Irving Fisher Committee on Central Bank Statistics

BIS

The evolving role of central bank statistics

Archana Dilip, Zukiswa Mdingi, Olivier Sirello, Bruno Tissot[1]

Executive summary

Central bank statistics are undergoing profound transformations as the information ecosystem continually evolves. On the supply side, innovation, especially through digitalisation and novel analytical techniques, is making data more available, usable and reusable. This has been accompanied, on the demand side, by the need for better evidence on which to base policymaking when addressing growingly complex issues. As a result, data have increasingly become a core strategic asset underpinning central banks' operations and functions, including their statistical responsibilities. Such an evolution has certainly improved the quality of the reference statistics central banks produce, especially in terms of accuracy, granularity and timeliness. But it has also highlighted the importance of safeguarding the integrity of the information central banks manage and use, through shared principles, robust methodologies as well as adequate governance and collaboration with the stakeholders populating the broad data ecosystem.

Fortunately, **central banks' long-standing expertise with data has enabled them to embrace these transformative changes effectively**, with widespread benefits spilling over to their various functions. Their statistical role and related activities, both within the organisation and in the broader economic and financial system, have equipped them with the tools to sustain the provision of trustworthy information for policymakers and society at large. In turn, their extensive data knowledge has increasingly become instrumental in supporting their various operations, reflecting the fact that data have become ubiquitous in today's world.

After various decades of profound transformations, **the central bank statistical function has matured significantly**, characterised by a relentless commitment to robust ethical standards, strong professional independence and sound international cooperation. Yet it also needs to keep pace with the growing complexity of policy issues, the uncertainty arising from evolving global and more interlinked challenges, as well as the rapid but often unpredictable advances in technology. Quite ironically,

[1] Respectively, Assistant Adviser, Reserve Bank of India and former Visiting Statistician, Bank for International Settlements (BIS) (adilip@rbi.org.in); Associate Economic Statistician, South African Reserve Bank and former Visiting Statistician, BIS (zuki.mdingi@resbank.co.za); Senior Statistical Analyst, Monetary and Economic Department, BIS (olivier.sirello@bis.org); Head of Statistics and Research Support, BIS, and Head of the Secretariat of the Irving Fisher Committee on Central Bank Statistics (IFC) (bruno.tissot@bis.org).

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the more innovation opens new avenues for using and producing data, the greater the need for strengthening the fundamental principles, practices and methodologies developed by central bank statisticians over time.

Addressing these issues calls for developing an ambitious roadmap to further enhance the central banks' statistical role. Drawing on the IFC members' experiences, **six main priorities** have emerged thus far:

- To **make sense of the expanding data universe**, which provides multiple opportunities for improving central banks' statistical offerings, especially in terms of the breadth, speed and timeliness as well as the depth and length of the information produced.
- To **leverage innovative techniques** to transform the abundance of available data into meaningful and policy-relevant insights. In particular, the emergence of generative artificial intelligence (AI) is offering entirely new prospects, especially to support statistical and analytical processes.
- To **continue to deal with important priorities in terms of "traditional" statistical work**, calling for continuous refinements in methodologies, data collection and management processes. A key aspect relates to the implementation and ongoing maintenance of international statistical standards to secure the coherence, consistency, comparability and relevance of official statistics.
- To **expand the availability of central bank data and statistics to broader audiences**. Greater and better data dissemination can improve transparency and public trust, ultimately underpinning policy effectiveness. Reflecting this, important efforts are being made to make data adequately accessible, usable and shareable, with communication and engagement with users playing an increasingly important role.
- To **develop agile, integrated and scalable information technology (IT) architectures supported by adequate governance**, not least to advance innovation effectively and responsibly. Migration to novel solutions has to be carefully managed as an evolutive process rather than a disruptive shift, allowing for a gradual phasing out of legacy systems. Other key requirements are to develop integration capabilities, both to combine novel techniques with traditional ones and to link data from disparate sources and with different formats.
- To **enhance cooperation with the various stakeholders in the data ecosystem**, especially to support the international exchange of data and best practices that play an essential role in central bank statistics. To be effective, collaboration should be mindful of preserving the well-established ethical standards and professional independence of central bank statisticians.

1. Introduction

Central bank statistics are undergoing profound transformations in the new information era. A first trigger is the constant evolution of the data universe, with

the increased supply of vast and various indicators driven by the digitalisation of economies. In particular, high-frequency and real-time inputs derived from satellite imagery, social media, payment systems and mobile phone records are increasingly complementing traditional statistics. Second, growing computing power and innovative technologies, such as AI and machine learning (ML), provide unprecedented opportunities to collect, process, store and analyse vast amounts of data, especially when supported by significant investments in cutting-edge technology and skills. Third, and perhaps more fundamentally, data are increasingly instrumental for adequately informing policies in central banks, particularly as they face complex economic, financial, social and geopolitical issues.

As a result of these structural forces, **data are** – **and becoming increasingly so** – **a strategic asset**, influencing how central banks both produce statistics and use evidence to conduct their policies. This evolution has reinforced the need to follow rigorous statistical methodologies, improve collaborative work and enhance data literacy among users, not least to secure public understanding of and trust in the pursuit of their mandates. Needless to say, central bank statisticians have been at the forefront of these efforts, building on their continuous and proven experience built over decades in collecting, processing and making use of high-quality economic and financial information.

There is also growing awareness of the **importance of developing innovative and structured approaches when dealing with data**. AI, ML and big data analytics have gradually shifted from experimentation to application in central banking, allowing statisticians to make the most of new, alternative data sources. Innovation can also boost productivity and automate data workflows, while the greater availability of ready-made open source software has dramatically lowered entry barriers. Furthermore, innovation can assist in addressing the increasingly multidimensional policy issues faced by central banks, from monetary and financial stability to payments, fraud prevention, consumer protection, financial inclusion, literacy and the impact of environmental hazards.

Yet practice shows that **innovation is less a revolution than a progressive evolution rooted in solid foundations**. Ironically, the more possibilities for handling complex and novel data arise, the clearer the need to further strengthen the fundamental and long-standing methodologies, governance arrangements and principles developed by statisticians over time. Accordingly, central banks have been following a hybrid approach that combines the best of both traditional and innovative solutions to transform raw – and often noisy – data into high-quality information, including through agile and scalable architectures. But much more remains to be done, as the integration of new information sources and techniques into central bank operations can raise difficulties, especially regarding data accuracy, consistency, protection and security, as well as the related institutional capacity to be built.

Moreover, both the opportunities and challenges brought by the data revolution have **reinforced interest in developing common solutions and enhancing collaboration** within and across data ecosystems, whose boundaries are constantly evolving. Such coordination can be essential for supporting the quality of official statistics, fostering the integration of external sources in internal data frameworks and ensuring cross-country harmonisation – a clear precondition for tackling complex global issues. Fortunately, important progress is already being made, in terms of cross-border data sharing – for example, the various initiatives under the aegis of the

BIS and its committees in the aftermath of the Great Financial Crisis (GFC) of 2007–09,[2] the update of major statistical manuals in 2025 and other international projects calling for comprehensive data governance frameworks at the national, regional and global level.

Against these rapid changes, the overview of this IFC Bulletin attempts to offer a **long-term perspective on the evolution of central bank statistics and their role within the broader structural shifts shaping today's information ecosystem**. Specifically, it shows that central bank statistics have adapted to transformative changes while preserving at their core the fundamental principles of quality, objectivity and independence for the benefit of policymakers and society at large. This analysis draws on the various contributions gathered at the IFC's 12th biennial conference on "Statistics and beyond: new data for decision-making in central banks", attended by representatives from central banks, international organisations, academia and the private sector from about 70 jurisdictions. It first takes stock of the various evolutions and challenges in the statistical function of central banks (section 2). In turn, it illustrates the several initiatives, leveraging novel information sources (section 3) and data techniques (Section 4). It then emphasises the continuous efforts being made to enhance statistical frameworks (section 5) and data dissemination (section 6), calling for improving data infrastructures (section 7) and supporting global cooperation while safeguarding the pivotal role of the independent central bank statistical function (section 8).

2. The evolving statistical role of central banks

While central banks have traditionally been heavy data users to support their mandates, they have also **developed a proper statistical function to produce reference information for the public**. This function has evolved dramatically in the past few decades, reflecting in particular the impact of innovation, the growing complexity of the financial system and the consequences of diverse crises. Its transformation – from paper-based data collection to digitisation[3] and, more recently, big data analytics and AI tools – has been associated with notable shifts in data practices, governance frameworks and organisational structures.

Five transformation waves

Central banks have a long-standing tradition of gathering information on key monetary and financial indicators which goes back to their early origins in most countries (Flandreau (forthcoming)). The European interwar period in the 1930s in particular laid the foundation for establishing dedicated statistical activities among central banking functions, generally related to regular data dissemination and international cooperation to improve cross-country comparability of statistics (Yee

[2] Eg the monitoring of large and systemic global banks (Bese Goksu and Tissot (2018)).

[3] Digitisation refers to converting information from a physical into a digital format; more broadly, it also supports the improvement of business processes (ie "digitalisation") and the expansion of the data supply (Lipton (2017)).

(2024)).[4] Turning to the Bretton Woods period up to the 1980s, central banks further formalised their statistical responsibilities, especially in the wake of the development of modern national statistical systems (NSS) worldwide.[5] Key features of this period were the development of frameworks governing statistical activities organisation-wide and, in parallel, the system-wide recognition of central banks as producers of official statistics, especially in the areas of external and financial sector accounts.[6] Yet, in practice, data collections were largely manually processed and fragmented, often leading to silos both within central banks (eg across functional areas) and the statistical system.

The 1990s saw central banks stepping further into their statistical role for at least two reasons. On the one hand, this period marked the beginning of digitisation, laying the groundwork for advances in technology, standardisation and data collection methods. On the other hand, various episodes of global financial instability – particularly related to crises in emerging market economies as well as the formation of a new monetary area in Europe[7] – drove the demand for more comprehensive and standardised financial and economic data. These developments gradually converged with the introduction of data dissemination standards by the International Monetary Fund (IMF) to guide national authorities in releasing economic and financial statistics to the public.[8] Meanwhile, the launch of the IFC in this period also contributed to further developing statistical standards as well as promoting knowledge-exchange among central banks (Dodge (2004)).

A third wave was the **general shift observed in the 2000s towards integrating statistics into IT systems**, especially in the wake of the widespread development of the internet and IT capabilities. In particular, the focus of central banks was on setting up comprehensive institution-level information management frameworks to index, store and disseminate their data. These modernisation efforts benefited from key developments in information standards (Froeschl (1999)). A noteworthy example is the Statistical Data and Metadata eXchange (SDMX) initiative, now sponsored by eight major international organisations, which started in 2002 with a focus on

[4] The BIS's key role was – and continues to be - to facilitate the exchange of (statistical) information among central banks as well as to "gather and exchange data […] of a monetary and economic character […] to form a basis of judgement in guiding credit policy and […], deciding the proper course of conduct [and] read the obscure premonitory signs of financial weather"; see BIS (1935), Tissot (2022) and Clement (2023).

[5] National statistical systems – comprising the national statistical office (NSO) and other producers of official statistics, including central banks in many cases (but not all) – were typically established after World War II (Trewin (2007)). Yet NSOs' efforts to systematically measure economic activity began earlier and culminated internationally in the 1950s with the release of the System of National Accounts (SNA) under the aegis of the United Nations Statistical Commission; see Rice (1946) and UNECE (2025a).

[6] For example, see Le Gallo (2021), Schipper et al (2025) and Tsujimura and Tsujimura (2025).

[7] See De Bonis and Piazza (2020).

[8] The IMF dissemination standards comprise, among others, the Special Data Dissemination Standard (SDDS), established in 1996 to guide countries that have, or that might seek, access to international capital markets in the dissemination of economic and financial data to the public; and the enhanced General Data Dissemination System (e-GDDS), established in 2015 to guide countries in data dissemination by supporting transparency and helping to create synergies between data dissemination and surveillance – with a particular focus on developing countries in Africa; see IMF (2013) and dsbb.imf.org.

exchanging macroeconomic time series (Eurostat and UNECE (2002)). Its scope gradually broadened to the entire data life cycle, with the development of metadata repositories, a common vocabulary and additional features for dealing with new data types, such as micro-level records (IFC (2025a)). In parallel, the eXtensible Business Reporting Language (XBRL) emerged as a global standard for supporting the digital reporting of business and financial information, the disclosure of which has become mandatory in most countries since the GFC.[9]

A fourth wave reflected the **unprecedented profusion of data (or "data deluge"), in particular with the advent of big data in official statistics since the 2010s**. This was in the context of combined factors on both the supply (eg data management infrastructures, IT tools and abundance of data by automated systems) and the demand side (eg increased needs for granular databases, especially following the GFC, expansion of supervisory functions and growing multidimensional policy issues).[10] The adoption of big data was particularly rapid among central banks (Serena et al (2021)), providing them with unprecedented opportunities to use new information sources, experiment with innovative analytical toolkits and improve overall operational efficiency (Bholat (2015)). The area of monetary policy, in particular, was seen as a major beneficiary of this development, together with macroprudential supervision (Piechocki and Leslie-Bini (2017)).

The last and fifth wave is the **current shift with, on the one side, the continuous expansion of the data supply and, on the other, the increasing interest in using AI** as a new way to use and produce information. This reflects the fact that central banks are both broadening the palette of data types at their disposal and integrating data more extensively across all their various functions and operations. Perhaps more fundamentally, this trend has also prompted central banks to rethink and strengthen their role as producers, users and disseminators of reliable and meaningful reference information to serve the public good (Box A).

Overall, and interestingly, **an analysis of IFC activities captures quite comprehensively the evolution of the central banking statistical role across time and countries**. For instance, the initial years of the Committee – established in 1997 – focused on national accounts and monetary aggregates,[11] laying the groundwork for the integration of financial statistics. In the aftermath of the GFC, attention shifted to financial stability analysis and cross-sector and -country linkages. The mid-2010s saw an increased focus on broader data issues, from the use of micro records to balance sheet analysis and, lastly, the emergence of big data. While other priorities (eg climate change, Covid-19 pandemic) also emerged in the most recent period, a key focus remained AI/ML and data science issues and their related governance and communication aspects.

[9] Case in point, the United States began to deploy XBRL for public company filings in 2008; see sec.gov.

[10] The G20 Data Gaps Initiative (DGI) was launched in 2009 by G20 Finance Ministers and Central Bank Governors to address data gaps revealed by the GFC, with a focus on collecting higher frequency and granular data. The first and second phases, in 2009–15 and 2015–21, respectively, were followed by a third phase (DGI-3), launched in 2022 and spanning a five-year horizon (IMF et al (2023)).

[11] See Kenessey (1997) for the influence of Irving Fisher (whom the IFC is named after) on modern national accounting.

Box A

The institutionalisation of the role of statistics in central banks: a global perspective

Central banks have a strong and robust connection with statistics, reflecting the importance of relying on sound evidence to effectively pursue their mandates. To this end, they heavily ***use*** data to formulate, communicate, monitor and assess their policies.① In parallel, they also ***produce*** statistics *to infer meaningful and high-quality information from raw data*. This role of central banks as statistical producers has expanded over time, arguably driven by the growing importance of financial activities in today's society and, in turn, the need to better monitor and regulate them.② It also reflects central banks' increasing contribution as compilers of official statistics, along with other national statistical authorities, to provide as a public good a factual basis for assessment and decisions on economic, social and environmental issues.③ Yet the way central banks organise their statistical role diverges across countries, often hinging on institutional, legal and social traits. This box provides a bird's eye view of the different patterns worldwide, with a common bottom line: there is not a unique role model, rather a mix of different practices which all underline the critical importance of data and statistics in central banking.

Analysing the statistical role of central banks begins by first looking at how they structure their activities internally. Historically, the creation of statistical teams went in tandem with the setup of economic or research departments in most countries.④ Albeit initially somewhat sporadic, such close in-house relationships between central bank statisticians and economists quickly became the norm, as an operational necessity to rely on timely, tailored and parsimonious indicators to base their policies.⑤ Fast forward to the present, central banks can be categorised into three groups based on the way they organise statistical production. The largest group has established centralised statistical units, formally separated from other functional entities (Graph A1.A). These arrangements typically not only echo the cross-cutting nature of data across central banking; they also often reflect the importance of ensuring the autonomy of statistical work from other areas and adhering to scientific standards. A second group, featuring a significant minority of central banks, includes statistics as part of a larger unit, typically economics or research. Finally, a few central banks spread statistical teams across multiple areas, including central banking operations, payments and supervision.

A second factor influencing the statistical role of central banks relates to their contribution as providers of official statistics – a concept that can be understood as *public reference information compiled in accordance with well-established standards in terms of quality, impartiality, transparency and coverage*. In virtually all countries, central banks disseminate statistics of general interest on a wide range of topics related to their mandates, such as banking and financial intermediation, income and wealth, payments, financial inclusion, climate and, increasingly, prudential supervision.⑥ Moreover, central banks also produce key macroeconomic aggregates – often closely collaborating with the national statistical office (NSO) – related to monetary and financial issues, such as financial accounts and external sector statistics (Graph A1.B). Yet, here again, national practices differ markedly. At one extreme, the central bank plays a central role in producing large sets of economic statistics, for instance related to GDP, as is the case in Belgium and Chile.⑦ At the other extreme, some central banks may have only a marginal – if any – role in compiling public statistical indicators; this is typically the case in Australia, Canada and Norway, where the NSO centralises most of their production.

A third factor relates to the way the statistical function of the central bank – irrespective of its size – is formally recognised in the national statistical system (NSS). The NSS is typically defined in the national statistical law as formally covering the authorities in charge of official statistics, possibly also including the central bank (generally through its statistical department) as recommended by international practice.⑧ Noteworthy examples in Europe are Belgium, Croatia, Estonia, Germany, Greece, Iceland and Switzerland.⑨ However, in other jurisdictions, such as France,⑩ the central bank may not be formally or directly part of the NSS as statistical agency, even if it is de facto actively involved in the production of official statistics. This can reflect various institutional considerations, such as the formal independence of the central bank from other public authorities.

There is, however, one common feature to the statistical activities performed by central banks, regardless of their affiliation with the NSS or their actual role in the provision of reference economic indicators: **they widely adhere and commit to the well-established standards underpinning official statistics.** On the one hand, this commitment can be formalised, as in the case of the European Statistical System of Central Banks (ESCB), which refers to internationally

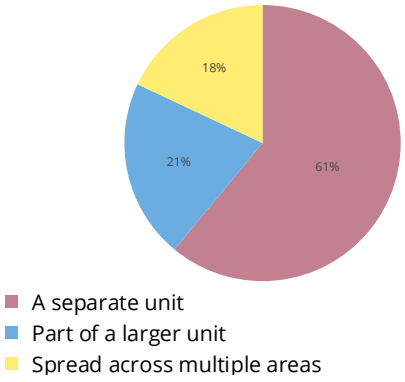
agreed quality standards such as the United Nations Fundamental Principles of Official Statistics (UN FPOS) as well as the European Statistics Code of Practice.⑪ Similarly, in the United Kingdom, the Bank of England's Statistical Code of Practice reflects, and largely aligns with, that of the UK Statistical Authority, which applies to all compilers of official statistics at the national level (except the Bank of England).⑫ On the other hand, in countries with less formal frameworks, there is often a clear commitment of the central bank to adhere to the principles of statistical quality, impartiality and independence, underlining the importance of having adequate processes in place to ensure effective monitoring of and compliance with these principles.⑬

Finally, another common – and increasingly important – dynamic is that central banks operate in rapidly changing data ecosystems. On the one hand, they are generating new data types that are essential to inform their various functions and, broadly, the public discourse. Typical cases include micro (and often big) data as well as textual information – whose availability, volume and granularity have continued to expand over the past few decades, reflecting broader structural developments in central banking and technological advances such as artificial intelligence. On the other hand, central banks are also increasingly relying on alternative data sources provided by multiple and often new public and private entities.⑭ This development puts a premium on developing a data stewardship role with sound ethical practices, to enhance the quality of the reference information central banks use as well as to promote synergies and clarify responsibilities across the various stakeholders involved in the data ecosystem.⑮

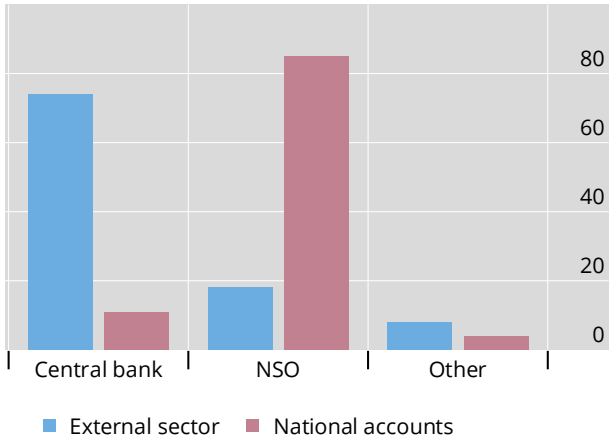
The central bank statistical function: organisational structures and responsibilities

In per cent of surveyed jurisdictions — Graph A1

A. Organisation of the statistical role in central banks[1]



B. Compilation of official macroeconomic statistics by institution type in the statistical system[2]



[1] Based on 51 responses from IFC (2024a). [2] Covering IMF Special Data Dissemination Standard (SDDS) and SDDS+ subscribing countries. "External sector" statistics include external statistics, exchange rates, external debt, international reserves and foreign currency liquidity, and merchandise trade. "Other" includes cases of shared coordination responsibilities across institutions.

Sources: IFC, IMF, authors' calculations.

① Božič Verbič (2025). ② Borio (2013). ③ UNSD (2025). ④ Yee (2024). ⑤ Goodhart (2010). ⑥ Bholat (2013). ⑦ See the Institute for National Accounts in Belgium (of which the National Bank of Belgium is part) and the Basic Constitutional Act of the Central Bank of Chile (section 53). ⑧ UNSD (2025). ⑨ See the list of NSOs and other national authorities in the European statistical system (as of February 2026); see ec.europa.eu. ⑩ Barut-Etherington and Golfier-Chataignault (2024). ⑪ See Solans (2004), Schubert (2020) and the public commitment on European Statistics by the ESCB; see ecb.europa.eu. The ECB also endorses the Principles governing international statistical activities by the Committee for the Coordination of Statistical Activities (CCSA); see unstats.un.org. ⑫ Bank of England (2013). ⑬ For instance, the transfer of the functions of the NSO to the central bank in El Salvador highlighted the importance for the central bank's statistical department to secure adequate professional independence as per the International Statistical Institute (ISI) Declaration on Professional Ethics and UN FPOS; see isi-web.org. ⑭ For example, the Covid-19 pandemic underscored the need for leveraging alternative data sources to sustain statistical production during times of crisis (de Beer and Tissot (2020)). ⑮ See UNECE (2024, forthcoming).

New challenges posed by the ongoing data revolution

After various decades of major transformations, the central bank statistical function has matured significantly, characterised by a focus on international cooperation and knowledge-sharing, the commitment to high ethical standards and strong professional independence. Yet it is still facing acute challenges brought by the ongoing data revolution.

A first challenge is the **desire for additional information to support central banks' public mandates effectively**, especially in the aftermath of the GFC. One example relates to the need to better monitor emerging issues such as non-bank financial intermediation and sustainable finance, as emphasised by Alberto Naudon, former chair of the IFC. The Covid-19 pandemic also served as a wake-up call to make better use of alternative indicators to complement traditional data sources and secure the continuity of statistical production during periods of information disruptions ("statistical darkness"; de Beer and Tissot (2020)). It also further emphasised the need for central banks to actively incorporate new data types and advanced AI/ML methods to strengthen their analyses and support policy work.

A second issue is how to benefit effectively from the **new opportunities offered by technological innovation**. This calls for robust computing power, secure data storage and advanced software tools to support increasingly complex analyses. It also demands an adequate workforce, with sufficiently diverse skillsets and expertise. Reflecting this, and in line with other statistical organisations, central banks have been attracting more data experts, in addition to more traditional profiles well versed in statistics and economics. Yet competition for filling positions of data scientists, data engineers and quantitative analysts can be rather intense. Moreover, complex data workstreams often require the multidisciplinary combination of advanced analytical capabilities, IT knowledge and business expertise, which can be difficult to assemble (Russo (2025)).

A third challenge is **the need to safeguard the integrity of the information produced and used by central banks**, not least to secure public trust – an important point given the proliferation of unverified sources and alternative facts in today's societies (OECD (2024), UNECE (2025b)). A key consideration is thus to maintain the high quality and credibility of standards governing official statistical activities, with due consideration of the explainability and interpretability of the novel data techniques and types incorporated as well as of their related accuracy, privacy, security and ethical concerns (UNECE (2026)). It also calls for investments in cyber security, the setup of well-structured, streamlined and transparent data processes, and the development of integrated information systems. These efforts often need to be undertaken within a comprehensive data governance framework, ensuring adequate incorporation of various information sources and effective deployment of advanced AI-based tools and big data technologies.

In addressing these challenges, central bank statisticians have focused on six main areas: new information sources, innovative data techniques, statistical methodologies, data dissemination, IT infrastructure as well as cooperation.

3. First objective: making sense of the new data universe

Central banks are facing a brand new and continuously expanding data universe. It provides **multiple opportunities for improving their statistical offering**, especially in terms of the data's breadth, speed and timeliness, depth and length.

Breadth: the growing supply of novel data

Emerging **information sources such as satellite imagery, web pages, social media and payment transactions are expanding the palette of inputs for statistical work.** For instance, Bank of Namibia uses credit card data to measure digital payments and better assess cross-border trade flows and sectoral dynamics. Tapping into alternative sources can also offer new insights for conducting evidence-based policies, such as early warning signals and real-time perspectives on economic developments (Sahm (2025)). Recent work carried out at the Bank of Finland has enabled the extraction of sentiment indicators from unstructured information (specifically communication texts by the European Central Bank (ECB)), which can then be combined with real-time economic outlook data to assess the impact of monetary policy decisions.[12] Similarly, Bank Indonesia has been using real-time gross settlement (RTGS) payments data coupled with banking customers' information to complement indicators on financial intermediation and soundness, while the Central Bank of the Dominican Republic has derived a customer sentiment index from high-frequency quantitative and qualitative information sources. In these various cases, the new information gathered has proved particularly insightful for analysing economic developments and supporting policy actions.

Speed and timeliness: making use of higher-frequency data for faster insights

High-frequency data can offer new intelligence on rapidly changing economic and financial market conditions, allowing central banks to monitor developments as they unfold rather than relying on lagged periodic reports. Hence, their integration represents a critical requirement for moving from traditional analytical systems based on delayed evidence to almost real-time monitoring, as exemplified by the Billion Prices Project, based on the systematic collection of online price data to measure inflation almost instantaneously (Cavallo and Rigobon (2016)). Moreover, rapid fluctuations in prices displayed on the internet or scanned in shops can provide a better understanding of the inflation process. For instance, research by the Central Reserve Bank of Peru shows that supermarket prices can vary significantly in response to daily circumstances and provide valuable indications of inflation regimes. Lastly, the use of high-frequency indicators can be particularly useful in times of disruptions in the provision of standard statistics and/or sudden changes in the economy, as

[12] This work also echoes similar projects leveraging AI-powered techniques to deal with "soft" information sources, such as meeting notes, policy briefs and other business intelligence; see Gray et al (2025).

exemplified during the Covid-19 pandemic (Jahangir-Abdoelrahman and Tissot (2023)).

Depth: capturing granular information

Innovation has greatly **facilitated the collection and use of micro data sets, which provide vast amounts of detail** at the entity or financial instrument level. Moving beyond aggregated indicators to get a sense of idiosyncratic specificities can help in developing much deeper insights. Reflecting this, many central banks around the world have been compiling detailed security-by-security databases (Dilip and Tissot (2024)).[13] Another example is the Central Credit Register managed by Banco de Portugal, which collects monthly policy-relevant information on a loan-by-loan basis for all credit granted in the country exceeding a certain threshold – with information on, for example, outstanding and initial amounts, debtors, credit providers, collateral and loan conditions such as maturity and interest rate. Such granular insights can be usefully leveraged to support analytical exercises and in turn more targeted policies. Similarly, firm-level balance sheet data have proved critically important for analysing the transmission of monetary policy decisions to the economy as well as risks and vulnerabilities in the financial system, in turn supporting prudential supervisory tasks and macro-financial stability monitoring. For instance, Bank Al-Maghrib uses detailed firm-level data to analyse Moroccan companies' financing dynamics and assess their broader implications in terms of financial stability.

Certainly, **dealing with granular information raises important difficulties**, in terms of analytical and methodological complexity, IT investments and protection of sensitive records. It is thus necessary to have well-designed and comprehensive data management processes when dealing with this type of information. In practice, this demands well-defined data validation and processing procedures, including for performing transformation and matching operations. One example is the SESA (standardisation, enrichment, scanning and aggregation) framework developed at the Hong Kong Monetary Authority (HKMA) for dealing with trade-level over-the-counter derivatives data. Handling such types of data poses important difficulties, reflecting their large size, high complexity and inherent quality issues (eg double-sided reporting (IFC (2018a)). To address them, the HKMA framework includes four-steps, ie the *standardisation* of entity names and identifiers, the *enrichment* of the data collected with additional fields through mapping and statistical computation, the *scanning* of possible anomalies and the *aggregation* of the processed data for analytical and policy support.

Length: constructing historical series

Central banks are increasingly recognising **the valuable information gained from economic and financial indicators encompassing extensive temporal coverage**.

[13] In particular, a number of central banks have been developing instrument-level databases (eg securities and loans) to support monetary and financial stability analyses. Noteworthy examples include, inter alia, the Reserve Bank of Australia's securitisation data set (Fernandes and Jones (2018)) as well as the centralised securities database (CSDB) and analytical credit data sets (AnaCredit) of the European System of Central Banks; see ecb.europa.eu.

Such insights can be instrumental to identify long-run financial trends and cyclical deviations, assess vulnerabilities and, in turn, formulate adequate monetary and financial stability policies (Drehmann et al (2012)).

Yet **properly chaining, or "splicing", multiple series across time raises a number of difficulties for statisticians**, not least because of the complex break adjustments to be performed. Fortunately, thanks to increasingly sophisticated tools and carefully designed methodologies, comprehensive time series can be developed that span several centuries consistently. In view of the diversity and complexity of the operations involved, a key requisite is to ensure that the dissemination of historical data is supplemented by a detailed compilation methodology, with extensive source documentation and transparent metadata. These efforts require the combination of diverse skillsets ("statistorians"), leveraging statisticians' best data management practices and historians' long-term perspective (Bignon et al (2022)).

In recognition of the importance of this topic, **the IFC has been actively supporting the central bank network on historical monetary and financial statistics (HMFS),** which brings together central bank statisticians and academic experts to focus on long-run historic monetary and financial data that are relevant to policymakers (Borio (2023)). In parallel, the BIS has renewed its efforts to publicly disseminate long series covering areas such as credit, policy rates, inflation or property prices. The last addition was in 2024, when data on the total assets of the more than 50 central banks worldwide were published, most of them going back to the date of the central banks' establishment. This new data set provides historical insights that are particularly valuable to understand today's policy questions, for instance in terms of quantitative easing/tightening policies and interest rate controls.

Such BIS work has also underlined the **importance of developing in-depth methodological expertise** on, for instance, past changes in accounting treatments and the assessment of missing data points. In particular, creating time-consistent historical series calls for having a very meticulous approach to access archived information on ancient monetary operations, as illustrated by the Bank of France project to build a continuous series of its balance sheet over 223 years. Missing data, especially for war periods, were reconstructed by analysing archival records and replicating the original compilation methods. Similarly, the Bank of England has conducted extensive archival research to reveal operations hidden in its published balance sheet figures, starting from 1696. The focus was directed particularly towards off-balance sheet activities, including those undertaken during World War I.

4. Second objective: leveraging new data techniques

Expanded toolkit for statisticians…

After various decades of profound transformations, **central banks are adopting innovative data techniques to support their activities**, supported by large investments in IT and staff. This is in recognition of the various opportunities offered by new data science tools spanning big data analytics to AI/ML-based approaches (IFC (2025b)). Experience suggests that these tools appear well suited for processing non-traditional, unstructured data – such as text and images – as well as for capturing

non-linearities. In particular, ML techniques using neural networks have been found to fare better than traditional models when dealing with large-scale multivariate data sets. A key feature is their ability to compress the dimensionality of the data into compact representations before reconstructing the original input (Doersch (2021)). Recent ECB work on entity-level banks' balance sheet data, for instance, shows that, in comparison with more traditional econometric approaches, these models perform well in capturing complex temporal dependencies and high-dimensional patterns. Moreover, the integration of explainable AI techniques like Shapley Additive exPlanations (SHAP) values ensures that detected anomalies can be adequately interpreted (Lundberg and Lee (2017)).

AI/ML applications are also transforming data processing for statistical production, bringing unprecedented speed and accuracy. One widespread case relates to statistical quality processes, especially for detecting anomalies. There are numerous robust, off-the-shelf models that can be used in a cost-effective way for real-time validation of massive data sets whose accuracy would be impossible to verify manually. For example, the Bank of Thailand's regulatory data transformation project processes over 25 million records monthly using various ML-based outlier detection techniques (eg isolation forest). Similarly, the Central Bank of Malaysia has leveraged supervised learning models such as a Light Gradient Boosting Machine (LightGBM)[14] that can automatically identify irregular patterns in large, complex data sets without requiring extensive manual labelling.

However, to obtain reliable material, **vast amounts of high-quality inputs are typically needed to feed the new models and mitigate the risk of faulty output** (the so-called "garbage in, garbage out" phenomenon). High computational power is also often required, which can be costly and complex to set up. Cloud services could be one solution, but their use may remain constrained by security and sovereignty concerns. The "black box" nature of the new tools is a further caveat, especially for central banks willing to explain and communicate their policy decisions based on well-understood evidence. Moreover, stochastic models have proven to perform well in terms of interpretability and theoretical foundation (Ruggeri et al (2025)).

This calls for adopting complementary approaches, with adequate methodological guidance. In the context of nowcasting, for instance, ML algorithms excel at processing high-frequency alternative data, while traditional econometric models thus far remain crucial for understanding causal relationships and ensuring the interpretability of results. In practice, the choice of a given data technique will therefore often depend on the type of application and the characteristics of the underlying data (Desai (2023)), and more traditional approaches can continue to be preferred depending on the use cases. State-of-the-art probability surveys are one telling example, since they benefit from extensive past use among official statisticians. They continue in practice to support various specific exercises, by providing a well-designed framework for collecting data in a parsimonious and unbiased way compared with non-probability data samples (Beaumont (2020), Ricciato (2022), Holmberg (2025)). Illustrating this point, the Reserve Bank of New Zealand has recently developed a Business Expectations Survey to get high-frequency insights

[14] Other popular models include random forests, decision trees, Adaptative Boosting, the Ridge Classifier, logistic regression and the Support Vector Machine.

into economic expectations, using a three-pronged approach focusing on households, businesses and experts such as professional forecasters.

…with new prospects offered by generative AI

A **key innovation relates to generative AI**, which can produce human-like multi-format content, especially text, by learning patterns from vast amounts of existing information. In particular, large language models (LLMs) constitute a distinct class of generative AI systems trained on vast textual data sets to generate human-like outputs. They can support analytical tasks by summarising content, assisting in coding, drafting and translating – possibly freeing human resources for developing new, higher-value activities (Korinek (2024), IFC (2025b)). As a recent example, the Central Bank of Malaysia has been using generative AI to strengthen typical workflows such as data queries, transformations and visualisations.

One **important field for central bank statisticians relates to computer programming**, which represents the backbone of many of their processes. For instance, generative AI has proved particularly useful for various automation tasks, with specialised models and co-pilots that automatically generate codes, help with debugging, generalise scripts and document them for enhanced understanding (UNECE (2023a)). Achieving high-quality computing work requiring minimal manual correction is also facilitated by AI-powered translators (such as systems like the "SAS to R Transcompiler") that can effectively convert legacy codes from proprietary statistical software to open source programming languages.

Perhaps more fundamentally, **generative AI has the potential to transform the entire statistical production chain**, for instance by streamlining and automatising routine tasks, summarising information, generating analytical reports and reducing manual interventions and risks of errors. The SDMX Metadata AI Assistant (MAIA) by the BIS shows for example that this can greatly improve metadata editing processes, which are traditionally time-consuming and labour-intensive, by, for example, supporting the automatic application of capitalisation rules, ensuring the correct spelling of institution names, performing comprehensive formatting cleanups and checking for grammar and syntax errors.[15] More generally, LLM-based automation can enhance the consistency and accuracy of statistical data sets as well as improve statistical classification tasks (UNECE (2025c)).

Extraction of policy-relevant insights

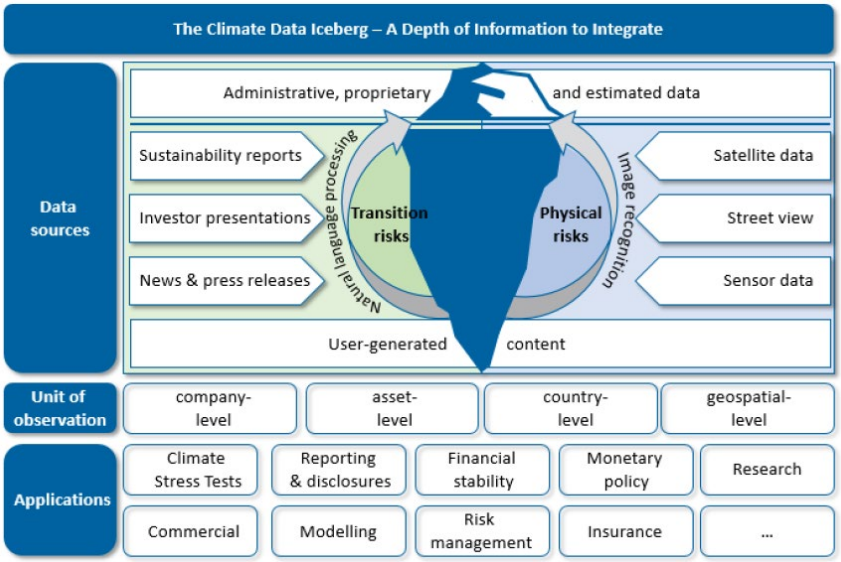
A core concern for central bank statisticians is how to transform raw data inputs into meaningful information, particularly for policy users. Innovative data techniques can support them in two ways: to address information gaps when available indicators are scarce; and to extract relevant signals from data that are either too complex, noisy or overwhelmingly large to be analysed manually.

On the one hand, **AI techniques can be particularly useful to gain quicker and deeper insights as well as fill information gaps**. One key aspect is their ability to use alternative sources to answer user needs more rapidly, eg when the data are

[15] This Python-based, open source tool is available on sdmx.io.

available only with significant lags. For instance, the Labor Market Intelligence System by Bangko Sentral ng Pilipinas leverages online job postings to address publication lags in official labour statistics, enabling real-time monitoring of job markets and supporting nowcasting or short-term forecasts of unemployment. Innovative models can also help compile new indicators. In particular, natural language queries allow for extracting insights from extensive textual databases that were previously almost impossible to translate into actionable synthetic indicators. A telling example relates to climate change, an area where central banks often face a data iceberg comprising vast amounts of information hidden in sources like corporate sustainability reports and satellite imagery (Graph 1). LLMs can help to measure greenhouse gas (GHG) emissions with great granularity, set up detailed physical risk assessments at precise geographic levels and monitor policies. Such enhanced capabilities can therefore support more robust climate risk analyses that can be essential for financial stability assessments.

The climate data iceberg: making sense of vast and complex information Graph 1



Source: H Doll, E Kormanyos, S Walter and G Werb, "The climate data iceberg – a depth of information to integrate", *IFC Bulletin*, no 66, February 2026.

On the other hand, **innovative data techniques help make sense of the avalanche of data characterising today's societies**. They can be effectively used to transform complex and vast amounts of information into parsimonious indicators, for instance by capturing patterns in large data sets and detecting signals that would be hard to extract manually – allowing statisticians to "see the forest as well as the trees within it" (Borio (2013)). These features are particularly important for designing early warning systems that are crucially needed to support financial stability analyses. As an example, the Bank of Israel has set up a "two-dimensional sentiment" framework combining entity recognition with sentiment analysis to analyse the real estate market. The methodology involves identifying relevant stakeholders, including construction companies, investors and mortgage borrowers, while extracting their sentiments towards topics such as housing demand, supply, policies and interest rates. Advanced pattern recognition systems can also help uncover previously hidden

relationships in financial market data. For instance, research conducted by the Bank of Japan using transactional-level single-name credit default swap (CDS) contracts enables a better analysis of the role of market participants in affecting pricing dynamics and the impact of market conditions.

5. Third objective: enhanced statistical methodologies

New statistical approaches are needed

Central bank statisticians continue to face important priorities in terms of "traditional" statistical work, **calling for further refinements in methodologies and standards, new data collections and improved data management processes**. One priority is to ensure the relevance and adequacy of the measurement of a rapidly changing financial and economic system. Primary examples include capturing the increasing digitalisation of financial services – which often complicates oversight of interconnected markets and payments – as well as globalisation – which spans multiple intermediaries, regulatory frameworks and borders.

These **multidimensional challenges can reveal blind spots and render long-standing indicators inadequate for policy formulation, monitoring and assessment**. For one, the expansion and innovation of financial markets as well as of payment systems – in terms of activities, participants and technologies – may weaken the representativeness of conventional economic statistics, hiding emerging vulnerabilities and risks. Another difficulty is that most current issues are global, often reducing the scope of decisions made by national authorities unless they are coordinated internationally. For example, global value chains (GVCs), multinational enterprises (MNEs) and transnational financing networks – typically related to worldwide corporate fiscal strategies[16] and the transfer of (intangible) assets – are increasingly exposing blind spots in national data-reporting exercises (Tissot (2016)). They can also trigger significant distortions in macroeconomic aggregates such as in small open economies, as seen with the 2015 "Irish case" (OECD (2016)). More broadly, the unfolding of the current global "polycrisis" – ie where geopolitical, environmental, social and technological crises interact (Lawrence et al (2024)) – may test the boundaries of existing statistical frameworks that are conceptually split across siloed domains and national borders and, in turn, may fail to comprehensively capture complex phenomena such as well-being, inclusiveness and sustainability.[17]

These gaps are particularly significant in external sector statistics, an area of great interest for central banks as both data producers and users. In practice, they often hinder any comprehensive measurement of the various developments with a global nature, for instance regarding economic activity, financial services or climate change issues (Diz Dias et al (2025)). For instance, growing bilateral asymmetries in cross-border statistics may challenge the overall quality of balance of payments (BoP)

[16] Eg base erosion and profit shifting (BEPS) strategies (OECD (2025a)).

[17] Case in point, increased attention has been paid to address the limitations of as well as over-reliance on indicators such as GDP (cf the "beyond GDP" initiative); see MacFeely (2025), UN HLEG (2025) and UNSC (2026a).

and international investment position (IIP) data. Furthermore, the growing complexity and globalisation of the financial system – accompanied by a proliferation of special purpose entities (SPEs) and captive financial institutions (CFIs) – continue to pose a number of compilation challenges, including regarding the treatment of royalties and licensing services, intellectual property products (IPPs) and merchanting activities.[18] This may, in turn, make economic analyses and financial stability risk assessments even more complex.

Implementing, maintaining and updating international statistical standards

Fortunately, the **international community has been actively addressing the most pressing statistical methodological issues**. One milestone was reached in 2025 with the publication of the new Integrated Balance of Payments and International Investment Position Manual (BPM7) and revised System of National Accounts (2025 SNA), with a key global priority over the coming years being their implementation supported by the provision of practical guidance (UNSC (2025a)). Another breakthrough was the release of the fifth edition of the Organisation for Economic Co-operation and Development (OECD) *Benchmark Definition of Foreign Direct Investment* (FDI), which introduces new and revised indicators to enhance FDI statistics (OECD (2025b)). Work is being undertaken in parallel to update other major international standards and guidelines, such as the IMF *Monetary and Financial Statistics Manual and Compilation Guide*, the *Government Finance Statistics Manual* and the System of Environmental-Economic Accounting (SEEA) Central Framework.

Advancing methodologies has been an essential step to further improve the coherence, consistency, comparability and overall relevance of official statistics, in turn ensuring adequate informing of policies both within and across countries. For instance, important progress is being made to enhance the actual compilation of from-whom-to-whom (FWTW) tables to complement traditional financial accounts with a detailed picture of creditor and debtor sectors by financial instruments, allowing for better analysis of intersectoral linkages. As illustrated by the National Bank of the Republic of North Macedonia, such FWTW information requires integrating multiple data sources (eg loan-by-loan reports, trade credit investments, funds' activities) and drawing from different reporting systems. More generally, the revised manuals have introduced important methodological enhancements along a broad spectrum of topics, ranging from digitalisation to well-being and sustainability (Annex A).

Looking forward, more efforts are warranted to adequately implement the updated standards, requiring global coordination, resources and careful planning with an overarching strategy (UNSC (2025b)). A gradual approach has been devised to this end, with the identification of specific phases related to preparation, capacity building, data collection, stakeholder engagement and full adoption of the standards. Perhaps more fundamentally, the international community is also rethinking how to maintain and update the various international statistics standards (ISS), reflecting the

[18] This is because they involve purchasing goods from one country and selling them to another without the goods entering or leaving the SPE's host country (Tunç and Tissot (2017)).

need for better alignment and clarification of their related manuals, compilation guides and handbooks (UNSC (2026b)).

Moreover, existing **statistical standards may need to be continually revisited** – on an ongoing basis, whenever possible, rather than through periodic yet infrequent revision exercises – to secure their relevance as the world constantly changes. From this perspective, the revised manuals represent a key opportunity to stimulate new research areas, as illustrated by the ongoing ECB initiative related to SPEs[19] that aims to facilitate the implementation of harmonised definitions across euro area countries and has already led to specific data releases. Similarly, De Nederlandsche Bank has explored new approaches to assess the complete investor risk exposure, noting the shortcomings of focusing only on direct holdings. Among the various related methodologies, the *look-through* approach can help calculate indirect portfolio positions held via investment funds using available information from supervisory reports. Another aspect especially important for central banks will be the measurement of crypto assets, which – despite the guidance provided by the 2025 SNA/BPM7[20] – may create unexpected practical difficulties and in particular inconsistencies across countries, as argued in recent research by the Bank of Japan. Lastly, the completion of DGI-3 will allow for further progress on sustainability issues, for instance regarding the development of more comparable taxonomies for green financial instruments.

6. Fourth objective: making data available and transparent

Enhancing data accessibility

Central banks have been publicly disseminating more data over recent decades, in the context of both their statistical[21] and policy functions – for instance by publishing background information on monetary policy meetings.

Greater data dissemination presents many benefits. Public transparency allows for reduced information asymmetries across economic agents, as well as a better general understanding of policy decisions and monitoring of their impact. Reflecting this, important efforts have been made by central banks to make their statistics openly accessible, usable and shareable ("open data") – initiatives which are becoming increasingly strategic in the context of AI readiness (UNSC (2026c)). These initiatives have been encouraged and accompanied by major international organisations, for instance in the context of the IMF Special Data Dissemination

[19] SPEs are defined as formally registered and incorporated legal entities recognised as institutional units and resident in an economy, with no or little employment (maximum of five employees), minimal physical presence and limited physical production in the host economy.

[20] Fungible crypto assets without a corresponding liability are treated as non-produced non-financial assets recorded in a separate category, while crypto assets with a corresponding liability are treated as financial assets. Ongoing efforts are being undertaken at the international level to provide compilation guidance on crypto assets (AEG (2025)).

[21] Eg the expansion in statistics compiled by central banks related to financial accounts (IFC (2020)), external statistics (IFC (2024b)) and sustainable finance (IFC (2022, 2025c)).

Standard (SDDS), the UN Sustainable Developments Goals (SDGs), the DGI and various BIS/IFC initiatives.[22] A recent example is the proposal to improve global debt data availability and quality in the context of the World Bank's Debtor Reporting System (DRS), established in 1951 to collect loan-level external debt data for assessing countries' creditworthiness and economic management. The scope of this exercise has already widened significantly to encompass non-guaranteed private sector debt, complex restructuring instruments and non-traditional creditors. Further efforts are underway to update the DRS in response to the evolving international financial landscape, improve creditor-debtor data reconciliation and align its methodology with the recently revised SNA/BPM standards.

Fully fledged statistical communication

Central banks are increasingly aware that **statistical communication is an essential aspect of the data lifecycle**, especially for making the most of the value of the statistics they produce (UNECE (2018), IFC (2024c)). It helps to ensure that the disseminated data reach their target audience without any ambiguities and misrepresentation, in turn better supporting policies and higher-quality public discourse. For instance, research by the Central Bank of Armenia illustrates how adequate communication on inflation developments can help shape individual perceptions and expectations on prices and ensure better alignment with the inflation target.

As a result, **communication strategies have undergone a fundamental shift**, from focusing on traditional disclosure practices to more sophisticated approaches using advanced analytical techniques and visualisation technologies targeting multiple stakeholders – with a duly segmented approach across policymakers, businesses, journalists, researchers and the general public (IFC (2023a)). This calls for using a broad range of channels to support statistical communication, including not only traditional engagement approaches (eg press releases, newsletters, outreach events) but also dedicated institutional websites, data portals and social media to better engage with users. Perhaps more fundamentally, as automated systems – including AI-based systems – are increasingly becoming top consumers of official data, the development of robust application programming interfaces (APIs) has become an essential aspect of modern statistical data dissemination, by enabling real-time access to different data sets and providing better accessibility, security and integration capabilities. Illustrating this point, a recent project at the Central Bank of Chile aims to develop a free and open source Python library that allows for a simple and standardised way to access the central bank's data in ready-to-use formats as well as more sophisticated functions providing additional data transformation features.

Yet, although recent experience shows a general trend towards making data more available, **progress is often gradual, suggesting that a more structured and cautious approach may be warranted**. To start with, proper data validation rules and documentation should be in place before releasing data to the public (Annex B). A second important point, underscored by the Working Group on Statistical

[22] For example, see Tissot (2022) and IFC (2025d).

Communication of the European System of Central Banks (ESCB), is to ensure that the target audience has sufficient statistical literacy, a concept that can be understood as "*the ability to interpret and critically evaluate statistical information and data-related arguments encountered in diverse contexts of daily life*".

Lastly, **communication coordination between central banks and other data providers can reap many benefits**. First, within the public official data ecosystem, fostering alignment in communication is becoming increasingly strategic. This is essential not only to ensure accurate interpretation of standard reference statistics but also to prevent their misuse. Such collaborative efforts are also particularly crucial as user demands grow more multidimensional, in turn making data communication more complex. To address this issue, the revised 2025 SNA and BPM7 provide – for the first time – guidance on communication strategies for official statistics providers, including central banks, NSOs and international organisations.[23] Second, turning to private actors, tech firms may have high-performing technological infrastructures, analytical capabilities and financial resources that can help develop and maintain sophisticated data-generating systems, with important opportunities, not least to enhance data transparency and timeliness (Martin and Fu (2025)). Relatedly, public-private partnerships can be explored when official data are missing, including through dedicated arrangements such as data commons and collaboratives (Verhulst et al (2019), Bartolomucci and Bresolin (2025)). For example, Bank Indonesia has been able to access private data created as a by-product of digital services under a comprehensive data partnership arrangement. A similar use case is the integration of data from mobile phone companies into BoP by the Bank of Italy. Another example relates to corporate sustainability activities in Spain, where the creation of common green data spaces with integrated registers for pollutant and emissions data has proved useful for supporting the central bank data work.

However, **establishing public-private partnerships for producing statistics may face a number of challenges** (IFC (2021)). A key one relates to the volatility of the data sources being considered, which can become obsolete and/or be discontinued without advance warning (Braaksma and Zeelenberg (2015)). A telling example was during the Covid-19 pandemic, when statisticians had to rely on freely available yet privately owned indicators to cope with major disruptions in the traditional public data supply (de Beer and Tissot (2020)). While this proved particularly useful at the time, one clear lesson worldwide has been that access to privately held information can be difficult, costly and risky.[24] In addition, the expertise needed to conduct often time-consuming and resource-intensive individual negotiations for accessing private data sets should not be underestimated. Lastly,

[23] See the newly introduced chapters 21 and 20 of the 2025 SNA and BPM7, respectively.

[24] Eg the typical risk of sudden discontinuation of the data, such as in the case of the Apple COVID-19 mobility trends reports, that were no longer publicly available after April 2022; see Finazzi (2023). Another example may be related to the unexpected limitation of services by third-party platforms, such as the ones observed after the change in terms and conditions of the X (formerly Twitter) API in 2023. More broadly, one key issue is that access to information by private sources – typically regulated through freedom of information laws – is not acknowledged as a legal right in most jurisdictions, unlike access to information held by public authorities. This may pose a notable issue when private information is officially used for policy purposes, such as in the case of climate change (UNCCC (2025)).

success will also depend on the active involvement of private data providers, in terms of methodological compliance and adequate disclosure of metadata information.[25]

7. Fifth objective: modern IT infrastructures to integrate new data and tools

From legacy systems to innovative and adequately governed data solutions

Central banks are fully aware that technology investments can yield significant long-term benefits, including by reducing manual intervention, enhancing computational capabilities and boosting overall productivity. This calls for **developing agile, scalable, secure and robust IT architectures**, not least to flexibly answer unforeseen user needs, address larger data work, adequately protect confidential data and, perhaps more significantly, safeguard overall data quality (Araujo et al (2025)). The overall objective is to have a comprehensive approach covering the entire data life cycle, from collection to dissemination, and the ability to integrate various information sources and techniques.

Yet, in practice, **statisticians often deal with legacy systems** characterised by limited scalability, siloed databases and overnight batch processing.[26] As a result, central banks have been developing a hybrid approach, allowing for the combination of traditional methods with innovative ones that are arguably better suited to handle the vast and complex amount of information at their disposal.[27] In practice, the modernisation of statistical IT systems will therefore typically address three main goals in parallel: (i) maintaining/strengthening well-tested traditional statistical capabilities as a core foundation; (ii) developing selective AI/ML capabilities focused on areas where these techniques provide clear advantages; and (iii) investing in hybrid methodologies and systems that combine the strengths of both approaches. One merit of such a progressive approach could also be to make available isolated development and testing environments, eg in the form of a "sandbox", enabling safe exploration with new tools and data sources without compromising production systems.

More generally, experience suggests that **sound data governance**, **management and stewardship can be instrumental to making the most of innovation** (Annex C). On the one hand, data governance – intended as a system of decision rights and accountabilities for the management of data – ensures that data assets are adequately gathered, stored, processed, shared and protected across the

[25] Eg the case of a US online real estate company, whose data are used by the Board of Governors of the US Federal Reserve System for official statistical purposes (Hume McIntosh (2021)).

[26] One such example is central banks' extensive use of legacy software for handling traditional time series products (IFC (2023b)).

[27] Like central banks, many NSOs and international organisations have undertaken similar modernisation projects, for example by moving towards open source technologies (UNECE (2023b, 2025d)) and adopting new data dissemination platforms (see recent projects by eg the BIS, IMF, OECD and United Nations).

organisation (IFC (2021), DAMA International (2017)). The widespread attention on data governance – especially at the global level – has been accentuated by the need to address pressing emerging issues, such as those posed by AI and various digital threats (eg cyber security and confidentiality protection risks). On the other hand, data stewardship ensures that data are governed to benefit the entire community of users (UNECE (2024)). This is particularly strategic nowadays, as the increasingly competitive data ecosystem is blurring boundaries between authoritative and non-authoritative sources, pushing public organisations such as NSOs and central banks to rethink their roles as data producers, curators and users. In any case, both sound data governance and stewardship require dedicated teams for managing and curating data (Križman and Tissot (2022)). They also call for an organisational and cross-functional approach to data beyond the statistical function, involving data owners, IT and subject matter experts as well as operational and communication functions.

Integrating data from multiple sources

A key requirement of new IT systems is the ability to integrate multiple data sets from various sources, types and formats (IFC (2025e)). This underscores the essential role of data integration in improving the quality of central bank statistics by leveraging various inputs. For example, the experience of Banco de Portugal is that cross-validation mechanisms for BoP data with national financial accounts figures can lead to more robust quality controls, helping to identify inconsistencies across instruments and time. For instance, they allow for combining data on new loans and credit to identify changes in housing liabilities. Similarly, the Reserve Bank of India has set up a new Centralised Information Management System (CIMS) that covers the entire data life cycle (eg from collection to processing, storage, standardised reporting, dissemination and analytics) and includes major features, such as automated data transmission, SDMX-driven data management and big data open source technology, as well as robust governance rules. A key objective is to facilitate the management of complex data flows from multiple sources, enhance quality assurance capabilities and offer advanced analytical processes in a cost-effective way.

Integration also offers a solution to address information gaps, helping to balance growing data demands with the need to cope with strained statistical resources and reduce reporting burden. Case in point are climate-related statistics, which are characterised by significant shortcomings, particularly in terms of availability and global consistency. As illustrated by a recent initiative by the Bank of Spain's Central Balance Sheet Data Office, such gaps can be mitigated by developing alternative data solutions through institutional collaboration, for instance by using econometric models to estimate corporate carbon footprints, integrating voluntary sustainability indicators into small and medium-sized enterprises (SMEs) annual filings and extracting environmental insights from existing financial statements. Another project relates to the Spanish Fintech Observatory to better analyse fintech credit activity by combining multiple data sources, including a census of resident fintech companies, national accounts information and specialised data collected from crowd-lending platforms. In a similar vein, the setup of a new database in Luxembourg for captive financial institutions combines information from the Eurostat EuroGroups Register and local registers of business entities and corporate balance

sheets to better track investment patterns and enhance the understanding of the activities of complex intermediaries that operate across multiple jurisdictions.

Third, **data integration can make statistical processes more effective and efficient**, for instance by improving timeliness, reducing manual workflows and using analytical capabilities more effectively. For example, Bank Al-Maghrib has developed a comprehensive system to integrate data from various sources, including credit and payment account registers, bank accounts, corporate financial statements and debt securities. This setup allows for the provision of more rapid and comprehensive insights on the indebtedness of economic agents and payment difficulties, in turn supporting risk monitoring exercises. It also proved particularly helpful to support public policies during the Covid-19 pandemic, helping authorities to rapidly assess sectoral financing needs and cash flow problems and develop adequate responses such as refinancing programmes for SMEs.

Yet, to be fully effective, **data integration requires a move from fragmented data systems to comprehensive information platforms with advanced capabilities**. This requirement is illustrated by Bank Indonesia's BI-ANTASENA project for integrated regulatory reporting, which relies on a single platform consolidating various existing systems. Sophisticated techniques were needed to process granular data and perform record linkage operations across multiple data sources, for instance to resolve entity ambiguity issues and account for different data formats. Similarly, state-of-the-art name-matching and grouping algorithms have proved essential for maintaining a comprehensive security-by-security database and avoiding double-counting (Pérez et al (2017)).

Developing modern data architectures

Turning to the **main features underpinning modern data architectures**, central banks' experience thus far suggests focusing on six distinct layers.[28] The first one, *data collection*, represents a comprehensive intake mechanism for the entire architecture, by systematically gathering information from different sources, types and formats. The second layer, *transformation and integration*, aims to ensure data quality and usability through integration[29] and validation[30] processes. The third, fourth and fifth layers relate, respectively, to *storage and repository* (ie to systematically organise the data),[31] *processing and analytics* (ie to transform the data into information through statistical techniques) and *access and privacy* (ie to support analytical capacity while adequately protecting the data). The final layer, *dissemination and interface*, allows

[28] See existing international statistical data architectures, such as the Common Statistical Data Architecture (CSDA) and the Common Statistical Production Architecture (CSPA), and the ongoing work to update them into a new Statistical Architecture Framework in the context of the UNECE High-Level Group for the Modernisation of Official Statistics.

[29] Common approaches include ETL (extract, transform and load) and ELT (extract, load and transform); see IFC (2025e).

[30] These may cover schema validation (ie check that the data adhere to a specified structure and format) and business rules validation (ie check logical consistency, editing and imputation rules).

[31] Options include relational databases, NoSQL and Hadoop-based systems (often for large-scale unstructured data sets) or data lakes for flexible schema-on-read capabilities. Storage solutions can be hosted on-premises or externally (ie cloud).

releasing the data, including through visualisation, analytics and business intelligence tools (IFC (2019)). Other important features include the provision of real-time capabilities, automated report generation systems, APIs and data portals. This layer should also support micro data access facilities, for example through secure terminals (IFC (2025d)).

The adequate design of the above layers can be **instrumental in making the IT architecture both robust and secure**. It will in particular allow for implementing a holistic governance framework comprising role-based access control mechanisms (ensuring that sensitive information is accessible only to authorised persons) and quality assurance mechanisms that are essential for maintaining public trust in the information being produced and used by central banks.

8. Sixth objective: enhancing cooperation while safe-guarding central banks' statistical role

Cooperating with and through data

International data exchange plays a fundamental role in central bank statistics. One historical reason has been addressing the scarcity of cross-country comparable data for policy, a task that the League of Nations, founded in 1920, began to deal with. The establishment of the BIS a decade later further institutionalised central bank data cooperation, not least to address the "statistical fog" caused by the growing importance of international gross capital flows and, broadly, financial developments (BIS (1934), Clement (2004), Borio et al (2009)).[32] Such structured international exchanges still offer considerable benefits nowadays, and even more so in the context of the ongoing data revolution (IFC (2015, 2023c)). For instance, they can help address large asymmetries appearing in bilateral euro area-US current account data – an issue of particular importance given today's focus on external imbalances across countries (Pastoris and Schmitz (2020, 2025)). Similarly, the trilateral country comparison exercise for BoP/IIP data involving Austria, Italy and Spain and recently coordinated by the ECB has helped address inconsistencies and define reconciliation methods.[33]

Over time, such structured exchanges have expanded beyond central banks to include other relevant stakeholders within the broad data ecosystem. First, within the NSS, central banks have long-standing relationships with NSOs, for example to compile financial accounts and external statistics (UNECE (2020)). A tangible initiative in this regard is the European Network of Multinational Enterprise Coordinators (MNEnet), established in 2021 to strengthen cooperation with regard to the treatment of MNEs. Second, sharing arrangements are increasingly including participants beyond the NSS, such as international organisations and regulators (eg

[32] In parallel to BIS efforts, the collection and publication of central bank data have been also strengthened by the international statistical cooperation frameworks developed by the IMF and the UN after World War II.

[33] Cf the related establishment of the FDI Asymmetry Resolution Mechanism (FDI ARM) and the Asymmetry Resolution Mechanism for Trade in Services (ITSS ARM), launched in 2022 to address the most important asymmetries among EU member states' data.

financial supervisory authorities (IFC (2023c)).[34] Third, and more recently, they have also involved academia and private actors, a trend that reflects both central banks' awareness of the benefits their (often granular) data can provide to researchers and the growing relevance of data acquisition programmes (especially from commercial providers) to support statistical compilation exercises.

Looking ahead, experience thus far suggests at least three focus points. First, from a governance perspective, there is a need to deliver practical guidance on the form of sharing agreements, often depending on the type, means and goals of the data to be exchanged. Arrangements – typically memoranda of understanding or other more binding legal provisions – should be carefully designed to cover various aspects comprehensively, including in terms of security, confidentiality, sharing, enforceability and institutional safeguards. The development of international assessment frameworks, such as the one developed by the DGI, can be useful and practical in this regard (IMF et al (2025)). Second, on the technical side, specific ways should be found to securely share data while adequately protecting their confidentiality. Efforts are underway to advance privacy-enhancing and privacy-preserving technologies, including secure multiparty computation techniques (Jansen et al (2025)). Such initiatives become increasingly relevant as technology evolves quickly and raises important issues – such as potential quantum-related vulnerabilities to re-identify masked information and bypass encryption techniques (Auer et al (2025)) – that also appear to require further work. Third, and relatedly, all these efforts can build upon and complement existing best practices on exchanging and communicating information on micro-level data – a key objective of the International Network for Exchanging Experience on Statistical Handling of Granular Data (INEXDA) (IFC (2018b)).[35] Specifically, central banks' experience is that anonymised information should be communicated to external parties under clear and robust output control procedures, comprising both automated checking and manual review processes.

Promoting knowledge transfer

Beyond data, **central bank statisticians are increasingly interested in exchanging best practices for the various aspects related to statistics and information management.** Collaborative networks mitigate the risks of fragmented knowledge and duplication of effort, by allowing institutions to learn from each other's experiences, share best practices and co-invest their (limited) resources, particularly in emerging areas such as AI. There is also growing demand for international cooperation to develop common standards and guidelines on broader data and statistical matters. For example, the IFC has developed a dedicated knowledge centre over the past few years to foster the dissemination of best practices and leverage the experience of central banks, with material available both publicly (ie through focused methodological or guidance notes) as well as internally (ie through a secure platform for sharing restricted information among fellow central banks at their own request). A number of central banks have also been developing ad hoc collaborative efforts,

[34] See Tissot (2017) for the specific experience on data sharing developed under the BIS's auspices.

[35] Especially its Statistical Disclosure Control Working Group established in 2023.

for example to foster cross-border exchange of data and methodological practices, with the ultimate purpose of improving statistical quality.[36]

More generally, **a number of ambitious international initiatives** are underway to deliver solutions that facilitate cross-sector and cross-border exchanges in the global statistical community. For instance, the OECD has developed guidance related to the "data openness continuum" that can foster access to and sharing of data sets and AI tools (OECD (2021, 2025c)). Attention is also increasingly being paid to setting up adequate data governance structures at the global level, including through standardised terminologies, knowledge-sharing mechanisms and collaborative repositories (UN CEB (2024), MacFeely et al (2025), UNSC (2026d)).

Another key area relates to **AI, whose emergence and fast-paced adoption have hastened the need for international cooperation** (BIS (2024), IFC (2025b)). Knowledge exchange can be effectively spurred on by the formation of various communities of practice and expert networks aiming to drive innovation in a harmonised way, with a focus on practical applications and strategic issues. The Network of Experts in Machine Learning established within the ESCB exemplifies this collaborative trend with the exchange of concrete use cases among national central banks. Similarly, the UNECE High-Level Group for the Modernisation of Official Statistics (HLG-MOS) plays a pivotal role as an international platform to exchange experiences and lessons learned in the various facets related to innovation in official statistics. Perhaps more fundamentally, there is a growing recognition of the strategic need for robust international knowledge exchange among all relevant stakeholders in the broader data ecosystem. This is particularly important for advancing issues such as AI readiness, which typically may demand a globally coordinated dialogue with private sector counterparts, such as big tech companies (UNSC (2025c)).

Safeguarding central banks' statistical role in the evolving information ecosystem

While the ongoing data revolution calls for more cooperation in the data ecosystem, it also highlights the decisive role played by central banks through their statistical function in providing high-quality and factual-based economic and financial reference information.

The starting point is that **central banks have been increasingly committed to ensuring the quality of their data and statistics, including in terms of independence**. This institutional feature is particularly crucial to their mandate for compiling official statistics: it represents a fundamental pillar of accountability, as professional independence and sound ethical practices are warranted to ensure that the evidence produced and used to inform policies is impartial, objective, transparent and relevant (Mann (2025)). Not surprisingly, this aspect is formally enshrined in widely recognised standards endorsed by the official statistics community, such as the UN Fundamental Principles of Official Statistics, the Principles Governing

[36] Eg the recent establishment of an informal network among various central banks of Portuguese-speaking countries to exchange best practices in the domain of external statistics.

International Statistical Activities[37] and the European Statistical Code of Practice (Schubert (2020)). These not only guarantee that statistics are produced and disseminated free from any interference; they also (re)affirm that the professional independence of compilers and their adherence to undisputed scientific and ethical standards is a core pillar of any high-quality statistical information in today's world.

Yet the transformative changes over the past few years, particularly with the data revolution and the growing complexity of the policy landscape, **can raise a number of broader quality and ethical issues**. First, with multidimensional policy issues increasingly being addressed, there could be a tendency to use *any* available data for *any* purpose. However, not all data will be adequately suited for statistical purposes, since this will typically depend on their actual design, provenance and overall quality. For instance, the use of administrative or private data can lead to ethical concerns – such as impartiality – when used for official statistics (Ljones (2011)). Second, as data ecosystems are constantly evolving, traditional boundaries (eg between authoritative and non-authoritative sources) become increasingly blurred, in contrast to well-defined, traditional statistical institutional frameworks. In particular, data ecosystems are now populated by quite different participants, including private entities and quasi-public organisations, each with distinct – and often competing – objectives, interests and practices (Menghinello et al (2020)).

Fortunately, several developments can contribute to safeguarding central bank statistics and their role for the public good. First, there is growing focus on ensuring rigorous quality assurance frameworks to underpin the production of all central bank data, not least to assess their caveats, reliability and impartiality. This calls in particular for having a specific yet adequate treatment of those data used for non-statistical purposes – for instance, by promoting transparency efforts and ensuring the adherence to the International Statistical Institute's (ISI) Declaration on Professional Ethics that aims to guide the wide array of creators and users of statistical data and tools (IFC (2024c)). Second, from an organisational point of view, central banks are increasingly assigning their statistical work to dedicated teams. This can be particularly important to ensure professional independence, ensuring that the data produced are relevant, objective and free of any purposeful bias (IFC (2024c)). Third, from a system-wide perspective, such independence can be formally secured by recognising the entities in central banks producing official statistics as part of the NSS, as recommended by international best practices and with due consideration of national arrangements.[38] Fourth, central bank statisticians have been, together with their counterparts from NSOs and international organisations, actively reflecting on how to develop official data stewardship efforts to support the diffusion of well-established statistical principles and practices in the wider data ecosystem (IFC (2026, forthcoming)).

[37] For example, intergovernmental institutions such as the ECB also committed to these principles; see unstats.un.org.

[38] For example, see UNSD (2025).

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Annex A: Aligning statistical frameworks with today's analytical and policy priorities

The joint release of the revised SNA and BPM7 in 2025 – a *première* since their establishment shortly after World War II – represents a fundamental step forward to align statistical measurements with current priorities and expectations. Building on their previous versions in 2008 (SNA) and 2009 (BPM6) and consistently incorporating the extensive guidance material developed since then to address emerging gaps, the new manuals introduce important enhancements in several areas. A prominent enhancement relates to digitalisation, with further definitions and clarifications of the full spectrum of digital economic activities, including digital platforms and intermediation services, crypto assets, e-commerce, fintech and digital transactions. These advances are of notable interest to central bank statisticians, particularly in light of the ongoing interest in e-money and digital forms of cash (see chapters 22 and 16, respectively, of the 2025 SNA and BPM7).

Another area is the measurement of globalisation, especially the treatment of multinational enterprises and cross-border production arrangements as well as the ownership of international property products (see chapters 23 and 15, respectively). This will in particular allow better harmonisation of indicators on global manufacturing arrangements as well as special purpose entities.

Advancements also span other areas, such as the measurement of Islamic finance, the informal economy, inequalities and well-being. Specifically, a distinctive feature has been to better incorporate the various factors affecting well-being, living standards and the sustainability of economic development – not least in recognition of the well-known limitations of standard national accounting indicators such as GDP. The 2025 SNA addresses these limitations, for instance by highlighting the importance of the net domestic product (NDP) concept as a measure of economic growth that adjusts for depreciation and resource depletion.

Closely related, one important aspect of the new manuals relates to environmental data issues, the measurement of which has become a pressing issue especially since the 2015 Paris Agreement. The revised SNA expands the classification of assets to better account for natural resources, with a "split-asset" approach allowing for distinguishing economic benefits between ownership and extraction rights. Supplementary indicators are being added to measure ESG (environmental, social and governance) in financial accounts and support the analysis of the use of non-renewable energy sources in non-financial accounts. Lastly, a related issue relates to the ongoing work to identify and measure in a harmonised way "green" financial instruments that can support green and climate-related objectives. This issue is particularly relevant for central banks, which have been actively and jointly collaborating on this topic in the context of the IFC, the DGI-3 and other international forums (IFC (2025c)).[39]

[39] Including the international Working Group on Securities Databases (WGSD) tasked after the Great Financial Crisis with improving information on securities markets.

Annex B: A simplified checklist for public data dissemination

Central banks are increasingly willing to make more information available as part of their various statistical, analytical and policy functions. This trend appears to encompass both an expansion in terms of volume (eg publication of new indicators or more detailed breakdowns), types (eg release of micro data) and dissemination formats (eg time series, simplified documentation through dedicated data inventories). However, careful consideration should be given to assess the overall quality and broader governance aspects of the disseminated information, to ensure that it meets user needs adequately and effectively.

Certainly, well-established international guidance is available to guide statistical organisations including central banks. Notable examples include the Fundamental Principles of Official Statistics, the UN National Quality Assurance Framework (NQAF), the IMF Special Data Dissemination Standard (SDDS), the European Statistics Code of Practice and the work of the Committee for the Coordination of Statistical Activities (CCSA). Yet this guidance often remains inherently high level and relates to official statistics, which typically represent only a fraction of the broad information universe disseminated by central banks.

Table B.1 provides a simplified though comprehensive checklist to assess the various operational implications of public data dissemination in terms of staff resources ("People"), data organisation ("Processes") and rules ("Policies").

A practical checklist for public data dissemination in central banks — Table B.1

People	Owner	Who is the owner (department/unit) accountable for this data set?
	Steering committee	Which are the overseeing bodies in charge of the overall strategy (eg governance, risk monitoring, budgetary control and guidance)?
	Steward	Who are the personnel identified for regular management of this data set?
	User	Is the user profile clearly identified (eg policymakers, general public, machines)?
Processes	Communication	Is the communication tailored to targeted audiences (eg journalists, decision-makers, general public)?
		Have measures been taken to communicate data and trends?
	Dissemination	Are vintages regularly released?
	Documentation	Is there proper documentation to review the flow of data across the entire life cycle?
		Are compilation practices documented (eg transformations, validations rules)?
		Is version control used for compiling the data and/or are revisions explained?
		Has the scope for integration with other databases been identified with proper identifiers?
		Are there any other sources of data to check for consistency?
		Have provisions been made for accounting for missing data?
		What are the quality checks in place (eg accuracy, completeness, timeliness)?
	Metadata management	Are well-documented metadata available with details on coverage, sources, definitions etc?

	Relevance	Is the scope of the data well defined (eg to address existing gaps)?
		Are the data unique or do they complement other data sets (eg in terms of granularity/frequency)?
		Is the frequency/granularity/timeliness/punctuality adequate to meet the purpose?
		Are backdated or historical data available and well documented in the data set?
	Standardisation	Have (international) standards been used for compiling, modelling and disseminating the data (eg globally harmonised concepts to ensure cross-country comparability)?
	Storage	How is the data stored and what is the size of the space occupied?
	Backup	At what frequency is the data backup taking place?
Policies	Ethical considerations	Have considerations been made on ethical standards compliance?
		Is use of open source tools as per the organisation's policy?
	Privacy	Has the level of confidentiality been identified? Have proper measures (masking/anonymisation) been taken to protect private data?
	Revision	Is there a revision policy with mechanisms for communicating revisions?
	Risk management and business continuity plan	Is a hierarchy/escalation process defined for unforeseen circumstances?
		Have considerations been made to make data available in case of unforeseen risks?
	Terms of use	Are the data disseminated through well-established licences and/or terms of use/redistribution?

Source: authors' elaboration.

Annex C: A decade of transformations in central banks' data role

In a rapidly evolving landscape, central banks are undergoing transformative changes in how they collect, analyse and use data to inform policy.

Traditionally, they have relied primarily on standard indicators such as surveys, time series and financial statements. Over time, the scope has widened to include large, unstructured and/or granular information from diverse sources such as social media, payment systems and satellite imagery. This expansion requires new capabilities to process, model and extract insights from complex and often real-time data sets. The integration of big data applications, AI/ML-based techniques and more accessible computational power have been instrumental factors in this regard.

These transformative changes have been evident across both advanced and emerging market economies, as illustrated by the case of eight central banks.① In particular, over the last 15 years, these central banks have gradually formalised data management frameworks as a way both to practically unlock new analytical capabilities and strategically recognise data as an asset supporting their various tasks. For example, the growing focus on climate risk has led them to recognise the importance of integrating traditional information sources (eg financial reports) with broader data (including satellite imagery) and new analytical techniques (eg scenario analysis and stress tests) supporting their monetary and financial stability analyses (Nefzi et al (2025)).

The above evolution has been mirrored by a shift in priorities along five key dimensions (Table C.1) and one clear bottom line: central banks increasingly recognise high-quality, standardised and transparent data as a fundamental infrastructure to effective policymaking.

Pillars of data transformations: a retrospective thematic analysis[1] Table C.1

Dimension	2012–15	2022–24	Key shift
Data strategy and governance	Ad hoc management of statistical data; limited mention of data strategy and infrastructure	Frequent references to data governance, information architecture, metadata standards, data lakes and data reporting and dissemination platforms	From siloed to more strategic, organisation-wide governance frameworks
Data collection and standards	Fragmented reporting formats; internal or legacy systems	Widespread adoption of SDMX, XBRL and push for machine-readable reporting and cross-border data harmonisation	From siloed systems to more interoperable solutions
Institutional capabilities	Few mentions of technical teams; statistical functions nested within economics units	Establishment of data science teams and integration of data-driven innovations into organisational workflows	From specialised (with a focus on economic and statistical skills) to multidisciplinary teams incorporating IT knowledge

Decision-making	Reliance on standard macro indicators (eg GDP)	Introduction of experimental and/or composite indicators (eg non-bank intermediation, sustainability issues, digital economy)	From conventional metrics to more ad hoc analytics
IT infrastructure	Back-end-focused IT upgrades; minimal analytics functionality	Investment in cloud platforms, interactive dashboards, data lakes and real-time analytics	From back-office IT structures to (real-time) support systems
Dissemination and communication	Limited data dissemination formats and channels	Increasingly sophisticated data portals, application programming interfaces (APIs), micro data facilities and social media	From generalised releases to more targeted communication and user engagement

[1] Based on the thematic analysis of the annual reports published by the central banks of Chile, euro area, India, Indonesia, Japan, South Africa, United Kingdom and United States for the periods 2012–15 and 2022–24.

Source: authors' elaboration.

Across the eight central banks surveyed, several developments have reflected the increased relevance of data in informing policies in a consistent and harmonised way. In Europe, significant progress has been made through initiatives like the Integrated Reporting Framework (IREF) and the Banks' Integrated Reporting Dictionary (BIRD), both aiming to standardise supervisory and statistical reporting. In India, the central bank has developed the Centralised Information Management System to consolidate data reporting, while the Central Bank of Chile and South African Reserve Bank have built comprehensive data portals to foster open data access. In most cases, ML and real-time analytics have been leveraged to support operations, particularly in areas like nowcasting, fraud detection and climate-related stress testing. These innovations were matched by growing institutional capacity, with many central banks establishing dedicated data governance bodies and interdisciplinary teams to deal with data science projects.