frends

Real-World Pressure

The Rapid Rise of Climate Regulation

– and How to Solve It with Integration

The new rules of business

The climate agenda is rewriting the rules of business. As regulations tighten and stakeholders demand transparency, the pressure to deliver measurable impact grows by the day.

Leaders aren’t just complying, they’re connecting. Strategy to action, processes to results, carbon emissions to systems. Seamless integrations turn scattered and complex sustainability data into clarity, agility and impact.

In a world of rising demands, that’s not just survival.
That’s advantage.

Executive summary

Leaders aren’t just complying, they’re connecting. Strategy to action, processes to results, carbon emissions to systems. Seamless integrations turn scattered and complex sustainability data into clarity, agility and impact.

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As corporate sustainability regulations accelerate worldwide, sustainability reporting has shifted from a voluntary initiative to a legal and strategic imperative. But delivering on requirements isn't just about what you report; it’s about how your organization collects, connects, and governs the underlying data.

This whitepaper explores the forces reshaping ESG reporting, from regulatory pressure to stakeholder demand, and how organizations can move beyond fragmented systems and manual processes toward integrated, real-time and auditable sustainability data infrastructure.

Drawing on real-world industry examples and technical architectures, the whitepaper examines why iPaaS (Integration Platform as a Service) has emerged as a powerful foundation for scalable ESG transformation.

Whether your business is starting its sustainability journey or modernizing existing systems, this guide outlines how to align your integration strategy with both compliance demands and long-term value creation.

Table of Contents

1 The Rise of Mandatory Corporate Sustainability Reporting — 1

2 Who, What, and When — 4
Upcoming reporting requirements across regions

3 Driving Forces Behind Business Sustainability Efforts — 6

4 The Heart of Sustainability Reporting: Integration — 11
Upcoming types of ESG integration

5 The Reporting Software Landscape — 15
- Market sizing, vendor segmentation and adoption trends
- Selecting the right sustainability tools
- Beyond sustainability platforms

6 Approaches to ESG Integration — 24
Integration models comparison: Standard vs. iPaaS vs. Hyperscaler

7 Real-World Industry Example: Maritime ESG Integrations — 28
- Maritime system architecture
- Transforming ESG with iPaaS
- AI-enabled ESG integration

Table of Contents

8 Architecture in Practice 46

9 Conclusion 49

10 Glossary Table 51

01

The Rise of Mandatory Corporate Sustainability Reporting

In June 2023, there were just over 3,100 documented national-level climate laws and policies globally. As of mid-2025, that number has surged to 5,000+ across 196 countries and jurisdictions - marking a 60% increase in less than two years.

1. The Rise of Mandatory Corporate Sustainability Reporting

This rapid acceleration is **fueled by a wave of global policy momentum:**

- Tightening sustainability and disclosure mandates, such as the EU's CSRD and Green Taxonomy
- National adaptation and transition frameworks across both developed and emerging economies
- The growing influence of climate-related trade, tax and supply chain policies

At the same time, this surge in regulation is unfolding against a backdrop of **geopolitical instability and economic uncertainty:**

- Ongoing conflicts and war in key regions
- Shifting leadership in climate policy powerhouses like the U.S.
- The rise of climate skepticism-fueled backlash movements and legal challenges
- Global inflation and evolving carbon pricing mechanisms

The result? **A high-stakes, fast-moving regulatory environment** where companies must not only comply but stay agile amid uncertainty.

The shift from voluntary to mandatory sustainability disclosure is accelerating in 2025. Landmark regulations — including the EU's Corporate Sustainability Reporting Directive (CSRD), the US SEC Climate Disclosure Rule, and the UK's Sustainability Disclosure Requirements — are coming into force.

For thousands of companies worldwide, this is the year sustainability reporting moves from a nice-to-have to a legal obligation.

Now is the time to prepare, get the right tools in place, align with new standards, and ensure your organization is ready to meet these fast-approaching deadlines.

What is **ESG Reporting?**

ESG reporting is the process through which companies disclose data on their operations in three key areas: Environmental, Social and Governance, wich each area including pressing topics for a resilient future.

- Environmental includes climate impact, CO2e emissions, energy use, resource consumption, waste and biodiversity.
- Social brings elements such as human rights, community engagemente and responsibility, employee welfare, diversity, equity, and inclusion (DEI), customer satisfaction.
- Governance ensures corporate ethic, compliance, anti-corruption, board diversity, executive compensation.

Sustainability reporting is **how companies take responsibility for their social and environmental impact.** It empowers stakeholders, supports informed investment, and helps meet regulatory obligations - all while driving improved internal practices. But it also faces real challenges around standardization, trust, and comparability.

02

Upcoming reporting
requirements across regions

Who, what and when?

In the table below are the upcoming sustainability reporting requirements and deadlines for the different regions and jurisdictions.

Region	Requirement	Key Topics	Who must report	First reporting year (for FY ending)	Notes
EU	CSRD (Corporate Sustainability Reporting Directive	ESRS: Environment, Social, Governance (double materiality)	Large companies in the EU and non-EU companies with significant EU operations	FY 2024 - reports in 2025 (companies previously under NFRD) FY 2025 - reports in 2026 (all other large companies FY 2026 - reports in 2027 (listed small and medium enterprises) FY 2028 - reports in 2029 (non-EU companies meeting tresholds)	Phased in by size and listing status
UK	SDR (Sustainability Disclosure Requirements)	TCFD - aligned climate and sustainability information	Asset managers, asset owners, and large companies listed on UK markets	From Jul 2025 for fund sustainability labels and related disclosures	UK Green Taxonomy integration to follow
US	SEC Climate Disclosure Rule	Climate risks, governance, Scope 1 and 2 emissions (Scope 3 if material)	Public companies that file with the SEC	Large Accelerated Filers - FY 2025 (filed in 2026) Other filers - phades in FY 2026-2027	Scaled by filer status; Scope 3 delayed or limited
AU	ISSB - aligned mandatory sustainability reporting	Climate risks, emissions IFRS S1 & S2)	Large Australian companies meeting specified tresholds	FY 2024-2025 (phased depending on entity size)	Phasing over 3 groups
SG	SGX Climate Reporting	TCFD/ISSB climate disclosures	Listed issuers in high-impact sectors	FY 2025 reports (filed in 2026)	Other sections to follow

As organizations progress through their sustainability journeys, their ESG strategies and leadership models continue to mature. While the structure varies by size and industry - from informal, dual-role ownership in small firms to dedicated CSOs and sustainability committees in large enterprises.
What unites them all is the mounting pressure to act.

But where is this pressure coming from?

03

Driving Forces Behind Business Sustainability Efforts

The push for corporate sustainability is no longer just an ethical imperative or part of a marketing effort, it's a strategic response to clear external and internal demands.

From capital markets to the end customer, sustainability targets are shaping how companies operate, hire, and invest.

There are a few **core forces** accelerating this shift.

a.) Investors & financial markets

- Sustainability KPIs directly influence access to capital, insurance terms and investor confidence
- Poor ESG practices raise reputational and compliance risks, issues increasingly priced into equity valuations and credit ratings
- In Europe, a total of €25M+ fines were given between 2024-2025 and $21.5M+ in the US, primarily consisting of greenwashing practices, SFDR/CSRD enforcement, product/fund claims and SEC-led actions

Beyond financial penalties, sustainability-related fines often trigger lasting consequences, damaging brand reputation, reducing investor trust, lowering ESG ratings, and forcing costly internal overhauls to regain regulatory and market credibility.

What does it mean?

- Poor ESG performance is now priced into capital access and valuations.
- Fines are only one aspect. Brand damage and investor loss are often present. Sustainability efforts benefit the bottom line through profits, efficiency gains, and reputation.

b.) Government & regulations

- Governments today are no longer passive observers of corporate sustainability, they're active enforcers, standard-setters and economic catalysts. Across Europe and globally, climate legislation and sustainability mandates are reshaping how businesses and cities must operate.
-
- ESG compliance is now embedded in a wide range of legal areas: financial reporting, supply chain due diligence, product labeling, emissions tracking and human rights.
-
- In many countries, government funding, tax incentives and procurement contracts are now tied to ESG performance - **creating financial upside for proactive companies and risk for laggards.**

What does it mean?

- Compliance is no longer optional; it's embedded into operational DNA.
- Proactive ESG posture unlocks public funding, tax breaks and growth opportunities.

This creates a **non-negotiable compliance landscape** for mid-sized and large companies.

c.) Employees

- According to Deloitte's 2023 Global Gen Z and Millennial Survey, 69% of employees expect their employer to invest in sustainability efforts like carbon emissions reduction and waste minimization.
- More than 70% consider an employer's environmental credentials when applying for a job.
- In fact, 1 in 5 younger employees have already changed jobs due to environmental concerns.

What does it mean?

- Sustainability is a talent magnet and retention tool
- Companies ignoring sustainability risk losing their future workforce

Sustainability is no longer a soft value, but a **strategic differentiator.**

d.) Customers & market expectations

- In PwC's 2024 Voice of the Consumer survey (31 countries, 20,000+ respondents), 80% of consumers said they are willing to pay more for sustainably produced goods. They're prepared to pay 9.7% more on average for those options

- A PDI Technologies 2024 study showed that 80% of U.S. consumers would choose sustainable products over similar alternatives with 71% willing to pay more when the product is priced under $10

What does it mean?

- Consumer demand is clear: sustainability and conscious consumerism are not a niche preference, but a mainstream filter.
- Sustainability is now a price-insensitive value driver.

Consumers are signaling with their wallets: sustainability is not optional - it's expected.

e.) IT & tech leadership

- IT and technology teams are increasingly positioned at the core of sustainability execution, reflecting a shift from symbolic reporting to strategic infrastructure.

- A 2024 IBM State of Sustainability Readiness Report found that 88% of business leaders plan to increase investment in IT for sustainability over the next 12 months

- Within this group, 57% identify brand reputation as their top driver, followed by 54% targeting energy cost reductions and 52% prioritizing operational resilience.

- About half feel their sustainability data systems are mature, and 38% intend to significantly increase spending on sustainability-focused IT in the upcoming year.

- 90% of executives believe AI can positively impact sustainability goals, but 56% are not currently leveraging AI for ESG.

- 50% report that their data capabilities are not mature enough to effectively track sustainability KPIs.

- There is a notable perception gap. 67% of C-suite leaders believe their organization is proactive on climate resilience, versus only 56% of

What does it mean?

IT Investment

Sustainability is moving beyond compliance toward becoming a core part of digital strategy

Data Maturity Gap

Successful sustainability integration hinges on improving data systems and measurement

AI Opportunity

Organizations recognize AI's potential for ESG, even if adoption is still emerging

Leadership Alignment Issues

Close collaboration across C-level, IT and sustainability teams is crucial for ESG success

Whether driven by shareholders, employees, regulators or end-customers, the most successful organizations treat ESG as a core transformation lever, not a box-ticking exercise. Sustainability reporting is no longer a voluntary initiative; it has become a strategic and operational necessity.

The pressure is rising on corporate and IT leaders to ensure that their data, systems and governance models can keep pace with growing expectations and global unpredictability.

While these forces span regulatory, financial and societal pressures, **technology leaders are increasingly tasked with translating these demands into operational reality.**

That's where IT integration and data infrastructure come into play.

04

The Heart of Sustainability Reporting: Integration

No matter which regulation applies, one thing is clear: integration sits at the heart of every ESG reporting process.

Bringing together data from finance, operations, HR, supply chains and external partners is at the foundation of accurate, assured and compliant reporting. Without strong integration across systems and teams, even the most prepared organizations will struggle to meet the new standards.

When we look at **upcoming sustainability reporting regimes (those rolling out from 2025 onward)**, they are not just about new disclosure rules.

They also require **new types of data integration within organizations.**

Here are the key integration types involved in ESG reporting that are coming up (or being intensified).

1 Financial–sustainability data integration (double material

What: Linking financial systems (ERP, accounting) with sustainability data (GHG emissions, workforce metrics, supply chain data).

Why: New standards like EU CSRD/ESRS and ISSB S1/S2 require companies to show how ESG factors affect financial performance and vice versa.

Coming: Expect deeper ERP integration with ESG data platforms so that sustainability KPIs are embedded into financial statements.

2 Supply chain data integration

What: Gathering Scope 3 emissions and social metrics from suppliers and integrating them into corporate ESG systems.

Why: Rules in EU CSRD and upcoming value chain reporting requirements demand companies look beyond their own operations.

Coming: New supplier portals and APIs to pull validated data from vendors and partners into ESG reporting tools.

3 ESG platform–assurance integration

What: Integration between ESG reporting software and audit/assurance platforms.

Why: Many new rules (CSRD, SEC) require limited or reasonable assurance over sustainability disclosures.

Coming: Built-in workflows for evidence management, document trails and direct auditor access.

4 Taxonomy & regulatory integration

What: Mapping reported activities to regulatory taxonomies (e.g., EU Green Taxonomy, UK Green Taxonomy).

Why: Required for disclosures like the % of revenue, CapEx, OpEx aligned with taxonomy criteria.

Coming: ESG tools will integrate taxonomy mapping engines that pull activity data from business systems and classify them automatically.

5 CrossSystem API integration (HR, EHS, Operations)

What: Combining data from HR systems (diversity, safety), EHS platforms (environmental health & safety), and operational monitoring (IoT, energy meters).

Why: Detailed ESRS or ISSB metrics require operational data that historically sat in silos.

Coming: ESG platforms will increasingly offer readymade connectors to HRIS, EHS, and IoT platforms.

6 Continuous reporting integration

What: Moving from annual manual reporting to continuous or quarterly automated ESG data flows.

Why: Investors and regulators are pushing for more frequent updates, not just one sustainability report a year.

Coming: Integration with real-time dashboards and continuous data ingestion pipelines.

The next wave of mandatory sustainability reporting isn't just about disclosure; it's about driving **new integration types.**

- → Financial ↔ Sustainability data
- → Supplier value chain inputs
- → Auditor platforms
- → Taxonomy classification engines
- → HR/EHS/IoT systems
- → And real-time data pipelines

05

The Reporting Software Landscape

Beyond regulatory mandates, the shift is becoming operational: 70% of European companies are expected to adopt dedicated data management systems for non-financial ESG metrics within five years - an indicator that ESG readiness is becoming standard infrastructure.

The ESG reporting software segment (focused on disclosure and compliance) is projected to **grow from USD 0.95 billion in 2024 to approximately USD 2.6–2.73 billion by 2030**, with a CAGR of 17–18%.

The broader sustainability SaaS market, which includes reporting, analytics, risk, carbon accounting and value chain tools, was valued at USD 4.1 billion in 2025 and is forecasted to reach USD 8.9 billion by 2030.

The signals are clear:

The signals are clear:

- Accelerating global market growth in both narrow and broad ESG toolsets
- Regulatory urgency driving adoption across tens of thousands of organizations
- Analyst consensus on widespread uptake within the near term

Climate tech market metrics

The demand for digital solutions to manage sustainability data, reporting and compliance has surged. The ESG software market is evolving, with a mix of broad platforms and specialized tools emerging to serve distinct regulatory and operational needs, from the number of vendors and market size to adoption projections and growth rates. It highlights the scale, segmentation and drivers shaping the climate tech ecosystem today.

Metric	Value	Scope
Total ESG Software Vendors	150–200+ globally	Includes both pure-play and multi-function platforms
Pure-Play ESG Platforms	100+ listed in specialized directories	Focused solely on ESG reporting, carbon, or compliance tools
Global ESG Software Market	USD 4.1 bn	Broader ESG software category (reporting, analytics, etc.)
(Projected Global Market 2030)	USD 8.9 bn	Same broad scope — includes reporting, risk, due diligence
ESG Reporting Software Segment	USD 0.95–0.98 bn	Narrower definition: disclosure and compliance tools only
Projected ESG Reporting Segment (2023)	USD 2.6–2.73 bn	CAGR ~17–18%; excludes analytics, carbon tools
EU ESG Software CAGR	29%	Driven by CSRD and CSDDD mandates across 50,000+ firms
Expected EU Company Adoption	70% adopting ESG data management within 5 years	Focus on non-financial data systems, not just reporting

Navigating through the jungle of climate tech SaaS vendors is a tedious task. Below are some curated overviews of platforms, each offering different value propositions, priorities and technical depth.

Choosing the right one depends heavily on your organization's needs:

Navigating through the jungle of climate tech SaaS vendors is a tedious task. Below are some curated overviews of platforms, each offering different value propositions, priorities and technical depth. Choosing the right one depends heavily on your organization's needs:

- Primary ESG focus (e.g., reporting vs. decarbonization vs. risk)
- Overall sustainability strategy (compliance-driven or value-creation focused)
- IT and data architecture (on-prem, hybrid, or cloud-native)
- Security and data sovereignty requirements
- Integration needs with ERP, HR, finance, or operational systems

Regardless of the platform, what matters most is how well the tool aligns with:

1. Company's sustainability maturity
2. Regulatory exposure
3. System landscape

Other options – if not climate tech SaaS?

Organizations don't have to jump directly into full sustainability platforms. Depending on their budget, team size and reporting urgency, a combination of manual tools, consultants, APIs or hybrid setups may be more appropriate in early stages or specific industries.

There are other options:

Option	Best for	Trade-offs
Manual Spreadsheets	Small teams or ESG beginners	No automation – hard to audit
ESG Consultants	Strategic setup or CSRD readiness	Costly – less scalable
Disclosure Portals (CDP etc.)	External validation/supplier use	Not internal workflow tools
ESG APIs	Tech-savvy teams	Developer dependency
EHS/Compliance Platforms	Industrial firms	Limited ESG frameworks (CSRD, SFDR)
Custom Internal Systems	Enterprises with in-house IT	Time- and resource-intensive

Manual spreadsheets

rely on manual data entry and management, which means teams need to spend extra time ensuring accuracy and consistency. Auditing and cross-checking can be challenging because there's no built-in automation or workflow control.

ESG consultants

provide expert guidance and strategic setup, but this approach usually comes with higher costs. It can also be less scalable over time, as each new requirement may demand additional external support.

Disclosure portals (CDP etc.)

are excellent for external validation and standardized reporting. However, they are not typically designed as internal workflow tools, so companies may still need separate systems to manage day-to-day sustainability processes.

ESG APIs

offer flexibility and can integrate sustainability data into existing systems, which is great for tech-savvy teams. On the flip side, they require developer involvement for setup and ongoing maintenance, which may add complexity.

EHS/compliance platforms

are often well-suited for industrial firms because they handle environmental, health and safety compliance. Their ESG coverage can be narrower, with limited alignment to broader frameworks like CSRD or SFDR, depending on the provider.

Custom internal systems

give full control and customization aligned with company needs. The tradeoff is the significant investment of time and resources required to design, build, and maintain these systems internally.

Sustainability strategies live or die by their ability to **access, standardize, and connect data across systems.**

Whether you're using a SaaS ESG platform, custom tools, spreadsheets or consultants, the most persistent pain point is **data fragmentation and integration complexity**

- Sustainability data often lives across finance (ERP), HR systems, energy meters, supply chain tools and external partners.

- These systems are often not built for native or real-time interoperability. While many vendors offer “off-the-shelf” or “standardized” integration solutions, they usually fall short when applied to the highly varied and evolving complex data landscapes that corporate sustainability reporting requires.

- Regulatory reporting frameworks (like CSRD or SEC) require consistent, auditable and traceable data, often spanning Scope 1–3 emissions, DEI stats, supplier risks, etc.

Without a clear **integration strategy,** sustainability data becomes siloed, manual, and error-prone, regardless of the software you choose.

IT teams end up **building costly one-off connections** or struggling to **scale reporting** efforts across units or geographies.

Cross-Functionality is Key
CFOs want ESG data linked to financial performance
CIOs focus on data security, architecture and scale
CSOs need assurance-ready, auditable sustainability KPIs
HR, OPS, Supply Chain are critical data owners

The consequence?

Business leaders can't trust or act on insights when data is fragmented or outdated.

It’s not just about the tool you choose to use; it’s whether your **data flows supported by architecture and a secure environment.**

True value differentiators of ESG integration goes far beyond ticking reporting checkboxes. It lies in **turning compliance into competitive advantage.**

By transforming sustainability data into actionable insights, organizations can make smarter decisions, manage risks more effectively, unlock new opportunities for value creation and achieve actual impact.

From investors to employees, today's stakeholders demand more than transparency. They expect **accountability, measurable progress, and impact.** To meet these expectations, organizations must move beyond baseline compliance and adopt integrated systems that **deliver real-time, decision-ready insights.**

High-value ESG integrations

The table below highlights some of the most common high-value ESG integrations, the insights they produce and the strategic value they deliver across environmental, social and governance dimensions.

	Integration	Insights	Value
Environment	Carbon accounting tools	Scope 1/2/3 emissions tracking	Compliance (CSRD, SEC), decarbonization planning, investor trust
	Energy/resource monitors	Energy, water, waste by site/product	Cost savings, efficiency, lower emissions
	Supply chain ESG platforms	Supplier scores, labor risks, deforestation	Lower reputational risk, sustainable sourcing
Social	HR / DEI platforms	Diversity, pay gap, inclusion metrics	Attract talent, equity, stronger culture
	Employee engagement & wellbeing	Burnout, retention risk, satisfaction	Higher productivity, lower turnover
Governance	Whistleblower / ethics tools	Incident trends, conduct breaches	Trust, accountability, lower legal risk
	Board governance tools	Board diversity, engagement, oversight	Aligns governance with stakeholder goals
Reporting	ESG reporting platforms	Unified scorecards, trend analysis	Supports CSRD/GRI/TCFD, builds confidence
	ESG KPI dashboards	Performance vs targets (Net Zero, DEI)	Shows progress, drives decisions

While there are many more integrations tailored to specific industries, this overview highlights a key truth: the real power of sustainability efforts lies in connecting systems, insights and outcomes. With the right integration processes in place, climate action evolves from a reporting obligation into a strategic enabler, fueling compliance, operational efficiency, cultural alignment and long-term value creation.

A business case beyond compliance

ROI of ESG Integrations

40-60% faster reporting cycles
Through automation and reduced manual data prep

Lower audit cost
With structured, traceable and assured data

Real-time decision support
Linking financial and ESG data for strategic planning

Reduced regulatory risk
By ensuring consistent, up-to-date disclosures

The cost of inaction? Missed funding, reputational damage and operational inefficiencies.

06

Approaches to ESG integration

There’s no one-size-fits-all approach to ESG data integration. The right fit depends on your organization’s architecture, resources and long-term strategy. When organizations move beyond manual, script-based or point-to-point integrations, they typically consider three dominant models, each suited to different levels of scale, complexity and cloud maturity.

There's no one-size-fits-all approach to ESG data integration. The right fit depends on your **organization's architecture, resources and long-term strategy.**

When organizations move beyond manual, script-based or point-to-point integrations, they typically consider three dominant models, each suited to different levels of scale, complexity and cloud maturity.

1

Standard manual or scripted integration

This is the most common starting point. Organizations often rely on CSV exports or custom scripts to pull sustainability-related data from siloed systems. While fairly simple to implement, this approach becomes harder to scale and audit as reporting requirements grow.

2

iPaaS (Integration Platform as a Service)

iPaaS platforms provide a centralized orchestration layer to connect any API, technology and supply chain systems across cloud and on-premises environments. The nature of iPaaS provides built-in reusability, connectors, templates, rapid implementation and governance features lowering the total cost of ownership in most scenarios.

They are well-suited for companies with diverse IT stacks and evolving ESG needs.

Hyperscaler-native architectures (e.g., Microsoft, AWS, Google Cloud)

3

For organizations already deeply invested in ecosystems like Microsoft Azure or AWS, building sustainability data pipelines using native services (e.g., Azure Data Factory, Power Platform, AWS Glue) can offer convenience and alignment with existing infrastructure. The aggregation of these various hyperscaler services provides governance, scalability and flexible capabilities – as long as you combine them together.

However, this approach may not suit every organization. ESG teams often face long dependency chains on internal cloud or DevOps resources, and customization can be limited by the native toolsets. Some companies also seek to avoid vendor lock-in or are constrained by licensing, cost or data residency concerns – all of which can make hyperscaler-native solutions less attractive for ESG-specific use cases.

Hybrid and composable strategies

4

Many organizations are also adopting hybrid architectures (mixing cloud and on-prem for compliance reasons) or composable architectures (modular, API-first approaches) to improve agility and reduce lock-in.

In short, don't just pick a tool - pick an approach that aligns with your architecture, ambitions, and accountability.

Whether you integrate through hyperscaler modules or a dedicated iPaaS, the goal is to **avoid vendor lock-in and enable flexibility for future growth.**

Standard vs. iPaaS vs. Hyperscaler

Understanding the trade-offs helps ensure that ESG integration efforts are not only compliant, but also sustainable and future-proof.

The table below compares these approaches across key dimensions such as security, cost, scalability and vendor lock-in.

	Standard	iPaaS	Hyperscaler
Security & Compliance	Minimal governance, hard to audit	Built for hybrid; data can stay on-prem; audit trails	Strong cloud security but data leaves on-prem; governed by single vendor
Scalability & Flexibility	Low - each new system needs custom work	High - vendor-agnostic, composable	Scales well in that eocsystem, less flexible in hybrid
TCO & Cost Model	Low upfront, high hidden cost over time	Predictable subscription; lower TCO long-term	Usage-based; TCO rises with volume
Maintenance	High - constant script updates	Low - central orchestration reduces effort	Moderate - managed by provider but tied to their updates
Vendor lock-in	Low, but fragile	Low - integrates across platforms	High - tied to one cloud stack
Capability investment	Low learning curve, but heavy ongoing effort	Lower barrier with low-code/ no-code tools; centralized management	Requires specialized skills per module and ongoing training
Best fit	Small ESG programs with limited scope	Firms with mixed environments or complex ESG needs	Firms already standardised on Microsoft/Azure/AWS

To bring this to life, let’s look at a concrete example from the maritime industry, where real-time high-value ESG integration unlocks both compliance and operational value.

07

Real-World Industry Example

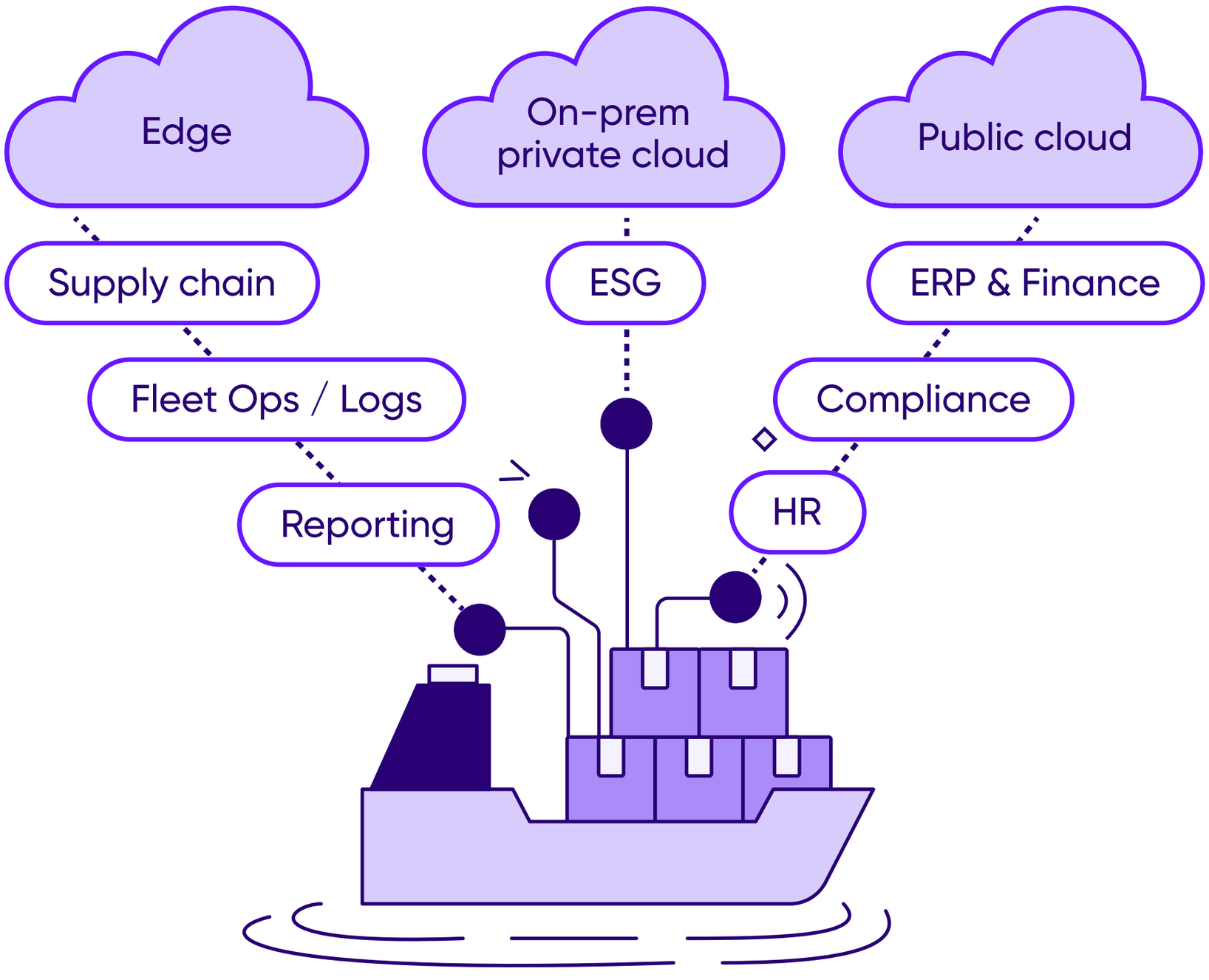
Maritime ESG Integrations

In many organizations, ESG integration is still managed through a patchwork of file transfers, manual processes and point-to-point connections.

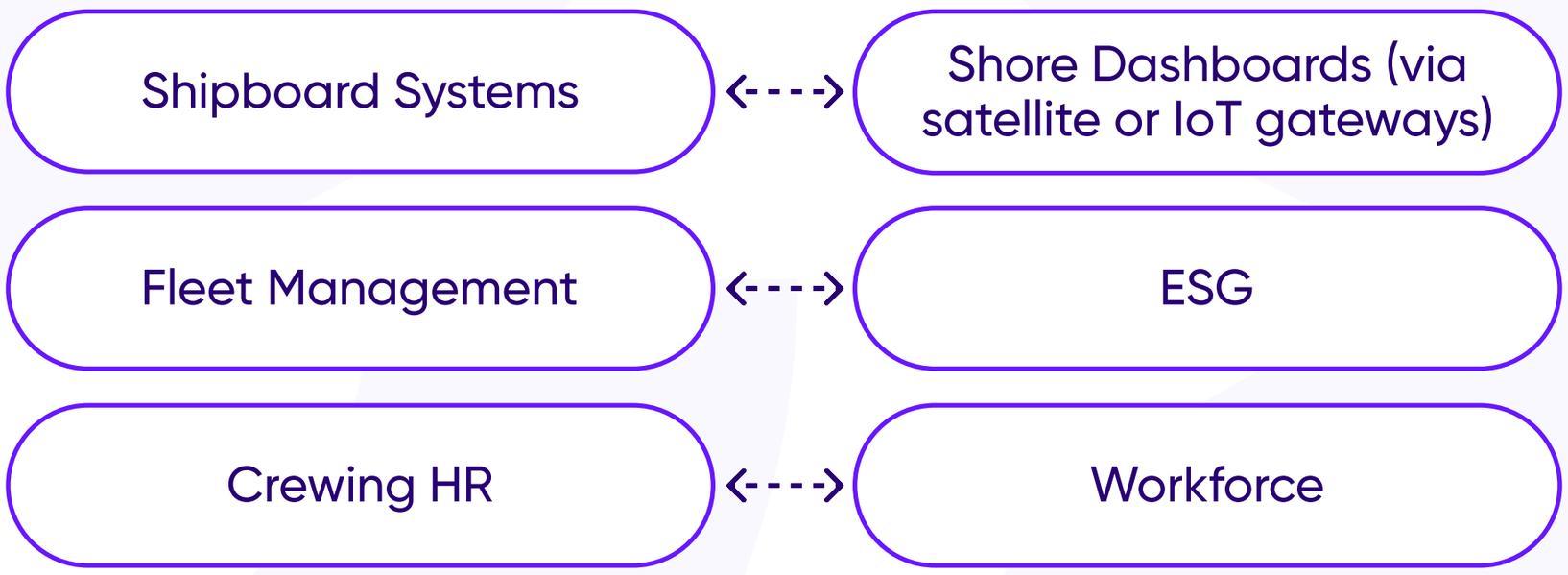
Operational, HR, and financial systems may be technically connected, but **the flow of ESG data is often fragmented, delayed, and difficult to scale.**

Let’s look at an industrial sectors like shipping and maritime as an example.

Maritime ESG Architecture



In practice, **ESG reporting for a maritime company** often integrates:



With new frameworks like **EU ETS for shipping (from 2024/2025), CSRD, and IMO decarbonization targets,** these systems are essential to capture and integrate the right data.

Environmental data such as fuel logs, engine hours or voyage details is typically extracted from legacy systems, often **via CSV files, custom scripts, or direct database connections.**

HR metrics like DEI statistics and crew hours may reside in standalone systems with limited API support, requiring periodic uploads or spreadsheet workarounds.

Financial data used to link cost and emissions often comes from **ERP exports, with calculations handled offline.**

The diagram below represents a typical sustainability data integration approach in the maritime industry, where data must be sourced from a range of systems across operations, HR and finance. In this setup, integration is technically feasible, but often relies on a mix of CSV exports, manual uploads, direct database onnections, and custom scripts.

Standard ESG integration flow

How the flow works

1

ESG systems

Data for ESG reporting is manually structured or prepared with scripts before it can be sent to other systems.

2

Fleet operations/logs

Operational data such as fuel logs, route information or engine hours is collected.

This data is usually pulled in through an API or CSV exports.

3

HR system

HR metrics such as crew hours, diversity data or training records are uploaded periodically or synced manually.

4

ERP & Finance system

Financial information like costs, budgets or allocations is exported or linked via custom scripts.

5

Reporting

The compiled sustainability data is then sent to a reporting tool to produce sustainability reports.

7. Real-World Industry Example: Maritime ESG Integrations

In the setup shown, **every data stream ultimately converges in a central integration layer**, which acts as a hub where inputs from disconnected systems are collected, combined, and prepared for reporting.

Once centralized, KPIs are compiled and passed to the reporting stage, **enabling organizations to produce sustainability reports.**

The upside from this setup is that it leverages existing systems and familiar processes, requires little upfront investment, and provides a baseline level of centralization - enough to meet initial ESG reporting requirements without adopting newer technologies.

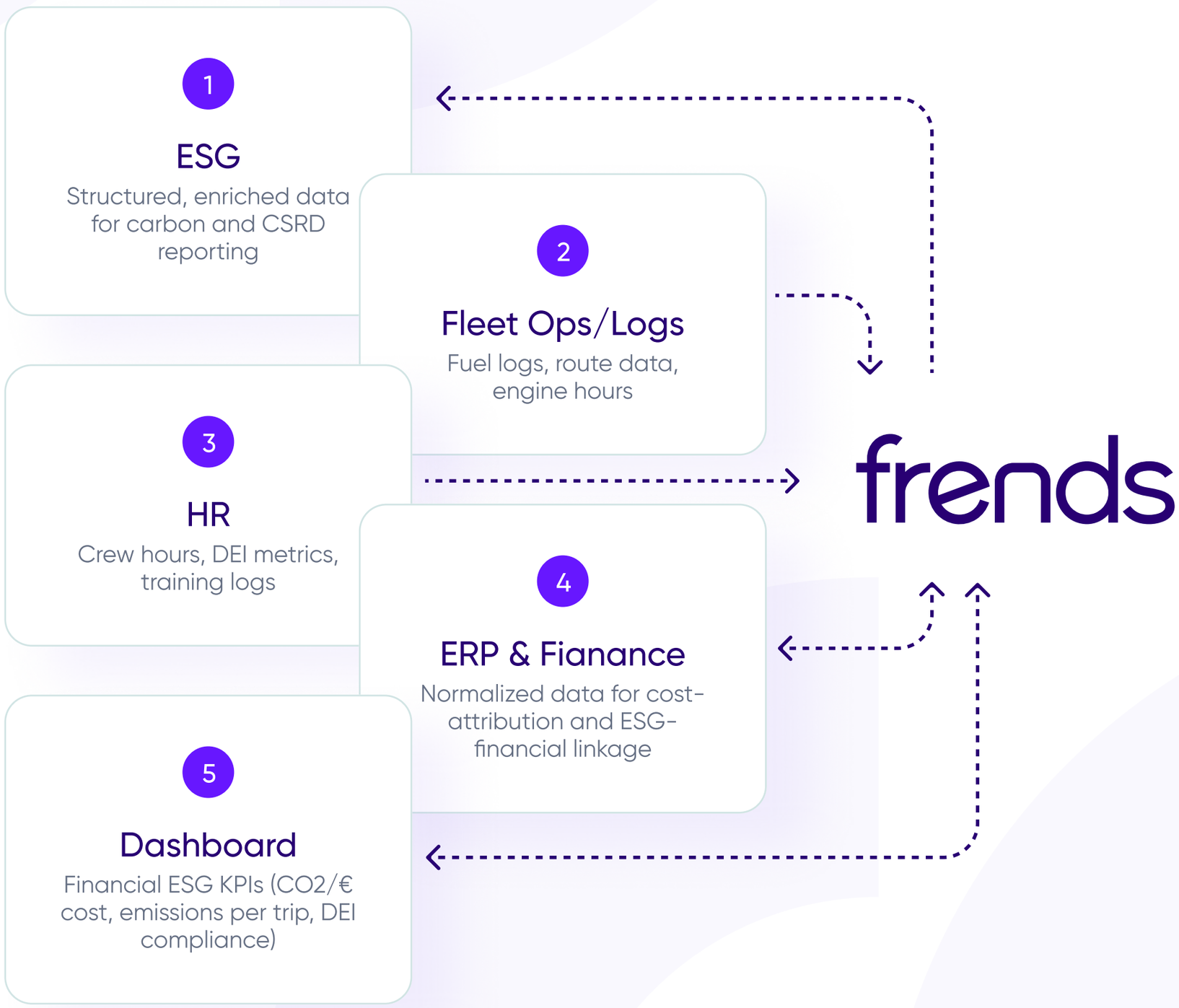
However, static reporting alone won't reduce risk, improve performance or support growth.

Real value comes from **building a data-driven ESG infrastructure** — one that delivers operational clarity, regulatory confidence and a genuine strategic advantage.

While many tools can move or manage data, most fall short when faced with the scale, complexity, and compliance demands of enterprise ESG.

7. Real-World Industry Example: Maritime ESG Integrations

Let's explore how this same flow is transformed with an iPaaS, delivering real-time automation, systemwide control and audit-ready sustainability insights.



How the flow works

ESG systems

Sustainability data is not just collected but structured and enriched automatically.

1 Carbon data and CSRD-specific metrics are preprocessed for reporting.

Outcome: Sustainability data arrives pre-structured and enriched, eliminating manual prep work and ensuring CSRD-ready metrics are instantly available for reporting.

Fleet operations/logs

Fuel logs, route data and engine hours are ingested in real time through APIs or connectors.

2 Data is automatically cleaned and prepared before entering the flow.

Outcome: Operational data (fuel, routes, engine hours) is always clean, current and reliable, giving a real-time view of emissions and efficiency.

HR system

Crew hours, DEI metrics and training logs are integrated directly.

3 Updates feed continuously rather than periodic manual uploads.

Outcome: Crew and workforce metrics are continuously up to date, improving the accuracy of diversity, equity, inclusion (DEI) and safety reporting without extra effort.

ERP & Finance system

Financial data is normalized and linked to operational data (e.g., cost per CO_2 unit).

4

ESG and cost data are tied together to support financial linkage.

Outcome: Financial data is directly linked to operational metrics, enabling meaningful KPIs like cost per CO_2 unit and supporting clear sustainability-financial connections

Dashboard

Final sustainability KPIs (CO_2/€ cost, emissions per trip, DEI compliance) are compiled by the iPaaS.

5

These metrics are delivered directly to dashboards or reporting tools in real time.

Outcome: Decision-makers see live KPIs in one place – CO_2 per euro, emissions per trip, DEI compliance – delivered in real time and ready for reporting or analysis.

This is where iPaaS makes a difference

An iPaaS acts as a **modern integration layer**, connecting data across multiple systems, applications, and business units. It standardizes, automates, and governs data flows in real time – **ideal for environments where information is fragmented across operations, HR, finance and supply chains.**

Each integration plays a critical role in capturing sustainability data, from fuel consumption and voyage logs to crew metrics and cost allocations. When **unified through an iPaaS, these data flows produce real-time insights** across environmental, social and governance dimensions.

This creates a foundation not just for **accurate reporting, but for measurable business value** – whether it's enabling decarbonization, ensuring compliance, advancing DEI, or linking sustainability to financial performance.

Maritime ESG Integration Value

The right data, routed through the right systems, delivers ESG value

	Integration	Insights	Value
Environmental	Fleet Ops / Logs Integration	Fuel consumption, voyage data, engine hours → Scope 1 emissions	Enables carbon reporting (CSRD, EU ETS, IMO DCS); supports decarbonization
Social	HR Systems Integration	Crew hours, training, DEI stats	Supports DEI reporting, social compliance, and labor safety assurance
Governance	ERP / Finance Integration	€ cost per trip/ton/km linked to CO_2 & energy used	Enables ESG–financial linkage (e.g., cost per emission unit)
Cross-Cutting	ESG Reporting Platforms	Structured, compliant reporting for Scope 1–3, DEI, cost-linked emissions	Ensures CSRD/TCFD alignment, investor-grade reporting
	ESG KPI Dashboards / Scorecards	Final metrics: CO_2/trip, € per ton-km, DEI performance	Supports executive review, benchmarking, and internal accountability

This isn't about patching systems together. It's about creating an enterprise-wide ESG backbone that ensures:

- Real-time automation over manual data wrangling
- Full visibility and control over fragmented systems
- Built-in security, traceability, and compliance by design
- The agility to evolve with growing ESG demands

Maritime iPaaS Integration Value

Reason	iPaaS Benefits
Connects Across Systems	ESG data comes from many silos (Ops, HR, Finance, IoT). iPaaS is built to bridge them all
Standardizes Data	Raw data is messy and inconsistent – iPaaS can clean, map, and normalize it in real time
Automates Workflows	ESG reporting requires recurring data flows (monthly, quarterly). iPaaS automates this reliably
Scales Easily	As ESG scope grows (more suppliers, more regulations), iPaaS handles increasing complexity.
Auditable & Secure	ESG data must be traceable, secure, and often regulated. iPaaS provides built-in audit trails
Vendor-agnostic	Works with any app, cloud, or legacy system – unlike point solutions tied to one stack

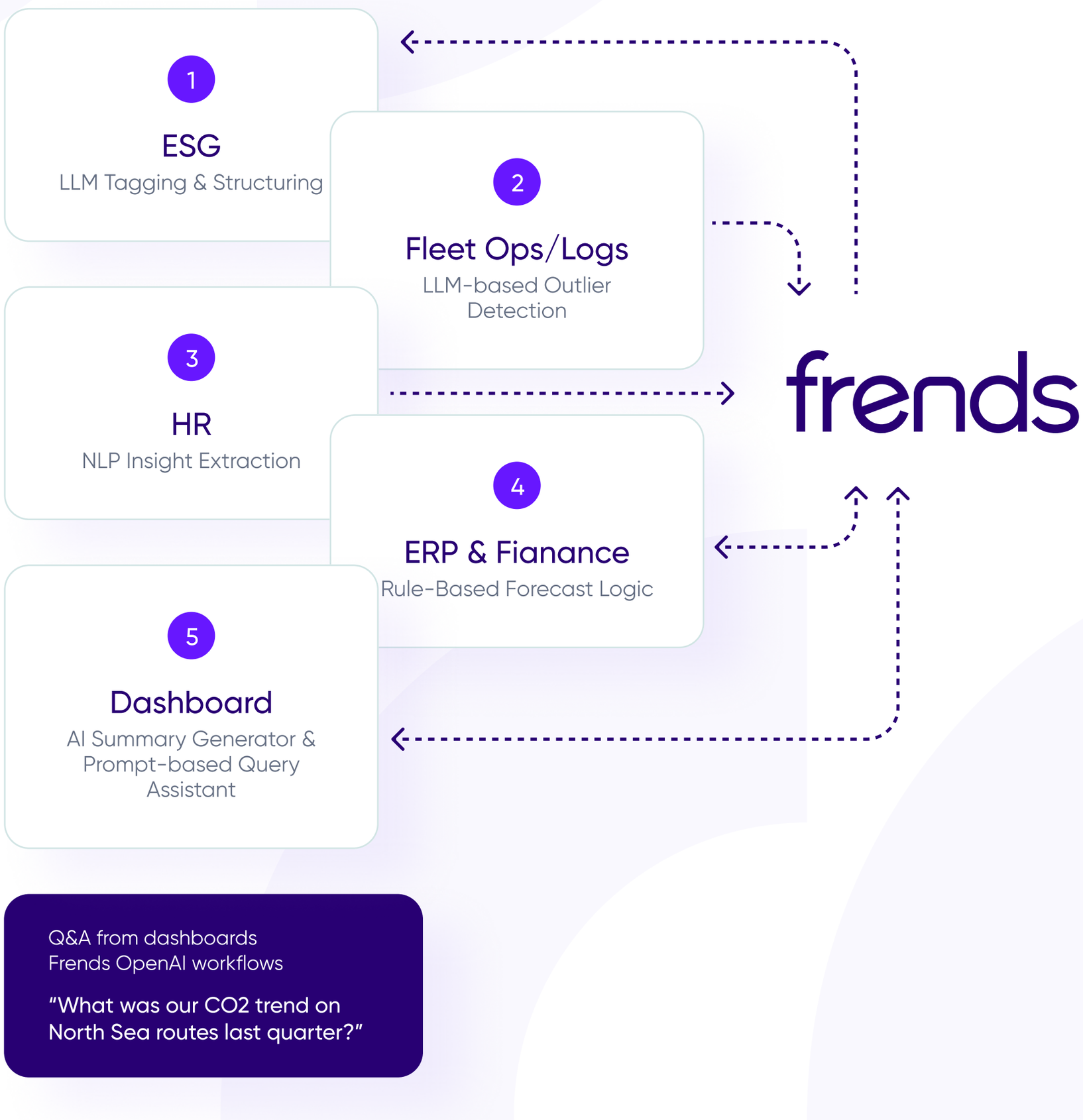
As expectations grow and data volumes accelerate, there's an opportunity to go even further.

The next evolution is AI-enabled iPaaS, which builds on those proven integration benefits and adds an additional layer of intelligence on top.

Instead of simply moving and transforming data, the platform starts to interpret and enrich it in real time.

iPaaS AI-enabled integration flow

The diagram below shows how AI features, like outlier detection, predictive forecasting, and natural language dashboards, turn an already powerful integration layer into a proactive ESG engine that not only reports on past results, but helps shape future decisions.



How the flow works

ESG systems - LLM Tagging & Structuring

1

Frends' native OpenAI connector or LLM task receives raw operational records (fuel logs, voyage notes, maintenance comments) and applies trained prompts to classify and structure them into ESG-ready fields — for example tagging emissions as Scope 1, Scope 2, or Scope 3.

Benefit: Eliminates manual tagging or complex script maintenance.

Outcome: Faster preparation of sustainability data with consistent classification that aligns directly to reporting frameworks like CSRD or IMO DCS.

Fleet operations/logs - LLM-based outlier detection

2

Ingested fleet data streams (e.g., API or CSV) are evaluated against historical baselines. The LLM identifies anomalies, such as sudden spikes in fuel use or engine hours that fall outside learned patterns, and flags them inside the workflow.

Benefit: Early detection of errors, fraud or operational inefficiencies without waiting for batch reviews.

Outcome: Data quality improves by reducing incorrect emissions values and enabling timely corrective action.

HR - NLP insight extraction

3

HR records (crew hours, DEI metrics, training logs) are processed with NLP prompts that extract keywords, trends and compliance gaps (e.g., overdue safety certifications or diversity ratio anomalies).

Benefit: Automatic enrichment of operational data with social and workforce insights without separate manual audits.

Outcome: More comprehensive ESG reporting that covers both environmental and social KPIs with minimal additional effort.

7. Real-World Industry Example: Maritime ESG Integrations

ERP & Finance - Rule-based forecast logic

4

Financial and operational data are joined in-flow, then passed through configurable logic blocks (built in Frends scripting) that apply forecast models or regression coefficients pre-trained on historical cost and emission data.

Benefit: Forecasts (like CO_2 per trip or € per ton-km) are generated within the integration layer rather than in external spreadsheets or BI post-processing.

Outcome: Leaders get predictive KPIs in real time, supporting proactive cost control and decarbonization planning.

Dashboard - AI summary generator & prompt-based query assistand

5

Final sustainability KPIs are passed to LLMs for narrative generation, creating CSRD-ready text, summaries or alerts. Through Frends' OpenAI workflows, users can also submit natural-language questions from dashboards ("What was our CO_2 trend on North Sea routes last quarter?") and get real-time answers from live data.

Benefit: Reduces time spent drafting reports or digging through dashboards.

Outcome: Executives and stakeholders get clear, actionable insights instantly, improving decision speed and confidence.

Ensuring data integrity, lineage & AI transparency in **ESG pipelines**

As sustainability data flows across operational systems, HR platforms, cloud analytics and AI models, it is essential to ensure data trustworthiness. Regulatory frameworks like CSRD, ISSB and the SEC Climate Rule emphasize not just what is reported – but how the underlying data is generated, handled and verified.

This puts two foundational requirements in focus:

- **Data integrity:** Ensuring that data hasn't been lost or tampered with across systems.
- **Data lineage:** The ability to trace the origin, transformation, and flow of data across the ESG pipeline.

AI Shouldn't Be a Black Box

- Prompts, inputs, and outputs should be logged as part of the integration workflow.
- Every AI interaction should be traceable – not hidden in proprietary logic.
- Essential for regulatory assurance, audit readiness, and long-term trust.
- Transparency supports accountability in AI-assisted ESG decisions. This should be enabled by design – capturing every step without adding opacity.

AI in ESG reporting should be explainable, auditable, and fully transparent.

7. Real-World Industry Example: Maritime ESG Integrations

By maintaining audit logs, initiating validation checks, and managing system handoffs, orchestration platforms ensure traceability and accountability across every step of the data lifecycle.

This transparency-first approach also applies to AI-enabled workflows. When orchestration tools trigger AI actions — such as classification, summarization, or anomaly detection —, the entire interaction (prompt, input, output) can be logged. This prevents black-box opacity and supports explainability and assurance in AI-assisted ESG processes.

A real-world example comes from a Frends client in the retail sector, where audit logs are protected by design. If a log entry is missing or altered, the platform automatically triggers an alert, making manipulation both detectable and actionable. This level of traceability is critical when ESG disclosures must withstand **regulatory or third-party assurance.**

Together, these AI features don't replace the iPaaS benefits you already rely on, they layer intelligence on top to **deliver cleaner data, richer insights and faster action across processes**, giving true business value outcome.

Ensuring data integrity, lineage & AI transparency in **ESG pipelines**

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AI ≠ ESG Shortcut

Explainability
Can the AI's ESG logic be traced and understood?

Validation
Are AI outputs reviewed by domain experts?

Bias Mitigation
Are social and DEI metrics free from distorsion?

Audit readiness
Can decisions or reports be justified to regulators?

AI is a tool, not a shortcut. Responsible use is key to building long-term trust

Choosing the **right foundation**

There are many ways organizations attempt to connect sustainability data: from custom scripts and point-to-point connectors to standalone climate tech platforms or heavy-duty ETL pipelines. Each approach can play a role, depending on the maturity, architecture, and urgency of the ESG program.

But there are trade-offs.

Custom code can be powerful, but it's hard to scale, audit or maintain across teams.

ETL tools excel at data movement but often miss the real-time orchestration and decision logic needed for ESG processes. And many climate tech platforms offer limited integration depth, making it hard to connect operational, financial and sustainability data in a consistent, governed way.

This is where integration platforms, particularly iPaaS, offer a differentiated advantage.

They provide a centralized, agile layer to manage sustainability data flows across departments, tools and cloud/on-prem environments. More than just moving data, they enable transparency, audit readiness, automation and resilience.

iPaaS transforms ESG from a static reporting function into a connected, responsive system — built for trust, built for scale, and built to evolve.

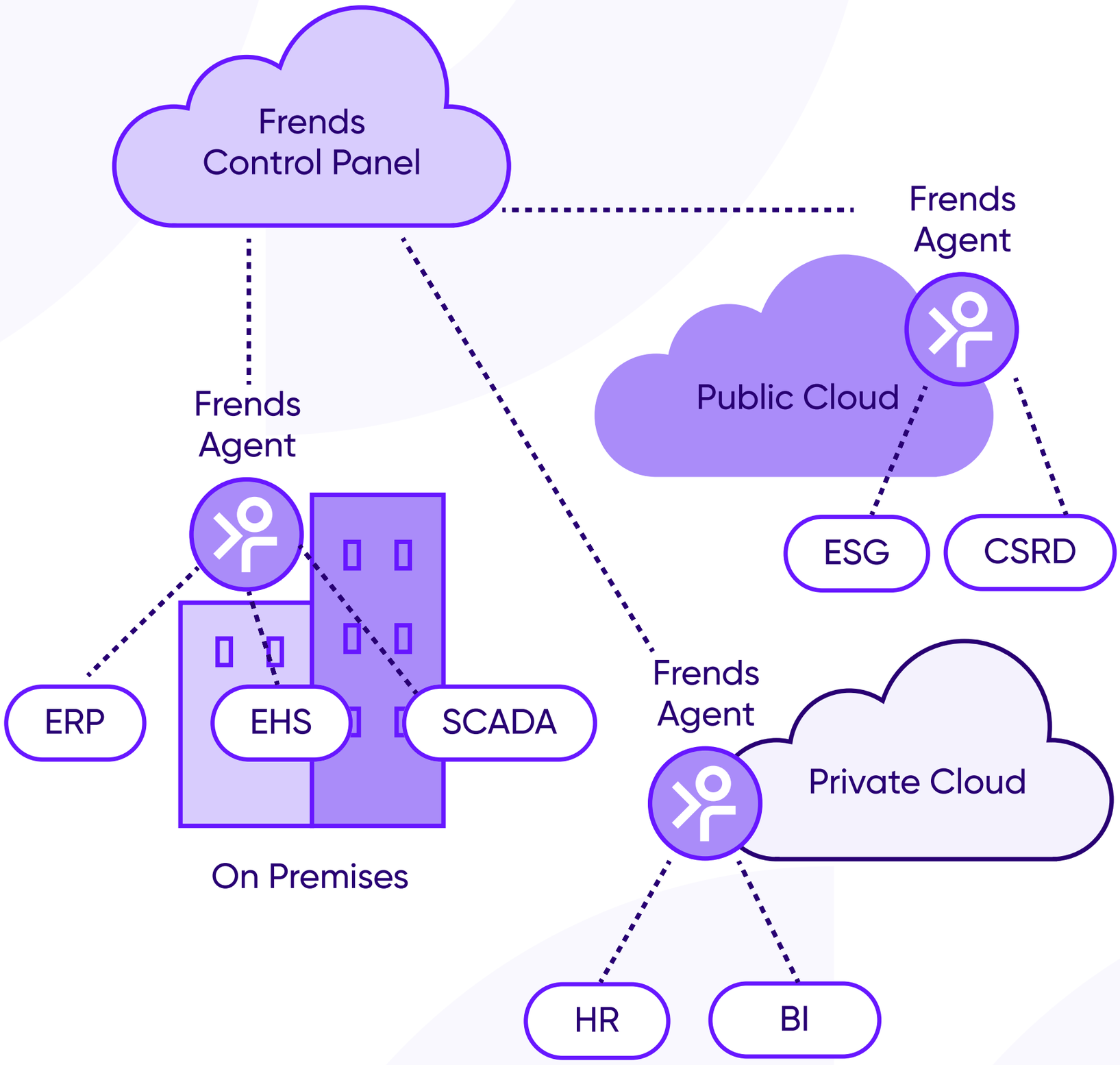
Let’s look at how that comes together in practice.

08

Architecture in Practice

Frends can be deployed in a hybrid architecture, with one or more on-premises agents managing secure internal data flows, while Frends Control Panel handles orchestration, coordination and integration with external systems and SaaS platforms.

Architecture scenario example



The image above illustrates how iPaaS can be deployed in a hybrid architecture to meet different security and operational needs.

At the center is the Frends Control Panel, orchestrating and monitoring all flows. Frends Agents run wherever they are needed:

- On-premises, alongside ERP, SCADA, or EHS systems to handle sensitive internal data.
- In public cloud for ESG or CSRD integrations.
- In private cloud to connect HR and BI systems securely.

How requirements are met

Core compliance and operational needs are even supported out of the box

GDPR compliance through EU-hosted options, local agents and masking tools.

Audit trails with full logging, timestamps and execution history.

PII separation by masking or pseudonymizing at the source before cloud transfer.

Role-based access controls for workflows and logs.

Where to run ESG tasks

Different layers can run in the most appropriate environment

Sensitive HR/finance: On-prem with a Frends Agent.

Operational ESG flows: Hybrid with agents and cloud.

Reporting and dashboards: in cloud BI tools.

External submissions: via cloud APIs such as CSRD portals or CDP.

This architecture ensures **sensitive data stays protected** while still allowing **seamless integration with cloud-based ESG tools**. It balances security, compliance and flexibility, making it easy to scale and adapt as reporting requirements evolve.

Requirement	How Frends Supports
GDPR compliance	EU-hosted, local agents, masking tools
Audit trails	All flows logged with timestamps and execution history
PII Separation	Mask or pseudonymize at source before cloud transfer
Role-Based Access	User/group controls for workflows and logs
Layer	**ESG Data Tasks**
Sensitive HR/finance	On-prem with Frends Agent
Operational ESG flows	Hybrid (Frends Cloud + Agent)
Reporting/dashboarding	Cloud (BI tools)
External submissions	Cloud API (CSRD portal, CDP)

09

Conclusion

The climate tech conversation is no longer about if you report – it's about **how well your systems, teams and data can support what you report.** From regulatory readiness to operational efficiency, the real advantage now lies in how you connect finance to emissions, HR to impact, and strategy to execution.

9. Conclusion

Integration may not be the flashiest part of it, but it’s the part that makes everything else work.

No fancy dashboards, AI summaries or climate commitments will hold up if the data behind them is scattered, manual or unverifiable.

The future of sustainability reporting belongs to organizations that **build infrastructure for transparency** — not just once a year, but every day.

Organizations that treat ESG as a compliance checkbox will soon fall behind, not just in reporting, but in credibility, competitiveness and resilience.

On the other hand, those who invest in scalable integration, combining IT infrastructure, governance and AI, will gain more than just regulatory compliance. They'll **unlock visibility across operations, accelerate decision-making and build a strategic edge** in a carbon-constrained, regulation-driven world.

And whether you're in IT, compliance or sustainability, here's the bottom line:

If your systems can’t talk to each other, your ESG strategy probably can’t either.

10. Glossary Table

Term	Meaning
CSRD	EU Corporate Sustainability Reporting Directive: mandates large companies disclose social and environmental risks and opportunities from 2024 and report using ESRS
ESRS	European Sustainability Reporting Standards: cover environmental, social & governance topics and ensure interoperability with ISSB & GRI standards
ISSB / IFRS S1/S2	IFRS Sustainability Disclosure Standards: S1 sets general sustainability-disclosure requirements; S2 sets climate-specific disclosures; both incorporate TCFD recommendations
EHS	Environment, Health & Safety: discipline that protects human health and safety by minimizing hazards in workplace and environment
HRIS	Human Resources Information System: software that manages HR processes such as payroll, time tracking and benefits
PII Separation	EU Corporate Sustainability Reporting Directive: mandates large companies disclose social and environmental risks and opportunities from 2024 and report using ESRS
ERP	Enterprise Resource Planning: system that integrates and manages core business processes and allows departments to share information
IoT	Internet of Things: network of devices with sensors and software that connect and exchange data with other devices or the cloud
API	Application Programming Interface: software interface enabling one program to access services of another while hiding internal details
CapEx	Capital expenditure: spending to acquire or upgrade fixed assets like property, plant or equipment
GHG	Greenhouse gases: a category of gases that trap heat in the atmosphere, leading to the effects of climate change; examples include carbon dioxide, methane and nitrous oxide
Scope 1 emissions	Direct emissions from an organization's own operations
Scope 2 emissions	Indirect emissions from purchased electricity, steam, heating or cooling consumed by an organization
Scope 3 emissions	Other indirect emissions across the value chain, both upstream and downstream. It includes emissions from the production of purchased goods and services, transportation of goods, employee commuting, etc.
Net zero	The state where the amount of carbon dioxide emissions released into the atmosphere is equal to the amount removed
EU ETS	EU Emissions Trading System: cap and trade carbon market that covers major emitting sectors and reduces its cap over time
CSDDD	Corporate Sustainability Due Diligence Directive: EU law requiring companies to identify and address adverse human rights and environmental impacts across operations and value chains
CDP	Carbon Disclosure Project: nonprofit that helps companies and governments disclose environmental impacts to drive sustainability action
DEI	Diversity, Equity and Inclusion: frameworks promoting fair treatment and full participation of all people, especially historically underrepresented groups
Greenwashing	Behavior or activities that make people believe that a company is doing more to protect the environment than it really is
SaaS	Software as a Service: cloud model where providers host and manage application software that users access via the web

10. Glossary Table

Term	Meaning
iPaaS	Integration Platform as a Service: cloud-based tools that integrate applications and data across on-premises and cloud environments
Hyperscaler	Very large cloud provider offering massive compute and storage resources through elastic cloud platforms
On-prem (on-premises)	Software installed and run locally, on an organization's own computers rather than in the cloud
CSV	Comma-Separated Values: plain-text file format where table fields are separated by commas
ROI	Return on investment: metric measuring profit relative to investment cost
TCO	Total cost of ownership: purchase price plus all operating costs across an asset's life
DevOps	Integration and automation of software development and IT operations to shorten development cycles
ETL	Extract, transform, load: data integration process that extracts data, transforms it (cleans it) and loads it into a data store
AI	Artificial Intelligence: simulation of human intelligence by machines, including learning, reasoning and self-correction
LLM	Large Language Model: AI model trained on vast text data to process and generate human language
NLP	Natural Language Processing: field focused on understanding and generating human language; includes semantic analysis and generation
SCADA	Supervisory Control and Data Acquisition: control system architecture with computers, networks and sensors for high-level supervision of machines
BI	Business Intelligence: data analysis process for collecting, preparing and analyzing data to support decisions
GDPR	General Data Protection Regulation: EU law governing collection and processing of personal data and requiring transparency about data use and breaches
PII	Personally Identifiable Information: information that can distinguish or trace an individual's identity, such as name or social security number

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