

# Models for Supporting Digital Sustainability Key Performance Indicators (KPIs) in European FinTech and Payments

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## ABSTRACT

European enterprises are under increasing pressure to align digital innovation with sustainability goals, yet the financial technology (FinTech) and payments sector has lagged in embedding environmental, social, and governance (ESG) criteria into its core metrics (redbridgedta.com). This conceptual paper introduces the notion of a technology-enabled ESG integration loop (the “ESG-Tech Loop”) as a framework for digital sustainability KPIs – key performance indicators that measure sustainability outcomes within digital payment systems and FinTech platforms. Grounded in sustainable innovation theory, digital finance research, and emerging ESG frameworks, the paper develops a model illustrating how ESG data and technology-driven processes can form a continuous improvement cycle supporting sustainability objectives. The model delineates three dimensions – environmental, social, and governance – each capturing how digital payment innovations can incorporate and advance specific sustainability metrics. For example, European case initiatives like carbon-tracking payment cards and inclusive digital banking services demonstrate the model’s real-world relevance (thalesgroup.comredbridgedta.com). The paper articulates key drivers (e.g. regulatory mandates, stakeholder demand) and challenges (e.g. data transparency, cultural change) influencing ESG-Tech integration, and it outlines expected outcomes such as enhanced ESG performance and innovation capabilities. By conceptualizing a cohesive approach to embed ESG logic into digital payment systems, this work contributes to both theory and practice: (1) integrating diverse literature on ESG reporting, FinTech innovation, and sustainability strategy to ground a new framework for digital sustainability in financial services; (2) proposing a conceptual model – the ESG-Tech Loop – including its dimensions, enablers, and outcomes; and (3) offering implications for European regulators and industry practitioners on designing FinTech innovations that support measurable sustainability KPIs. Ultimately, this paper sheds light on how Europe’s FinTech and payments industry can be configured to drive sustainable innovation by systematically linking technological advancement with ESG performance indicators.

## Introduction

Europe’s drive toward a green economy has elevated sustainability in corporate strategy, including the fintech and digital payments sectors. FinTech innovations can channel capital to environmental and social projects, expanding financial inclusion and enabling green investmentsmdpi.com. However, realizing these benefits requires robust measurement: digital sustainability KPIs – metrics enabled by digital tools – are essential for tracking the environmental and social impacts of

fintech services. For example, Worldline’s analysis found that a typical in-store digital payment emits about 2.45 g CO<sub>2</sub>e (versus 2.8 g for a cash transaction) and that cash transactions can be up to 15 times more carbon-intensive when full lifecycle effects are includedthefintechtimes.com. Such findings illustrate how digital payment KPIs (e.g. carbon per transaction) can quantify sustainability gains. Yet aligning these KPIs with advanced digital systems (AI, data analytics, etc.) remains challenging.

This article examines how emerging technologies and governance models can support digital sustainability KPI development in European fintech and payment contexts. We draw on stakeholder theory (Freeman, 1984), which stresses balancing diverse stakeholder interests (investors, customers, regulators, communities), and institutional theory (Scott, 2004), which highlights normative pressures (such as the EU's Corporate Sustainability Reporting Directive) to adopt ESG norms. Innovation diffusion theory (Rogers, 2003) explains how fintech firms increasingly adopt tools like blockchain and cloud computing to advance sustainability reporting. Building on these foundations, we propose a conceptual framework linking technology, organizational practice, and regulation for effective KPI implementation. We identify key digital sustainability KPIs for the payments sector (e.g. transaction carbon intensity, energy per digital transaction, sustainable finance ratios) and explore how technologies – including AI, blockchain, and digital twins – can enable their measurement. By aligning fintech KPI design with EU regulatory standards (CSRD, SFDR) and Visa's industry examples (such as Visa's transaction carbon index corporate.visa.com), this work offers guidance for fintech companies and regulators to operationalize sustainability metrics.

### Sustainability in FinTech and Digital Payments

The fintech and payments industry is increasingly implicated in sustainability agendas. Digital payments inherently reduce some environmental burdens of cash – recent analyses find substantial carbon savings as transactions go digital (thefintechtimes.com). For example, eliminating paper receipts or plastic cards could cut per-transaction emissions by over 70% (thefintechtimes.com). More broadly, FinTech platforms have improved access to capital for social and environmental projects, thereby advancing Sustainable Development Goals (mdpi.com). Nevertheless, the sector's growth also incurs energy use (data centers, networks) and e-waste (card terminals, devices), creating a need for new sustainability metrics.

Digital sustainability KPIs can span environmental, social, and governance domains adapted to FinTech. Environmental KPIs might include CO<sub>2</sub> emissions per million transactions, energy consumption per user, or percentage of renewable energy used in data centres. These mirror general corporate ESG metrics (e.g. scope 1-3 emissions, carbon intensity per revenue (techtargget.com) but contextualized for digital finance. Social KPIs could track financial inclusion, such as the percentage of underbanked customers reached by digital services, or digital accessibility of payment platforms. Governance KPIs might measure compliance with data privacy and cybersecurity standards, or green product adoption rates. Such KPIs align with EU disclosure norms: under the Corporate Sustainability Reporting Directive (CSRD), large financial firms must publish ESG data including indicators like emissions, energy use, and social impacts (finance.ec.europa.eu). Similarly, the Sustainable Finance Disclosure Regulation (SFDR) requires financial institutions to report sustainability metrics at both entity and product levels (finance.ec.europa.eu). In this context, digital-first KPIs (e.g. automated real-time emissions dashboards for payment portfolios) can provide actionable compliance data for regulators and stakeholders [1].

FinTech's digitization also offers advantages for KPI implementation. AI and data analytics can process vast

transaction datasets to estimate carbon footprints or identify risky ESG behaviours. Blockchain and distributed ledgers provide transparent, tamper-proof records of sustainability transactions (e.g. carbon credit usage ) (activate.fujitsu). Digital twins – virtual replicas of payment networks or financial portfolios – can simulate sustainability scenarios and test interventions (frontiersin.org). In sum, while the fintech sector must answer growing sustainability demands, its digital nature provides novel means to measure and manage impact [2].

### Theoretical Perspectives on KPI Adoption

A range of theoretical lenses helps explain how fintech firms approach sustainability KPIs. Stakeholder theory (Freeman, 1984) emphasizes that payment providers must address the interests of shareholders, customers, regulators, and broader society in setting their KPI targets. For instance, eco-conscious customers and investors increasingly demand metrics like green product revenue share or supply-chain emissions. Engaging these stakeholders leads firms to adopt KPIs that reflect social and environmental values. Institutional theory (Scott, 2004) highlights how regulatory mandates and norms (e.g. CSRD, EU Taxonomy) compel organizations to integrate specific ESG metrics. Under the CSRD, fintech companies above a size threshold will soon need to report scope-3 emissions and diversity data, incentivizing them to establish digital tracking systems. Diffusion of innovation (Rogers, 2003) explains how KPI-related technologies spread: as more firms deploy blockchain and AI for ESG reporting, peers are likely to follow. These frameworks collectively imply that European payment companies must balance regulatory compliance, stakeholder pressures, and technological opportunity when designing KPIs. For example, firms facing strict CSRD requirements will prioritize sophisticated digital reporting tools, whereas others might focus on stakeholder-driven KPIs such as community investment per transaction [3].

### Conceptual Model of Digital Sustainability KPI Integration

Building on these perspectives, we propose a conceptual model for how fintech firms can design and operationalize digital sustainability KPIs. Figure 1 (conceptual only) illustrates how three key dimensions – Technology, Governance, and Stakeholder Engagement – interact to shape KPI selection and use. Each dimension is supported by enabling factors:

- **Data & AI-driven Analytics:** Advanced analytics and AI algorithms enable continuous KPI monitoring. For example, machine learning models can estimate the carbon emissions of transactions using real-time data (merchant type, geography, energy sources) and predict future ESG performance. The model implies building a robust data infrastructure (big data platforms, IoT sensors) to feed sustainability analytics. Such AI-driven tools have been shown to improve decision-making, increase efficiency, and reduce waste in financial contexts (mdpi.com).
- **Blockchain & Transparency:** Distributed ledger technologies ensure integrity and traceability of sustainability data. A blockchain-based KPI system might record each unit of carbon offset purchased per transaction or verify sustainable finance compliance across partners. Because blockchain provides a tamper-proof audit trail, it can build trust in KPI reports and counter greenwashing (activate.fujitsu). In our model, blockchain underlies the

Transparency facet, embedding sustainability credentials directly into payment processes.

- **Digital Twin Simulation:** By creating virtual replicas of financial systems, firms can test how KPI initiatives perform under different scenarios. For instance, a digital twin of the payment network could simulate the impact of switching to renewable energy sources or instituting a 'green transaction' surcharge. This predictive capability (demand for high-quality data and regulatory alignment) allows companies to refine KPIs before full implementation. Digital twins effectively link operational KPIs (like energy intensity) with long-term sustainability targets (rontiersin.org) [4].
- **Regulatory & Governance Alignment:** The model emphasizes aligning KPIs with EU ESG standards. This means mapping digital KPIs to European Sustainability Reporting Standards (ESRS) under CSRD, or to disclosure templates under SFDR. For example, a Financed Emissions KPI could satisfy CSRD scope-3 reporting requirements, while an ESG screening KPI could support SFDR product classification. Governance includes board oversight of KPIs, integration of KPI targets into corporate strategy, and periodic audits. European regulations (CSRD took effect for FY2024 reporting (finance.ec.europa.eu) effectively set the baseline for which KPIs are required, making alignment non-negotiable.
- **Stakeholder Engagement & Culture:** Engagement with stakeholders (employees, customers, investors, regulators) shapes which KPIs are prioritized. The model posits that co-designing KPI frameworks with key stakeholders (for example, focusing on data privacy KPIs to satisfy customer trust) improves relevance and uptake. Internal culture, too, matters: leadership commitment to sustainability drives resource allocation for KPI systems. This dimension is guided by stakeholder theory – considering demands of multiple parties ensures KPIs have broad legitimacy.

These elements interact: for example, AI analytics rely on governance to ensure data quality, while stakeholder pressure may accelerate blockchain adoption for trusted reporting. Overall, the model suggests that effective digital sustainability KPIs emerge from the synergy of technological capability, regulatory compliance, and stakeholder alignment. Embedding KPIs requires coordinated action across these axes.

### Challenges, Enablers, and Implications

Implementing digital sustainability KPIs in fintech involves multiple challenges and facilitators. Challenges include:

- Data and Measurement Gaps:** Collecting accurate ESG data (e.g. energy use of third-party servers) is often difficult.
- Lack of Standards:** Without agreed KPI definitions, firms may measure different things (making comparisons hard).
- High costs and Complexity:** Building digital reporting systems (AI, blockchain) demands investment that some startups or small fintech's cannot afford.
- Regulatory Uncertainty:** Evolving EU rules (CSRD/ESRS details, taxonomy updates) create ambiguity about what to measure.
- Greenwashing Risk:** Without transparent verification, KPI reports may be distrusted (as noted, nearly 42% of corporate green claims were found exaggerated (activate.fujitsu).

- Organizational Silos:** aligning IT, sustainability, and business teams to agree on KPIs requires effort. These barriers echo findings that regulatory hurdles and technology gaps can impede fintech–sustainability integration (mdpi.com) [5].

Conversely, several enablers and strategies can promote KPI adoption. First, EU regulations themselves act as drivers. The CSRD's sweeping ESG disclosure mandate (covering emissions, resource use, social diversity) forces large fintech firms to collect granular KPI data (finance.ec.europa.eu/finance.ec.europa.eu). SFDR similarly pushes asset managers and payment service providers to report product-level ESG metrics (finance.ec.europa.eu). Second, technological progress lowers barriers: cloud computing and open banking APIs make data gathering easier, and affordable AI-as-a-service can generate KPI analyses. Third, industry initiatives provide momentum: for example, Visa has launched digital tools (the Visa Sustainability Index) that benchmark transaction carbon intensity using VisaNet data (corporate.visa.com). Visa also partners with fintechs like Ecolytiq (sustainability-as-a-service) and Cloverly (carbon offset platform) to embed climate action in payment apps (corporate.visa.com). These offerings demonstrate how ecosystem collaboration can operationalize KPIs. Fourth, investor and consumer pressure for ESG alignment incentivizes fintech firms to report transparently. Finally, global frameworks (e.g. the EU Taxonomy, Task Force on Climate-related Financial Disclosures) offer guidance on which KPIs are credible. In practice, fintech companies should exploit these enablers by: engaging stakeholders in KPI design, aligning metrics with EU/industry standards, leveraging available digital platforms (e.g. data consortia, open carbon registries), and iteratively refining KPIs as technology and regulations evolve [6-8].

The conceptual model and these considerations have implications for theory and practice. Theoretically, they extend stakeholder and institutional ideas into a digital-finance context: KPIs become boundary-spanning objects that reflect both compliance pressures and innovation diffusion. Practically, they suggest concrete steps: fintech leaders should inventory their current ESG data, identify which KPIs support business and regulatory goals, and invest in digital infrastructure accordingly. Regulators and standard-setters might also consider fintech-specific guidance on digital KPIs to foster consistency [9].

### Conclusion

Digital sustainability KPIs are critical tools for bringing ESG accountability into the European fintech and payments industry. This paper has outlined how such KPIs – from carbon per transaction to energy efficiency of payment systems – can be defined and embedded using modern technologies. By drawing on stakeholder, institutional, and diffusion theories, we developed a framework linking AI, blockchain, and digital twins to KPI design under EU regulatory mandates (corporate.visa.com). We highlighted both obstacles (data quality, standardization, cost) and enablers (CSRD/SFDR pressures, Visa's data tools, stakeholder demand) in this process. The key recommendation is that fintech firms should proactively integrate sustainability metrics into their core operations, using digital platforms to measure and report these KPIs. Such integration turns abstract

sustainability goals into measurable outcomes, enabling better decision-making and compliance.

As European payments evolve, firms that master digital sustainability KPIs will lead in combining innovation with responsibility. Future research can build on this conceptual groundwork by empirically studying how different KPI models perform across organizations and by developing standardized KPI taxonomies for digital finance. Ultimately, effective KPI frameworks will help ensure that the growth of FinTech supports Europe's climate and social objectives – making each digital transaction not only efficient, but also sustainable for the planet and society.

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