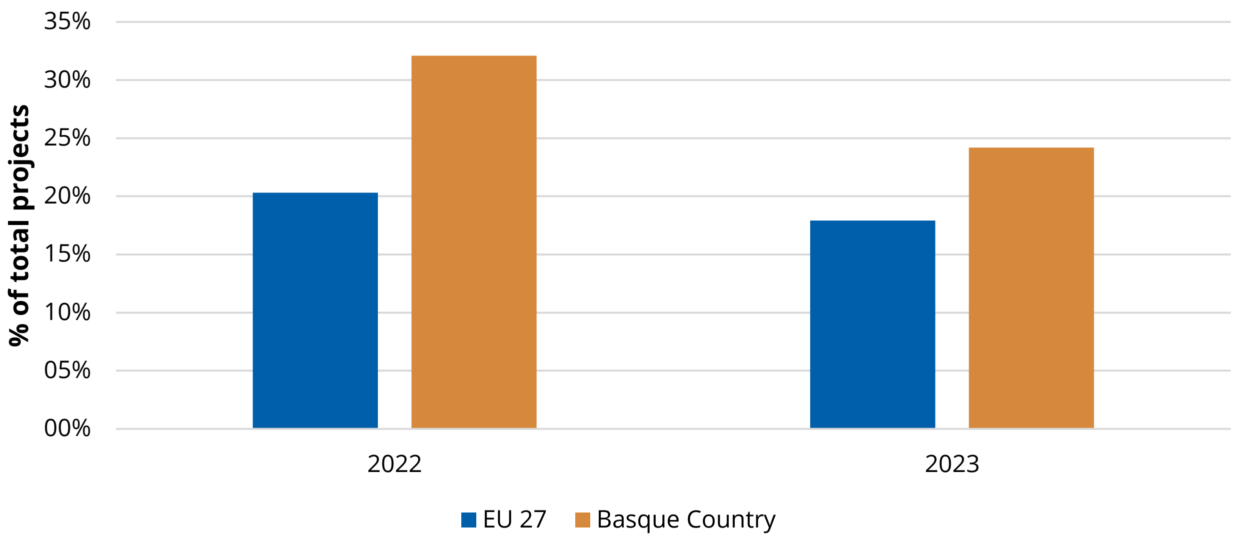


Source: Horizon Dashboard. Compiled by authors

Social challenge: digital transition (SDG 9 Industry, Innovation and Infrastructure)

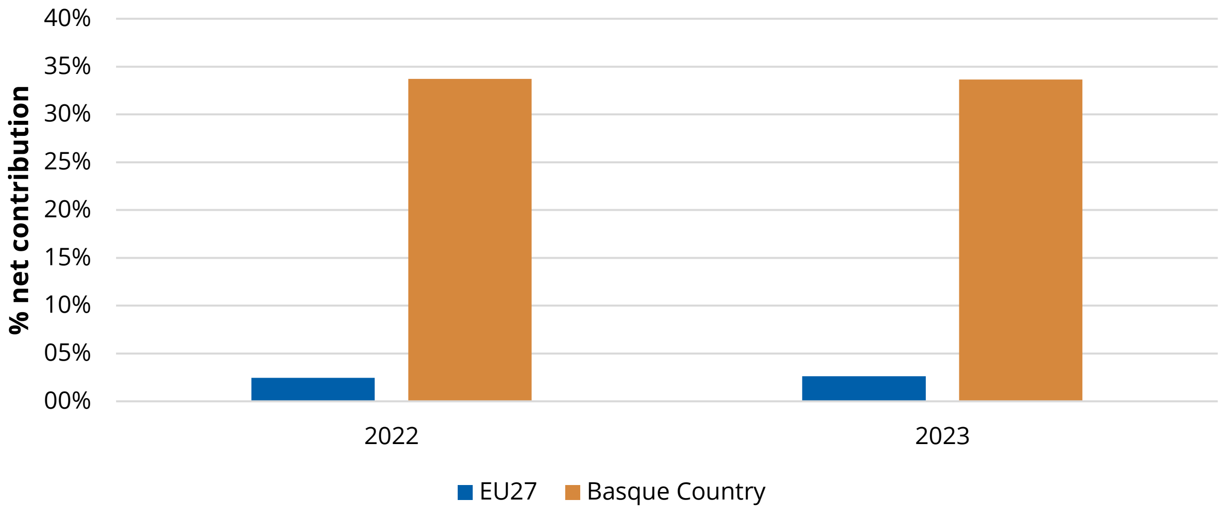
Within the thematic priorities, the Digital World, Industry, and Space area, with its clear industrial focus, is closely aligned with SDG 9. An analysis of the number of projects of Basque organisations within the Horizon Europe programme and their net contribution reveals that, in 2022, the EU's net contribution to organizations in this thematic priority represented 33.7% of the total for the Basque region (a percentage similar to the number of approved projects). This proportion was sustained in 2023, although there was a noticeable decline in the number of projects signed in this area. Nonetheless, Basque participation in this field within the European context is significant, with involvement in 17.9% of the projects in 2023 and 2.6% of the EU's total net contribution, substantially surpassing the Basque Country's share of the European GDP (0.49%).

Graph 51: Basque participation in digital world, industry and space. Projects



Horizon Dashboard. *Compiled by authors.*

Graph 52: Basque participation in digital world, industry and space. Net contribution

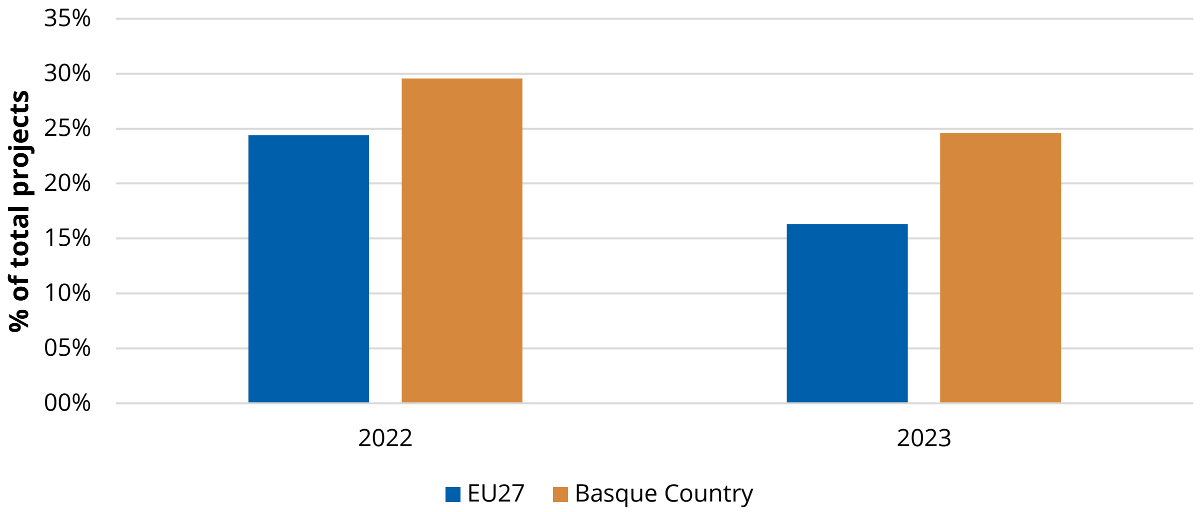


Source: Horizon Dashboard. Compiled by authors.

Social challenge: energy and climate change (SDG 7, 11 and 13)

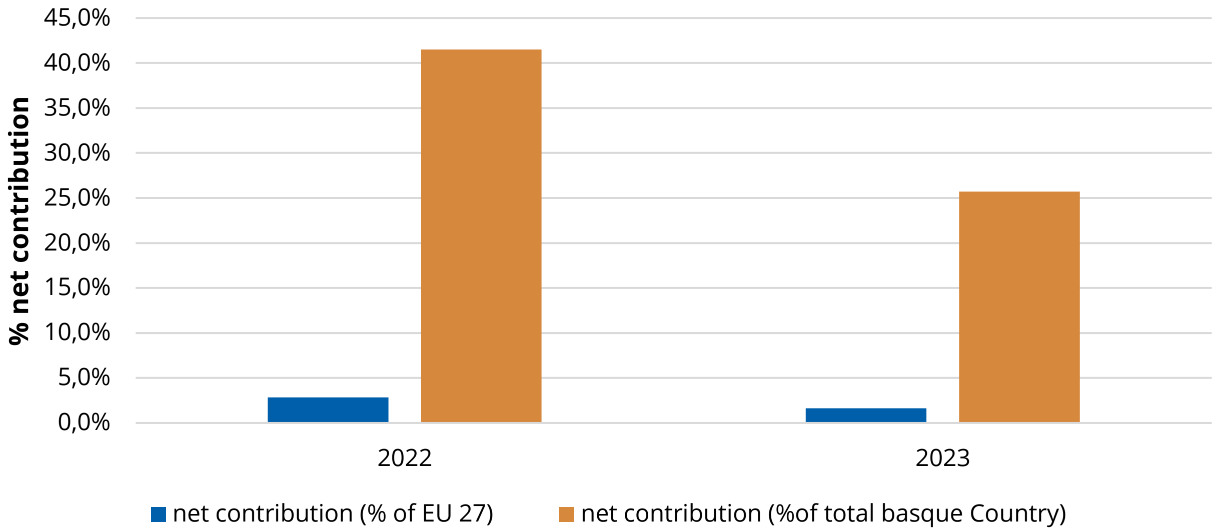
In 2022, the Basque Country's net EU contribution in the Climate, Energy, and Mobility priority accounted for nearly 42% of the total Basque figure, highlighting the specialisation of Basque organizations in this thematic area that contributes to SDGs 7, 11, and 13. In 2023, there was a reduced contribution (25.75% of the Basque contribution), but the proportion of projects signed in this domain remained stable compared to the previous year (comprising between 25% and 30% of all projects in this sector within the Basque Country). Moreover, the net contribution of Basque participation in relation to the EU-27 total, exceeding the Basque Country's share in the EU, stood at 2.8% in 2022 and 1.6% in 2023, corresponding to 24.4% of the EU projects signed in 2022 and 16.3% in 2023.

Graph 53: Basque participation in Climate, energy and mobility. Projects



Source: Horizon Dashboard. Compiled by authors

Graph 54: Basque participation in Climate, energy and mobility. Net contribution

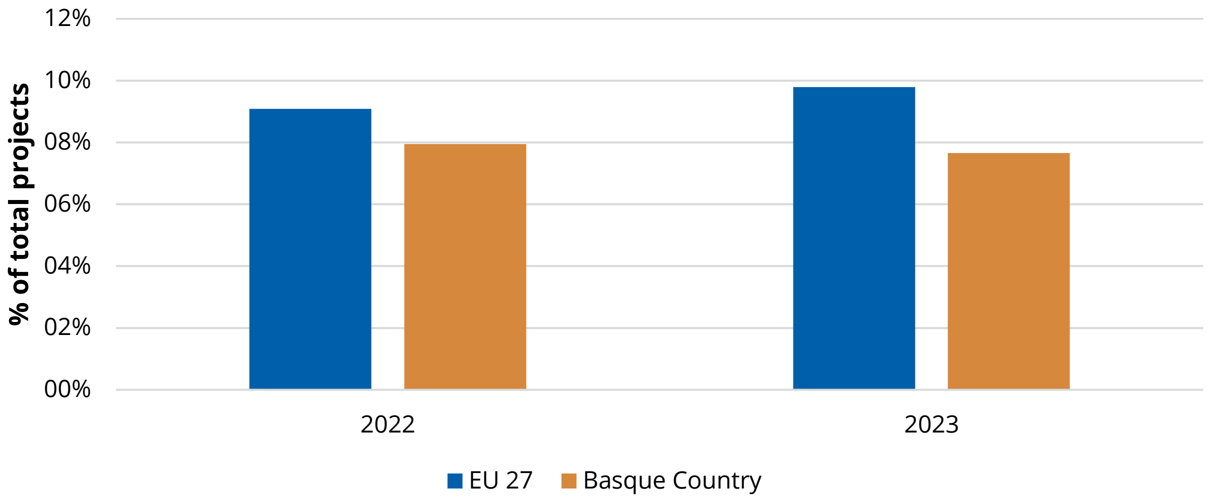


Source: Horizon Dashboard. Compiled by authors.

SDG 13 "Climate action"

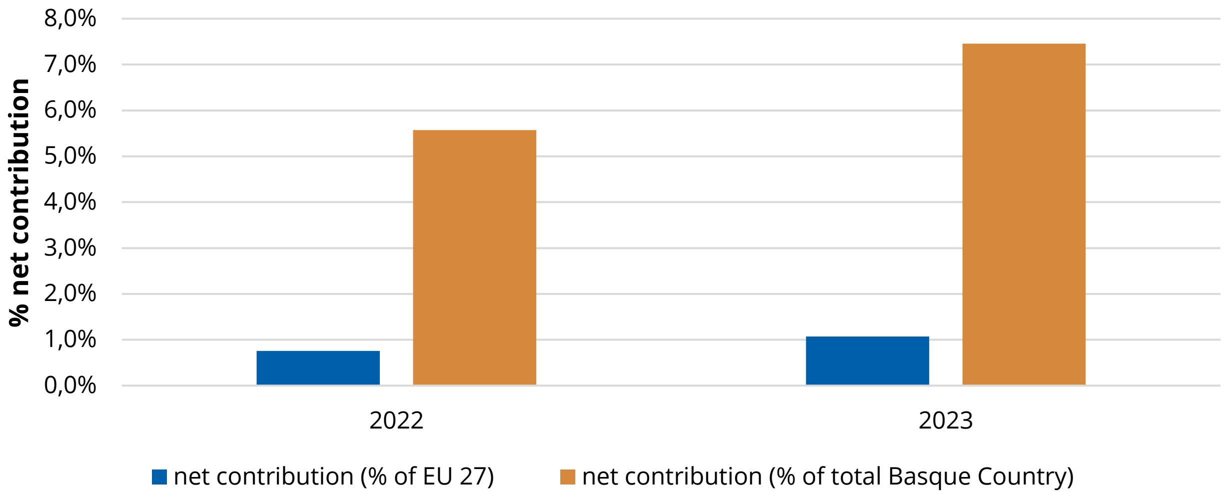
Another thematic priority contributing to SDG 13 is Food, Bioeconomy, Natural Resources, Agriculture, and Environment. In this field, the net contribution has increased in 2023, in terms of both the Basque total and the overall EU contribution, although the percentage of projects signed in relation to the total from the Basque Country did not increase. Thus, in 2023, 7.7% of European projects in this priority included Basque participation, representing 1.1% of the European contribution and 7.5% of the Basque contribution.

Graph 55: Basque participation in Food, Bioeconomy and Natural Resources, Agriculture and Environment. Projects



Source: Horizon Dashboard. Compiled by authors.

Graph 56: Basque participation in Food, Bioeconomy and Natural Resources, Agriculture and Environment. Net contribution



Source: Horizon Dashboard. Compiled by authors.

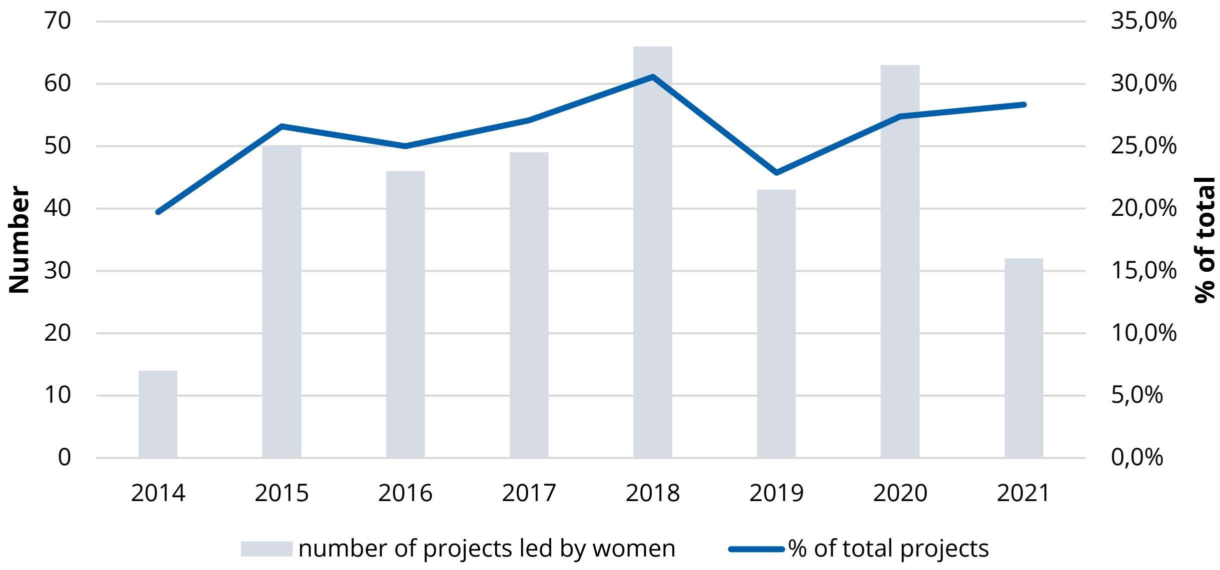
Social challenge: gender equality (SDG 5 Gender equality)

Women coordinators of European projects

Source: Horizon Dashboard. European Commission

The data that can be obtained on women coordinators of European projects, an indicator that contributes to SDG 5, through European Commission sources refer to the Horizon 2020 Framework Programme (2014-2021) and are self-reported by participants. From these data, it is apparent that the average percentage of projects led by women during this period in the Basque Country is 26.7%, with an inconsistent pattern over time.

Graph 57: Project leadership by women



Source: European Commission. Compiled by authors.

3.2.5. Other outputs

This section includes other outputs of the R&D&I process. All of them contribute to SDG 8 on economic growth and employment.

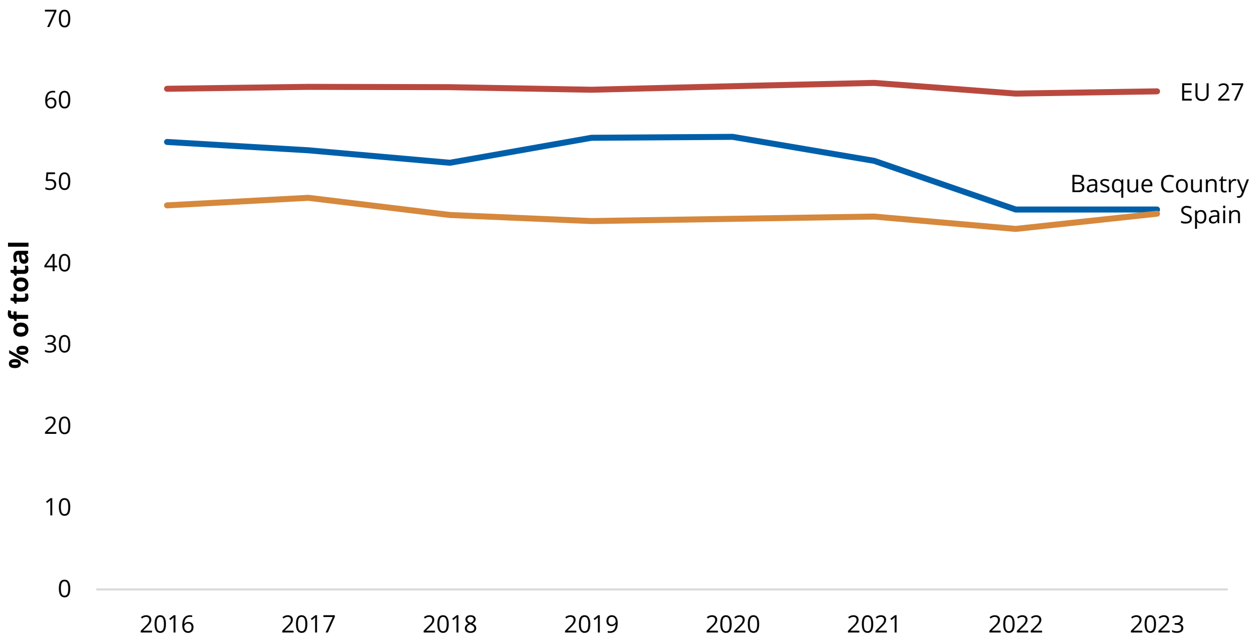
Social challenge: quality employment (SDG 8 Decent work and economic growth)

Exports of high and medium-high technology products

Source: Eustat (Basque Statistics Office). Foreign Trade Statistics (ECOMEX)

This indicator, which measures the monetary value of high and medium-technology product exports as a percentage of total exports, has declined in 2022 and 2023, reaching 46.7%. The drop may be influenced by the rise in the price of energy products, which constitute a significant portion of the total Basque exports. Throughout the period, the Basque Country has been below the European average and above Spain; however, the gap has closed due to the aforementioned decline over the past two years.

Graph 58: Exports of high and medium-high technology products (%)



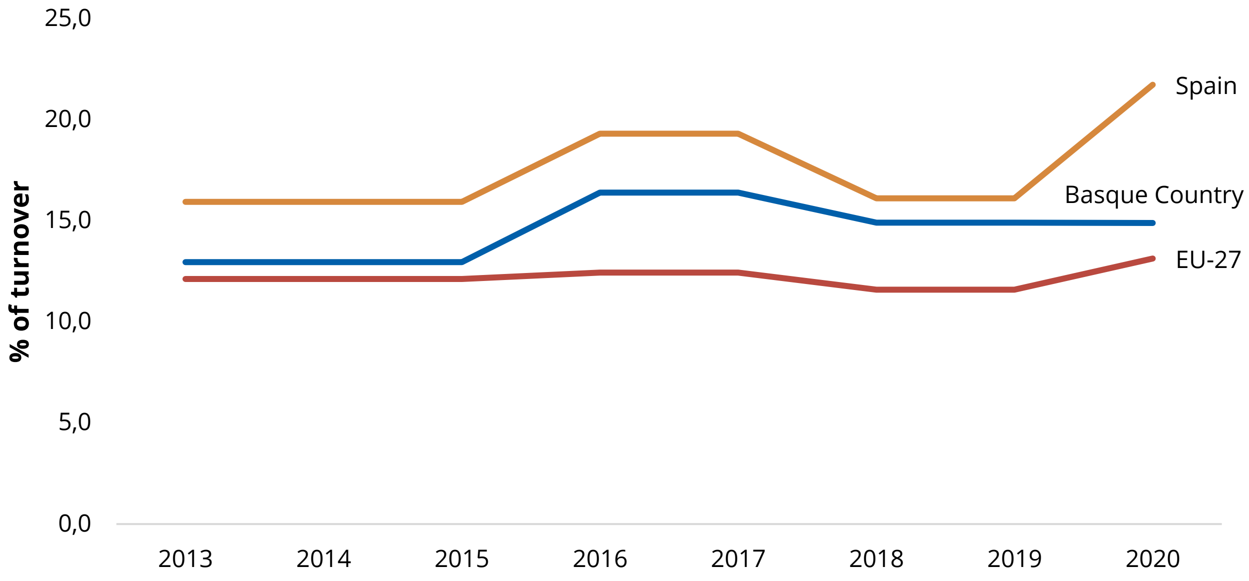
Source: Eustat and EIS. Compiled by authors

Sales of new products (of total turnover)

Source: Eustat (Basque Statistics Office). Innovation Survey

This indicator shows the percentage of sales of new or significantly improved products (for the company or for the market) over total turnover. The Basque Country shows a more or less stable trend throughout the period analysed. The Basque Country is above the European average, although below the Spanish average.

Graph 59: Sales of new products (of total turnover)



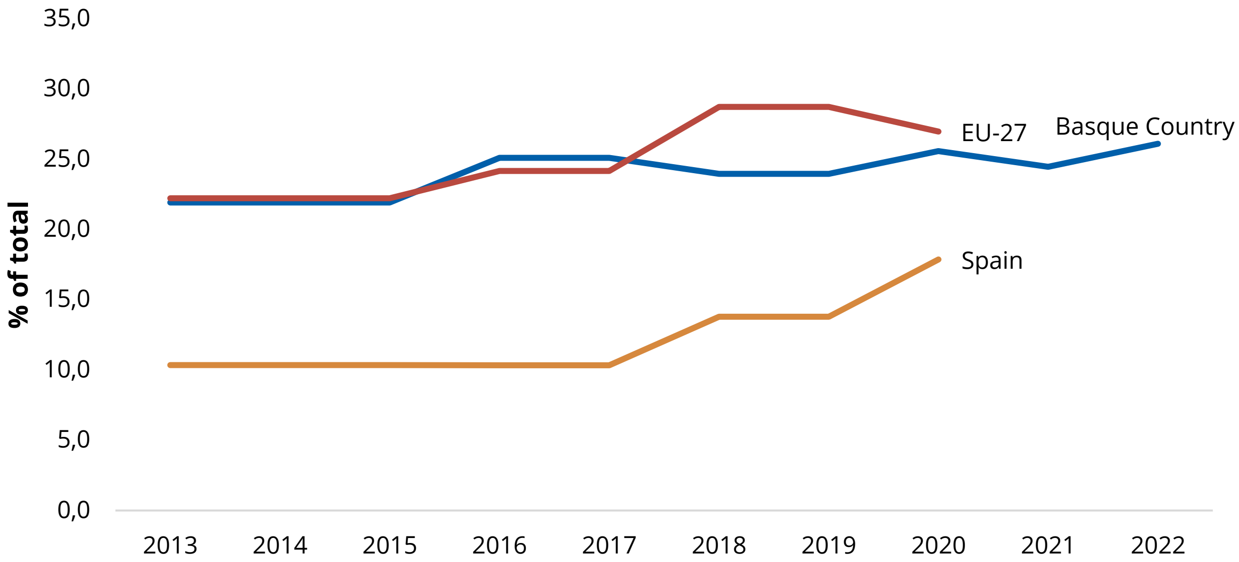
Source: Eustat and EIS. Compiled by authors.
NB: Data available up to 2020.

Product innovative SMEs (as % of SMEs)

Source: Eustat (Basque Statistics Office). EIS.

The data on the percentage of SMEs with more than 10 employees that are product innovators indicate an upward trajectory in the period analysed (2014-2022). As depicted in the graph, the Basque Country consistently outperforms Spain in terms of the proportion of product-innovative companies throughout the entire period. Relative to the European average, there was a consistent trend until 2017, followed by an increasing gap in 2018 and 2019, and then a return to comparable levels in 2020. Subsequently, due to the absence of data for Spain and the EU, the Basque Country experienced a mild decline in 2021 and a rebound and growth in 2022.

Graph 60: Product innovative SMEs (% SMEs)



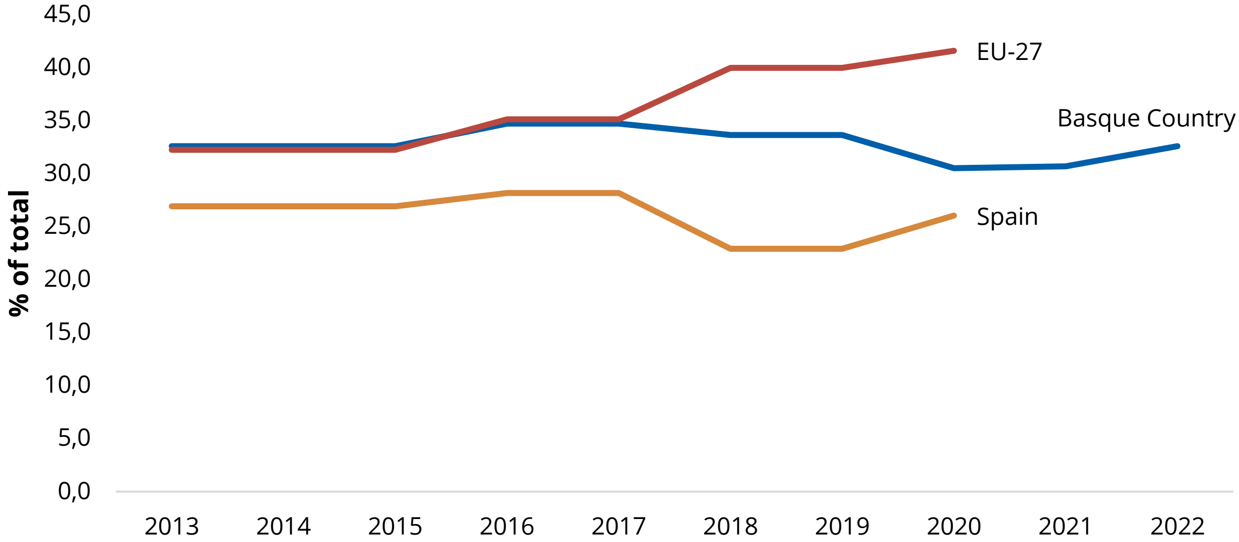
Source: Eustat and EIS. Compiled by authors.
NB: No data available for Spain and EU-27 from 2020.

Innovative SMEs in business processes (as % SMEs)

Source: Eustat (Basque Statistics Office). EIS 2023

Regarding the share of innovative companies in business processes, the Basque Country stands at about 32% of the total SMEs with more than 10 employees during the studied period (2013-2022). Compared to Spain, the Basque Country ranks higher. Nonetheless, it followed a trend very close to the European average until 2017, at which point the European average began an ascending trajectory, while the Basque Country's trend was descending.

Graph 61: Innovative SMEs in business processes (% SMEs)



Source: Eustat and EIS. Compiled by authors.
NB: No data available for Spain and EU-27 from 2020.

3.3. Summary of results of the methodology by social challenges

Overall contribution to SDG 9 (Industry, innovation and infrastructure)

Firstly, the strengths and areas for improvement pertaining to SDG 9 are presented in a broad scope. The positive trends in R&D staff and expenditure indicators, along with the percentage of STEM access, are highlighted as strengths. In terms of output, scientific excellence, as evidenced by various publication metrics and the coordination of European projects, is also notable. The areas for improvement, considering both inputs and outputs, lie within the business sector, including innovation investments, patent applications, and involvement in European projects:

	Strengths	Areas for improvement
Input	• Positive trend in FTE staff engaged on R&D • Positive trend in percentage of access to STEM degrees. • Positive trend in R & D expenditure as a percentage of GDP, standing at 2.1% in 2022., of which 1.6% corresponds to the companies and private not-for-profit institutions.	• Business investment in innovation has deteriorated compared to 2020.
Output	• Good results in terms of scientific publications per million inhabitants, above the Spanish and EU-27 average. There has also been a positive pattern in publications in the top 10% of most cited publications and in international collaboration. • Positive trend and good positioning in the participation in European projects of Horizon Europe	• Performance in patents per million inhabitants below the European average, but with a positive trend in the number of applications. • Trend towards a decrease in the leadership of European Horizon Europe projects.

Below are the key messages for each social challenge defined in the STIP 2030:

Social challenge: Health (SDG 3 Health and Well-being)

Output indicators are mainly available in the field of health. Both the positive trend in business R&D expenditure (albeit still lower than that devoted to other social challenges) and scientific output measured in terms of publications in this field stand out.

	Strengths	Areas for improvement
Input	• Positive trend in R&D spending on health by the private sector.	• The weight of business R&D expenditure in this area is lower than in the social challenges of energy and climate change and digital transition, and lower than in other comparable territories.
Output	• Good results in terms of scientific publications in both absolute and relative terms. Specialisation in scientific publications with respect to the EU 27. • Good positioning in patents in health-related technologies, even higher than the positioning in green patents. • Positive performance in business R&D measured through participation in regional funding programmes, particularly strategic Hazitek. • Increased public funding for health research.	• Low relative weight in Basque participation in European projects in this area. • Downward trend in the weight of patents related to health technology domains in the last year available.

Social challenge: Digital transformation (SDG 9 Industry, Innovation and Infrastructure)

In this area, the Basque strength in business R&D investment and the returns from European funding programmes stand out. Areas for improvement would include patenting performance in this area:

	Strengths	Areas for improvement
Input	• Large share of business R&D expenditure linked to the digital transition (almost half of total expenditure).	• Loss of relative weight in business R&D expenditure (although not in absolute terms).
Output	• Positive trend in terms of scientific publications in both absolute and relative terms. Specialisation in scientific publications with respect to the EU 27. • A large share of R&D funding measured through participation in regional and European funding programmes is concentrated in this area. • Good positioning in participation in the Horizon Europe programme with a net contribution greater than the weight of the Basque Country in European GDP.	• Low relative weight of scientific publications in this area, compared to other areas (e.g. Health). • Under-specialisation in green ICT-related patents compared to Europe. • Loss of weight in the funding of regional programmes (Hazitek and Elkartek) in the last year.

Social challenge: Energy and Climate Change (SDGs 7, 11 and 13)

In relation to the social challenge of energy and climate change, the findings indicate substantial investment in R&D and strong output measures, particularly regarding specialisation compared to Europe in both scientific publications and green patents, as well as active participation in the Horizon Europe programme. Notable successes and progress are primarily concentrated in the energy sector.

	Strengths	Areas for improvement
Input	• 30% of the internal business sector R&D spending is allocated to areas associated with the social challenge of energy and climate change (predominantly in the sectors of energy, infrastructure, and transport), marking a 5% increase since 2014. It is only exceeded by expenditures on industrial production and technology connected to the social challenge of digital transformation (SDG9).	• Of the R&D spending reviewed, the smallest proportion is allocated to the strictly environmental field.
Output	• In terms of scientific publications, the last three years (2019-2022) have seen favourable results, with publications in this category representing 16.3% of the total, trailing only behind the number of publications in the health sector. When compared with the EU-27, the Basque Country is noted for specialising in publications directed at this social challenge, particularly those pertaining to SDG7 (energy) • Positive performance in green patents, with the Basque Country specialising in comparison with the EU-27. In this field, energy patents account for around half of all green patents in the Basque Country. • Over 20% of regional R&D funding is channelled into the cleaner energy domain (in both strategic Hazitek and Elkartek programmes), showing an upward trajectory. • In 2022, the Basque Country's net reception of EU contributions in the Climate, Mobility, and Energy priority amounted to nearly 42% of the total Basque engagements. Additionally, Basque organisations were involved in 24.4% of EU projects initiated in 2022, underlining the region's excellence and focus in this thematic area, contributing to SDG7, 11, and 13.	• Lower percentage weight of green patents over health patents.

Subsequently, the outcomes of two broader social challenges, gender equality and quality employment, are presented.

Social challenge: Gender equality (SDG 5 Gender equality)

Regarding contributions to the social challenge of gender equality, noteworthy strengths include the positive trend in the representation of women in R&D personnel, the achievement of parity in the university system, and the surpassing of the European average in the percentage of women's STEM enrolments. Despite these improvements, gender disparities persist in R&D personnel and STEM enrolments, as well as in women's leadership in European projects.

	Strengths	Areas for improvement
Input	• Considerable increase of women among R&D personnel as well as teaching and research staff in the last decades. • Data close to gender parity in research and teaching in the Basque university system. • The percentage of STEM access for women is above the European average (EU-27).	• Room for improvement in R&D personnel, as women account for 36.9% of the total. • Percentage of STEM access for women remains low (9.6% compared to 20.1% for men).
Output	• The number of publications on gender has increased by one percentage point in the last decade (to 3%). Expertise in gender publications with respect to Europe.	• Uneven performance in leadership of European projects by women, which still stands at 26.7% in 2021.

Social challenge: Quality employment (SDG 8 Decent work and economic growth)

Among the indicators analysed in the report that contribute to SDG 8 on economic growth and quality employment, the most relevant to the social challenge associated with employment are emphasised below. Notably, the Basque Country's development and standing in knowledge-intensive employment is a strength, with areas for enhancement identified in the exports of high- and medium-technology products and in the number of trademark applications.

	Strengths	Areas for improvement
Input	• Positive trend in knowledge-intensive employment (21.4% of the total), with a position above the European and Spanish average.	
Output	• Positive trend over the last available year in the percentage of companies innovating in product and/or business processes (40.5%) • Upward trend of innovative SMEs in product and stability in innovative SMEs in innovative SMEs in business processes.	• Low weight of publications in this field compared to the rest, and, moreover, it is under-specialised compared to the EU. • Negative trend in the share of high and medium technology product exports out of the total, which could be influenced by the price rise of energy products and their significance in overall exports. • There is a downward pattern (with a minor improvement in 2022) in the proportion of new product sales to total revenue, positioned below the European average. • There is room for improvement in the number of EU trademark applications relative to comparable regions.

4. Other relevant local and international cases

The UN is making concerted efforts to localise the Sustainable Development Goals. Regionally, and within the European context, initiatives have been undertaken to adapt the SDG measurement framework to regional metrics (JRC, 2022), although these have not specifically targeted R&D.

The exploratory study backed by the European Commission (European Commission, et al., 2023) not only brings forth a developed Scorecard of indicators but also identifies a selection of exemplary practices regarding innovation policies that support the SDGs. As a result, the following are recognised as frontrunners: Sweden, with its Governmental Research Council for Sustainable Development Formas, managing programmes on Climate, Sustainable Spatial Planning, Food, and Oceans and Water; Denmark, with its SDG Investment Fund, a public-private initiative that furthers SDGs via private sector investments; and Germany, with its Green and Sustainable Finance Cluster.

Serbia | Pilot case of the JRC methodology

Within the Global Pilot Program on Science, Technology, and Innovation for the SDGs, the Joint Research Centre crafted a methodology to assess R&D's contribution to the challenges posed by the SDGs via RIS3. This novel methodology was piloted in Serbia, under the Smart Specialisation Strategy its government enacted in February 2020. The methodological tools employed in Serbia included:

- Identifying SDG priorities within statistical and strategic documents, assigning high, medium, or low priority.
- Charting the networks of national and international stakeholders for each SDG.
- Pinpointing key themes for each SDG within the realms of science, technology, and innovation.
- Gauging the nation's potential through R&D outcomes (publications, patents, European projects, and innovation funding).
- Mapping the interplay between innovation outputs and SDGs.

Illustration 1: Summary of potential impacts of S3 priorities and key emerging SDG challenges in Serbia

	Information and communication technologies	Food for Future	Creative Industries	Future Machines and Manufacturing Systems	Energy Efficient and Eco-Smart Solutions	Key Enabling Technologies
Goal 1. No Poverty	Indirect	Indirect				
Goal 2. Zero Hunger		Direct	Indirect	Indirect	Indirect	Indirect
Goal 3. Good Health and Well-being	Direct		Indirect		Indirect	Indirect
Goal 4. Quality Education	Direct		Direct			
Goal 5. Gender Equality	Indirect		Indirect			
Goal 6. Clean Water and Sanitation		Indirect		Indirect		Indirect
Goal 7. Affordable and Clean Energy	Direct	Indirect	Indirect	Indirect	Direct	Indirect
Goal 8. Decent Work and Economic Growth	Indirect	Indirect	Indirect	Indirect	Indirect	Indirect
Goal 9. Industry, Innovation and Infrastructure	Direct	Indirect	Indirect	Direct	Indirect	Direct
Goal 10. Reduced Inequalities	Indirect		Indirect			
Goal 11. Sustainable Cities and Communities	Indirect			Indirect	Indirect	Indirect
Goal 12. Responsible Consumption and Production		Indirect	Direct		Indirect	Indirect
Goal 13. Climate Action		Indirect	Indirect	Indirect	Indirect	Indirect
Goal 14. Life Below Water		Indirect	Indirect	Indirect		
Goal 15. Life on Land		Indirect	Indirect	Indirect	Indirect	
Goal 16. Peace, Justice and Strong Institutions						

Source: [S3 JRC platform. https://s3platform.jrc.ec.europa.eu/pilot-methodology#fragment-89005-sjth

In the Basque Country, members of the Basque Science, Technology and Innovation Network (RVCTI) are also embracing the contribution to the SDGs, increasingly integrating this approach into their strategic planning. In this regional setting, AZTI and Tecnalia are notable for their proactive approach to measuring and monitoring their SDG contributions.

AZTI

- ✔ AZTI technology centre aligns its strategy and entire planning process with the SDG framework, from comprehending its primary contributions to defining its mission. The SDGs serve as a crucial element for the full spectrum of the organisation's activities.
- ✔ It particularly recognises its contributions to significant challenges such as: SDG 13 (Climate Action), SDG 14 (Life Below Water), SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), SDG 2 (Zero Hunger).

- ✔ Its latest Technological Plan introduces a set of change drivers (population, values, stocks, etc.) associated with the SDGs. They use a matrix that connects the organisation's objectives with the SDGs they support, which aids in tracking progress.
- ✔ AZTI's SDG-centric focus has led to strategic decisions, such as discontinuing certain technology lines or intensifying efforts in underdeveloped areas.

Tecnalia

- ✔ Tecnalia regards SDG measurement as a crucial tool for enhancing contributions towards the SDGs. Consequently, it recommends that contributions to the SDGs should be solicited not only retrospectively, at the end of processes, but also proactively and throughout.
- ✔ Through its initiatives, it contributes to strengthening local capacities in science and technology to address the following global challenges: SDG 3 (Good Health and Well-being), SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), and SDG 17 (Partnerships for the Goals).
- ✔ Tecnalia assesses its SDG contributions through two approaches:
    - Direct contribution, encompassing both R&D activities and organisational operations towards the sustainable development goals. They pinpoint specific evidences of outcomes or pursuits related to the SDGs and maintain an exhaustive record.
    - Indirect contributions by facilitating the necessary transitions to realise the SDGs. For this purpose, they have developed a unique methodology inspired by Loorbach et al. (2017) and Sachs et al. (2019).

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5. Conclusions

This final section presents the key findings from both the initial exploration of a methodology capable of measuring Science, Technology and Innovation's contribution to the SDGs, and from the application of this method in assessing the contribution of the STIP 2030 to the social challenges outlined in the Plan, which are in line with various SDGs.

The genesis of this report was to perform a state-of-the-art analysis, reviewing both scholarly literature and documentation from international organisations, in addition to evaluating experiences both globally and within the Basque Country. These assessments reveal a strong interest in **discovering effective approaches** for quantifying STI's impact on the SDGs, and highlight **the absence of a universally adopted and standardised methodology**.

Adopted approach

Within regional research and innovation strategies for smart specialisation (RIS3), **two primary approaches** are identified:

- The first involves linking areas of smart specialisation with particular SDGs (either individually or multiple). In the Basque Country, a clear correlation exists between the strategic priorities set in the STIP 2030 and the SDGs, offering a significant advantage for this method. For instance, the Cleaner Energy priority corresponds directly with SDG 7 Affordable and Clean Energy. However, for opportunity territories, this alignment becomes more intricate. Along with this, this approach presents a series of challenges. Firstly, it necessitates an effort in the definition of indicators and the collection of ad hoc information, which bears implications for the analysis of time series as well as for benchmarking with other territories. Secondly, it exclusively quantifies the contribution to the SDGs connected with the RIS3 domains, omitting the impact of Science, Technology and Innovation on other SDGs.

- The second approach involves correlating standardised R&D&I indicators from international statistics with the SDGs. Currently, numerous R&D&I indicators gather data across various thematic fields that can be linked to the different SDGs, and in some instances (for example, patents or publications), specific methodologies have been established for this assignment. While this method has its shortcomings, it facilitates, unlike the former, a direct measurement of the contribution of STI to the SDGs and a comparison across different regions.

The methodology developed in this report is geared towards **prioritising measurement through the second approach, supplementing it with the first approach** in instances where data for the second is not available. Therefore, in the process of supplementing the information, each RIS3 domain has been associated with the social challenges they address, as outlined in the STIP 2030, and the specific SDGs to which they correspond.

General limitations

Regardless of the chosen approach, four general limitations for measuring R&D&I contributions to the SDGs are acknowledged.

1. The intrinsic definition of the SDGs complicates measurement since the goals are interconnected and vary in character. Some are thematic or sector-specific (such as SDG 3, Good Health and Well-being), while others are broader in scope (like SDG 5, Gender Equality). Therefore, it is **exceptionally challenging to allocate indicators to SDG contributions that are mutually exclusive**. For instance, within the developed methodological framework, all indicators contribute to SDG 9, Industry, Innovation, and Infrastructure due to their inherent STI nature, even if they also address more specialised SDGs.
2. Similarly, if we categorise the SDGs based on their alignment with social challenges, the extensive scope and intricate nature of these challenges indicate that there is **no direct one-to-one correlation between the social challenges of STIP 2030 and SDGs**. For instance, the challenge identified as digital transformation corresponds with SDG 9, yet not all indicators measuring the contribution to this SDG are necessarily associated with the specified social challenge.
3. It is also important to highlight that the SDGs outline specific targets, of which only a select few pertain to STI. The adopted methodology presupposes that the STI's contribution to the SDGs extends beyond the specific targets set by the UN. Consequently, the **developed methodology is designed to assess the STI's contribution at the general SDG level rather than at the target level**.
4. Lastly, a significant portion of the information available from various data sources, including R&D&I statistics and details on R&D&I funding programs, **remains categorised by scientific disciplines** (for example, Exact and Natural Sciences). This classification complicates the task of allocating contributions to social challenges or SDGs, as these scientific disciplines often contribute to multiple goals.

Key methodological considerations by social challenge

In applying the developed methodology, a primary step involves **distinguishing indicators** based on whether they represent a **resource (input) or a result (output) from the R&D&I process** (irrespective of their role as an input or output for the corresponding SDG). For instance, indicators related to R&D spending are inputs to the innovation process, whereas publications or patents represent outputs.

After making this initial distinction, each indicator is further categorised by the social challenge identified in the STIP 2030 to which it contributes, along with the related SDG(s).

Generally, contributions to SDG 9 are evidenced through a comprehensive array of R&D&I input and output indicators, the majority of which are included within the STIP 2030 Scorecard. However, when applying the methodology to the different social challenges and their corresponding SDGs, we find the following particularities:

- **Social challenge of health (SDG 3)**: Mainly health-related output indicators are available. Further progress is needed in the search for indicators and measurement methodologies to assess the contribution of R&D&I in this area.
- **Social challenge of digital transformation (SDG 9)**: A range of input and output indicators are available to measure the contribution to this social challenge, although in some cases it is assumed that these indicators capture data with a broader scope than the digital transformation itself.
- **Social challenge of energy and climate change (SDGs 7, 11 and 13)**: This social challenge covers the largest number of indicators, especially in the area of energy (7 indicators) compared to four indicators for SDGs 11 and 13.
- **Social challenge of quality employment (SDG 8):** Given the final result component of this challenge with respect to the R&D&I process, most indicators are concentrated in the output category (7 of the 8 indicators).
- **Social challenge of gender equality (SDG 5):** To measure the contribution of STI to this challenge, there are more input indicators than output indicators (4 of the 5 indicators are input indicators). Progress could be made in the definition of output indicators, collecting data on women's leadership in the field of regional R&D&I projects or patents registered by women inventors.

Final conclusions

Considering the general limitations previously outlined, the analysis conducted from the implementation of the developed methodology on the STIP 2030's contribution to the prioritised SDGs within the Plan leads to the following significant conclusions:

Concerning the outcome of the contribution, it is inferred that:

- Overall, the contribution to and **progress in R&D&I is positive** with respect to both inputs and outputs. However, areas requiring improvement are also identified (including, but not limited to, patent performance per million inhabitants, business investment in innovation, and the proportion of women in STEM fields).
- Regarding specific social challenges, a positive contribution is noted across all domains. The **STIP 2030's contribution to the social challenge of energy and climate change stands out** in particular, given its consolidated strengths in the most pertinent indicators.

Regarding the methodology, the following should be noted:

- This initial attempt at **measuring** the contribution has revealed **areas for potential improvement**. It is crucial to investigate methods for gathering such information in the medium to long term. For instance, within public funding applications for R&D&I, we could advance towards a more comprehensive measurement system by requesting details pertaining either to the RIS3 domain or the specific social challenge or SDG addressed.
- The study focuses on measuring the social challenges addressed by the STIP 2030. However, the plan also highlights talent as a critical element, emerging as a vital challenge for the region's future competitiveness. Consequently, subsequent iterations of the assessment could recognise **talent as a sixth social challenge** engaged by the STIP 2030, enabling an

examination of its influence on SDG 4, Quality Education, due to its intrinsic relationship with the training and cultivation of talent.

- Finally, it is noteworthy that stakeholders within the Basque Science, Technology, and Innovation Network are progressing in designing methodologies to measure their contributions to the SDGs. This effort is both positive and complementary to the methodological groundwork laid by this study. Moving forward, it will be crucial to **develop shared measurement standards** to enable more cohesive data integration in the future.

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