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When old tech beats new tech: Sustainability reporting with XBRL

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Summary

- XBRL speeds up sustainability data extraction, making data up to 10x faster and cheaper to report than extracting from PDFs.

- Emerging markets are leading adoption of digital standards for sustainability disclosure: India mandates XBRL for sustainability reports, while South Africa is moving ahead with voluntary disclosure; most developed markets still rely on PDFs, until at least 2028.

- Digital-first reporting enables sustainability data to reach the market in a fraction of the time it otherwise would, improving the ability of investors to assess what companies are worth, manage material risks and allocate capital accordingly.

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A widely available technology may be key to solving an emerging problem for corporate sustainability disclosure.

XBRL (eXtensible Business Reporting Language) represents a global standard for consistent, comparable reporting of financial information, with the vast majority of companies in major markets required to report in this digital format.

Yet as countries across the world adopt standards for disclosure of sustainability- and climate-related information, the format for such information remains largely left to companies' discretion. The result: Sustainability information remains consigned to PDF files, with no consistent format and no way to extract data efficiently, compounding work for companies that have multiple reporting obligations and delaying the availability of financially relevant information for financial markets.
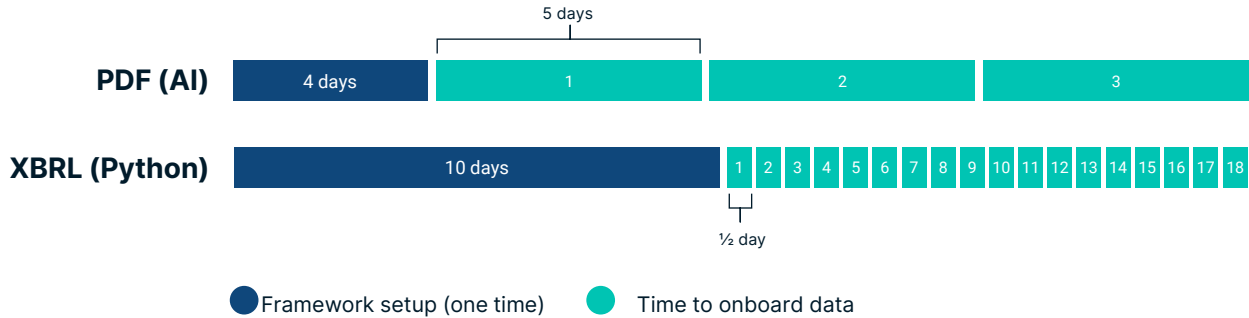
Adoption of XBRL for sustainability reporting would mark a critical evolution in global sustainability norms. Adoption would also allow investors to extract material financial information from sustainability disclosures as much as 10 times faster and at a fraction of the cost of using artificial intelligence to pull unstructured data from PDF files, according to an analysis by the MSCI Sustainability Institute that examined data from XBRL-based sustainability reporting in India.

Though AI shows promise in its ability to read and extract unstructured data from documents, the speed and accuracy with which it can do so lags in comparison and consistency with digital formats such as XBRL, which allows users to process and share their data efficiently by describing it in a structured way. To date, however, India, which has mandated use of XBRL for sustainability reporting, and South Africa, which allows companies to file sustainability disclosures in XBRL voluntarily, remain the only two countries that have implemented the use of machine-readable data for sustainability reporting.[1]

Below we map the digital disclosure landscape for sustainability reporting and highlight how regulators and other stakeholders can encourage a digital-first approach.

Extraction times: PDF vs XBRL

Source: MSCI Sustainability Institute

A mainstay of financial reporting

The use of structured data for financial reporting has become mainstream across global financial centers since the establishment of XBRL for financial reporting in 2000.[2] The U.S., China, the European Union, the U.K., India, Japan, Singapore, South Korea all have instituted XBRL-based financial reporting systems.[3] Taken together, companies representing 84% of global market value reported their data in XBRL, as of December 2024.[4]

Detailed tagging of financial data enables investors to synthesize corporate disclosures rapidly and consistently.[5] Think of XBRL as akin to putting a barcode on each piece of financial data. In a PDF, the information "Revenue: 1,000,000" might appear as simple text and numbers. These are easy for human readers to understand, but there is nothing to flag their meaning for software. In an XBRL report, the 1,000,000 figure is given a machine-readable digital tag that links it with a precise, clearly defined concept (in this example revenue) and enables comparison with equivalent data. Importantly, the tag also carries crucial metadata, such as currency and time period, as well as the information's relationship with other facts.

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Once companies tag data in XBRL it can flow automatically into a range of reports, including sustainability disclosures and annual filings, without the need to reenter the same information in different formats.

Inline XBRL (or iXBRL) is the preferred XBRL format for financial reporting. It presents data in both machine- and human-readable form in a single document, enabling companies to maintain their unique branding, design and layout, and human readers to view the original report as created by the preparer, while also providing embedded XBRL tags that computers can recognize.[6]

Regulators require use of XBRL for a wide range of reports. The U.S. Securities and Exchange Commission, for example, requires the use of XBRL for company financial statements.[7] Companies in the U.K. must file both their tax returns and annual reports in XBRL format.[8] The XBRL-based European

Single Electronic Format is the mandatory reporting format for annual financial reports from companies in EU-regulated markets.[9] Listed companies in China, which in 2004 became the first country to require XBRL for securities filings by public companies, are required to file financial statements in the digital format.[10]

The use of structured data holds similar advantages for sustainability reporting. Not only does the use of data standards such as XBRL save companies time and money, but disclosure in digital formats enables sustainability-related financial information to reach the market in a fraction of the time it otherwise would, improving the ability of investors to assess what companies are worth, manage material risks and allocate capital accordingly.

Sustainability data stuck in the past

As the costs of a warming world rise, regulators are increasingly requiring companies to disclose comprehensive, timely and forward-looking information about sustainability- and climate-related financial risks, as well as climate-focused targets and transition plans.

Yet the use of structured data in sustainability disclosures remains limited. Even as global baselines such as the disclosure standards developed by the International Sustainability Standards Board (ISSB) and frameworks such as the European Union's Corporate Sustainability Reporting Directive (CSRD) take effect, information that regulators require from companies frequently remains largely confined to PDF files. A digital route exists, with ISSB and European ESRS taxonomies already available, but so far regulators have been slow to take advantage of it.

India, which mandates the use of XBRL for reporting under its Business Responsibility and Sustainability Reporting (BRSR) framework, is the only country thus far to have required use of structured data for sustainability reporting. This mandate came into effect in 2024 for data from the 2023 financial year.

In Europe, where many listed companies already use software to submit securities filings in XBRL, the European Commission has hitherto refrained from instituting XBRL-formatted disclosure under the CSRD while it considers its so-called Omnibus package of proposals to scale back and simplify the directive.[11] More broadly, a review of requirements across jurisdictions shows a clear global mismatch between the rolling out of sustainable reporting regulations and sustainable digital reporting capabilities.

Financial reporting
216 implementations

Sustainability reporting
1 implementation
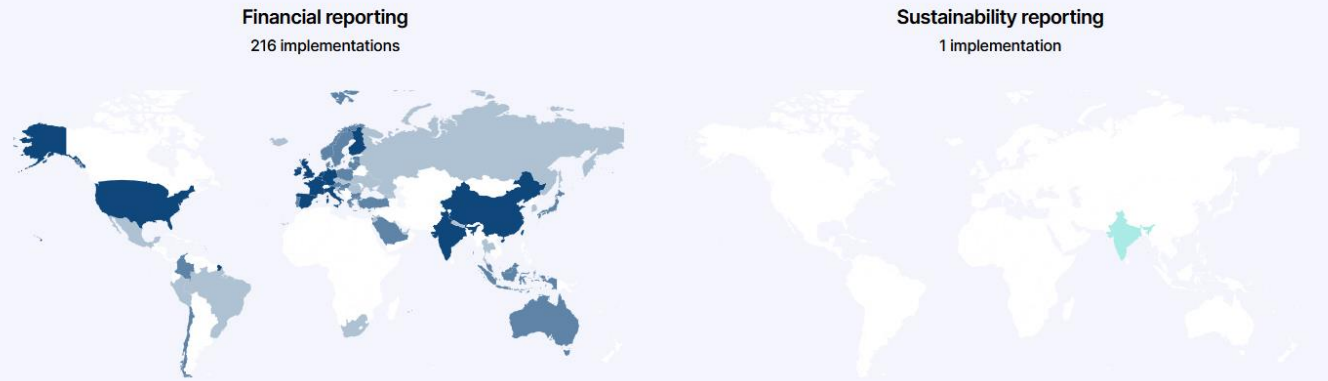
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Table: Comparing jurisdictions' sustainable-reporting regulation with sustainable digital-reporting capabilities

Markets	Sustainable reporting regulation?	Sustainable digital reporting capabilities?
Developed		
Australia	🟢 Yes	🟡 Planned
Canada	🟢 Yes	🔴 No
European Union	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
France	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
Germany	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
Hong Kong	🟢 Yes	🟡 Planned
Japan	🟢 Yes	🟡 Planned
Luxembourg	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
Netherlands	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
New Zealand	🟢 Yes	🔴 No
Singapore	🟢 Yes	🟡 Planned
Switzerland	🟢 Yes	🟡 Planned
United Kingdom	🟡 Forthcoming (expected 2026)	🔴 No
Subnational		
California	🟢 Yes	🟡 Planned
Emerging		
Brazil	🟡 Forthcoming (expected 2026)	🔴 No
Chile	🟢 Yes	🔴 No
China	🟡 Forthcoming (expected 2026)	🔴 No
Hungary	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
India	🟢 Yes	🟢 Yes
Indonesia	🟢 Yes	🔴 No
Malaysia	🟢 Yes	🔴 No
Mexico	🟢 Yes	🔴 No
Philippines	🟡 Forthcoming (expected 2026)	🔴 No
Poland	🟢 Yes	🟡 Planned via EU CSRD/ESRS (expected 2028)
Qatar	🟡 Forthcoming (expected 2026)	🔴 No
Saudi Arabia	🟢 Yes	🔴 No
South Africa	🟢 Yes	🟢 Yes (voluntary)
South Korea	🟡 Forthcoming (expected 2026 or later)	🔴 No
Taiwan	🟢 Yes	🔴 No
Thailand	🟡 Forthcoming (expected 2027)	🔴 No
Turkey	🟢 Yes	🟡 Planned
UAE	🟢 Yes	🔴 No

Source: MSCI Sustainability Institute

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Learnings from India

India stands out for its initiative to make digital sustainability disclosure mainstream. While other countries, including Japan and Turkey, have launched public consultations on proposals for digital disclosure, India is the only country to have mandated XBRL-based sustainability reporting, with companies already reporting.

That's not to suggest the mandate, which covers India's 1,000 largest listed companies, hasn't met with challenges. They include technical hurdles, such as inconsistent labeling by filers, and the need for substantial issuer education. The willingness of the Securities and Exchange Board of India to adjust along the way by refining templates, offering clarifications, and building digital literacy, has helped to maintain momentum.

A comparison of India's XBRL-based sustainability disclosures with AI-driven PDF extractions highlights advantages of the digital format. Early findings from our Institute's analysis of the Indian companies covered by the BRSR mandate suggest that the initial one-time setup for digital onboarding may take twice as long compared with AI-enhanced extraction of the same information from PDF files (See *Extraction times: PDF vs XBRL*). Once in place, however, XBRL-based reporting enables entities to extract and process each new datapoint up to 10 times faster, speeding analysis and actionable insight, while ensuring greater accuracy.

Properties	PDF	XBRL
Data format	Unstructured text, tables, images, scanned data	XML-based, structured
Parsing approach	Extract data using natural-language processing and AI prompt engineering	Extract data using tags with help of Python scripts
Time to onboard data	• One-time AI prompting setup = 4 days • Subsequent datapoint onboarding = 5 days	• One-time setup = 10 days • Subsequent datapoint onboarding = 0.5 day
Cost	~ US $500 for AI large-language model (LLM) application program interface	No cost
Accuracy and reliability	• Variable (depends on LLM model, size, data disclosure, and AI prompt quality) • Probabilistic • Consistent FY attribution • Correct representation of blanks	• High (extracts data as-is based on tag) • Deterministic • Inconsistent financial year (FY) attribution of values (example, 2023 value attributed to 2024 and vice versa) • Can produce incorrect representation of blanks (e.g., data fields that do not apply represented as numeric zero)

Source: MSCI Sustainability Institute

These findings highlight the importance of investment by both governments and companies in systems, training and cross-sector collaboration. The dividends include a more transparent, responsive and investor-friendly sustainability reporting ecosystem.

Note that here we compare the use of XBRL data with AI-driven extraction of unstructured data. But the two are not mutually exclusive. While XBRL-based reporting alone offers clear advantages in speed and accuracy, the most powerful approach will likely be a combination of the two: using digital tagging of data in XBRL to strengthen AI-driven analysis.

Given their larger capital flows and regulatory infrastructures, developed markets might be expected to drive advancement of digital sustainability disclosures. Some are. Japan, for example, has opened a consultation on digital sustainability disclosures.[12] Still, emerging markets such as India, South Africa and Turkey appear to be leading the charge.[13]

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Practical steps

The case for digital-first disclosure is gaining traction amid the global push for disclosure of sustainability-related financial information. Experience from countries such as India and South Africa highlight the value of a digital-first mindset, even while disclosure standards themselves are still in development.

Experience further suggests that starting with structured data at the outset of sustainability reporting and expanding its scope over time has succeeded in encouraging its adoption.

Incorporating feedback from companies and other stakeholders on a regular basis has helped to broaden support. Regulators, companies, securities exchanges and investors each have a role to play.

While every country will find its own path based on local circumstances, early examples in emerging markets suggest that investing in digital infrastructure from the outset can help avoid costly retrofits later.

Regulators
Regulators can help by creating incentives for structured reporting, together with technical guidance, education and feedback.

Companies
Issuers will benefit from viewing digital disclosure as an investment in long-term efficiency and a tool for creating visibility in the market rather than a compliance obligation. Use of structured data for reporting holds appeal for shareholders and other stakeholders, while improving internal monitoring, trendspotting and benchmarking.

Exchanges
Securities exchanges play a pivotal role as intermediaries. For example, major Indian exchanges are helping their listed companies with BRSR reporting by providing tools in Excel/XML format, which automatically convert disclosures into SEBI-compliant XBRL reports.

Investors
Investors benefit from the use of structured data, which can feed directly into systems that inform investment decision-making and stewardship. Easier access to information with fewer language limitations stands to open up a wider opportunity landscape. Investors can catalyze progress by providing clear feedback on their data needs.

Looking ahead

Digital reporting of sustainability-related information via XBRL can accelerate the availability of such information for investors, policymakers and other stakeholders across capital markets, while streamlining reporting for companies. The use of XBRL for global financial reporting has demonstrated the value of digital tagging in enabling users to synthesize disclosures consistently and at a fraction of the speed of pulling unstructured data from PDF files. Its application in combination with AI holds the potential to advance sustainability reporting even further.

Early adopters like India show that it is possible to build a new architecture for transparency. By learning from such efforts, stakeholders across the map can use structured data to create a foundation for effective reporting and, by doing so, maximize the value of sustainability disclosure for investment decision-making..

References

[1] "Full speed ahead as India leads on digital sustainability reporting," XBRL International, Dec. 8, 2024. See also, "The Future of Sustainability Reporting in South Africa," This Week in Sustainability, May 30, 2025.

[2] XBRL is based on eXtensible Markup Language (XML) for tagging financial data. See, "Financial Reporting for Commercial and Industrial Companies, US GAAP," XBRL Steering Committee, July 31, 2000.

[3] Listed companies in South Korea with exceeding KRW 10 trillion must adopt XBRL for their financial disclosures starting this year. See "Korean FSS expands XBRL application and bolsters support for listed companies," XBRL International, July 7, 2024. See notes that follow for references to mandates in other jurisdictions.

[4] Analysis by XBRL International staff (internal research, unpublished), based on market capitalization data from the World Federation of Exchanges and implementation details from the XBRL International project directory.

[5] See, for example, "Public comment on The Enhancement and Standardization of Climate-Related Disclosures for Investors (RIN 3235-AM87)," MSCI, May 31, 2022.

[6] "XBRL Guide for Business," HM Revenue & Customs, Gov.UK, April 8, 2020.

[7] "Inline XBRL Filing of Tagged Data," Release Nos. 33-10514; 34-83551, Securities and Exchange Commission, June 28, 2018.

[8] "Taxonomies accepted by HMRC," HM Revenue & Customs, Gov.UK, May 2, 2025.

[9] ESEF Hub, XBRL International Consortium, available at http://esef.xbrleurope.org.

[10] "Filing of Securities Investment Funds in XBRL," China Securities Regulatory Commission, May 21, 2009. See also, "XBRL Around the World," Journal of Accountancy, Oct. 1, 2008.

[11] "Omnibus I," European Commission, Feb. 26, 2025.

[12] "Publication of the 2026 EDINET Taxonomy (draft) and the development plan for the 2027 EDINET Taxonomy," Financial Services Agency, Aug. 8, 2025.

[13] See "Jurisdictional Profile: Turkey," IFRS Foundation, updated June 12, 2025 (Entities will be required to upload their sustainability-related disclosures in digital format starting this year.)

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About the authors

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About the Institute

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