Network for Greening the Financial System

Information Note

Improving Greenhouse Gas Emissions Data

July 2024

NGFS

Central Banks and Supervisors
Network for Greening the Financial System

Table of Contents

Foreword

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The NGFS Expert Network on Data (EN Data) is pleased to present the Information Note on Improving Greenhouse Gas (GHG) Emission Data.

The document reflects the rich and diverse experiences of the Expert Network's members as we strive to improve the availability of granular data on GHG emissions. Our goal is to increase awareness among central banks and supervisors about common challenges in compiling and using GHG emissions data, and to explore potential solutions for bridging data gaps. Our focus on GHG emission data is driven by two factors: firstly, the NGFS Final report on bridging data gaps identified GHG emission as one of the most significant gaps, particularly regarding the granularity of data; and secondly, the important need to monitor progress towards transition to a low-carbon economy.

The note presents several case studies from various jurisdictions, highlighting the main challenges and potential strategies to overcome these obstacles. The key challenges include the aggregation of data with different granularities and heterogeneity, comparability issues due to lack of standardisation of methodologies, and the lack of comprehensive data, particularly forward-looking information and disclosures from smaller companies.

Given that the collection of official GHG emission data often fall outside the direct purview of central banks and supervisory authorities, it is essential to collaborate with relevant government agencies to achieve alignment and promote convergence on data methodologies. Moreover, the ongoing effort to harmonise international standards should be continued, complemented by active knowledge exchange among peers on workable solutions, such as the use of technology and available data sources to enhance GHG data estimation.

We are optimistic about further progress in this area, underpinned by the evolving landscape of more harmonised disclosure standards and promising technological advancements in recent years, such as geospatial analysis. With these developments in mind, we are confident that continuous discussions and the exchange of experiences within the network will encourage members to press forward with our collective efforts to improve the availability, reliability and comparability of GHG emission data.

We appreciate the contributions of the Expert Network's members to this document. Our special thanks go out to the team lead for his leadership and dedication to this work.

1. Introduction

The availability of high-quality climate data is critical to supporting the integration of climate-related issues in the operation and risk management of the financial sector and in the transition to a low-carbon and sustainable economy. Considering this issue, the Network for Greening the Financial System (NGFS) has launched a series of structured initiatives to address this need for climate-related data. During the period 2020-2022, the NGFS Workstream on Bridging the Data Gaps (BDG) worked on assessing climate-related data needs and availability and studied data gaps and key challenges to closing such gaps. Building on this experience, the NGFS Expert Network on Data (EN Data) was launched at the beginning of 2023. It aims at exchanging information and experiences to build collective capacity and facilitate dissemination of ideas and good practices regarding climate data. The NGFS initiatives on climate-related data are also in line with the third phase of the Data Gap Initiative (DGI-3, 2022[1]) led by the International Monetary Fund, which also recommended: 1) to address climate change data gaps to monitor progress towards emission targets and the transition towards a low carbon economy; 2) to support green financing as a key instrument in the transition to a more resilient economy; 3) to assess the transition effect of climate policy on firms' profitability and stability.

The EN Data was founded on the basis of the diagnostic of the NGFS Workstream BDG, which identified a series of climate-related data gaps related to the availability, reliability, and comparability of climate-related data. It highlighted that some of the largest gaps are related to emissions and geospatial data types, which in turn limit the usability of transition sensitivity metrics[2]. As a consequence of this diagnostic, the Subgroup on Improving Emissions was launched by the EN Data in April 2023, following the recommendations to "increase the availability of granular data on emissions" outlined in the Final Report on Bridging Data Gaps[3]. The main purpose of the group was to exchange experiences and knowledge on initiatives taken to improve greenhouse gas (GHG) emissions data, particularly in terms of granularity. The outcome of this work is this information note, whose structure is organised as such:

- Section 2 outlines the use cases of GHG emission data by supervisors, regulators and central banks. It describes the different countries' experience about the availability, sources, metrics, classifications and/or categorizations, methodologies of granular GHG emission data.
- Section 3 identifies the limits of the information currently being used by supervisors, regulators and central banks, drawing on insights and challenges from the different member´s experiences.
- Section 4 consolidates the ideas and good practices being developed to bring some solutions to the challenges in building emission data.

The document highlights several issues that should be addressed to improve GHG emission data, and therefore, reduce the climate data gap for different use-cases in the financial system.

Central banks, supervisors and regulators need to accelerate data collection of financed emissions by financial institutions, while regulatory authorities could provide information through their websites to disseminate information as a way to increase supervised entities' awareness of the importance of sustainability indicators. Moreover, companies need to measure and report GHG emissions in a standardised manner, to allow for easier monitoring, referencing and comparison. This is an important issue, as there is a wide heterogeneity of approaches used by different providers of data on GHG emissions, especially those regarding Scope 3 emissions. Collaboration between central banks/supervisors and external data providers and government agencies is crucial to improving the quality of emission data.

GHG emission data provided by the financial sector has many uses, including, among others, the following ones:

1. Monitoring and collecting data from supervised companies as a way of measuring the environmental impacts of investments.

1 https://www.imf.org/en/News/Articles/2022/11/28/pr22410-g20-leaders-welcome-ndgi-to-address-climate-change-inclusion-financial-innovation.

2 Other types of metrics include alignment, physical vulnerability, footprints, mobilization, others/combined metrics.

3 NGFS (July 2022), Final report on bridging data gaps, https://www.ngfs.net/sites/default/files/medias/documents/final_report_on_bridging_data_gaps.pdf.

2. Providing information (concerning for example carbon-sensitive investment and carbon footprint indicators) to build indicators for policy development by financial regulators.
3. Providing a better understanding of climate-related risks for related sectors in support of clients' transition toward low carbon/net zero operations. Financial institutions help their clients in the development of data-collection templates with the aim to understand their emissions.
4. Enhancing the understanding of risk exposure in climate-risk scenario analysis/stress testing where financial institutions and supervisors conduct trial exercises of climate-risk scenario analysis that depend on available data granularity.
5. Informing clients and investees about GHG emissions in the value chain.

Granular data is not directly available and there are several issues related to the measurement, estimation, and collection of GHG emission data. There are trade-offs between collecting and estimating/modelling granular data on emissions. Collecting GHG emission data bears costs in terms of reporting design, search of information, monitoring and verification, and consistency of the reported emissions. On the other hand, modelling granular GHG emissions is often based on unknown and limited accessible data, especially when measuring Scope 3 emissions. The consistency of emission data across different providers also significantly decreases when estimations are required to fill data gaps raising comparability problems from the use of different methodologies and a lack of transparency coming from third-party providers. As modelling methods often require specific technical expertise, there is a need for stakeholders to build their capacity to understand the advantages and disadvantages of the methods of different providers.

Supervisors may want to coordinate with governmental agencies on the collection and dissemination of emission data, in order to facilitate the transition toward a net-zero economy. The collection of GHG data is currently being performed in a decentralized way, where users rely on ESG reports from companies for some data, on public providers at the facility/industry level for other data, and finally have to integrate all these data with the environmental accounts from National Statistics Institutes (NSI). This collection process bears operational costs and risks, and is difficult to track and monitor.

Public availability of comprehensive, consistent, and comparable emission data and financial indicators is needed to facilitate both disclosure and harmonization. However, the lack of mandatory international reporting standards and the differing disclosure policies across firms and countries bring challenges when building aggregates at the sector, country, or regional levels that could accurately represent the impact of activities on the environment. The existence of various reporting standards and methodologies available to calculate and measure carbon emissions poses challenges to market participants, who need to understand how the metrics are calculated. Regulatory frameworks should guarantee comparability of data, including measurement units and metrics across frameworks.

Overcoming the challenges to improve emission data requires advancements at different levels. It is crucial to engage the relevant actors in the design, collection, and diffusion of data on GHG emission. Collaborative approaches not only need to build up definitions, methodological and disclosure standards but also to improve transparency, comparability and monitoring of metrics and indicators.

2. Approaches to emission data

2.1 Provision of emission data

The provision of emissions data takes place at different levels of the financial system, from individual financial assets to financial portfolios, including across asset classes, to financial institutions and even wider financial centers. Most developments in data, metrics and methodologies are based on tracking emissions at the corporate level, which relate directly to the underlying real-economy activities and their climate impacts. Further, there has been a focus on corporate-related financial assets, especially listed corporate equity. Further developments are however needed in other asset classes, such as sovereign bonds, to avoid "blind spots" in portfolios.

2.1.1 Metrics and methodologies

Broadly speaking, four types of emissions-based metrics are generally considered, namely (1) historic or current emissions, (2) emissions targets, (3) alignment metrics, and (4) offset metrics[4].

Metrics to assess the historic or current greenhouse gas emissions performance of financial assets can be in absolute or intensity terms. For corporate-related assets, there are three main methodologies to measure GHG performance, namely Absolute Emissions Contraction (AEC), Sectoral Decarbonization Approach (SDA), and Economic Intensity Contraction (EIC). Different GHG performance metrics have different advantages and disadvantages, as summarised in Table 1. For example, the AEC approach relates more clearly to the remaining carbon budget and climate impacts of cumulative carbon emissions, while the SDA normalises for size and growth. For sovereign bonds, the AEC and EIC approaches can in principle be used as well. For infrastructure and real estate, the SDA is most suitable.

4 OECD (2023) Assessing net zero metrics for financial institutions: Supporting the monitoring of financial institutions' commitments.

Table 1 **Overview of GHG performance metrics for corporates**

	Advantages	Disadvantages	Data needs	Data availability
AEC: Absolute Emissions Contraction (Rate of change in GHG emissions)	• Emissions reductions are predictable. • Less data intensive. • More clearly relates to the remaining carbon budget and climate impacts of cumulative carbon emissions. • Can be applied to all asset classes. • Incentivizes efficiency improvements and substitution of higher-emitting products or technologies with lower emitting alternatives.	• Increased GHG performance can de due to decreased output rather than improved performance. • Could disincentivise business growth, even for activities with a better climate performance. This particularly affects start-ups and young companies.	Low	High
SDA: Sectoral Decarbonization Approach (GHG emissions divided by physical output)	• Reflects GHG performance and efficiency improvements regardless of entity size, business growth and price changes. • Applicable to homogeneous sectors, companies, and asset classes. • Incentivizes both efficiency improvements and growth into or expansion of lower-emitting products or technologies.	• Data intensive. • Difficult to apply to companies with diverse activities and in heterogeneous sector. • Absolute emissions could still increase while intensity-based climate performance improves.	High	Low
EIC: Economic Intensity Contraction (GHG emissions divided by economic output)	• Reflects GHG performance and efficiency improvements regardless of entity size. • Applicable to non-homogeneous sectors and companies. • Economic/Financial denominator is easy to understand for an investor audience. • Relates more closely the relationship between emissions and the economy. • Incentivizes both efficiency improvements and growth into or expansion of lower-emitting products or technologies.	• Volatile with macroeconomic conditions; may make it difficult to tack true changes in GHG performance. • Absolute emissions could still increase while intensity-based climate performance improves. • Difficult to assess the Paris Agreement consistency of projections for economic denominators (e.g. GDP).	Medium	Medium

Note: Data needs refer to both needs on corporate GHG emissions data and other corporate output data such as production volumes, value added or financial performance. Data availability is generally higher for listed than unlisted companies, however, the relative availability remains the same.

Source: Noels, J. and Jachnik, R. (2022), "Assessing the climate consistency of finance: Taking stock of methodologies and their links to climate mitigation policy objectives", OECD Environment Working Papers, Nº 200, OECD Publishing, Paris, https://doi.org/10.1787/d12005e7-en.

The design and use of metrics to measure financed emissions can also be challenging for stakeholders, and methodologies are evolving. The emissions of individual financial assets relate directly to the emissions from real-economy activities. These can be aggregated at the level of a financial portfolio; however, it comes with the challenge of accounting for double counting of Scope 3 value chain emissions. Further, at the level of financial institutions, emissions from investees and borrowers are aggregated under financed emissions metrics, which represent almost all emissions of a financial institution (i.e. financial institutions' Scope 1 and 2 emissions are typically negligible). The methodology to calculate financed emissions is further detailed by the GHG Protocol and the Partnership for Carbon Accounting Financials (PCAF). Further, new methodologies are being developed to analyze and report changes in financed emissions. Emissions reductions in a financial portfolio can be driven by real-world decarbonization by underlying firms, portfolio reallocation, or also changes in data coverage and nominal effects such as evolution of asset value. Emissions attribution analysis aims to distinguish these drivers of changes in financed emissions.

Emissions targets and alignment metrics add a forward-looking perspective to GHG performance metrics. Both rely crucially on emissions scenarios to inform their consistency with a given temperature goal, such as the ones of the Paris Agreement. Scenarios by different providers (e.g. IEA, ISF-OECM, JRC, NGFS) can have different temperature outcomes, different sectoral and geographical granularity, and rely on different mitigation strategies, assumptions and feasibility challenges[5]. Alignment metrics

5 See further details in Noels, J., et al. (2023), "Climate change mitigation scenarios for financial sector target setting and alignment assessment: A stocktake and analysis of their Paris-consistency, practicality and assumptions", OECD Environment Working Papers, Nº 223, OECD Publishing, Paris, https://doi.org/10.1787/bcd25b82-en.

combine information from the current emissions and emissions target metrics and compare the resulting pathway against a climate change mitigation scenario, following a climate-alignment assessment methodology. The distance of the target to the climate scenario defines the implied temperature degree and level of (mis)alignment. Providers of alignment ratings all follow their own methodologies.

Different perspectives on climate alignment translates into methodology providers making different choices across methodological steps of a climate alignment assessment. This leads to different ratings that are difficult to reconcile (see Figure 1), similar to what was found for ESG ratings[6]. For example, absolute versus intensity-based alignment metrics may find different alignment results for a given asset. The temporal coverage of the methodology is also a strong driver of alignment results and variation. Notably, alignment tends to be assessed more frequently as being achieved using methodologies that only look at a unique point in time in 2050. However, such results may allow for delayed action and fail to capture the cumulative emissions that drive temperature outcomes.

Figure 1 **Results of long-term alignment assessments for selected listed corporate equity**

Company	Provider 1	Provider 2	Provider 3	Provider 5	Provider 4
Company A	Not aligned	Not aligned	Not available	2 Degrees	Not aligned
Company B	Not aligned	Not aligned	1.5 Degrees	Not aligned	Not aligned
Company C	Not aligned	Not aligned	Not aligned	Not aligned	2 Degrees
Company D	1.5 Degrees	2 Degrees	Not aligned	Not aligned	Not aligned
Company E	1.5 Degrees	2 Degrees	Not aligned	Not aligned	Not aligned
Company G	1.5 Degrees	2 Degrees	Not aligned	Not aligned	Not aligned
Company F	Not aligned	1.5 Degrees	Not aligned	Not aligned	Not aligned
Company H	Not aligned	Not available	Not available	Not aligned	Not aligned
Company I	Not aligned	1.5 Degrees	Not available	Not aligned	Not available
Company J	Not aligned	2 Degrees	Not available	2 Degrees	Not available
Company K	Not aligned	Not aligned	Not available	2 Degrees	Not aligned
Company L	Not aligned	2 Degrees	Not aligned	Not aligned	Not aligned
Company M	Not aligned	Not available	Not available	Not available	Not aligned
Company N	Not aligned	Not available	Not aligned	Not aligned	Not aligned
Company O	Not aligned	Not available	Not aligned	Not aligned	Not aligned
Company P	Not aligned	2 Degrees	Not available	Not available	2 Degrees
Company Q	2 Degrees	2 Degrees	Not available	Not aligned	Not aligned
Company R	Not aligned	Not aligned	Not available	Not aligned	Not aligned
Company S	Not available	Not aligned	Not available	Not available	Not aligned
Company T	Not aligned	2 Degrees	Not available	Not aligned	Not aligned
Company U	Not aligned	Not aligned	Not available	Not aligned	Not available
Company V	2 Degrees	Not aligned	2 Degrees	Not available	Not aligned
Company W	Not aligned	1.5 Degrees	Not aligned	Not available	2 Degrees
Company X	2 Degrees	Not aligned	Not aligned	Not available	Not aligned

Source: Noels, J. and Jachnik, R. (2022), "Assessing the climate consistency of finance: Taking stock of methodologies and their links to climate mitigation policy objectives", OECD Environment Working Papers, N°. 200, OECD Publishing, Paris, https://doi.org/10.1787/d12005e7-en.

6 See Boffo, R., and R. Patalano (2020), "ESG Investing: Practices, Progress and Challenges", OECD Paris, https://www.oecd.org/finance/ESG-Investing-Practices-Progress-Challenges.pdf.

Aggregate-level assessments of financial portfolio alignment add another layer of complexity and can hide individual activities that may be misaligned. There is no widely-agreed approach to aggregate and allocate alignment results for a given financial asset class, and even less so across different asset classes as these need to follow different alignment assessment methodologies. While portfolio-level metrics and aggregation approaches need to be developed further, such approaches raise environmental integrity concerns, notably by obscuring asset-level performance and methodological differences across asset classes, and thus require careful consideration and methodological transparency.

Climate science and literature treat offsets with caution, notably in terms of the risk they pose of delaying or replacing actual GHG reductions, as well as in relation to their environmental integrity and additionality. In the context of net-zero emissions, the urgency of absolute emission reductions remains. These reductions need to be front-loaded and to cover all emission sources. This means that carbon dioxide removals should be used cautiously, and the use of carbon offsets should be regulated effectively. There are many questions around the integrity and additionality of offsets. In this context, the SBTi standard states that offsets cannot be counted as reductions towards meeting a near-term target. Companies must account for reductions resulting from direct action within their operations or value chains. While there is little guidance on offset reporting, more transparency is needed.

As different metrics come with advantages and disadvantages, a range of complementary metrics and data can provide a more comprehensive view of transition risks and decarbonization contributions in the financial sector. Emissions-based metrics are outcome metrics, but additional metrics could relate more directly to net-zero strategies, divestment, and changes in portfolio composition. Complementary indicators of progress, such as measures of the presence and characteristics of concrete plans (including to upscale climate solutions and transition strategies), can further help put GHG-based alignment assessment results in perspective and provide a more holistic view. Additionally, data on forward-looking capacity, production and capital expenditure plans of companies can add an element of credibility, especially when the main alignment metrics consider corporate targets in the far future.

2.1.2 Data types and sources

The provision of data on the different metrics described above, across asset classes and levels of aggregation, comes from a large variety of sources: current and historical emissions can be self-reported by an entity or estimated or modelled by a third-party data provider. Commercial data providers such as Arabesque, Bloomberg, FTSE, LSEG (formerly Refinitiv), MSCI, and S&P collect emissions data reported by companies and fill the gaps with estimations. The estimation methodologies are not always transparent and can result in large differences.

Reported historical emissions and emissions target data are disclosed through mandatory or voluntary initiatives. A lot of corporate disclosure has come through voluntary initiatives/frameworks (including CDP, SBTi, TCFD and NZAOA Target Setting Protocol) and open-source data initiatives (including ECIU Net Zero Tracker, Climate Watch Net-Zero Tracker, and the NZDPU). For sovereign bonds, for example, data may be used from UNFCCC National Inventory Submissions, the Global Carbon Project, and the OECD among others. For real estate, sources are more limited, but for example the Carbon Risk Real Estate Monitor (CRREM) can be considered. Further, increasing mandatory disclosure initiatives – such as EUTL, EFRAG, and SEC – are likely to increase the availability of quality data over the coming years.

Alignment metrics build on such disclosures and add another layer of data transformations. Historical data needed for corporate alignment ratings, depending on the methodology, include absolute emissions, production outputs, value added or revenue. Forward-looking data collected by climate alignment rating providers typically refer to emissions reduction targets, more rarely also to planned capital expenditure. Providers of alignment ratings include Arabesque (S-Ray Temperature Score), Carbon4 Finance (Carbon Impact Analytics), CDP-WWF (Temperature Ratings), MSCI (Implied Temperature Ratings), PACTA, right. based on science (right°), S&P Sustainable1 (formerly Trucost), Transition Pathway Initiative (TPI).

Some rating providers, such as CDP and TPI, rely solely on self-reported disclosure by companies in their climate alignment assessments. This may also provide an incentive to companies to improve disclosure. Many other providers also rely on modelled data, at least to some degree.

When rating providers aim to rely primarily on reported emissions, disclosure is often too limited to achieve sufficient coverage for a portfolio analysis. Moreover, reported emissions may be unverified. Modelled data helps improve coverage especially for entities in emerging and developing economies and for unlisted companies. On the other hand, modelled data increase uncertainty as they are based on assumptions and, often, on sectoral averages.

Finally, the quality of data on offsets is very limited. Companies with climate pledges are not yet transparent and clear about their use of offsets in metrics, targets, and plans[7].

2.2 Objectives of central banks and supervisors related to improving emission data

Financial institutions need to accelerate their collection of data on financed emissions, as the relevance of climate change mitigation will increase over the years together with their macroeconomic implications. Their activities are likely going to be accordingly reoriented. This transformation will require banks, insurance companies and other financial institutions to process new information on a highly granular scale about the contribution of the financed economic sectors to the ongoing process of climate change. Reliably measuring carbon emissions will be a key requirement and emission reductions will probably have an impact on the pricing of financial assets in carbon-intensive sectors.

As explained in Section 2.1.2., emission data of borrowers or investee companies can be available to supervised financial institutions in two ways: 1) by collecting them directly from borrowers or investees (reported emissions); or 2) by applying an attribution factor to physical-activity or economic-activity data provided by borrowers or investees (estimated/modelled emissions). As a general rule, reported emissions are preferred as they are considered more accurate than estimates. When this is not available, physical-activity based estimated emissions tend to be more accurate and are therefore preferable to economic-activity estimates. The methodology proposed by the PCAF provides principles for a harmonised treatment of emission data in order to achieve a certain degree of comparability for data coming from different financial institutions. The guide also proposes scores for evaluating data quality as well as necessary requirements for getting reliable emission data under one of the two options available[8].

Whenever the approaches used for measuring financed emissions differ, these inconsistencies can translate into diverging GHG performance assessments, as shown by a study carried out on GHG emissions data produced by three commercial data providers[9]. The study investigates the reasons behind these inconsistencies and examines the possible consequences for assessing firms' environmental performance. Inconsistencies are widespread in every emissions category, through time and across sectors. The lowest – yet important – inconsistencies are observed in direct emissions data (Scope 1) and they progressively increase in indirect emissions (Scope 2 and Scope 3). A positive finding is that these inconsistencies stem from the existence of few common sources, mostly related to the kind of requirements for emission disclosures, and hence data comparability may improve in the future.

A major progress is taking place with the transition from good practices to disclosure templates mandated by regulation. This process has already started in EU. The European Commission Delegated Regulation 2022/1288 provides technical standards specifying the content and presentation of information in relation to the principle of "do no significant harm" to European environmental objectives. The regulation specifies the content, methodologies, and presentation of information in relation to sustainability indicators and adverse sustainability impacts. To this end, Table 2 presents formulas for the calculation by market participants of the GHG emissions of their portfolio by computing a linear weighed combination of the investee companies' GHG emissions, weighted by the share of the value of the companies owned by a market participant. A similar approach is followed for the carbon footprint and other indicators derived from emissions, as shown in the following table.

7 See also https://newclimate.org/sites/default/files/2023-04/NewClimate_CorporateClimateResponsibilityMonitor2023_Feb23.pdf.

8 https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf.

9 See for example: https://joint-research-centre.ec.europa.eu/publications/discrepancies-corporate-ghg-emissions-data-and-their-impact-firm-performance-assessment_en.

Table 2 **Emission indicators to be provided by market participants, Commission delegated regulation (EU) 2022/1288, ANNEX 1**

Indicator	Formula to apply for the computation
GHG emissions	$\sum_{n}^{i}[\frac{current\ value\ of\ investment_i}{investee\ company's\ enterprise\ value_i} x\ investee\ company's\ scope(j) GHG\ emissions_i]$
Carbon footprint	$\sum_{n}^{i}[\frac{current\ value\ of\ investment_i}{investee\ company's\ enterprise\ value_i} x\ investee\ company's\ scope\ 1,2\ and\ 3\ GHG\ emissions_i]$
GHG intensity of investee companies	$\sum_{n}^{i}[\frac{current\ value\ of\ investment_i}{current\ value\ of\ all\ investments} x\ \frac{investee\ company's\ scope(j) GHG\ emissions_i}{investee\ company's\ revenue_i}]$
GHG intensity of sovereigns	$\sum_{n}^{i}[\frac{current\ value\ of\ investment_i}{current\ value\ of\ all\ investments} x\ \frac{The\ country's\ Scope\ 1,2\ and\ 3\ GHG\ emissions_i}{Gross\ Domestic\ Product_i}]$

The approach followed by the EU provides a standardized tool to compare the emissions and the carbon footprint of the investment portfolios of different financial institutions. This uniformity of evaluation criteria will be greatly beneficial to supervisory authorities.

The recommendations of the Task Force on Climate-related Financial Disclosure (TCFD)[10], a global initiative to help organisations in reporting financial implications of climate change, may also act as examples of good practice for data collection of financed emissions. In the 2019 'A call for action' report[11], the NGFS emphasised the importance of a robust and internationally consistent climate and environmental disclosure framework, with NGFS members collectively pledging their support for the TCFD recommendations. The TCFD recommendation consists of four core elements: Governance, Strategy, Risk Management and Metrics and Targets. Under Metrics and Targets, the TCFD recommends organisations to disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material[12], including GHG emissions associated with the lending and investment activities of the organisation. The Task Force believes that GHG emissions disclosure is important to understand an organisation's exposure to risks and opportunities related to climate. As an example Bursa Malaysia – a regulatory body that oversees the Malaysian capital market – enhanced its Sustainability Reporting Framework with climate change-related disclosures so as to be aligned with TCFD recommendations[13], with the aim to elevate the sustainability practices and disclosures of listed issuers. Main Market listed issuers will be required to provide TCFD-aligned disclosures by 2025, including indicators related to GHG emissions, while ACE Market listed corporations will be required to provide a basic plan to transition towards a low carbon economy by 2025.

The implementation of taxonomies across the world supports the development of definitions, metrics and uses. Depending on their jurisdiction, financial institutions may also refer to common taxonomies/guidelines available in their region for guidance on assessing financed emissions. Taxonomies call for better quality GHG emission data to classify economic activities/bonds.

Supervised entities in their role of financial market participants should be able to rely on third-party data providers to help them comply with their disclosure obligations on sustainability issues. This is justified by the detailed and complex figures to be provided, often not available within their internal information systems and not always readily obtainable through public sources.

10 https://www.fsb-tcfd.org/recommendations.

11 https://www.ngfs.net/en/first-comprehensive-report-call-action.

12 https://assets.bbhub.io/company/sites/60/2021/07/2021-Metrics_Targets_Guidance-1.pdf.

13 https://www.bursamalaysia.com/sites/5bb54be15f36ca0af339077a/content_entry5c11a9db758f8d31544574c6/63312a2439fba20d86ba8e16/files/26Sept_2022_Bursa_Malaysia_Enhances_Sustainability_Reporting_Framework_With_New_Climate_Change_Reporting.pdf?1664169009.

Publicly available platforms where enterprises report their sustainability data (including emissions) are starting to become available for analysts and researchers, even if they are still largely incomplete and limited to listed companies. In spite of these limitations, which will decrease in the future, they are useful instruments for supervisors whenever they need to cross-verify sustainability data of supervised entities. It is important for analysts and supervisors to be able to rapidly assess the quality of the information provided and this evaluation would greatly benefit from a clear description of the sources used. For example, concerning investment, details should be provided on methods employed to obtain figures either directly from investee companies, or by carrying out additional research, or cooperating with third-party data providers or with external experts. Whenever assumptions and hypotheses are used, the template should include notes where they are described so that their reasonability may be easily checked. A possible solution to help the supervised entities is to give them a hierarchy of sources on investment emissions and other sustainability indicators. For example, the primary source could be the investee company's balance sheet and sustainability report. The second-best option could be publicly available data figures available on data repositories, with third-party providers as third best solution. In this regard, EU Regulation 2022/1288 provides a solution for information disclosure on how and to what extent the financed activities qualify as environmentally sustainable.

Data directories play the critical role of bridging data gaps, by providing comprehensive information, improving data availability, and creating awareness on data availability issues[14]. In producing national data directories, central banks and supervisors need to collaborate with external data providers and government agencies as they are the main sources of climate related data. For example, in Malaysia, the JC3, co-chaired by Bank Negara Malaysia (BNM) and Securities Commission (SC) Malaysia, issued and maintained a Climate Data Catalogue ("data catalogue") to serve as a source of reference on climate and environmental data for the financial sector and to enable informed decision-making by providing access to climate and environmental data. In producing the data catalogue, the JC3 committee engaged with the industry, private data providers and government agencies, to understand data availability and data gaps, including reasons of the gaps. In Mauritius, a Task Force on Regulation and Supervision[15] (from here on "The Task Force") was launched under its Climate Change Centre. The Task Force comprises representatives of the banking and insurance sectors and of the non-bank financial sector regulator, the Financial Services Commission (FSC), and seeks to assist in the determination of climate-related financial risks for the financial system, the development of supervisory expectations including disclosure requirements and bridging data gaps for these risks. The Task Force also serves as a platform for facilitating engagement with, and raising awareness on climate-related risks among, the financial sector's stakeholders. In Spain, there is a future project of building a national directory of greenhouse gas (GHG) data, mixing different data sources, which will consist of a joint collaboration among different administrative registers and institutions; Bank of Spain will be project promoter, data provider and sustainability expert adviser, and the National Statistics Institute (NSI or INE in Spanish acronym) will be acting as project leader. The NSI also collaborates with national registers, which are data providers. The goal of the project will be to create an integrated repository to store different climate-related micro databases available in each register for statistical purposes, comparing these with the climate information provided by the companies in their ESG reports. This will facilitate the use and the interoperability of the data for the stakeholders.

2.3 Use cases of emissions-based data

Many central banks and supervisors have launched initiatives on emissions data. The following section describes a few cases, while the subsequent section draws more specific lessons from these (and other) experiences.

14 The NGFS developed a directory to help financial sector stakeholders to identify important and relevant climate-related data sources to meet their needs, facilitate access to data, and thus improve the broader dissemination of existing climate-related data. The current directory web interface can be found here.

15 https://www.bom.mu/climatechangecentre.

Case study nº 1: collection of data through a survey of the insurance sector (IVASS)

In 2022, the Italian supervisory authority for the insurance sector (IVASS) launched a survey targeting all the companies in the Italian insurance market[16]. The survey will be repeated every year. The aim was to monitor physical risks from natural catastrophes, climate-related events and seismic events as well as transition and sustainability risks in the insurance industry. Besides many other variables, supervised companies are asked to fill a detailed template reporting their financed emissions for Scope 1, 2 and 3 broken down in 28 economic macro-sectors, obtained by aggregating NACE codes. The following two tables show the templates for emission data to be provided by each insurance company, presented for an illustrative single macro-sector A01 corresponding to Agriculture, Forestry and Fishing (crop and animal production, hunting and related service activities).

Table 3 **Template for the physical emissions of investments**

NACE CODE	Type of asset	End of year values		
		Carbon Footprint: total CO_2 or CO_2-equivalent emission associated to investments (Scope 1)	Carbon Footprint: total CO_2 or CO_2-equivalent emission associated to investments (Scope 2)	Carbon Footprint: total CO_2 or CO_2-equivalent emission associated to investments (Scope 3)
		Tons	Tons	Tons
A01	Debt instruments (bonds similar instruments)			
	Equity and shares			
	Other			
	TOTAL			

Table 4 **Template for the emission intensity of investments**

NACE CODE	Type of asset	End of year values		
		Carbon Footprint: total CO_2 or CO_2-equivalent emission associated to investments (Scope 1)	Carbon Footprint: total CO_2 or CO_2-equivalent emission associated to investments (Scope 2)	Carbon Footprint: total CO_2 or CO_2-equivalent emission associated to investments (Scope 3)
		Tons/Revenue (€)	Tons/Revenue (€)	Tons/Revenue (€)
A01	Debt instruments (bonds similar instruments)			
	Equity and shares			
	Other			
	TOTAL			

16 https://www.ivass.it/normativa/nazionale/secondaria-ivass/lettere/2022/lm-27-07/Letter_to_the_market_27_07_2022_en.pdf.

The carbon footprint is to be computed as a weighted average according to the following formula provided by the EU Commission delegated regulation 2022/1288[17]:

$$\sum_{n}^{i} \frac{current\ value\ of\ investment_i}{current\ value\ of\ all\ investments} x \frac{investee\ company's\ Scope\ 1,2\ and\ 3\ GHG\ emissions_i}{investee\ company's\ revenue_i}$$

Similar templates are used for the collection of figures relative to Taxonomy-eligible investments[18] (according to the European Taxonomy) and green bonds, as well as for the value of total investments. This latter variable is used for the computation of many sustainability indicators.

The main sustainability indicators derivable from these data are the following ones:

- share of assets in economic activities associated with environmental sustainability, where the sustainable investment is proxied by the amount of taxonomy-eligible investments. For the EU regulation this is a Key Performance Indicator (KPI) for the investments of insurance and reinsurance companies[19];
- ratio between CO_2 emissions and investment value;
- investments in climate policy relevant sectors (CPRS), as proposed by a methodology established by Battiston *et al.* (2017), adopted by the European Insurance and Occupational Pensions Authority (EIOPA)[20].

These indicators could not be completely computed after the first edition of the survey because the data quality was deemed not sufficient for some of them. Data quality will improve over time as insurance companies will become increasingly confident with non-financial variables, which were only recently introduced into their information systems. This progress will go hand in hand with the increased awareness on sustainability topics within the insurance sector. This process will be accelerated by a cooperative environment in which the regulator accompanies the supervised entities by sharing good practices and making support materials available in the form of tutorials, manuals, etc.

A critical observation from this use case is that an increase of data requirements is a necessity for supervisors and supervised entities alike. On the supervisory side, the activity framework must be expanded to incorporate climate change and climate-related risks and the datasets for assessing financial stability must be accordingly expanded. On the other side, insurance companies need new data flows to support the new responsibilities of their top management boards and for the new risks to be managed within internal control systems[21].

Another lesson from this case is that introducing mandatory disclosure requirements on climate-related risks is an iterative process in which data collection methods are progressively improved. A constant dialogue between supervisors and supervised entities is a precious tool in this process. The full implementation of climate-related disclosures is a pre-condition for effective insurance supervision of climate-related risks, but it is far from being satisfactory. Supervisors are currently coping with data gaps by creating specialized data collections to integrate official sources or public data and the IVASS survey is an example of these *ad-hoc* solutions. In the medium-long term, climate-related information should be included in regular reporting requirements of insurance companies[22]. The Solvency 2 prudential regulation for the EU insurance sector is based on a structured data collection that will be constantly expanded to take into account the growing climate-related risks.

17 See: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R1288 (page 40).

18 In the next years the companies will report taxonomy-aligned investments instead of taxonomy-eligible investment, which will be made possible by the extension of the Taxonomy scope.

19 See Annex IX of Commission Delegated Regulation 2021/2178 (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R2178).

20 The paper is available at web address: https://web.stanford.edu/group/emf-research/docs/sm/2019/wk2/battiston2017.pdf.

21 See: https://www.iaisweb.org/uploads/2022/01/210525-Application-Paper-on-the-Supervision-of-Climate-related-Risks-in-the-Insurance-Sector.pdf for an exhaustive overview of these topics for the insurance sector.

22 For this aspect in insurance supervision see: https://www.iaisweb.org/uploads/2022/01/210525-Application-Paper-on-the-Supervision-of-Climate-related-Risks-in-the-Insurance-Sector.pdf.

Case study nº 2: classification of issuers by the Bundesbank on the basis of emission intensity

Research in the Bundesbank uses greenhouse gas emission intensities (emissions / revenue) to classify issuers into two groups: those with a rather low emission intensity and those with a rather high emission intensity. Then, an evaluation is made on whether bonds issued by firms with a rather low emission intensity are priced differently compared to those from higher emission-intense firms. Data is provided by Institutional Shareholder Services (ISS) and Carbon 4 Finance (C4F). The analysis is mostly based on scope 1 and scope 2 emission, but also includes composite indicators from the two aforementioned data vendors. In contrast to pure emission data, these composite indicators often contain, among other components, a forward-looking component such as estimations of how the firm's future emission path falls within a certain scenario, for instance reducing emission by 2030 in compliance with the Paris agreement. Furthermore, scope 3 emissions are considered. However, due to the higher uncertainty compared to scope 1 and 2 emissions, the baseline indicator does not take scope 3 emissions into account. A rather low correlation of scope 3 emissions between ISS and C4F highlights this uncertainty. For firms in the sample, the correlation between scope 1 and 2 emissions is around 0.9, for scope 3 emissions it is 0.5. This can be explained by the fact that both data providers use models to estimate scope 3 emissions in the absence of reported data. Since emission intensity (emissions / revenue) is used throughout the analysis, results also depend on firms' revenue. This makes results to some extent vulnerable to changing economic results of the underlying firms. This effect is pronounced for firms engaged in the oil and gas industry. Low energy prices in 2020 decreased the revenue of such firms, thereby increasing the emission intensity since emission reduced only slightly.

3. Challenges and lessons learnt

3.1 Challenges in improving emission data

3.1.1 Methodological discrepancies

One of the main challenges when dealing with emission data is not just the availability of this information but also the quality and comparability it presents. Consequently, to improve emissions data the following aspects must be taken into consideration.

- **Methodological discrepancies.** The different methodologies for calculating GHG data and related metrics and, in some cases, the opaque publication by data providers and companies of their methodologies to calculate the data, result in an additional difficulty to clearly compare and analyse information. Therefore, a transparent methodological framework needs to be established as a reference.
- **Changes in data through time (re-expression of data).** Companies, when reporting information, tend to change previous years' data due to methodological updates in the way they calculate them. Due to the novelty and the few years of experience with GHG data, such changes and re-expressions in data are common. However, this issue must be addressed in order to have robustness and comparability over time. Probably in the coming years, as companies get more used to reporting this information and common metrics/methodologies are officially established in the different national and international reporting frameworks, changes in data could become residual and punctual, as it usually happens with financial information.
- **While current frameworks agree on the broad categories of emissions metrics needed, they propose a wide variety of metrics and information to measure climate performance[23].** Existing frameworks (IFRS, ESRS EFRAG, TCFD, GFANZ – among others) offer a substantial number of GHG-based metrics to assess climate action progress. On the one hand this is positive, as different approaches allow for a certain degree of flexibility to report and prepare this information. It could also allow for methodological innovation and looking at information through complementary angles. On the other hand, these multiple alternatives also increase difficulties in comparability of information and may confuse users of metrics based on different methodologies. For climate performance metrics beyond historical emissions, frameworks propose an even wider range of information points and metrics, with little overlap and limited consistency in the language used to refer to the same information points and metrics.
- At the same time, **the set of metrics proposed is not necessarily comprehensive**[24], with limited guidance on forward-looking elements, and only broad information proposed on carbon offsets for example, which results in gaps in the evidence needed to assess the credibility and integrity of financial institutions' progress against their net-zero commitments.
- Notwithstanding gaps in metrics, the number and range of proposed metrics highlight the relevance of relying on different types of complementary metrics, while **limiting the disclosure burden**, especially for smaller financial institutions. However, the lack of methodologically mature metrics, and consensus thereon, challenges metric prioritisation.

All of these challenges generate difficulties in both cross-checking and comparing data among different data-providers. Consequently, data gaps need to be filled, methodologies need to converge and GHG metrics and other climate performance metrics should be homogenized in order to increase the availability, reliability and comparability of data.

3.1.2 Different types of granularities and data compatibility at different levels

Another considerable challenge one faces when dealing with emissions data is the different types of granularities of the information presented, which makes comparison and aggregation of data difficult. Emissions data is available in the following different formats depending on the data sources analysed.

23 OECD (2023) Assessing net zero metrics for financial institutions: Supporting the monitoring of financial institutions' commitments. For a summary of the proposed information points and metrics under some of these existing frameworks, please refer to Table 2.3 of the OECD document.

24 Idem.

- **Data at facility level.** For some data sources information is available at facility level and this results in additional difficulties for company-by-company analysis and comparison (for example, in European GHG registers such as EU Emission Trading System or European Pollutant and Release Transfer, information is displayed at facility level). This problem is solved by aggregating data from these facilities using the company identifier of the owner, to correctly derive the amounts corresponding to that firm. However in some occasions the company identifier is a confidential piece of information, making it impossible to correctly associate each specific facility with the parent company. Finally, although very useful, this information has the potential problem of not representing the whole amount of GHG emissions of the company, as there could be other facilities or sources of GHG not included in the data sources. Even if facility level is theoretically the most accurate approach for regional aggregation (e.g. an industrial legal unit may have plants in different regions) or sectoral aggregation (in some cases, sectors vary across local units within a same legal unit), incomplete data coverage may lead those aggregations to be inaccurate.
- **Data at individual non-financial company level.** Another type of data available is GHG at the level of individual company. That is a particularly relevant level of granularity to construct any kind of analysis from it, as one can create group data, sector data, geographically aggregated data (provided the distribution of local units is assumed to be similar) using individual data as the basis of construction. Unfortunately, this type of granularity is not commonly available.
- **Data at group level (consolidated).** Due to regulatory requirements, most of the current GHG data being reported is at a consolidated level. This brings some issues in terms of the companies covered by the group, the perimeter of analysis, but above all the capacity to distinguish local/regional data. Usually big groups operate worldwide and GHG data reported in their sustainability reports correspond to the whole group, which results in a big obstacle for GHG regional analysis[25]. However, in recent years some large groups have applied best practices when reporting GHG data and present regional breakdowns, even if it is not a common practice.
- **Data at sectoral level.** Sector-level information is of great interest for comparisons and, furthermost, for the estimation and imputation of data when other information is not available. However, difficulties arise when trying to match and deal with the different sector classifications available and used by data providers (i.e. SICS classification[26] vs. NACE classification). In certain countries, GHG emission data is only available based on Intergovernmental Panel on Climate Change (IPCC) categories, but not categorised based on International Standard Industrial Classification of All Economic Activities (ISIC).
- **Data at the financial portfolio and financial institution level.** Increasingly, emissions data at the level of financial portfolios and financial institutions are disclosed. Such data further aggregate micro-data from non-financial firms, projects, or real-economy assets. Climate performance data of financial organisations can inform central banks on progress being made in their jurisdictions. However, there are remaining questions around methodology and data quality.
- **Data at regional/national level.** One could finally use GHG data at regional/national level. It enables stakeholders to have a whole picture of the total amount of GHG of a specific economy and to compare and contextualize other types of data available at different granularity levels in terms of coverage over the total economy. This data is also a useful benchmark to understand the possible errors with reference to the total amount of GHG created by aggregating micro data.

In summary, information might be available at group level (consolidated), at individual level from companies and private data providers, at macro level from the environmental accounts of the National Statistics Institutes and finally at the level of individual industrial complexes or facilities from some public providers (EU ETS, E-PRTR – among others). These heterogeneous sources make it difficult to compare and mix these different datasets in order to increase coverage and cross-check information.

25 For example, a Spanish telecom group can report its Scope 1 emissions for the whole group, but analysts would not be able to distinguish the amount corresponding to Spain.

26 Sustainable Industry Classification System (SICS): https://sasb.org/sics-classification-request/.

3.1.3 Data gaps for different assets, asset classes and portfolio segments

When analysing GHG data availability, one of the main issues is population coverage, especially for SMEs (Small and Medium Enterprises). Most jurisdictions exempt SMEs from presenting any type of environmental information, due to their limited resources in comparison to larger groups. This is a considerable data gap, given that SMEs normally represent most of the undertakings of a country. However, this situation is slowly changing for the following reasons.

- **Value chain requirements from bigger groups/ companies.** Bigger groups need information relative to SMEs to fulfill other regulatory requirements, and to operate with companies that are environmentally responsible and comply with ESG standards. This may increase the pressure on SMEs to focus on the preparation of this type of information.
- **Financing purposes.** SMEs will be led to produce this information by the requirements from financial institutions (banks) or investors, who will need it to comply with regulatory requirements. Moreover, this data is crucial when analysing risk profiles of SMEs in the context of financial transactions (i.e. a loan, an investment in the company). Transition and physical risk are increasingly being taken into consideration by banks/financial institutions and SMEs may need to correctly report information related to these risks in order to preserve their access to such institutions.
- **Market transparency** in general. It is key that SMEs provide clear and transparent information on their ESG risks for market participants and stakeholders to correctly evaluate them before creating any type of relationship. In Europe, future regulatory requirements will produce voluntarily SME standards for the preparation of this information in a uniform, comparable, and reliable way. This progress will support the competitive growth of SMEs and increase their resilience in the medium-long -term.

In conclusion, the lack of environmental data for SMEs is a problem to be addressed. The growing requirements from value chain, financial institutions and market transparency should lead to improvements in their environmental data reporting. However, in the meantime this data gap is dealt with by using proxies and estimates.

Further data availability challenges for (other) portfolio segments are reported below.

- Data quality, reliability, and accessibility are closely correlated with levels of economic development and geographical location, including Scope 1 and 2 GHG emissions data[27]. High-quality climate data for **emerging markets and developing economies** is therefore lacking.
- **Households GHG data.** GHG data are also difficult to obtain and estimate for households, which are responsible for an important share of GHG emissions.
- **Financial information from companies.** Imputations are generally made difficult by availability and quality issues with respect to financial data. Although such information may be available on a country-basis from national statistical offices, financial firms often have global exposures, requiring data from all countries where they are active. Using financial information about an entity, either for imputation purposes or for calculating indicators such as the Weighted Average Carbon Intensity, represents an additional challenge (i.e. variables such as turnover change over time due to both volume effects and price effects, meaning carbon intensity can decrease simply because of inflation). The use of financial variables to calculate indicators should also consider correcting for price effects, to get a clearer picture of the dynamics of the indicator.

3.1.4 Legal and regulatory issues

In terms of financial information, important advances in the last decades have made it possible to produce robust and high-quality data for economic analysis. However, the picture for environmental information is not as favorable. The existence of different points of views on environmental issues and the diverse degree of progress in environmental policies and information has led to various legal and regulatory frameworks, which make it especially difficult to have clear common information available. Although there have been significant advances in this area[28], the global regulatory framework is yet to be completed.

27 Source: Gardes-Landolfini, Charlotte, Ananthakrishnan Prasad, Fiona Stewart, Louise Gardiner, Aaron Levine, Robert Patalano, and Jolien Noels. 2023. "Activating Alignment: Applying the G20 Principles for Sustainable Finance Alignment with a Focus on Climate Change Mitigation." International Monetary Fund, World Bank, and OECD.

28 For example, in the European and ASEAN regions as highlighted in earlier examples.

Recently, the ISSB issued international standards (IFRS S1 and S2) for climate-related information supported by G20, FSC, IOSCO – among other, aiming to progress towards a common international framework for reporting this type of data. Such international standards provide a global baseline and should help achieve comparable information. However, the information points that are currently proposed are more qualitative than quantitative[29], and it is normally applied to large listed groups. For the rest of companies, only regional standards usually apply, and it is in this domain where the highest degree of interoperability and comparability must be reached. For example in the case of Europe, the Corporate Sustainability Reporting Directive (CSRD) appointed the European Financial Advisory Group (EFRAG) as technical advisor to develop ESG indicators (called the European Sustainability Reporting Standards – ESRS). During this process, one of the main considerations was to work with ISSB in achieving the highest degree of alignment to: (i) reduce reporting burden for companies that have to prepare ESG reports using both frameworks; (ii) guarantee comparability and understandability of ESRS in comparison with ISSB standards and with other regional/national standards that are aligned with this international commonly accepted framework. Finally, both EFRAG ESRS and ISSB standards have taken into consideration previous commonly accepted frameworks (such as the Global Reporting Initiative, the SASB standards or the TCFD framework) to create an easy route for companies that already have experience in the field, but also to try to concentrate and summarise in a common framework all the prior existing standards.

3.1.5 Decentralized data compilation and publication

For the moment the current outlook in terms of data availability entails a decentralized approach for users when searching for GHG data. Currently, users have to integrate different datasets in order to obtain a complete picture of GHG data[30], and estimations as well as imputations need to be conducted to deal with remaining data gaps.

Given the importance that environmental information has been gaining in the last years, GHG data could benefit from initiatives favoring its availability, quality and comparability. National data directories could be a step in that regard.

3.2 Lessons learnt: Critical success factors

3.2.1 Collaborative actions

Collaborative actions are playing a pivotal role in addressing data gaps and methodological challenges related to emission data among countries. The challenges include promoting the adoption of the TCFD recommendations and various climate disclosure frameworks, alongside addressing the lack of capacity and motivation for disclosure by implementing common definitions and methodologies. Public policies and roadmaps are published, or committees established by governments and central banks to outline collaborative action plans among national entities.

Central Banks and Supervisors can collaborate with external data providers and government agencies to improve the data quality of emission data by organising workshops and seminars, so as to increase the awareness among market participants of the differing methods of calculating emissions and the risk implied by this heterogeneity. These meetings should foster collaboration among the different actors towards a convergence of various methods. Such collaboration can lead to the establishment of data directories by different countries at global and/or national level.

Case study n° 3: Joint Committee on Climate Change in Malaysia

Malaysia is one of the successful examples of collaborative actions related to climate data. The establishment of the Joint Committee on Climate Change (JC3) in September 2019 adds a significant dimension to collaborative efforts in Malaysia. JC3 serves as a platform

29 Assessing net-zero metrics for financial institutions Supporting the monitoring of financial institutions' commitments, Table 2.3. https://www.oecd-ilibrary.org/finance-and-investment/assessing-net-zero-metrics-for-financial-institutions_dedcfe56-en.

30 For example, ESG reports from companies for some data, facility level public data sources such as EU ETS or E-PRTR, climate private providers such as ISS or C4F or Urgentem for other data. It is up to the user to integrate these sources with macro data such as the environmental accounts from National Statistics Institutes and other proxies.

for collaboration among financial industry players and regulators, specifically aimed at building climate resilience within the financial sector. This initiative complements a broader range of collaborative actions, emphasizing the importance of concerted efforts across sectors. It plays a crucial role in aligning policies and regulations with climate objectives. Key contributions of JC3 to the collaborative landscape include the following initiatives.

- **Industry Collaboration.** JC3 brings together stakeholders from the financial industry, fostering collaboration and collective action. By uniting regulators and industry players, the committee facilitates a comprehensive and coordinated approach to address climate-related challenges.
- **Climate Resilience.** The primary goal of JC3 is to enhance climate resilience within the financial sector. This involves developing strategies, guidelines, and initiatives that enable financial institutions to adapt to and mitigate the impacts of climate change. JC3 aims to identify the issues, challenges, and priorities encountered by the financial sector in navigating the transition towards a low-carbon economy.
- **Capacity Building.** JC3 likely engages in capacity-building initiatives, supporting financial industry players in enhancing their understanding of climate-related issues. The committee serves as a platform for information sharing and the dissemination of best practices in assessing and managing climate-related risks. This collaborative exchange of knowledge helps financial institutions better understand and navigate climate risks.

The JC3 Climate Data Catalogue[31], first published in December 2022 and updated on an annual basis, is a comprehensive reference for climate and environmental data designed for the financial sector. It serves as a call to action for stakeholders to collectively improve the availability and accessibility of climate data. The catalogue highlights critical data essential for pre-identified use cases, detailing information that is available, partially available, and unavailable.

Case study n° 4: National Sustainable Finance Roadmap of Armenia

In 2023, the Central Bank of Armenia unveiled the "National Sustainable Finance Roadmap of Armenia"[32], a comprehensive framework designed to guide the country toward achieving its climate and sustainable development goals. This initiative aims to enhance the financial sector's competitiveness and economic resilience while fostering sustainability alignment among key financial market participants (FMPs), including commercial banks, credit institutions, insurance companies, and asset managers. Key strategies outlined in the roadmap include:

- **Promoting Collaboration:** Encouraging close collaboration and cooperation among FMPs, relevant ministries, regional and international supervisors, and government/multilateral agencies to effectively manage physical and transition risks arising from climate change. The roadmap highlights the Central Bank's participation in Inter-Agency Sustainable Finance Working Groups, such as the Green Armenia Platform. These groups will serve as platforms for active dialogue, collaboration, coordination, and knowledge-sharing between different agencies, aligning with Armenia's international obligations.
- **Central Sustainable Finance Database:** Recognizing the absence of a shared data collection mechanism, the roadmap emphasizes the creation of a Central Sustainable Finance Database. While leveraging existing sectoral loan distribution figures and partnerships with international entities, the database will focus on collecting and utilizing relevant data exclusively related to the financial system.
- **International Partnerships:** To reinforce international cooperation for Armenia's sustainable development objectives, the roadmap encourages exploring additional partnerships and models. This involves designing new programs with existing partners, seeking memberships in organizations like the Coalition of Finance Ministers for Climate Action and Mainstreaming Climate Action in Financial Institutions Initiative, and deepening collaboration within networks such as Sustainable Banking and Finance Network, International Network of Financial Centres for Sustainability, and Network of Central Banks and Supervisors for Greening the Financial System.

31 https://www.bnm.gov.my/-/jc3-climate-data-catalog; https://www.jc3malaysia.com/about-data-catalogue.

32 https://www.cba.am/EN/pmessagesannouncements/National_Sustainable_Finance_Roadmap_06.10.2023.pdf.

Overall, the National Sustainable Finance Roadmap reflects a strategic vision for Armenia's sustainable development, emphasizing collaboration, data transparency, and international partnerships to achieve climate and sustainability goals.

3.2.2 Implementation of common definition and methodologies – standardization

Carbon footprint indicators of financial institutions play a key role in assessing the contributions of the financial sector to finance the transition to a net-zero economy and in revealing information on the banking sector's transition risks, which can hamper the transmission of monetary policy and challenge financial stability.

Case study n° 5: European Central Bank analytical indicators on carbon emissions

The ECB Governing Council set out a climate action plan through a press release in July 2021. This plan included an explicit commitment to develop by the end of 2022 new statistical indicators on climate change, covering sustainable finance (green bonds), carbon footprints of financial institutions, as well as financial institutions' exposures to climate-related physical risks[33]. These three sets of indicators were established following a thorough review of the users' needs conducted in 2020 , which indicated that while the European System of Central Banks (ESCB) policy needs for data are extremely diverse – ranging from granular data and ready to use indicators to support monetary policy preparation and implementation, to Key Risk Indicators and disclosure data for banking supervision, to broader structural analyses, model development and stress tests – these three sets of indicators had the highest priority. They were developed by the ESCB Statistics Committee Expert Group (STC EG) on Climate Change and Statistics, published in January 2023 and updated in April 2024.

The carbon footprint indicators[34] are based on ESCB granular loan and security data in combination with various public and commercial sources. The compilation of carbon footprints poses challenges regarding data availability for both debtor-level and creditor-level information, thus raising concerns about the consistency and representativeness of indicators across jurisdictions.

The indicators are broadly in line with those proposed by the TCFD, PCAF and the report on Macroprudential Challenges of Climate Change compiled by the ESRB and ECB. Similar indicators are also currently being discussed by other Eurosystem Committees. As methodological details and concrete implementation assumptions differ widely, results do too, hence stressing the need for developing common methodological and compilation standards.

3.2.3 Leverage on technology and available data sources

Assessing financial institutions' transition or physical risk ideally requires granular information on balance sheet, economic performance, emissions and physical location of counterparties who may be located anywhere in the world and may also be organised according to a complex corporate structure. Gathering granular-level data on global counterparties is typically beyond the scope of national statistical agencies, meaning one is left with commercial data providers.

Beyond the scope of this document which focuses on emission data, the indicators developed by STC EG on the physical risk of loan and security portfolios are calculated by combining ESCB granular loan and security data with granular data on company (affiliate) locations, linked to physical hazard geospatial data via address level information. While previous studies applied similar bottom-up approaches, the indicators presented in this report are based solely on publicly available climate data of higher quality. This guarantees both independence from commercial data providers and control over the compilation methodology.

Artificial intelligence is increasingly being used to deal with mitigation and adaptation tasks related to climate change. For example, machine learning (ML) has been used to prepare GHG emissions estimates for companies using uses multiple datasets, such as company location, size, and ESG data, and industry data. Currently, an interesting AI application is being developed through project Symbiosis in Hong Kong whose experience is shown in Box 1.

33 https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps48~e3fd21dd5a.en.pdf.

34 https://www.ecb.europa.eu/stats/all-key-statistics/horizontal-indicators/sustainability-indicators/data/html/ecb.climate_indicators_carbon_emissions.en.html#data_access

Box 1

Project Symbiosis: Scope 3 emissions of SMEs

The BIS Innovation Hub Hong Kong Centre is currently working on a project, Symbiosis, that aims to explore how to use Artificial Intelligence and big data technologies for supply chain disclosure and adaptation.

Background: Globally regulations are evolving, increasingly requiring the disclosure of emissions. For example, the EU's new Corporate Sustainability Reporting Directive (CSRD) requires Scope 3 disclosures by certain large corporates including banks. The European Banking Authority in Europe requires banks to disclose information on financed scope 3 emissions. The Basel Committee on Banking Supervision (BCBS) is seeking to complement the International Sustainability Standards Board's (ISSB) initiatives by developing a set of bank-specific Scope 3 disclosure requirements.

While Scope 1 and 2 emissions are increasingly well understood and disclosed, including in the financial sector, Scope 3 emissions are less well defined and harder to track. Nevertheless, the TCFD and the ISSB each refer to the tracking and disclosure of Scope 3 emissions.

The finance industry notes that "Limited data is often the main challenge in calculating financed emissions." Furthermore, the data limitation is most acute for SMEs in supply chains who contribute to Scope 3 emissions of most major multinational corporations (anchor buyers), who in turn typically are funded by financial institutions through a wide array of financial instruments, thereby creating financed emissions for these institutions.

Solution: Project Symbiosis will seek to improve scope 3 tracking by working with private sector and NGOs in creating Artificial Intelligence supported methodologies for *upstream SME emissions disclosure*. These same disclosures will be used for connecting SMEs to adaptation finance (referred to as bankable solutions). By doing so the project will aim to create symbiotic relationships between SMEs and funding sources. The intention is to catalyze market evolution towards Scope 3 disclosure and adaptation finance linked to such disclosures.

Another interesting application that leverages on Generative AI for enabling climate risk analysis is shown in Box 2 below.

Box 2

Project Gaia – Enabling climate risk analysis using Generative AI[1]

Project Gaia, an initiative of the BIS Innovation Hub Eurosystem Centre and the Bank of Spain, the Deutsche Bundesbank and the European Central Bank, leveraged AI to enable the comprehensive analysis of climate-related risks in the financial system.

Background: Central banks, supervisory authorities and financial institutions need higher quality and more accessible data to model the financial risks posed by climate change. As the global landscape for climate-related reporting standards and practices is still fragmented, accessing relevant climate-related indicators takes significant effort. In financial institutions' corporate reports, climate-related data are buried among other financial and non-financial information and, in many cases, information pertaining to one company is split across multiple reports, and relevant information is contained in texts, tables, footnotes and figures. These challenges constrain the usability of climate-related information.

Solution: Gaia phase I demonstrated the power of creating AI-enabled intelligent tools to automate existing workflows. By automating information extraction, Gaia opens the possibility of analyzing climate-related indicators at a scale that was not previously feasible. Concretely helping climate risks analysts search within corporate climate-related disclosures and extract data quickly and efficiently on 20 indicators such as total emissions, green bond issuance and voluntary net-zero commitments.

Gaia delivered a first proof of concept (PoC) demonstrating that with the help of Large Language Models (LLMs), it is possible to automate the task of identifying such indicators across a large set of reports, significantly reducing manual effort in climate assessments.

1 https://www.bis.org/publ/othp84.pdf

Climate-related data continues to be limited or non-existent in many parts of Global South. Hence, one approach for central banks and financial institutions is to have an idea of emissions from specific sectors to calculate relevant proxy emissions based on data available for other countries. Sectoral data from GHG inventories and Input-Output Matrixes can be used to create sectoral GHG emission proxies that can be used by financial agents. A description of data that can be obtained from a sample of global sources is provided in Table 5 below.

Table 5 **Global sources of GHG emissions proxies**

Global common data source name	Content
IMF Climate Change Dashboard on Greenhouse Gas Emissions[1]	• Provide data on GHG emissions from economic activity: CO_2 Emissions, Emissions Intensities, and Emissions Multipliers based on OECD information.
Carbon dioxide emissions embodied in international trade[2]	• Production and demand-based Carbon dioxide (CO_2) emissions of each country. Production-based CO_2 emissions are estimated by allocating the CO_2 emissions from fossil fuel combustion to the resident industries and households.
Open-source Data Inventory for Anthropogenic CO_2 (ODIAC)[3]	• A global high-resolution emission data product for fossil fuel carbon dioxide (CO_2) emissions that combines space-based nighttime light data and individual power plant emission/location profiles to estimate global spatial extent of fossil fuel CO_2 emissions at a 1x1km.
Emissions Database for Global Atmospheric Research (EDGAR)[4]	• Global database of anthropogenic emissions of greenhouse gases emissions of greenhouse gases and air pollutants by country and on spatial grid, whose estimates are independent from information reported by Parties under the United Nations Framework Convention on Climate Change. EDGAR provides both emissions as national totals and grid maps at 0.1 x 0.1– degree resolution at global level, with yearly, monthly and up to hourly data.

1 https://climatedata.imf.org/pages/greenhouse-gas-emissions

2 https://stats.oecd.org/Index.aspx?DataSetCode=IO_GHG_2021

3 https://db.cger.nies.go.jp/dataset/ODIAC/DL_odiac2023.html

4 https://edgar.jrc.ec.europa.eu/

3.2.4 Promoting disclosure

Majority of EN Data members emphasized challenges regarding data availability and the significance of data disclosure, whether through mandatory or voluntary means. While mandatory disclosures are obligatory and follow standardized regulations, voluntary disclosures provide organizations with the flexibility to convey additional relevant information, showcasing a dedication to transparency, accountability, and on engagement with stakeholders.

- In 2021, the ***International Association of Insurance Supervisors*** introduced supervisory standards[35] aiming to integrate climate-related risks into the oversight of the insurance sector. Supervisors often collect additional information through surveys and targeted requests to assess climate risks, and the report suggests transitioning from ad hoc approaches to integrating climate risk information into regular reporting requirements for a more systematic approach.
- To assess investment sustainability, the ***Italian supervisory authority for the insurance sector (IVASS)*** gathers data through surveys, by categorizing financial instruments into three types: bonds, equities, and other instruments, and classifying issuers based on their economic activity using 28 categories. Within the data matrix columns, information on both financial quantities and non-monetary quantities related to Greenhouse Gas emissions is included. Derived from this module, sustainability indicators encompass the share of sustainable investment over total investment, investment carbon footprint, and investments in climate policy-relevant sectors.
- The ***Bank of Spain's*** report on the climate-related disclosure of its non-monetary policy portfolios aligns with the TCFD recommendations, covering governance, strategy, risk management, and metrics and objectives. This document, the first of its kind, exclusively focuses on the financial disclosure of the climate-related aspects of the Bank's euro-denominated investment portfolios. It includes detailed information on the calculation of the carbon footprint, as it strives to transparently disclose and manage climate-related aspects in its financial activities.
- The ***Banco de Portugal*** has published the first report on climate-related financial disclosures of its own financial assets. Publishing climate-related financial disclosures is the first step to measuring and publicly disclosing the environmental impact of the Eurosystem's own financial assets, in line with the Eurosystem's public commitment to do so and with the "Responsible Investment Charter",

35 https://www.iaisweb.org/uploads/2022/01/210525-Application-Paper-on-the-Supervision-of-Climate-related-Risks-in-the-Insurance-Sector.pdf.

whose guiding principles encompass the measurement and public disclosure of the environmental impact of these assets.

Case study n° 6: In-house credit assessment systems developed by euro area national central banks

The in-house credit assessment systems (ICASs) developed by euro area national central banks (NCBs) are an important source of credit risk assessment within the Eurosystem collateral framework. The main function of ICAS is to provide a score on the credit quality of the debtor/guarantor/issuer to assess the eligibility criteria of some types of collateral used by counterparties as a guarantee in the Eurosystem credit operations. ICASs will strive to obtain firm-level information to assess climate change risks by using the following solutions.

- A company's disclosure under the CSRD as the primary source for CCR related data whenever and as soon as it is available.
- For entities not within the scope of the CSRD or where CSRD data are not available yet, firm level information based on harmonized, generally accepted definitions and disclosures, e.g. from the EU emission trading system.
- Sectoral or regional information on CCR, in case no firm level information is available, ICASs may use. In addition, ICASs may obtain third party indicators for one or more CCR to support the assessment of these risks.

The evaluations should integrate information on a company's risk factors (e.g., carbon prices), its exposure to risks (e.g., greenhouse gas emissions), and its vulnerability after implementing mitigating measures (e.g., emission-reducing technology) for every category of climate change risk. The climate change risk assessments conducted by ICAS must prioritize transparency and objectivity, although obtaining dependable and comparable data poses a challenge for assessment sources, particularly in the short term. The methods employed for assessing climate change risks rely on innovative techniques, conforming to harmonized disclosure and industry standards, and emphasize forward-looking approaches.

Box 3

International standards and guidance (reporting template)

The TFCD was set up to develop a set of recommendations for voluntary and consistent climate-related financial risk disclosures, and issued the following recommendations on the disclosure of metrics and targets for climate-related risks:

a) disclose the metrics used to assess risks and opportunities in line with strategy and risk management processes;
b) disclose Scope 1 and 2 and if appropriate Scope 3 GHG emissions and the related risks;
c) describe targets used by the organization to manage risks, opportunities and performance against targets.

Reporting based on international standards and templates is key to the transition toward a low-carbon/net-zero emission economy. Some updates have taken place, but there are still issues that need to be addressed.

A major progress from good practices to disclosure templates have been the EU delegated regulation 2022/1288 provides technical standards specifying the content and presentation of the information in relation to the principle of "do no significant harm" to the European environmental objectives. The regulation specifies the content, methodologies, and presentation of information in relation to sustainability indicators and adverse sustainability impacts. Similar templates are used for the collection of figures relative to Taxonomy-eligible investments (according to the European Taxonomy) and green bonds, as well as for the value of total investments. This latter variable is used for the computation of many sustainability indicators.

…/…

Another important event has been the consultative document "Disclosure of climate-related financial risk", published for comments by the Basel Committee on Banking Supervision at the end of 2023[1], in which includes illustrative templates to facilitate comparability across internationally active banks. These templates include 3 GHG emission related indicators:

a) Template CRFR1: Transition risk – exposures and financed emissions by sector.
b) Template CRFR4: Transition risk – emission intensity per physical output and by sector.
c) Template CRFR5: Transition risk – facilitated emissions related to capital markets and financial advisory activities by sector.

Templates CRFR4 and CRFR5 request disclosure according to the 18 sectors defined by the TFCD based on Global Industry Classification Standard (GICS) at six– or eight-digit industry-level code for classifying counterparties.

Moreover, international standard-setters and developers of reporting frameworks have been working together to ensure the interoperability of reporting standards globally. The IFRS and the ISSB released two standards in 2023 - IFRS S1 and IFRS S2 - that fully incorporate the recommendations of the TCFD that are expected to be effective from 2024 when the IFRS Foundation will take over responsibility for monitoring the progress of companies' climate-related disclosures from the TCFD.

Finally, there is a need of reporting templates for forward-looking data of emissions to measure transition sensitivity and alignment as climate risks and opportunities are expected to manifest in the future and investors have therefore expressed interest in climate information that is forward-looking. Current forward-looking data are limited for transition risks.

1 https://www.bis.org/bcbs/publ/d560.htm

4. Best practices and going forward

4.1 Features and best practices that could be considered

4.1.1 Conducting survey to additional financial institutions to understand use and sources of sectoral GHG emissions data

In many countries, GHG emission data for every firm is not available its use by financial institutions. Instead, a common practice by financial users is obtaining GHG emissions data from public reports and sources and aggregating them according to an industry classification for its use in the estimation of sectoral GHG emissions proxies. The availability of more and better GHG emission data from the firms, the better are the estimates of these aggregated emission proxies.

4.1.2 Engaging relevant government agencies to improve availability and publication of sectoral GHG emissions data

Case study n° 7: Compiling the JC3 Climate Data Catalogue in Malaysia (further elaboration from case study n° 3)

In compiling the JC3 Climate Data Catalogue, it was observed that the key data providers for climate data comprise mainly the public sector (e.g. government ministries and agencies), followed by private sector (e.g. financial institutions (FIs), corporations, Small and Medium Enterprises (SMEs) and private data providers). Currently in Malaysia, sectoral GHG emissions data are published by the Ministry of Natural Resources and Environmental Sustainability (NRES) *via* the compilation of GHG National Inventory. The publication follows the IPCC Guidelines which are defined based on emissions from combustion/production activity. On the other hand, FIs' financial and investments activities are aligned with economic activities categorised based on the Malaysia Standard Industrial Classification (MSIC). As such, FIs requires sectoral GHG emissions data based on MSIC in order to conduct climate risk assessment such as transition risk, to compute financed emissions, and for climate related disclosure purposes. To bridge this data gap, BNM has approached NRES and Department of Statistics Malaysia to publish granular GHG emissions data by MSIC economic sectors, as availability of data based on commonly defined sector classification would bring the following benefits.

- Facilitate FIs in aligning strategies to achieve sectoral pathways under Long Term Low Emissions Development Strategies (LT-LEDS).
- Enable FIs to perform economic sectoral modelling and to conduct comprehensive transition risk assessments.
- Promote standardised reference for FIs and companies to measure and report GHG emissions for sustainability reporting and regulatory requirements.

One option is to publish the national System of Environmental-Economic Accounting (SEEA) Air Emissions Account, whereby emissions are categorised based on Standard Industrial Classification (SIC) as done in other countries. The SEEA is an international statistical standard that uses a systems approach to bring together economic and environmental information to measure the contribution of the environment to the economy and the impact of the economy on the environment. For Malaysia, the SEEA for Energy Account and Water Account has been published, however Air Emissions account is yet to be made available. Secondly, NRES can consider mapping the sectors between IPCC and MSIC and publish the data. This harmonisation will enable better comparability across different datasets, facilitating more accurate and meaningful assessments.

4.1.3 Developing initiatives to share and disseminate information

The websites of central banks and supervisory authorities could provide guidelines and standards of good reporting practices aimed to raise the awareness of the importance of sustainability indicators among supervised entities. Results of pilot studies and surveys could also be published through this channel with the same purpose. The communication should stress the possibility of a gradual approach for the provision of emission data by supervised entities, according to a granularity level increasing over time, as suggested by the NGFS to supervisors. The information provided on these websites should be documented with meta-data illustrating the ongoing quality improvement already made or planned over the next years. Emission data

are more readily available for big companies compared to medium-small enterprises and therefore require a massive effort of data integration from different sources to increase the coverage, as well as collaboration agreements with public bodies such as utility regulators and environment protection agencies. These issues should be highlighted in the on-line documentation.

A section of the web-site dedicated to sustainability could be set up with two purposes: 1) providing data to external researchers and analysts, 2) documenting which supervisory aims could be actually pursued with the available data and the improvements in data collection and data quality required for a full realization of all the supervisory objectives. The web-site of the European Central Bank offers a specialized section on Experimental indicators on sustainable finance which could be a template for other supervisory authorities seeking to promote the knowledge of sustainability in the financial sector. Within the experimental indicators, a sub-section contains analytical indicators on carbon emissions financed by the financial sector loan and securities portfolios. Another relevant example is the micro-database on sustainability indicators (CBS)[36] developed by the Central Balance Sheet Data Office (Bank of Spain) containing sustainability indicators (ESG) collected from the sustainability reports of Spain non-financial groups, using international standards. This ESG database is offered to external researchers and analysts through a controlled and secured environment in the data laboratory of Bank of Spain (BELab)[37].

4.2 Other potential areas for future work

4.2.1 Collaborative actions

Addressing the challenges highlighted in the previous sections through collaborative actions involves implementing a range of solutions. We report below some possible strategies.

Mandatory National Disclosure Policies

- Enforce mandatory national disclosure policies requiring financial institutions to disclose relevant climate and environmental data.
- Develop and implement standardized reporting frameworks to ensure consistency and comparability across the financial sector.
- Introduce a system of incentives and penalties to encourage compliance with disclosure policies, fostering a culture of transparency.

International Standards and Guidance

- Align national practices with established international standards and guidance for climate data reporting, such as those outlined by organizations like the TCFD.
- Invest in training programs and resources to enhance the capacity of financial institutions to comply with international standards, ensuring a harmonized approach.

Multilateral Collaboration to Share Experience

- Establish collaborative platforms where financial institutions can share experiences, challenges, and best practices related to climate data disclosure.
- Support collaborative research initiatives to develop innovative solutions and tools for addressing data gaps, drawing on the expertise of various stakeholders.
- Facilitate peer learning networks that allow financial institutions to learn from each other's experiences in overcoming challenges and improving climate data practices.

These collaborative actions across government, financial institutions, and businesses are instrumental in overcoming challenges, closing data gaps, and working towards a sustainable, low-carbon economy aligned with national climate objectives.

4.2.2 Methodological transparency

Current and historical emissions can be self reported by an entity or estimated or modelled by a third-party data provider. The estimation methodologies are not always transparent and can result in large differences. For example, commercial data providers, offering enterprise-level emissions, are often not transparent on the methodology behind imputing data, making it difficult to fully rely in this data and understand its calculation. In addition, there is little guidance on offset reporting what translates into lack of comparability and transparency between recordings.

36 For further information please refer to: https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/NotasEstadisticas/23/Files/nest17.pdf.

37 For further information please refer to: https://www.bde.es/wbe/en/para-ciudadano/servicios/belab/contenido/microdatos-disponibles/microdatos-de-indicadores-de-sostenibilidad--cbs-.html.

Consequently, a transparent methodological framework may need to be established as the one of reference to be used such as the GHG Procotol[38].

4.2.3 Usefulness of geospatial data on emissions and econometric models for estimating GHG data

Developments in satellite and wider geospatial data is enabling new sources of climate data, both on emissions and physical climate risks. Examples of emissions data based on such geospatial data include CRU, Emissions Database for Global Atmospheric Research (EDGAR) of the European Commission's Joint Research Centre (JRC), and Carbon Monitor. Such geospatial data can be used for different asset classes and levels of aggregation. It allows to build globally harmonized data and enables consistency in scope and methodology across jurisdictions and sectors. While their applications in finance are currently limited, further work can be explored, building on experiences in national and regional statistics. Another relevant topic is the use of econometric models to estimate the carbon footprint of non-available data such as the one from SMEs. Consequently, any close collaboration and knowledge sharing in this area would be of interest to improve the accuracy and reliability of this alternative source of information.

38 GHG Protocol: https://ghgprotocol.org/.

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Acknowledgements

This document on "Improving Greenhouse Gas Emissions Data" is a collaborative effort of the members of the Expert Network on Data (EN Data) of the NGFS.

This document was prepared under the auspices of Enrique Calfucura (Banco Central de Chile), serving as lead of the subgroup on improving emissions data, with support from Li Ming Ong (Bank Negara Malaysia) and Elena Triebskorn (Deutsche Bundesbank), co-chairs of the EN Data, and the NGFS Secretariat – Jasper Chan (Monetary Authority of Singapore), Alexia Watel and Léopold Gosset (Banque de France).

This document relies on the analysis and drafting work of the subgroup on improving emissions data members: Borja Fernández-Rosillo (Banco de España), Nathalie Rouillé (Banque de France), Susana Caleiro (Banco de Portugal), Taejin Park (Bank for International Settlements), Nur Izzati binti Mohd Jamal (Bank Negara Malaysia), Gor Lazyan (Central Bank of Armenia), Felipe Aviles (Central Bank of Chile), Rudolf Christoph (Deutsche Bundesbank), Trond Husby (De Nederlandsche Bank), Leandro D'Aurizio (IVASS Italy), Jolien Noels (OECD) and Faisal Aldulaylan (Saudi Central Bank).

The NGFS is also grateful to its other members and observers as well as other members of the Secretariat for providing comments and contributing materials to this document. The contents of this publication do not necessarily reflect the position or opinion of the above-mentioned institutions.


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