

Integrating the Climate Dimension into Economic Statistics: The Experience of the Banco de España*

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Abstract

Climate change has become a key concern for central banks due to its implications for economic activity, price stability and financial stability. This paper reviews the experience of the Statistics Department of the Banco de España in integrating climate considerations into its statistical production, covering the rationale, methodologies and data products developed over the past decade. It presents major initiatives such as the ESG microdata database for Spanish firms (CBS), the Multi-location Business Visualiser (ViME), the European ERICA database and the Banco de España's contribution to the ECB climate indicators. The paper also discusses ongoing work on biodiversity, geospatial data, international statistical standards and the application of artificial intelligence to climate statistics. The experience highlights the importance of data access, new analytical capabilities, international collaboration and user-oriented statistical development in supporting sustainable finance and climate-related policymaking.

Keywords: climate statistics, sustainability statistics, ESG indicators, artificial intelligence, biodiversity.

1. INTRODUCTION

Climate change is one of the most complex and far-reaching challenges facing the global economy today. Its impact extends well beyond the environmental sphere, touching the very variables that central banks are mandated to monitor and safeguard: economic activity, price stability and long-term growth. Against this backdrop, the availability of rigorous, comparable and timely climate statistics has shifted from an academic aspiration to an operational necessity for central banks and supervisory authorities.

This contribution summarises the presentation delivered at the international forum “Climate Risk and Sustainable Finance: Bridging Policy, Research and Practice”, held on 25 March 2026. It sets out, in a structured manner, the journey undertaken by the Statistics Department of the Banco de España to integrate the climate dimension into official statistical production, the projects that now form part of its regular catalogue of products, and the challenges and opportunities that will shape the agenda for the years ahead.

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The presentation was organised around three temporal axes that serve as the thread running through the narrative: the past — what we have done so far; the present — where we stand today; and the future — what challenges and opportunities lie ahead. This structure allows to understand not only the statistical products developed, but also the institutional, methodological and collaborative logic that underpins them.

2. THE STARTING POINT: WHY THE BANCO DE ESPAÑA VENTURED INTO CLIMATE STATISTICS

2.1. The institutional rationale

When the Statistics Department of the Banco de España launched this project approximately eight years ago, the first question that had to be answered was not technical, but fundamental: why are climate statistics relevant for a central bank? The answer, far from self-evident at the time, was built around three arguments that now form the conceptual foundation of all the work carried out.

First, climate change is the most significant global challenge facing humanity, with effects that extend well beyond the environment into the core macroeconomic variables that central banks track: growth, prices and long-term financial stability. A central bank that ignores the climate dimension in its economic analysis risks basing its decisions on an incomplete diagnosis.

Second, the financial sector plays a strategic role in the transition to a more sustainable economy. Banks, capital markets and institutional investors are the channels through which savings flow into productive investment; without adequate information on climate-related risks and opportunities, they can neither efficiently finance the transition nor properly value the exposure of their portfolios to physical and transition risks.

Third, central banks have both the mandate and the capacity to manage high-quality data. They possess experienced statistical infrastructures, privileged access to granular microdata from the financial system, and the institutional credibility needed to lead or co-lead the production of comparable and harmonised statistics. These assets place them in a unique position to tackle the challenge of climate statistics.

2.2. The initial diagnosis: identifying data gaps

Once the institutional rationale was established, the next step was to carry out a systematic assessment of the available data landscape. This analysis revealed that producing relevant

climate statistics required covering four fundamental dimensions, each characterised by significant gaps:

- Economic agents: information on firms and households was needed to assess their exposure and vulnerability to climate change, as well as their contribution to greenhouse gas emissions.
- Financial sector: banks and financial markets required indicators reflecting their exposure to climate-related risks and their contribution to sustainable finance.
- Location data: the geographic distribution of economic activities and assets is essential for assessing exposure to physical risks, which are inherently local in nature.
- Climate-related risks: both transition risks (arising from the decarbonisation of the economy) and physical risks (associated with extreme weather events and gradual climate shifts) required specific measurement frameworks.

A common feature of all these datasets was their non-conventional nature. Unlike traditional statistics (based on structured administrative sources, standardised questionnaires and well-established methodological frameworks) the new climate data posed significant technical challenges: it often originated from unstructured sources, there was little prior experience in handling it within the official statistics domain, and the treatment methodologies were still being developed at the international level.

2.3. Early in-house projects and new capabilities

Faced with these gaps, the Statistics Department launched a series of pioneering projects to explore new data sources and develop the capabilities needed to exploit them. In the initial phase, the focus was on the non-financial corporate sector, examining the potential of sources such as corporate sustainability reports (CSR/ESG reports), bond prospectuses, administrative sources for pollutant emissions, and commercial databases from specialised ESG and climate data providers.

The first concrete product of this phase was the construction of an Environmental, Social and Governance (ESG) microdata database for Spanish non-financial corporations, marking the first systematic attempt to introduce sustainable finance indicators into the Banco de España's statistical production. This pilot project demonstrated both the feasibility of the approach and the need to invest in new competencies: efficient management of granular microdata, record linkage across heterogeneous databases, text extraction from unstructured documents, and the application of machine learning algorithms to ensure scale and data quality.

2.4. The collaborative dimension: a shared journey

One of the most important messages from this initial phase is that the Banco de España did not walk this path alone. Producing meaningful climate statistics requires, by its very nature, a collective effort that transcends institutional and national boundaries. In this regard, collaboration with the European Central Bank and with the Eurosystem's climate statistics expert group proved fundamental to advancing towards the objectives defined at the national level.

At the national level, collaboration with the National Statistics Institute (INE) and with the Spanish accounting profession (including the bodies responsible for the Mercantile Register) was equally essential for precisely defining the required variables and ensuring consistency between the new climate indicators and existing statistical frameworks. At the international level, participation in initiatives such as the G20 Data Gaps Initiative broadened the methodological horizon and reinforced the legitimacy of the projects undertaken.

A further element worth highlighting is the role of user feedback. Researchers and other users of the early statistical products provided highly valuable input that helped reorient priorities, improve indicator quality and ensure the analytical relevance of the data produced. This two-way interaction between producers and users of statistics is one of the hallmarks of the working model adopted. It also reinforced a conviction that grew stronger over the years: climate change is a global challenge, and so is the production of climate statistics. The exclusively national perspective that had dominated traditional statistical production is no longer sufficient. International harmonisation of definitions, methodologies and indicators is not a methodological luxury, it is an indispensable condition for ensuring that climate statistics are comparable and credible.

3. THE CURRENT STATE: STATISTICAL PRODUCTS IN OPERATION

Following the exploratory projects of the first phase, the Statistics Department of the Banco de España now has a set of climate statistical products that form part of its regular production. The most significant of these are described below.

3.1. The ESG microdata database for Spanish non-financial corporations (CBS)

The first operational product is the database of sustainability indicators (CBS, the Spanish acronym for *Central de Balances sobre Sostenibilidad*) for Spanish non-financial corporations. It addresses a fundamental practical challenge: developing a systematic and scalable framework to monitor and analyse the sustainability information disclosed by firms in their sustainability statements.

The solution adopted involves building an in-house database of ESG indicators extracted from the sustainability reports of major Spanish non-financial firms, using advanced natural language processing (NLP) and machine learning techniques to automate the extraction, classification and validation of information. The pipeline covers everything from the identification and download of reports to the publication of clean, structured data.

A particularly noteworthy aspect of this project is its commitment to data accessibility. Beyond their use by researchers at the Banco de España, the CBS¹ is disseminated through the Banco de España's Research Data Center (BELab), enabling external researchers to link it with other microdata sources and generate new evidence on sustainability-related challenges and opportunities in the Spanish corporate sector.

3.2. The Multi-location Business Visualiser (ViME)

The second project highlighted in the presentation is the Multi-location Business Visualiser (ViME)², developed in close collaboration with the INE. This tool addresses a methodological limitation that is particularly relevant for climate statistics: geolocating companies based solely on their registered headquarters produces a distorted picture of the actual distribution of economic activity across the territory.

ViME enables a move from headquarters-based geolocation towards a multi-establishment approach, identifying productive facilities beyond firms' registered addresses. This has direct implications for the assessment of physical risks from climate change: knowing where a company's productive installations, employees and assets are located is indispensable for accurately estimating its exposure to floods, droughts, heatwaves and other extreme climate events.

The practical value of ViME was clearly demonstrated in the analysis of the impact of the DANA storm that struck the province of Valencia in 2024. When the estimated impact derived from headquarters-based geolocation is compared with that obtained using the multi-establishment approach, the difference amounts to 17% more in terms of sales, employment and assets in the affected municipality. This figure eloquently illustrates the systematic error introduced in any physical risk analysis that fails to account for the actual distribution of firms' operating centres.

1 Further information and access to the dataset are available on the following webpage: [link](#)

2 For further information on the Multi-location Business Visualiser (ViME), see the Banco de España's online visualisation tool available at [link](#).

3.3 The ERICA database: a European ESG corporate project

The third project presented is the ERICA database (European Reporting of Integrated Company Accounts with ESG data), developed under the umbrella of the European Committee of Central Balance Sheet Data Offices³ (ECCBSO) through the JECED Task Force (Joint ECCBSO-CMFB⁴ on Environmental Data). It is a joint initiative of national central banks and national statistical institutes from nine European countries, coordinated by the Banco de España, compiling harmonised ESG indicators for large listed European corporate groups.

The database covers approximately 1,000 corporate groups per year, with 95% coverage in terms of turnover, over the period 2005-2024. Its primary added value lies in the combination, within a single database, of consolidated financial information and ESG data, enabling integrated analyses of the relationship between corporate sustainability and financial performance.

The Banco de España leads this project, assuming responsibility for coordinating the JECED Task Force, hosting the database, designing the methodological framework and harmonising indicators across countries. This leadership position strengthens the Banco de España's presence in the European climate statistics ecosystem and allows it to contribute actively to the definition of common standards.

3.4. ECB climate indicators: sustainable finance, carbon footprint and physical risk

The fourth set of projects in which the Banco de España participates⁵ concerns the development of climate statistical indicators by the European Central Bank (ECB), structured around three broad categories: sustainable finance indicators, carbon footprint indicators and physical risk indicators.

The Banco de España's contribution within this framework goes beyond the supply of granular national microdata. Over the years, the Statistics Department has actively participated in the international methodological debate, putting forward proposals for improvement in areas such as estimating the carbon footprint of corporate loan portfolios, linking mortgage loans to energy performance indicators of underlying properties, and developing forward-looking indicators that allow future climate exposure to be anticipated beyond historical data.

3 European Committee of Central Balance Sheet Data Offices (ECCBSO): [Official website](#).

4 Committee on Monetary, Financial and Balance of Payments Statistics (CMFB): [link](#).

5 Further information on the initiative and its main findings is available in the Banco de España press release, accessible through the following webpage: [link](#).

This work has given rise to several published research contributions, illustrating how statistical production and methodological innovation can reinforce each other: data generates analytical questions, and the answers to those questions improve statistical production processes.⁶

4. WORK IN PROGRESS: THE OPEN AGENDA

Alongside the consolidated statistical products, the Statistics Department of the Banco de España has several active workstreams that represent both the natural continuation of existing projects and the opening of new lines of statistical research and development.

In the area of the G20 Data Gaps Initiative (DGI), the Banco de España is working on implementing the DGI-3⁷ recommendations on climate statistics, which include the carbon footprint of foreign direct investment, the development of harmonised forward-looking indicators, and climate statistics for the public sector.

On spatial harmonisation, work is under way to integrate geolocation projects with satellite and remote-sensing data, which offer unprecedented possibilities for improving the precision with which the geographic exposure of economic activities and financial assets to physical climate risks is estimated.

A particularly significant line of work is that related to biodiversity and nature, which broadens the focus beyond climate change in the strict sense. Indicators of water use and water stress, species conservation, and the protection of natural ecosystems and habitats are dimensions that are beginning to be incorporated into the official climate statistics agenda, anticipating the growing prominence they will hold in regulatory and reporting frameworks in the years ahead.

Finally, a strategic priority of the highest importance is the incorporation of climate and sustainability considerations into international statistical standards, notably the System of National Accounts (SNA) and the Balance of Payments Manual (BPM). The revisions currently under way will introduce new sustainability-related concepts and classifications that will fundamentally reshape the production of official economic statistics. The implementation of these requirements and the dissemination of the resulting statistical outputs are expected to be completed around 2030. Preparing the Banco de España for this transformation is therefore one of the department's key strategic priorities. For further information on the

⁶ See, among others, [Estimating the Carbon Footprint of Spanish Credit Institutions' Corporate Loan Portfolios \(Banco de España Occasional Paper\)](#); [Green Mortgage Loans in Spain: An Administrative Data Approach](#); and [Carbon Disclosures from Spanish Non-Financial Corporations: Comparing Data Sources and Analysing Historical Reporting Trends](#). These studies illustrate how granular climate-related datasets can support both policy-relevant research and improvements in statistical production.

⁷ International Monetary Fund (IMF), G20 Data Gaps Initiative (DGI-3) Recommendations: [link](#).

ongoing revisions of international statistical standards and their implications for economic measurement, see the Banco de España blog article “How do we measure and compare economies? New developments in 2025”.⁸

5. CHALLENGES AND OPPORTUNITIES: LOOKING AHEAD

5.1. Data access in a changing reporting landscape

One of the most immediate and complex challenges identified concerns the management of the shift taking place in the European data landscape. The coming months and years will bring significant changes to data access, driven by new European directives on corporate sustainability reporting.⁹ In particular, the need to strike the right balance between reducing reporting burdens on companies, a legitimate and necessary objective, and maintaining adequate access to quality, comparable and decision-useful data represents a dilemma that is genuinely difficult to resolve.

The argument put forward in this contribution is that it is not coherent to simultaneously reduce access to data and demand higher quality climate statistics. Both objectives are in tension and resolving that tension requires a data governance architecture that enables information to be shared between public administrations, statistical institutions and the private sector in a fluid, efficient and appropriately secure manner. Data spaces are emerging as a promising environment for structuring this exchange, but their effective development requires institutional and technical agreements that are still being shaped.

Comparability of standards is another central element of this challenge. If each jurisdiction or institution defines key concepts differently (carbon emissions, exposed assets, sustainable finance) the result will be a patchwork of incomparable data that hampers both economic analysis and financial supervision. Aligning the supply of data with the actual demand from users (central banks, supervisors, investors, researchers) is ultimately the criterion that should guide decisions on what data to produce and how to share it.

5.2. Climate intelligence: the convergence of artificial intelligence and climate statistics

The second major future vector is the transformative potential of artificial intelligence applied to the production of climate statistics. Under the concept of *climate intelligence*

⁸ Banco de España, How do we measure and compare economies? New developments in 2025, available at the Banco de España website: Banco de España [blog article](#).

⁹ Central Balance Sheet Data Office Annual Publication 2024, available in Spanish only at the Banco de España [website](#).

(sustainable), the Statistics Department conceptualises the synergistic combination of the analytical capabilities of artificial intelligence, including large language models (LLMs), and the production of sustainability statistics.

This convergence has the potential to transform statistical production processes along three main dimensions:

- **Granularity and quality:** the use of AI makes it possible to process massive volumes of unstructured data (corporate reports, regulatory documents, satellite images) with a level of granularity and precision that would be impossible to achieve with conventional methods. This translates into more detailed, more accurate and more traceable indicators.
- **Efficiency and scalability:** the automation of statistical processes through AI techniques reduces production costs and allows the scope of statistical projects to be expanded without a proportional increase in resources. Natural language processing, in particular, opens the door to extracting information from textual sources systematically and reproducibly.
- **Uncertainty and decision-usefulness:** incorporating scenario-based information and explicitly treating uncertainty in statistical indicators are conditions for climate statistics to be genuinely useful for economic and financial decision-making. AI can contribute to developing more sophisticated and better-calibrated forward-looking indicators.

The vision underlying the concept of climate intelligence is that AI is not simply an efficiency tool, but an enabler of new statistical capabilities that previously did not exist: processing texts in multiple languages and formats, automatically cross-referencing information from multiple sources, generating dynamic calibrations, and producing statistics at very fine geographic scales are examples of what this convergence can deliver.

6. CONCLUDING REFLECTIONS: LESSONS LEARNED AND PERSPECTIVES

The experience of the Banco de España in integrating the climate dimension into its economic statistics offers a set of lessons that may be of value to other institutions at earlier stages of this process.

First lesson: the rationale matters. Before investing resources in the production of climate statistics, it is necessary to have clarity about why they are relevant to the institutional mission. In the case of the Banco de España, the answer was articulated around three arguments: the impact of climate change on macroeconomic variables, the role of the financial sector in the sustainable transition, and the central bank's capacity to manage high-quality data.

This conceptual clarity facilitated the obtaining of institutional support and the alignment of projects with the institution's strategic priorities.

Second lesson: new data sources require new capabilities. Climate-related and sustainability data do not fit the conventional statistical paradigm. Their effective use demands skills that were not systematically present in statistical departments just a decade ago, including the management of unstructured data, data science and machine learning techniques, and the integration of information across heterogeneous data sources. Building these capabilities, through both investment in human capital and the development of technological infrastructure, has been a critical enabler of the projects' success.

Third lesson: collaboration is structural, not optional. The development of climate and sustainability statistics at the Banco de España has relied heavily on cooperation with a broad range of partners, including the ECB, the INE, private-sector stakeholders, and international fora such as the G20. These partnerships have been essential to ensuring methodological robustness, international comparability, and analytical relevance. Indeed, the collaborative dimension is not merely a feature of the production process; it is an intrinsic characteristic of climate statistics, which by their nature require the integration of expertise, data sources, and perspectives across institutions and disciplines.

Fourth lesson: users as compass. Feedback from researchers and other data users has played a key role in steering the development of projects towards where they are most needed. A statistical system that produces data without listening to its users risks generating information of limited analytical value. Opening data to external researchers (through the Banco de España's Data Laboratory, BELab) is a concrete embodiment of this principle.

Fifth lesson: the balance between access and quality is a policy challenge, not merely a technical one. The tension between reducing reporting burdens and maintaining a sufficient flow of quality data cannot be resolved through technical solutions alone. It requires public policy decisions on data governance models, reporting standards and information-sharing mechanisms between institutions. Central banks and statistical institutes have an important role to play in these debates, contributing their perspective on the analytical needs of official statistics.

Taken together, the experience of the Banco de España illustrates that integrating the climate dimension into official economic statistics is a long, demanding and multifaceted process, but also an extremely necessary and, ultimately, achievable one. The statistical products developed to date demonstrate that central banks can make a substantive and distinctive contribution to the climate statistics agenda, provided they are willing to invest in new capabilities, collaborate with a broad network of institutional partners, and orient their work towards the real needs of users.

The horizon ahead, with climate intelligence as a new technological driver, the implementation of the revised international statistical manuals as a renewed conceptual framework, and biodiversity as an emerging frontier, suggests that the next phase of this journey will be every bit as demanding, and as rewarding, as the first.