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Carbon Emissions Framework: Measuring Emissions from Digital Payments

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Foreword

The Payments Association's ESG Working Group Leads

The Payments Association's ESG Working Group is proud to present the next stage of its initiative to reduce carbon emissions in digital payments.

This ambitious project stems from the belief that the payments industry must play a pivotal role in promoting global sustainability and proving we can transform sustainability challenges into opportunities for growth and value creation. Through the collaboration of the payments community, we hope this framework will encourage members to kickstart their own initiatives to both measure and reduce carbon emissions from payments. Building industry momentum will be key to achieving sustainability.

We are proud to be part of an industry that is voluntarily progressing with carbon emissions management. This work has begun in advance of legal direction or international competition, reflecting the positive intention and trailblazing culture of those involved. We want to ensure the industry and world we leave behind enables future generations to thrive.

We encourage every organisation in the payments community, both domestically and internationally, to adopt the framework and begin the journey to managing and reducing carbon emissions. We want to foster a thriving debate and discussion on carbon emissions, so we seek your feedback as well as our overarching aim. If you have thoughts and ideas, please share them with us. It is exciting to be a part of this journey, and we look forward to leveraging our collective power to make a significant difference.

Imran Ali, Payments Consulting Director at KPMG and Charlie Bronks, Group Head of Sustainability at Crown Agents Bank – Co-Leads of the ESG Working Group

Introduction

The rapid growth of the digital payments industry is transforming the global financial landscape, driven by factors such as rising smartphone adoption and e-commerce expansion.

This digital shift is not just about modernising transactions; it represents a reimagining of how economies operate, connect, grow, and ultimately sustain themselves.

Growth of Digital Payments

In 2023, the digital payments market was estimated at USD 97.15 billion, and it is projected to reach approximately USD 343.91 billion by 2032, reflecting a compound annual growth rate (CAGR) of 15.08% during this period[1]. Some forecasts suggest even higher growth, with estimates predicting the market could reach USD 514.9 billion by 2033, at a CAGR of 17.2% from 2024 onward[2]. This expansion is not only a reflection of increasing transaction volumes but also a shift toward digital-first financial strategies among businesses and consumers.

Digital payments play a critical role in economic growth by improving transaction efficiency, financial inclusion, and access to services. The global transaction value for digital payments is expected to reach USD 11.53 trillion by 2024[3], underscoring the significant scale of activity facilitated by these technologies.

Insights gained from detailed emissions data can inform strategic decisions around technology investments, infrastructure optimisation, and process improvements, leading to a reduction in environmental impact while also cutting costs. It is clear that as the market grows, the environmental impact of this transformation cannot be ignored.

"While emissions measurement in the payments industry may be driven by regulatory compliance, it also presents a unique opportunity to rethink business processes and improve overall efficiency."

The Need for a Framework and Standard

The urgency to mitigate climate change means an increasing demand for accountability from companies, including those in the digital payments sector. Measuring and tracking carbon emissions enables payment service providers, processors, and related businesses to benchmark environmental performance, demonstrate climate leadership, and identify opportunities for reducing their carbon footprint. This process also supports compliance with current and anticipated regulations and contributes to long-term business resilience.

The digital payment value chain is inherently complex, involving multiple interconnected platforms, processes, and stakeholders across a global ecosystem. **As this sector expands, so too does its carbon footprint, and managing the challenge requires the support of a robust framework for measuring and managing emissions.** The UK's National Payments Vision (NPV), published in November 2024, which promotes developing innovation, enhancing competition, and ensuring security within the payments sector is directly supported by the TPA and our carbon emissions framework as we seek to support members in achieving sustainable growth.

Digital payment emissions are part of a broader challenge related to the increasing use of information and communication technology (ICT). ICT emissions are currently estimated at up to 6% of global emissions, with its share of global emissions predicted to grow to 14% by 2040 - more than the global iron and steel, cement and aviation industries combined[4]. There are multiple areas in the digital payments value chain where these emissions are created, for example:

Data Centres: Process and store payment transactions. Their carbon footprint depends on energy efficiency, cooling systems, and the source of electricity (e.g., renewable or fossil-fuel-based).

Networks: Data transmission through telecommunications networks contributes to emissions, especially in mobile and broadband networks.

Devices: Consumer and point-of-sale devices (e.g., smartphones, payment terminals) consume energy during transactions.

Software Operations: Back-end services and cloud platforms facilitating real-time processing require significant compute resources.

Banking Infrastructure: Servers and systems supporting financial institutions add to the overall emissions.

The challenge also lies in navigating the fragmented nature of ownership across the payments landscape, where different organisations control various parts of the chain, making consistent emissions measurements difficult. Without a standardised approach, efforts to decarbonise risk becoming siloed, disjointed, and ultimately not as effective as they could, or need to be.

Achieving consistency in emissions measurement is essential for the credibility of decarbonisation efforts and ensuring the integrity of data used in regulatory reporting and sustainability benchmarking. When organisations use different methodologies to collect and report emissions data, it creates discrepancies that can hinder comparability and distort the overall picture of the payments industry's carbon footprint.

"Carbon measurement is not just a regulatory checkbox but a strategic lever for sustainable business transformation and growth, is taking the opportunity to take a leadership role across the financial services industry."

The Payments Association's (TPA) ESG Working Group published the 'Sustainable Digital Payments: Measuring Carbon Emissions in the Payments Chain' report in October 2024, emphasising the importance of establishing a standardised carbon measurement approach across the payments value chain. The report called for greater consistency, comparability, and data integrity to help organisations proactively start their decarbonisation journeys ahead of regulatory mandates.

Measurement is the first and most important step toward action, and the Carbon Emissions Framework will support companies in not only measuring their emissions but create the foundation for reducing them, driving resilience and long-term growth.

The Carbon Emissions Framework has been designed to address these challenges by offering a practical, maturity-based approach for measuring carbon emissions within the digital payments value chain. It includes Scope 1, 2, and 3 emissions, taking into account embodied emissions, and is in line with global standards like ISO 21031 and the GHG Protocol ICT (Information and Communication Technology) Sector Guidance (GHGP-ICTSG). The framework not only helps companies meet current regulatory requirements but also positions them for future compliance, with a focus on scalability and continuous improvement. Through the maturity pathway, organisations are guided from basic emissions tracking to comprehensive Lifecycle Assessment (LCA), ensuring that all players in the ecosystem can participate meaningfully in the collective effort to reduce carbon footprints.

The Carbon Emissions Framework introduces a tiered maturity model that guides organisations from basic emissions tracking to comprehensive Lifecycle Assessment (LCA), aligning with regulatory requirements and industry standards. The maturity model provides a structured pathway to adopt progressively more detailed measurement practices, allowing companies to start with foundational metrics and evolve towards a full Scope 3 assessment, including upstream supplier emissions and downstream impacts. By offering guidance on emission factors, calculation methods, and data quality (such as using both market-based and location-based approaches), the framework ensures consistency across the payments ecosystem, supporting the comparability of emissions data and enabling organisations to benchmark their performance.

We encourage all members of the TPA to actively participate in adopting the framework, showcasing their commitment to sustainability, setting a foundation for regulatory alignment, and showcasing the sector's leadership in sustainable digitisation. **The time to act is now.** With the digital payments market growing exponentially, there is an urgent need for a coordinated, industry-wide effort to manage its environmental impact. This report provides a roadmap for organisations to start their decarbonisation journey, build a foundation for future regulatory alignment, and set the stage for the payments industry to become a leader in sustainable digital transformation.

Summary

Recognising and responding to the challenges outlined in the Sustainable Digital Payments report, our framework will develop a phased approach with clear boundaries and metrics across all stakeholders. The framework will provide the practical initial steps for baseline measurement, evolving toward detailed LCA and Scope 3 integration to address the supply chain aspects mentioned above. This phased strategy ensures that companies can start their measurement efforts immediately while allowing for continuous improvement, increased granularity, and sophistication of measurement, as well as preparing to align with emerging regulatory requirements.

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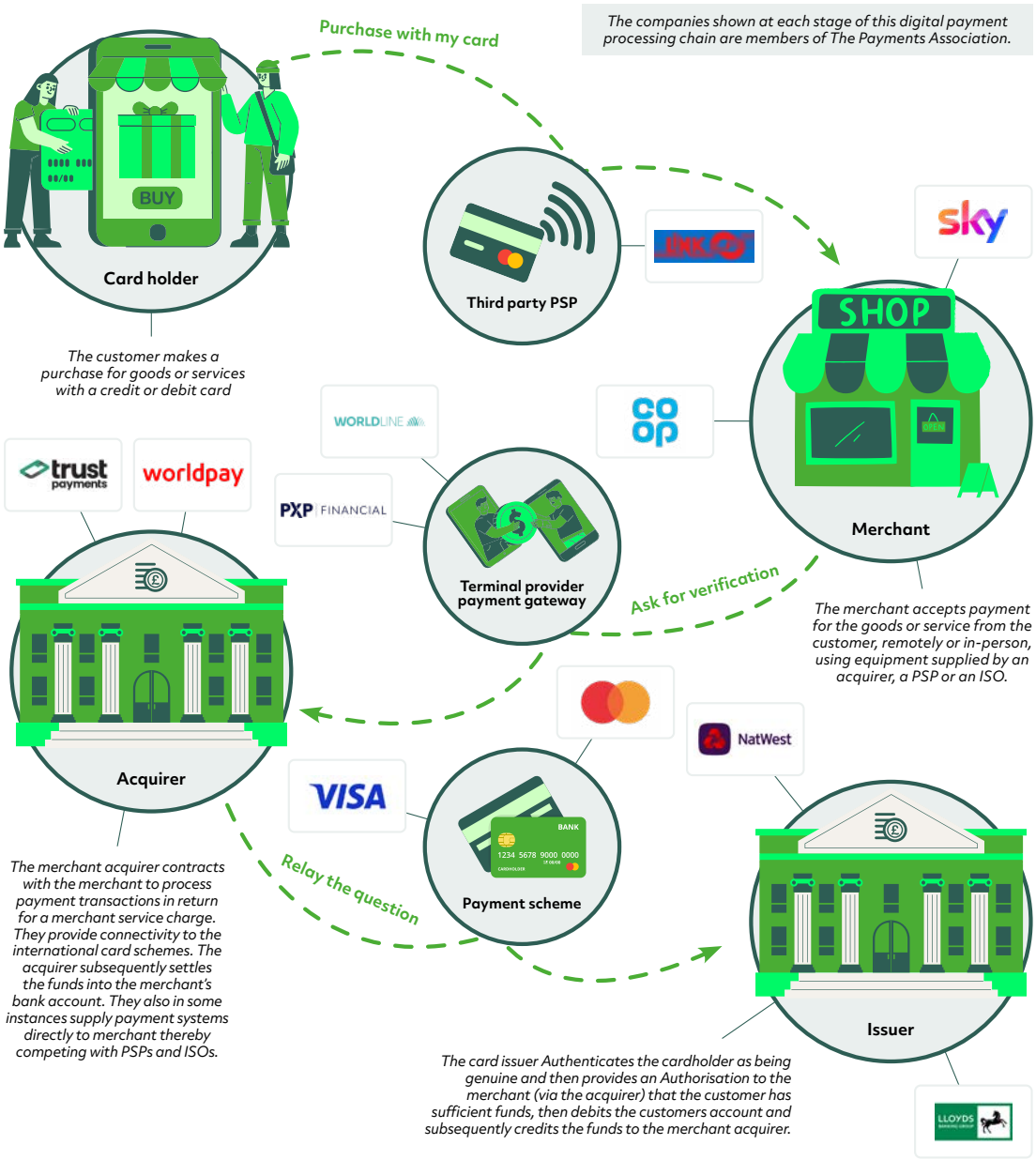
The Carbon Emissions Framework for Digital Payments

The digital payment value chain is a complex ecosystem composed of numerous interconnected processes, platforms, and services that enable the seamless transfer of funds across different payment types as shown in Figure 1.

This ecosystem includes multiple stakeholders such as payment service providers, merchants, issuers, payment schemes, acquirers, payment facilitators, and payment gateways. Each entity plays a specific role in the transaction process, contributing to different stages such as payment initiation, verification and authorisation, processing, clearing, settlement, and reconciliation.

Figure 1. Scope Infographic from the TPA report: 'Sustainable Digital Payments: Measuring Carbon Emissions in the Payments Chain'

Right is an example of a digital payment, specifically a card payment, demonstrating the part of the process from card holder to issuer.



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As a result of these complexities, the ownership boundaries within the digital payment value chain are not always straightforward, as different organisations may control various parts of the process. For example, a payment gateway might handle the initial payment data transmission, while a payment processor manages the routing, verification and authorisation, and separate payment or card networks take responsibility for clearing and settlement. The involvement of different entities means that no single organisation owns the entire process from start to finish.

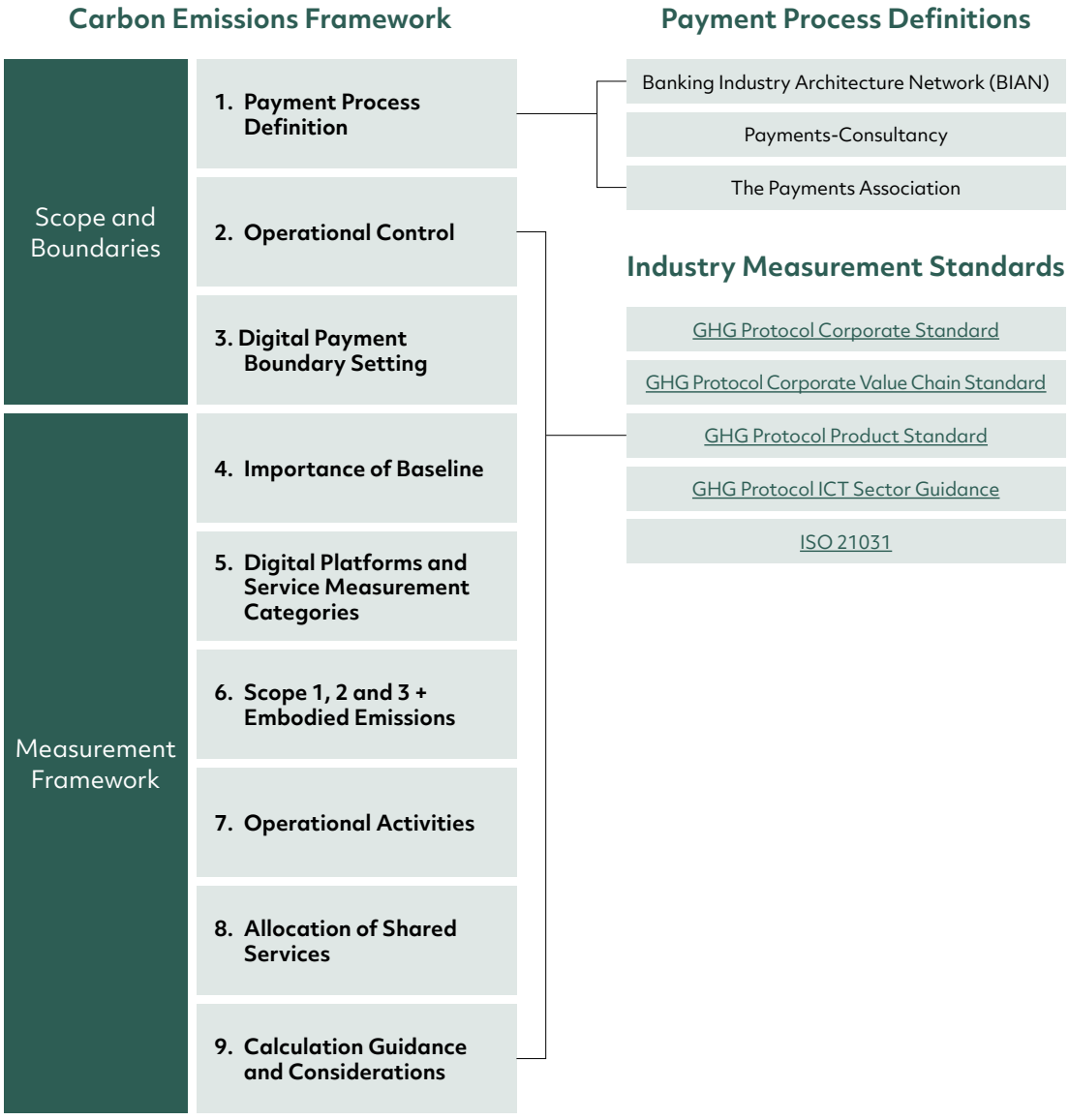
This fragmented ownership structure leads to variations in how products (e.g., credit cards, digital wallets) map to specific platforms and services. For instance, a credit card payment involves multiple systems, such as point-of-sale terminals, payment gateways, issuing banks, acquiring banks, and card networks, each providing critical infrastructure that underpins the payment journey. The platforms used—whether internal systems operated by banks or external networks like Visa or SWIFT—add further layers of complexity, as they may belong to different companies with varying responsibilities for emissions measurement.

Given this intricate web of processes and ownership, establishing clear **scope and boundaries** is essential for accurately measuring emissions across the digital payment value chain. Without clearly defined scope and boundaries the following challenges and risks are likely to occur:

- **Double-counting or omissions:** Multiple companies may inadvertently report the same emissions (e.g., from shared services), or emissions from certain services may be overlooked entirely.
- **Inconsistent reporting practices:** Variations in how companies measure and attribute emissions can lead to discrepancies in reported data, making it difficult to aggregate and compare emissions across the value chain.
- **Shared responsibility needs to be managed:** Since some platforms and services are used by multiple organisations (e.g., cloud-based payment processing), it is vital to allocate emissions proportionally, ensuring that each company does its part without overlap.

In order to manage this complexity, the Carbon Emissions Framework proposes a structured approach to firstly setting scope and boundaries across payment processes through clear definitions and boundary setting criteria, and secondly a consistent measurement framework to drive appropriate standards-based coverage and methods. As illustrated in Figure 2 below, we have constructed our framework around nine key areas, supported by precise industry definitions and measurement standards. These form the basis of Sections 3 and 4 as we detail the framework approach.

Figure 2. The Carbon Emissions Framework for Digital Payments



To support readers of the framework, refer to our online Key Terminology appendix, which provides a summary explanation of the important concepts, terms, and approaches described through the framework. This covers definitions of Scope 1, 2, and 3, as well as explanations of methods such as location vs. market-based approaches to calculation and a summary of the emerging regulations that will impact the reporting of digital emissions.

Scope and Boundaries

1. Payment Process Definition

To establish a robust framework for measuring carbon emissions, it is essential to use structured and widely accepted definitions for the key processes that make up the digital payment value chain. Establishing this foundation for setting scope and boundaries for measurement is key to the Carbon Emissions Framework, and allows for members and the TPA to map their measurement and data to a common and consistent taxonomy. In order to achieve this, we will use the Banking Industry Architecture Network (BIAN)[5] and the Payments Association's research on payment ecosystems[6].

BIAN Industry Standard Service Definitions

BIAN provides an established framework for mapping the service landscape and value chain architecture within banking, including payments. BIAN's services architecture is an industry standard and identifies and maps payment-related service domains and value chains covering, cross-product operations, payment processes, and clearing and settlement. These service domains include key processes such as payment execution, transaction authorisation, and clearing and settlement. The BIAN services architecture accommodates different payment types, ensuring that specific payment methods (e.g., card payments, Faster Payments, wholesale payments) are identified. Utilising BIAN's service-based definitions allows for the full lifecycle mapping of a digital payment, including pre-payment activities (e.g., payment initiation), in-process activities (e.g., authorisation and processing), and post-payment activities (e.g., reconciliation and settlement). By using this detailed service to process mapping, we can clearly define scope and boundaries and avoid gaps or overlaps in reporting. More information on BIAN can be found here: www.bian.org

The Payments Association's Research

TPA's perspective on digital payment processes complements the BIAN framework by emphasising practical, industry-driven considerations. The use of TPA's payment value chain process definitions aids in addressing shared challenges across the payments ecosystem, such as the importance of considering emissions from multi-party services and outsourcing.

"TPA's perspective not only aligns the framework with industry standards, but also incorporates real-world payment processing practices and operational nuances."

Payments Process Scope and Boundaries

Table 1 below provides a summary of the payment process definitions. These have been further verified according to the BIAN services taxonomy and value chain architecture[7] and TPA payment ecosystem analysis (see the online Key Terminology appendix).

Table 1. Payment Process Definitions - per Mark McMurtrie, Payments-Consultancy.

Payment Stakeholder	Payment Stakeholder Description	Payment Platforms (examples)	Payment Processes
Payer / Payment Service User	The sender of a payment	Person or Business (Bank Account Holder)	Makes payments from their payment account
Account Servicing Payment Service Provider (ASPSP)	Manages the payer's payment account The payers PSP for sending of funds The payees PSP for the receiving of funds	Bank, Financial Services organisation, Card Issuer	Manage payment account, Issue card/ financial account, Authenticate customer, Authorise funds, Settle funds
Issuer Processor	Third Party Processor (TPP) providing services on behalf of an issuer	FIS, Fiserv	Authorisation, card issuance, merchant management, invoicing, onboarding, PIN services, card dispatch
Payment scheme / Payment Network	Provide connectivity between card issuer and merchant acquirer. For bank payments the UK schemes include Faster Payments, BACS and Chaps	Visa, Mastercard, American Express, Discover	Message standards definition, creator of rules, Authorisation service, Settlement service
Acquirer	Contract with merchant and provide connectivity to payment networks	Worldpay, Barclaycard, Fiserv, Elavon, Worldline, Adyen, Stripe, Trust Payments, Planet Payments, etc	Scheme compliance enforcement, AML and KYC, authentication, authorisation, settlement services, fraud prevention services, reporting services
Payment Facilitator (PayFac)	Merchant services provider	Square, Dojo, SumUp, PayPal	Provision of merchant services (Acquirer Lite / Gateway Plus)
Gateway PSP	Provide connectivity between merchant and acquirer	Visa Cybersource, Mastercard, Worldline	Transaction processing, reporting, supply of acceptance devices/digital payments acceptance software, authentication services, fraud prevention services
Payment Initiation Service Provider (PISP)	Third Party Provider (TPP) initiating a payment on behalf of a payer	ApplePay, GooglePay, SamsungPay, Ope Banking providers, (including big Banks), Go Cardless, Truelayer, Plaid, Tink	Payment initiation
Account Information Service Provider (AISP)	Third Party Provider (TPP) that accesses payment account information on behalf of a payer	PISPs often also provide AISP data services, plus data aggregator specialists. Accounting solution providers Xero, Quickbooks, Intuit, Credit Kudos	Account information data services
Merchant	Sells products or services to customers	Categorised by market sector and size tier	Payments acceptance, acceptance devices, digital checkout solutions
Payee Payment Service User	The receiver of a payment	Person or Business (Bank Account Holder)	Receives payments from a payer
Payments acceptance device provider	Suppliers a range of physical card terminals	Verifone, Ingenico, PAX, Castles	Card acceptance devices
Risk/Fraud Prevention provider	Supply solutions to prevent fraud and manage risk	RegTech, Risk and Fraud solution providers Global, Regional or Domestic	AML, Risk and Fraud prevention solutions
Dispute Management provider	Service provider to merchants, acquirers or issuers	Chargeback 911	Chargeback management systems, pre dispute systems, ensure compliance with international payment network rules
Card provider	Card personalisation and manufacturer	Thales	Production and personalisation of payment cards

For further information, please refer to the online Key Terminology appendix where further information defining payment processes, types and platforms can be found for reference and in support of Table 1.

TPA Member Guidance:
By following this guidance, members now have a consistent taxonomy for the payment process to be measured according to industry standard mappings and definitions; this forms the starting point for what to measure. Next, it is important to be clear about the members scope of responsibility when undertaking measurement.

2. Operational Control

When measuring carbon emissions from digital payments, it is essential to set boundaries based on the operational control of payment-related infrastructure and processes. This means that each organisation is responsible for measuring emissions generated by the platforms and systems it directly controls or operates. For example, if a bank operates a digital payment processing platform, it is accountable for measuring the emissions from the data centres it uses and the software systems involved in processing payments.

Using operational control as the basis for defining responsibility aligns with the principles outlined in the GHG Protocol, the most widely used global standard for greenhouse gas accounting. The GHG Protocol dictates that the entity with the authority to implement operational policies, introduce efficiency measures, or make decisions affecting emissions should be responsible for taking action to reduce those emissions, thereby ensuring greater accountability and effectiveness in emissions reduction efforts.

"Under the operational control approach, a company accounts for 100% of emissions from operations over which it or one of its subsidiaries has operational control. It should be emphasised that having operational control does not mean that a company necessarily has authority to make all decisions concerning an operation. For example, big capital investments will likely require the approval of all the partners that have joint financial control. Operational control does mean that a company has the authority to introduce and implement its operating policies." - *GHG Protocol, Corporate Standard FAQ*[8]

Operational control is particularly appropriate for the digital payments value chain because it clarifies who is responsible for emissions within a highly interconnected and fragmented payment ecosystem. For example, emissions from data centres, payment gateways, and merchant point-of-sale (POS) systems are attributed to the entity that manages or operates these assets. This approach ensures that each entity within the value chain focuses on reducing emissions where it has the most influence, promoting more effective carbon management across the entire digital payment infrastructure. The operational control approach encompasses all Scope 1, 2, and 3 emissions, necessitating cooperation and transparency from various TPA members to fully account for all emissions, especially those related to the supply chain. The Carbon Emissions Framework recognises the challenges this creates and addresses them as part of the maturity framework described in Section 7.

TPA Member Guidance:
We now have a clearer understanding of what needs to be measured from an operational control perspective within the payments process. The next step is to establish boundaries for each part of the process to ensure comprehensive and consistent measurement coverage. This will allow organisations to focus their emissions reduction efforts where they have the greatest impact.

3. Digital Payment Boundary Setting

Now that a member has mapped the payment process to a defined taxonomy and assessed their operational control over the process, it is key to set a boundary around the process being measured. As guidance, the payment process types and recommended boundary setting are summarised in Table 2 below:

Table 2. Guidance on Boundary Setting Related to Key Payment Processes

Payment Process	Process Description	Boundary Setting Guidance
Payment Initiation	The process where a payment is initiated by a user or a business through various methods such as credit/debit cards, bank transfers, mobile wallets, or BNPL.	The entity managing the payment initiation platform (e.g., mobile banking app, POS system, or payment gateway) should measure emissions from customer-facing activities, such as the energy used by payment terminals or mobile apps and the servers hosting the payment initiation services.
Authorisation and Processing	Involves verifying the payment details, authenticating the payer, and processing the transaction. It ensures the legitimacy of the payment and prevents fraud.	Payment processors or financial institutions should measure the energy used in data centres for transaction processing, including fraud detection services. If third-party payment processors are involved, their emissions can be reported under Scope 3.
Clearing and Settlement	The process of exchanging payment information between financial institutions (clearing) and transferring funds to complete the payment (settlement).	The entities facilitating clearing (e.g., payment networks, card networks) or settlement and transfer of funds (e.g., central banks, payment networks) should measure the emissions from their respective infrastructure.
Payment Acceptance and Merchant Services	Involves the infrastructure that allows merchants to accept various payment types, including POS systems and online payment gateways.	Acquirers and issuers should measure emissions from the systems they use to manage payment acceptance. This includes merchant services platforms (primarily for acquirers) and card issuance infrastructure (primarily for issuers). Where systems are shared, emissions should be proportionally attributed based on usage.
Issuer and Acquirer Roles	The roles of issuing banks (providing payment instruments like cards) and acquiring banks (facilitating payment acceptance for merchants).	
Risk Management and Security	Covers fraud detection, compliance with security standards (e.g., PCI-DSS), and risk mitigation throughout the payment process.	Each organisation measures emissions from its security infrastructure, such as fraud detection software and compliance management systems, including any outsourced security services.
Reporting, Reconciliation, and Accounting	Includes maintaining accurate payment records, reconciling accounts, and providing reports for regulatory and auditing purposes.	Boundaries should include emissions from internal accounting and reconciliation software systems. If using cloud-based tools, emissions should be attributed as Scope 3.
Customer Service and Dispute Resolution	Handles customer inquiries, disputes, chargebacks, and refunds related to payment transactions, ensuring satisfactory resolution.	Contact centres or service platforms used for dispute resolution should be measured for emissions, especially if operated by the financial institution.

TPA Member Guidance:
We now have defined payment processes mapped, and a clear operational control and measurement boundary are in place. Before moving into Section 6 to describe in more detail what needs to be measured, it is important to ensure that we have awareness of and align to a standards-based approach to measurement. The next part of this section describes the industry standards.

Industry Measurement Standards

To consistently measure carbon emissions from digital payments, it is crucial to align with industry measurement and accounting standards. The combination of GHG Protocol standards, including the ICT Sector Guidance, Product Standard, and Corporate Value Chain Standard, as well as specific technology-related measurement methodologies, such as ISO 21031 and the SustainableIT taxonomy, ensures that the Carbon Emission Framework incorporates a robust and comprehensive approach that can address emissions through the digital payment value chain and at every stage of the payment lifecycle. Below is an overview of each standard and its relevance to digital payment measurement.

GHG Protocol ICT Sector Guidance

Tailors the general GHG Protocol to the ICT sector, providing specific methodologies for calculating emissions related to ICT activities, including hardware manufacturing, software development, and data centre operations.

Relevance to Digital Payments: This guidance is crucial for measuring emissions across key digital payment activities, such as the energy consumption of data centres and network equipment used in transaction processing. It addresses shared infrastructure, network energy use, and other factors critical to digital payments.

GHG Protocol Product Standard

Offers guidelines for conducting product lifecycle assessments (LCAs) to measure emissions across a product's entire lifecycle, covering development, use, and end-of-life stages.

Relevance to Digital Payments: Treating digital payment services as 'products' enables companies to evaluate the environmental impact of each payment transaction comprehensively. This approach helps to quantify emissions from servers, software operations, and the disposal of payment hardware, enabling targeted decarbonisation efforts.

GHG Protocol Corporate Value Chain (Scope 3) Standard

Provides a framework for measuring and reporting indirect emissions throughout a company's value chain, covering 15 categories of upstream and downstream activities.

Relevance to Digital Payments: Since Scope 3 emissions often represent the largest share of a digital payment's carbon footprint, this standard is essential for assessing emissions sources such as outsourced data services, production of payment terminals, employee commuting, and third-party logistics. It guides the setting of boundaries for data collection and supplier engagement.

ISO/IEC 21031:2024

The 'Information technology — Software Carbon Intensity (SCI) specification', provides a standardised methodology for calculating the carbon emissions associated with software systems. This standard aims to enhance awareness and transparency regarding the sustainability credentials of software applications, enabling practitioners to make informed decisions during design, development, and deployment to minimise carbon emissions.

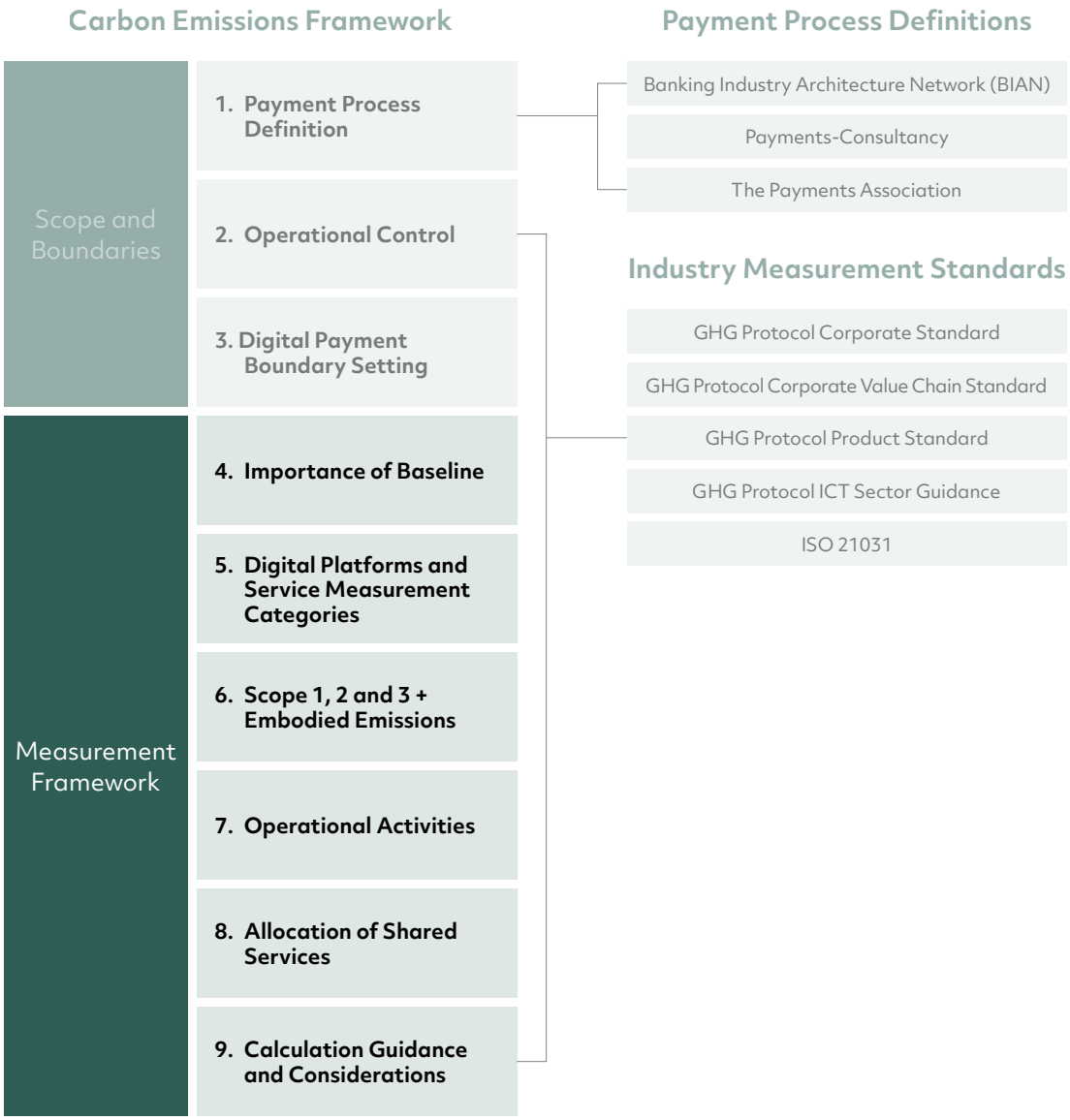
Relevance to Digital Payments: In the digital payments industry, software applications are integral to processing transactions, managing data, and ensuring security. By applying the SCI specification, companies can assess and reduce the carbon footprint of their software systems, leading to more sustainable operations. This aligns with broader goals of energy efficiency and responsible resource management, contributing to the overall sustainability of digital payment services.

Measurement Framework

The next crucial step is defining what to measure, as highlighted in the green box in Figure 3 below.

The remainder of this section will describe the measurement framework elements identified as items 4 to 9.

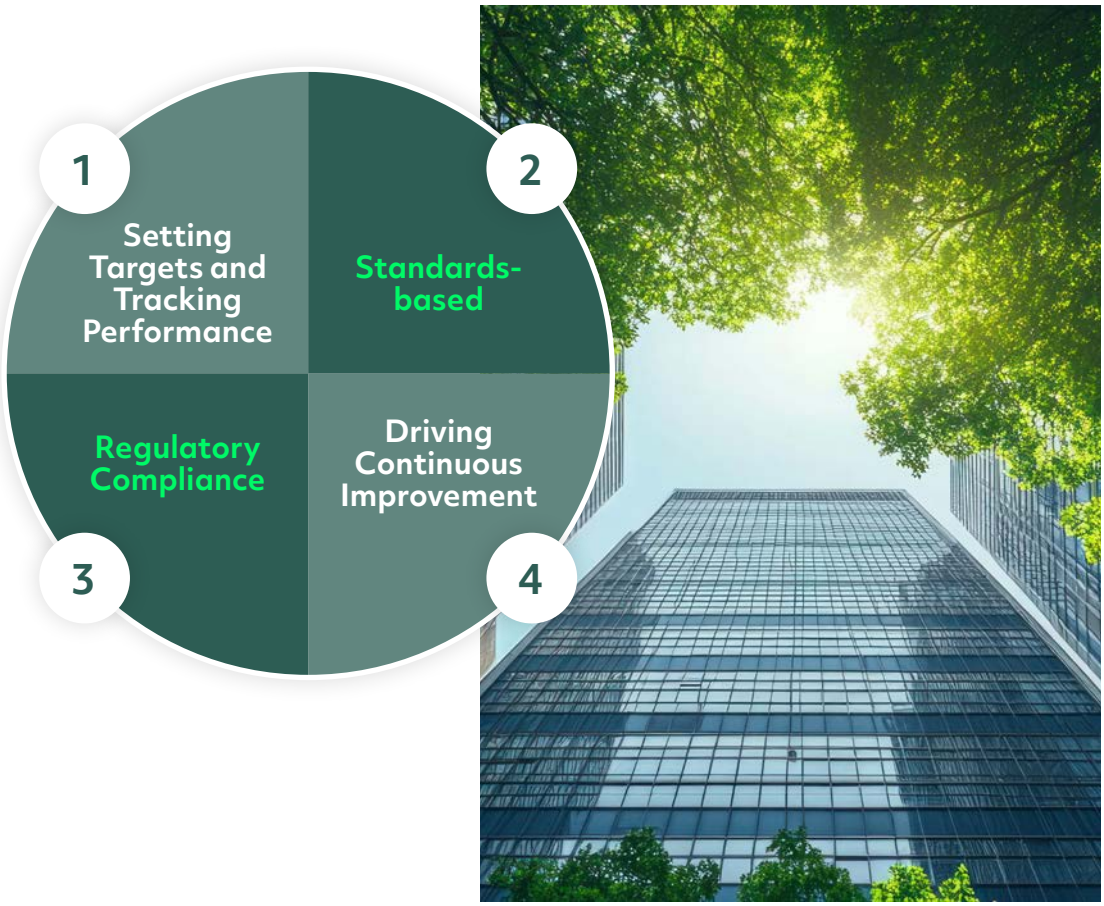
Figure 3. The Carbon Emissions Framework - Focus on Measurement



4. Importance of a Baseline

A baseline measurement is a critical first step in a carbon measurement framework, serving as a reference point for tracking progress, complying with regulations, and aligning with standards. Given the complexity of the digital payment value chain, establishing a clear baseline built on consistently defined scope and boundaries for each payment process is essential to accurately measure and manage emissions. The importance of a baseline measurement is shown in Figure 4 and described in the four themes below:

Figure 4. The Importance of Establishing a Baseline Measurement



1 Setting Targets and Tracking Performance

A baseline provides the initial quantitative assessment of a carbon footprint. By starting with a baseline, organisations can identify emissions hotspots associated with payment platforms and services, which makes it possible to set realistic targets, monitor reductions over time, and measure the effectiveness of decarbonisation initiatives.

2 Standards-based

Standards like the GHG Protocol Product Standard and ISO 21031 recommend conducting lifecycle assessments that begin with baseline measurement. This baseline captures emissions data across the lifecycle stages, from production and use to the disposal of payment terminals, software, and supporting infrastructure, providing a comprehensive view of the environmental impact. A standards-based approach ensures that baseline data serves as a benchmark for internal and external comparisons. It allows companies to evaluate their performance against industry norms or regulatory thresholds, helping them identify areas for improvement as well as product and service differentiation.

3 Regulatory Compliance

UK regulations, such as the Sustainability Disclosure Requirements (SDR) and Financial Conduct Authority (FCA) sustainable investment rules, already mandate the disclosure of carbon emissions and how financial institutions integrate sustainability into their products and services. With new requirements being driven by the UK Green Taxonomy and the Corporate Sustainability Reporting Directive (CSRD), detailed emissions disclosures related to digital products and services will become necessary. Establishing a baseline is essential for compliance, as it provides the basis for consistent annual reporting and tracking improvements against regulatory benchmarks. A baseline measurement also enables companies to prepare for these evolving regulatory obligations and ensures that they meet minimum disclosure standards as the regulations become more stringent over time.

4 Driving Continuous Improvement

A baseline provides a foundation for implementing feedback loops and making data-driven decisions on sustainability strategies. Continuously comparing current emissions data to the baseline enables organisations to adjust their approaches, prioritise high-impact areas, invest in effective technologies, and refine their carbon reduction plans based on real-time insights. Baseline measurements also support long-term goal-setting and the development of emissions reduction roadmaps. Companies can use the initial data to guide strategic planning, optimising resource allocations and targeting reductions in areas that yield the greatest environmental and financial benefits.

TPA Member Guidance:
Establishing a baseline measurement is a critical first step for accurately tracking progress, meeting emerging regulatory requirements and standards within the digital payments industry. It enables organisations to manage emissions across the entire payment value chain by setting clear scope and boundaries, ensuring comprehensive measurement, and continuously improving sustainability practices.

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5. Digital Platforms and Services: Measurement Categories

The digital payment value chain consists of multiple interdependent processes, each supported by a variety of digital platforms and ICT infrastructure. Establishing clear boundaries and creating a consistent approach for each process, taking into account the full lifecycle of digital payment activities, is crucial for accurately measuring and managing carbon emissions across this complex ecosystem. This requires identifying and then aligning measurement categories for digital payments with established standards and frameworks; see Figure 5 below:

Figure 5. Measurement Categories for Digital Payments

'Platform-related' Digital Emission Sources	'Associated' Digital Payment Emission Sources
Desktop Managed Services	Payment-Specific Devices and Hardware
Telecoms and Network	Transportation and Logistics
Data Centre	Broader Value Chain Systems
Cloud	Human Resources and Workforce-Related Emissions
Software	

As the Carbon Emissions Framework is focused on digital payments, it is key to link the measurement approach to a standard, industry definition, and categorisation of technology alongside the broader GHG Protocol accounting guidance.

Table 3 provides a detailed explanation of the measurement categories illustrated in Figure 5, fully aligning with the GHG Protocol ICT Sector Guidance and Accounting standards for Scopes 1, 2, and 3 which will be explained in further detail in Part 6 of this section. In addition, in the Carbon Emissions Framework, we align Scope 3 category measurements with our maturity stages (see Section 4), expanding Scope 3 coverage progressively depending on whether a lifecycle assessment (LCA) for the digital platform or application being measured is in place.

Table 3. Measurement Categories

Category	Description	Scope 1	Scope 2	Scope 3	Embodied Emissions
1. Desktop Managed Services	Measure energy use of desktops, laptops, and peripherals used in payment operations. Includes lifecycle emissions from production to disposal.	N/A	Energy used for operating devices in offices (electricity use).	Emissions from device manufacturing, employee commuting, and disposal.	Emissions from the lifecycle of devices, including manufacturing, transportation, and disposal.
2. Telecoms and Networks	Track emissions from telecom networks and data transmission services.	N/A	Electricity consumption for operating telecom equipment and data transmission infrastructure.	Emissions from outsourced network services and transmission activities.	Emissions from the production of telecom infrastructure and equipment.
3. Data Centre	Measure energy use of data centres used for payment processing, storage, and security operations.	On-site fuel use for backup generators in data centres.	Electricity used for data centre operations.	Emissions from third-party data centres, hardware lifecycle, and data storage services.	Emissions from the manufacturing of servers, storage devices, and cooling equipment.
4. Cloud	Track energy consumption of cloud computing services, including shared resources.	N/A	Electricity use associated with the operation of cloud servers and data storage.	Emissions from shared cloud infrastructure and upstream energy use by cloud service providers.	Emissions from the lifecycle of cloud infrastructure, including servers and network hardware.
5. Software	Measure emissions from software development, deployment, and operation, including optimisation efforts.	N/A	Energy used in software development and testing environments.	Emissions from outsourced software services, cloud-based development, and employee commuting.	Emissions embedded in the lifecycle of IT infrastructure used for software development.
6. Payment-Specific Devices and Hardware	Account for lifecycle emissions of payment terminals, POS systems, servers, and other hardware.	N/A	Electricity use for operating payment terminals, servers, and POS systems.	Emissions from hardware manufacturing, transportation, and disposal, as well as third-party maintenance services.	Emissions from the full lifecycle of payment devices, including production, use, and end-of-life treatment.
7. Transportation and Logistics	Measure emissions from logistics related to payment hardware transportation and employee travel.	Fuel use for company-owned vehicles (if applicable).	N/A	Emissions from third-party logistics providers, shipping, business travel, and commuting.	Emissions from the manufacturing and maintenance of transportation vehicles and shipping equipment.
8. Broader Value Chain Systems	Track emissions from support systems such as fraud detection, risk management, and compliance.	Fuel use for on-site backup power generation or heating/cooling systems (if applicable).	Electricity used for operational infrastructure like contact centres and fraud detection systems.	Emissions from outsourced services, data hosting, employee commuting, and cloud-based compliance platforms.	Emissions associated with the lifecycle of support infrastructure, including data centres and office equipment.
9. Human Resources and Workforce-Related Emissions	Account for emissions from employee activities, including commuting, business travel, and remote work energy use.	Fuel use for on-site office heating (if applicable).	Electricity used in office facilities or home offices for remote work.	Emissions from employee commuting, business travel, and third-party training facilities.	Emissions from the construction and maintenance of office buildings and workspaces.

Technical and Measurement Considerations

By structuring the framework according to the key categories described above, organisations can begin to comprehensively assess the carbon footprint of their digital payment processes through measurements of the technologies and operational activities supporting them. We go into further detail for each category below, providing examples of measurement considerations, coverage, and how they relate to digital payment activities.

1. *Desktop Managed Services*

Energy Use of Desktop Infrastructure

Measure the electricity consumption of desktops, laptops, monitors, and peripherals used by employees involved in payment operations, such as monitoring transaction processing or customer support, as well as in IT roles developing and supporting digital platforms related to a payment process.

Lifecycle Emissions of End-User Devices

Consider the lifecycle emissions of desktop and laptop computers used in payment processes, taking into account life cycle stages in software production, usage, and end-of-life, as well as roles supporting payment operations like IT support, data analysis, and back-office functions associated with the payment process under measurement.

2. *Telecoms and Networks*

Network Infrastructure Energy Use

Assess the energy consumption of telecom and network services that facilitate digital payments, encompassing data transmission, mobile networks, and leased lines that link payment gateways, point-of-sale devices, and cloud services.

Lifecycle Emissions of Network Devices

Account for the lifecycle emissions of network devices, such as routers, switches, and firewalls, used in payment processes. This should include usage through all life cycle stages, covering activities such as software production, use, and all roles that support payment operations, such as IT support, data analysis, and back-office functions associated with the payment process being measured.

Energy and Emissions from Data Transmission

Calculate emissions associated with the transmission of payment data over telecom networks, which is critical for real-time payment processing but also supports payment processes like transaction authorisation, payment clearing, and customer notifications.

3. *Data Centre*

Energy Use of Data Centres

Measure the electricity consumption of data centres used for payment transaction processing, data management, fraud detection, and security operations. This includes both in-house and outsourced data centres.

PUE (Power Usage Effectiveness) and Data Centre Efficiency Metrics

Analyse and assess data centre efficiency metrics to determine the effective use of energy for payment-related services.

4. *Cloud*

Cloud Service Energy Consumption

Assess the energy consumption of cloud services, encompassing servers, storage, and software applications, by allocating resources according to the workload and usage related to the payment process. This should include core payment processing as well as other processes such as hosting digital wallets, payment processing engines, and customer analytics.

Shared Resource Allocation for Cloud Services

Calculate emissions from shared cloud resources, distributed based on appropriate allocation methods (refer to Measurement Framework item 8, 'Allocation of Shared Services,' later in this section). This approach is critical for managing and allocating shared cloud resources used in multi-tenant payment platforms and software as a service (SaaS) solutions.

5. *Software*

Lifecycle Software Development and Operation Emissions

Measure emissions associated with developing, deploying, and running software applications supporting the full range of payment processes. Software measurement can be a useful boundary setter and will also encompass other measurement categories, so it is important to avoid double counting. For software companies developing payment capabilities and services, measuring their software product emissions provides transparency to companies using the software as part of their payment value chain.

Shared Resource Allocation

Calculate emissions from shared resources, distributed based on appropriate allocation methods (refer to Measurement Framework item 8, 'Allocation of Shared Services,' later in this section). This approach is critical for managing and allocating shared resources, which cover both technology and human resources.

6. *Payment-Specific Devices and Hardware*

Lifecycle Energy and Emissions from Payment Terminals and POS Devices

Measure the lifecycle emissions of payment terminals and POS devices, including manufacturing, operation, and disposal. This covers embedded carbon from production and energy use during payment processing.

7. *Transportation and Logistics*

Logistics for Payment Hardware Distribution

Measure emissions generated from transporting payment hardware, such as payment terminals, to retailers or end-users. These emissions can vary significantly based on factors like transport methods and distances. Additionally, the embodied emissions data provided by the device manufacturer may include emissions related to the production of payment devices. It is important to account for these emissions accurately in order to ensure comprehensive carbon reporting.

Travel-Related Emissions

Calculate emissions from business travel and employee commuting associated with the delivery of the payment process, digital product, or service being measured. Travel-related emissions for employees may already be tracked at an organisational level. Allocate a portion of these emissions specifically to the process under measurement to ensure full coverage and granular accounting for the payment process. This approach ensures detailed accounting and reporting, but it is important to avoid double counting.

8. *Broader Value Chain Systems*

Upstream Emissions from Support Systems

Include emissions from essential upstream support systems, such as fraud detection, risk management, and compliance systems that fall within your operational control. These systems are integral to digital payment processing but used more broadly within an organisation to cater for multiple products and services, and contribute to the overall environmental impact of the service before it reaches the end user. Accurately allocating emissions from these systems requires a sophisticated measurement approach and is typically achievable only at higher levels of maturity within an organisation.

9. *Human Resources and Workforce-Related Emissions*

Employee-Related Emissions

Employee-related emissions encompass all emissions arising from workforce activities, including Scopes 1, 2, and 3. Identify the workforce involved in activities supporting digital payments, such as software development, IT and payment operations, compliance, and customer service, to attribute employee emissions related to the digital payment process. Allocate emissions based on the proportion of time, effort, or roles that contribute to the lifecycle stages of digital payment services.

Employee Lifecycle Emissions

Employee-related emissions should be linked to different stages of the lifecycle for digital payments, ensuring emissions associated with the workforce involved in creating and maintaining digital payment platforms; ongoing emissions from employees supporting the functioning and management of payment systems; workforce emissions related to updates, compliance checks, and system improvements; and, when applicable, emissions from workforce activities involved in retiring or replacing outdated systems.

TPA Member Guidance:

By adopting a measurement framework that aligns directly with GHGP-ICTSG categories—Desktop Managed Services, Telecoms, Data Centre, Cloud, and Software—while incorporating payment-specific devices and operational processes, we ensure the framework is comprehensive and covers all aspects of digital platforms and processes. To ensure undertaking the correct measurement categories, members should carefully review the scope and boundaries they have set.

6. Scope 1, 2 and 3 + Embodied Emissions

"In the Carbon Emissions Framework, we align Scope 3 category measurements with our maturity stages (see Section 7), expanding Scope 3 coverage progressively depending on whether a lifecycle assessment (LCA) for the digital platform or application being measured is in place."

As highlighted in Table 3, the Carbon Emissions Framework mandates that all measurement categories be completed to comprehensively map emissions across Scopes 1, 2, and 3. As a reminder, refer to our online Key Terminology appendix, which provides a summary explanation of the definitions of Scope 1, 2, and 3.

Pre-LCA Stage: At this stage, five Scope 3 categories are measured where relevant based on an allocation of organisational-level data for a subset of categories. We align with the UK government technical specification PPN 06/21[9], which sets Scope 3 requirements for organisational carbon reduction plans. The categories included are:

- Category 4: Upstream Transportation and Distribution
- Category 5: Waste Generated in Operations
- Category 6: Business Travel
- Category 7: Employee Commuting
- Category 9: Downstream Transportation and Distribution

LCA Stage: When a lifecycle assessment is conducted, in accordance with the GHG Protocol Product Standard[10], an additional four Scope 3 categories are measured where relevant. These are incorporated into more advanced levels of maturity within the framework, and include the following categories:

- Category 1: Purchased Goods and Services
- Category 10: Processing of Sold Products
- Category 11: Use of Sold Products
- Category 12: End of Life Treatment of Sold Products

Embodied emissions—the emissions embedded in the entire lifecycle of hardware and equipment, such as payment terminals and data centre servers—are a critical component of Scope 3 emissions. These emissions occur throughout the manufacturing, use, and end-of-life phases of the equipment. It is important to note that, depending on ownership and operational control, embodied emissions can also be relevant to Scopes 1 and 2. Accounting for these emissions provides a more holistic view of an organisation's environmental impact and ensures comprehensive accounting across the carbon emissions framework.

TPA Member Guidance:
Prioritise high-quality, direct data sources for accurate emissions measurement and continuously improve data collection and tracking. Establish a strong baseline for consistent reporting and data-driven emissions reductions. Develop a GHG Protocol-aligned tracking system, collaborate with partners for Scope 3 data, and regularly update strategies to meet evolving requirements.

7. Operational Activities

To conduct a comprehensive lifecycle assessment of a digital product, emissions related to employee activities should be measured, as outlined in the GHG Protocol's Product Life Cycle Standard and Corporate Standard. These activities contribute to the product's overall carbon footprint and may include Scope 1, Scope 2, and Scope 3 emissions, depending on the organisation's control and influence:

- **Product Development:** This category includes emissions from employees involved in research and development (R&D), software engineering, and testing. These emissions cover energy use in office spaces and lab environments, as well as any specialised equipment required for product design and testing.

- **Operational Support:** Refers to the emissions resulting from various activities, including IT infrastructure management, data centre operations, and ongoing maintenance, which are essential for the continuous deployment and updates of digital products. Given the energy-intensive nature of these activities, they are critical to measure and manage.

- **Business Travel:** Emissions generated from business travel related to product development, client engagements, and meetings necessary for product advancement. This includes flights, train journeys, or other modes of transport used by employees to support the product being measured.

- **Remote Work and Commuting:** Emissions associated with employees working remotely or commuting to office locations. These emissions are important as hybrid and remote work models become more common, and their impact should be quantified to reflect the full operational footprint of the product.

The GHG Protocol encourages organisations to account for these emissions comprehensively and provide a complete picture of a product's environmental impact. By clearly categorising emissions under the appropriate scopes, organisations can enhance the precision and transparency of their carbon reporting.

TPA Member Guidance:
Follow the GHG Protocol's guidance to correctly categorise emissions from employee activities under Scope 1, 2, or 3. Establish clear boundaries and document the allocation of emissions, especially when activities support multiple products or services, to prevent double counting. To ensure transparency and precision, use robust data sources, prioritise direct measurements, and allocate emissions proportionally.

8. Allocation of Shared Services

Given the interconnected nature of the digital payments ecosystem, where multiple organisations share services (e.g., cloud infrastructure, payment networks), the framework includes an allocation approach for managing and accounting for shared services. This involves distributing emissions proportionally based on factors such as transaction volume or service usage, ensuring fair and accurate representation of each company's contribution to the overall carbon footprint, and avoiding double-counting emissions.

Allocation Based on Usage Metrics

When shared services or platforms (e.g., cloud infrastructure, payment networks) are used by multiple organisations within the value chain, emissions should be allocated proportionally based on measurable usage metrics. These metrics can include:

- **Transaction Volume:** The number of transactions processed by each organisation on the shared platform. This approach aligns with payment industry standards and ensures consistency in reporting. However, it may not account for differences in the complexity or resource intensity of different transaction types.

- **Processing Time or Resource Consumption:** Allocating emissions based on the processing time or computational resources consumed (e.g., CPU cycles, storage usage) for each organisation's tasks. This can provide a more accurate reflection of each organisation's impact, especially for complex processes that require more resources.

- **Weighted Allocation Based on Service Type:** When platforms perform multiple tasks (e.g., payment authorisation, clearing, and settlement), emissions can be allocated based on a weighted factor that reflects the resource intensity of each task. For instance, more computationally intensive processes like settlement could have a higher weight than simpler tasks such as authorisation.

Avoiding Double-Counting

Avoiding double counting is crucial to ensure the accuracy and integrity of emissions reporting, as duplicate entries can lead to overestimating an organisation's carbon footprint, skewing data, and undermining efforts to track and manage emissions effectively. Adopting the following approaches is recommended:

- **Clear Attribution Rules:** Establish rules that ensure emissions from shared services are reported by only one organisation or are split according to agreed allocation metrics. This requires setting clear guidelines for how shared emissions should be reported by each party, preventing duplication.

- **Central Repository for Emissions Data:** Utilise a centralised data repository (e.g., managed by TPA) to facilitate data sharing and verification across the value chain. This repository can track the allocation of shared emissions and ensure that emissions are not double-counted when aggregated.
- **Use of Emission Factors for Shared Services:** Apply standard emission factors for shared services to ensure consistency in calculations. This may include setting different factors for high-intensity processes (e.g., data-intensive transactions) versus low-intensity processes.

TPA Member Guidance:
To accurately account for emissions from shared services within the digital payments ecosystem, use a proportional allocation method based on measurable usage metrics, such as transaction volume or resource consumption. Ensure consistency by applying standard emission factors and establishing clear attribution rules to prevent double counting. Utilise a centralised data repository, if available, to facilitate data sharing, verification, and coordinated emissions tracking across the value chain. This approach will provide a fair and accurate representation of each organisation's contribution to the overall carbon footprint.

9. Calculation Guidance and Considerations

"Applying standardised emission factors and selecting the appropriate calculation approach are key to ensuring consistency and reliability in emissions reporting."

Accurate carbon emissions measurement across the digital payment value chain is crucial for organisations to understand and mitigate their environmental impact.

Emission factors translate activity data, such as electricity or fuel usage, into carbon equivalents (CO_2e), enabling a consistent quantification of emissions. The choice of emission factors, whether for energy consumption, data centre efficiency, or hardware lifecycle, must reflect geographical energy mixes and industry standards to provide meaningful insights.

In addition, understanding when to use market-based or location-based approaches is critical for capturing the true impact of energy use. These approaches affect how emissions from data centres, cloud services, and employee travel are calculated, highlighting the importance of selection based on an organisation's energy procurement and regional considerations. By taking into account these calculation methodologies, organisations can enhance their accuracy in reporting and align with frameworks such as the GHG Protocol, which help make informed decisions and effectively measure their carbon footprint. The following considerations are recommended to members:

1. Emission Factors

To accurately measure carbon emissions across the digital payment value chain, it is necessary to apply standardised emission factors and choose the appropriate calculation approach based on the type of emissions. Emission factors convert activity data (e.g., electricity consumption, fuel usage) into a carbon equivalent (CO_2e), enabling organisations to consistently quantify their environmental impact.

TPA Member Guidance:
Use Recognised Sources for Emission Factors: We recommend using emission factors from credible and authoritative sources such as, but not limited to: the UK Department for Energy Security and Net Zero (formerly BEIS) for the latest UK-specific emission factors; the International Energy Agency (IEA) for internationally recognised energy and electricity factors; and the U.S. Environmental Protection Agency (EPA) for factors specific to the U.S. region. Emission factors should be updated annually or as soon as new data becomes available to reflect changes in energy intensity and grid composition.

2. Market-Based vs. Location-Based Approaches

These approaches to emissions measurement exist to provide organisations with accurate and meaningful ways to account for their environmental impact, particularly in complex scenarios where energy consumption and procurement practices vary widely. As companies aim to understand and reduce their carbon footprint, it becomes crucial to measure emissions in ways that reflect both local energy realities and strategic energy sourcing decisions.

The location-based approach addresses the need to calculate emissions based on the average carbon intensity of the local grid where energy consumption occurs. This method offers insights into the regional impact of energy use, highlighting variations in emissions caused by differences in energy generation sources, such as coal, natural gas, or renewables, across different areas. It is particularly useful for understanding how energy consumption patterns contribute to emissions in specific geographical locations.

Meanwhile, the market-based approach exists to account for the environmental impact of strategic energy procurement decisions. This method uses emissions factors that reflect the choice to purchase renewable energy or engage in carbon offset agreements. By focusing on the impact of these procurement strategies, the market-based approach helps organisations quantify and substantiate claims about their use of 'green' energy sources, thereby supporting their sustainability goals and commitments.

3. Data Quality and Assurance

The accuracy of emissions measurement is heavily dependent on the quality of primary data used. High-quality, verifiable data is essential to ensure that emission factors are applied accurately and reflect real-world energy consumption. We recognise that not all data collection processes are currently perfect; nonetheless, all attempts to use precise data enhance the credibility of emissions reporting and ensure better alignment with standards that increasingly demand transparent and reliable data sources.

Various sustainability and reporting standards, like the Greenhouse Gas Protocol, highlight the importance of data integrity in emissions measurement in Chapter 7 of their Corporate Standard. We anticipate that emerging frameworks such as the EU Artificial Intelligence Act and the Corporate Sustainability Reporting Directive (CSRD) will enforce stricter reporting requirements, prioritising accurate and verifiable data.

"Continuous improvements in data quality and measurement methodologies help organisations stay aligned with regulatory expectations and industry benchmarks. Organisations must be mindful of the complexities and potential challenges of implementing updates to ensure their strategies remain both effective and practical."

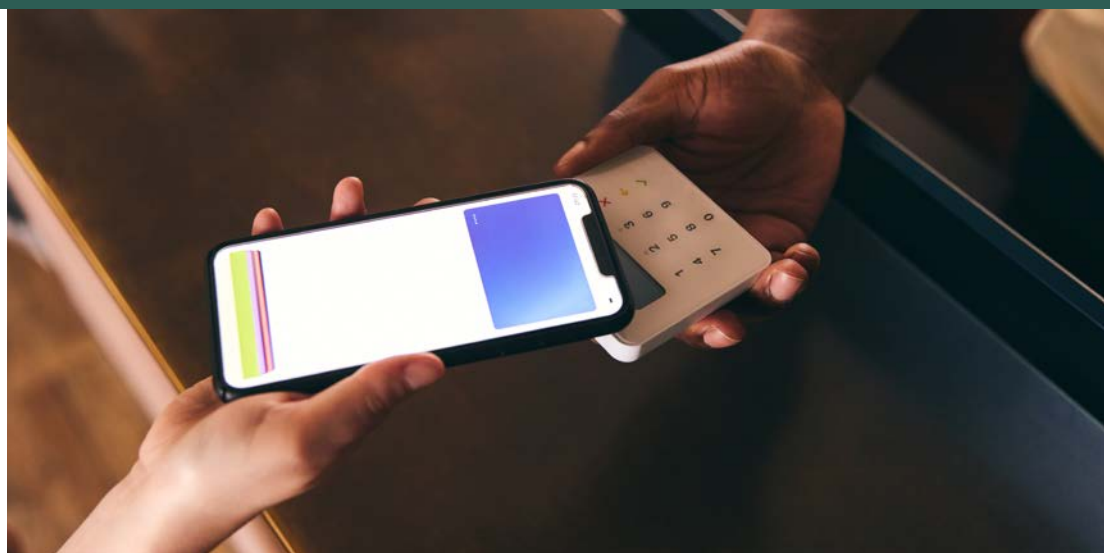
Of equal importance is the need for a periodic review and updating of emission factors. Energy intensity, grid composition, and other variables that influence emissions undergo changes over time. Regularly revising these factors ensures that measurement practices remain current and in line with evolving standards and best practices, such as those recommended by the Greenhouse Gas Protocol.

4. Measurement Timeframe

The standard and widely accepted reporting cycle for greenhouse gas emissions is based on the calendar year, running from January 1 to December 31. This annual cycle aligns with established protocols to ensure consistency, comparability, and transparency in emissions reporting across different organisations and sectors.

TPA Member Guidance:

We recommend using the location-based approach as the primary calculation method. This approach calculates emissions based on the average grid emissions factor for the region where the energy consumption occurs. It provides a transparent view of the actual environmental impact associated with the geographical location of the operations. However, if an organisation has specific renewable energy procurement practices (e.g., Power Purchase Agreements, Guarantees of Origin, or Renewable Energy Certificates), the market-based approach should be applied in addition to the location-based approach. This captures the impact of energy procurement choices and supports claims of renewable energy use.



The World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) developed the Greenhouse Gas Protocol, which emphasises the significance of a consistent reporting period. The GHG Protocol Corporate Standard recommends an annual reporting cycle to ensure reliable data collection, facilitate year-over-year comparisons, and enable organisations to track their progress in reducing emissions. Specifically, the protocol notes that "reporting on an annual basis is generally most relevant to stakeholders and facilitates comparability" (GHG Protocol Corporate Standard, Chapter 5)[11].

The International Organisation for Standardisation (ISO) also supports this annual cycle within ISO 14064-1, the standard for GHG reporting and verification. ISO 14064-1 Section 7.3.1 recommends that organisations define a consistent reporting period and suggests that an annual timeframe is most appropriate (ISO 14064-1)[12].

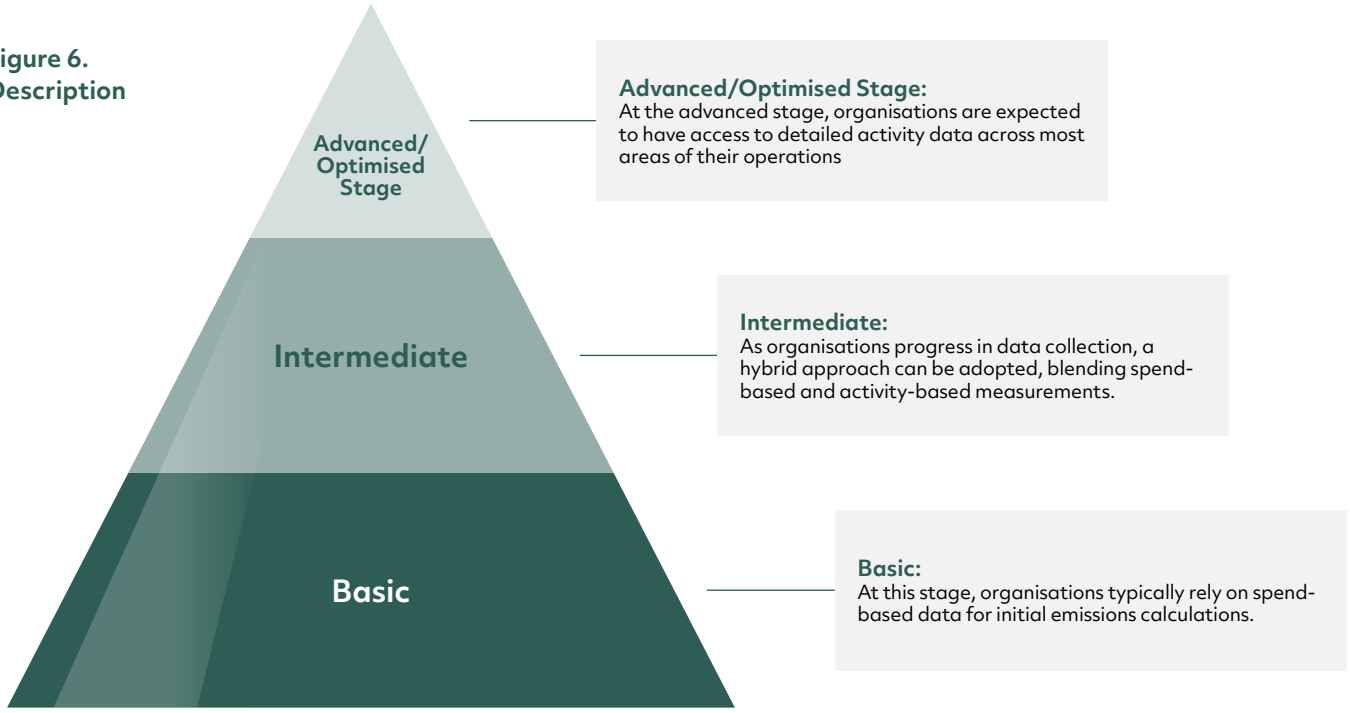
The CDP (formerly known as the Carbon Disclosure Project) aligns with this standard practice by requiring organisations to submit emissions data annually, covering the previous calendar year. This cycle helps provide stakeholders with timely, comparable data on organisational progress toward emissions reduction (CDP Reporting Guidance)[13].

5. Spend vs. Activity-based Calculations

Spend-based and activity-based approaches are both methods used for measuring emissions, each with specific applications depending on the data available and the level of detail required. A spend-based approach estimates emissions by applying emissions factors to financial expenditure for goods or services, making it useful when detailed activity data is unavailable.

In contrast, an activity-based (or process-based) approach calculates emissions based on specific data from activities or resource consumption, such as energy usage or material inputs, providing a more accurate assessment when direct data is accessible. These approaches can be implemented in stages according to our maturity framework, progressing from broader estimates to detailed measurements as an organisation's data maturity improves.

Figure 6.
Description



Basic Stage

When organisations have limited direct activity data, they can estimate emissions by applying sector-specific emissions factors to financial expenditures on goods or services.

For example, emissions related to outsourced services or purchased goods can be estimated based on the amount spent in these areas. This approach is often aligned with reporting standards for initial Scope 3 assessments, such as the GHG Protocol's guidance for companies beginning their emissions tracking journey. The spend-based approach is effective for broader estimates, making it a valuable starting point for organisations beginning their carbon measurements.

Intermediate Stage

Apply activity-based calculations to increase accuracy when specific activity data, such as energy usage in facilities or fuel consumption for transportation, is available. For other areas where direct data is still lacking, spend-based estimates may continue to be used. This stage offers a balanced method for improving emissions data accuracy across different Scope 3 categories, progressively integrating activity data as it becomes accessible. This approach aligns with the requirements for organisations looking to enhance their reporting consistency and precision without full lifecycle data.

Advanced/Optimised Stage
Here, a fully activity-based approach is recommended, using specific metrics like kilowatt-hours of electricity, litres of fuel, or kilograms of materials, and applying corresponding emissions factors to calculate the associated emissions. For categories such as the production, use, and disposal of payment hardware or employee commuting, activity-based data allows for precise measurements, reducing estimation errors. This level of detail aligns with lifecycle assessment (LCA) methodologies, such as those in the GHG Protocol Product Standard, which recommend direct activity data for advanced maturity organisations committed to detailed, transparent emissions reporting.

Using a maturity-based progression from spend-based to activity-based approaches allows organisations to start emissions reporting early while gradually improving data accuracy and reliability. This staged approach supports compliance with regulatory requirements and advances organisational goals in carbon footprint reduction.

TPA Member Guidance:
Take a tiered approach to data quality, following a hierarchy that aligns with the measurement timeframe and uses the most accurate methodology available.

(1) Begin with direct measurements and primary data where possible, prioritising activity-based approaches for the highest accuracy by capturing real-time data on resource usage or specific processes.

(2) Where direct data is not accessible, use industry-specific emission factors from recognised standards, applying spend-based or activity-based methods depending on data availability and reporting maturity.

(3) If necessary, use generic default factors as a last resort where specific data cannot be obtained.

(4) Organisations should conduct an annual review and verification of emission factor applications and calculations to ensure data remains accurate, aligned with standards, and compliant with evolving regulations.

Maturity Framework

The framework initially outlines four maturity levels for measuring carbon emissions in the digital payments value chain, progressing from Basic to Optimised with progressive sophistication and advancing measurement coverage.

All TPA members will be able to position themselves somewhere on the maturity framework, and as they progress from one level to the next over time, they achieve incremental value and transparency. The maturity levels are illustrated in Figure 6 and summarised in Table 4 below:

Figure 7. Carbon Emissions Framework Maturity Levels

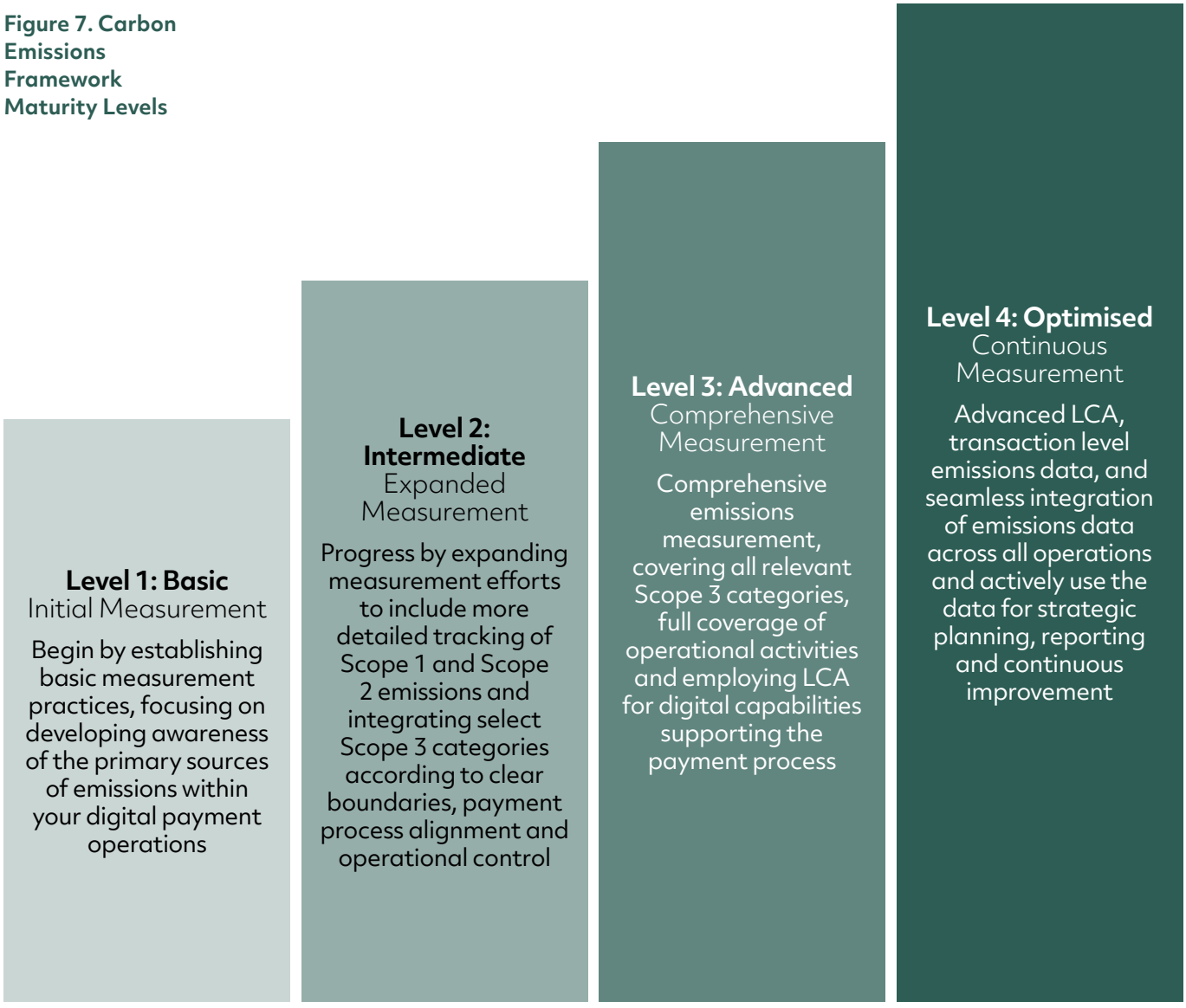


Table 4. Summary of the Carbon Emissions Framework Maturity Levels

Maturity Level	Description	Key Focus Areas	Key Outcomes
Level 1: Basic - Initial Measurement	Organisations begin by establishing basic measurement practices and raising awareness of emission sources in their digital payment operations.	■ Scope and boundaries understood for digital payment capabilities under operational control. ■ Primary Scope 1 and Scope 2 Emissions: Measure direct emissions from owned sources and indirect emissions from electricity. ■ Start tracking emissions related to operational activities (e.g., office facilities, commuting or remote work impacts) related to defined scope and boundaries under operational control. Include Scope 3 measurement / allocations if already being undertaken at organisation level.	■ Foundation for more advanced measurement practices. ■ Basic understanding of carbon impacts, including workforce contributions. ■ Support internal engagement and awareness activities.
Level 2: Intermediate - Expanded Measurement	Organisations expand measurement efforts to include detailed Scope 1 and Scope 2 tracking, integrating select Scope 3 categories aligned to established digital payment boundaries and operational control.	In addition to Level 1: ■ Include Scope 3 Emissions related to ICT and employees according to the defined scope and boundaries under operational control. ■ Enhanced energy monitoring, for example detailed energy use in data centres and cloud service providers. ■ Understand and prepare data for lifecycle assessments. ■ Enhance shared services allocation methods (e.g., transaction volume) should be used to distribute emissions for shared platforms.	■ Broader emissions visibility. ■ Improved understanding of total carbon impacts. ■ Better accuracy in shared services allocation and refined measurement practices. ■ Data readiness for Level 3.
Level 3: Advanced - Comprehensive Measurement	Achieve comprehensive emissions measurement, covering all relevant Scope 3 categories and performing full lifecycle assessments for digital payments capabilities.	In addition to Level 2: ■ Full Scope 3 coverage with measurement of emissions across all value chain activities. ■ Use of multiple metrics for shared services allocation, such as combining transaction volume and resource usage for greater precision. ■ Full transaction level (e.g., per payment) emissions data. ■ LCA with detailed lifecycle assessments covering all aspects of ICT and operational activities. ■ Measurement data is made available to broader TPA community. ■ Data is used to drive reduction and action planning, with clear targets and performance management.	■ Gain detailed insights into employee contributions across all lifecycle stages. ■ Ability to prioritise decarbonisation opportunities across the value chain. ■ Detailed insights into shared services contributions.
Level 4: Optimised - Continuous Improvement	Achieve seamless integration of emissions data across payment operations and technology, and use the data strategically for continuous improvement.	In addition to Level 3: ■ Real-time emissions data and updates to shared services allocation based on the latest data. ■ Aggregated transaction level emissions data across a digital payments value chain. ■ Continuously optimise based on lifecycle data. ■ Advanced reporting and benchmarking. ■ Embedded data collection and automated measurement. ■ Data aggregation across the payment value chain.	■ A fully integrated emissions measurement framework into payment processes and operations. ■ Comprehensive support for decision-making, compliance, and sustainability. ■ Advanced shared services allocation methods, supporting continuous improvement and strategic planning.

This maturity framework provides a structured pathway for digital payment companies to progressively improve their carbon measurement practices. It enables organisations to transition from basic awareness to a comprehensive lifecycle assessment, supporting meaningful decarbonisation and aligning with international standards.

Conclusion

In conclusion, building a robust carbon emissions measurement framework within the digital payment value chain relies on a few fundamental principles: setting a clear baseline, prioritising high-quality primary data, and aligning with established sustainability standards.

The Carbon Emissions Framework provides a structured measurement approach that covers all relevant emissions categories, from Scopes 1, 2, and 3, to embodied emissions in digital infrastructure. Proper allocation of shared service emissions and consistent calculation methods, whether location-based or market-based, further refine the accuracy of emissions data. Finally, maintaining data quality through regular updates, verification processes, and feedback loops helps ensure that organisations can adapt to real-time insights and evolving regulatory requirements. This comprehensive, standards-aligned measurement framework will help organisations create impactful emissions reduction strategies across the digital payment ecosystem, resulting in both environmental and operational benefits. To summarise the key principles:

Importance of a Baseline

establishing a clear baseline measurement is essential as it provides a reference point for tracking progress, setting realistic emissions targets, and supporting compliance with sustainability standards. To achieve this, organisations should define consistent scopes and boundaries for each payment process, which will enable accurate tracking across the digital payments value chain.

Digital Platforms and Services: Measurement Categories

organisations should map to the measurement categories to ensure consistent and comprehensive coverage across all aspects of their digital platforms. This includes categories like desktop services, telecoms, data centres, cloud, software, and payment-specific devices. By clearly setting boundaries within each category and allocating emissions proportionally, organisations can prevent the risk of double-counting across shared or overlapping services.

Scope 1, 2, and 3 + Embodied Emissions

accurately measuring emissions across Scopes 1, 2, and 3 is critical for obtaining a complete view of the environmental impact within the digital payment value chain. This approach also requires incorporating embodied emissions, which are emissions embedded across the lifecycle of essential hardware and infrastructure, such as data centre servers and payment terminals.

Shared Services Allocation

for emissions from shared services, such as cloud infrastructure or payment networks, organisations should use a proportional allocation method based on measurable usage metrics, including transaction volume, processing time, or resource consumption. This approach allows each organisation to fairly represent its contribution to the total emissions from shared services. Establishing clear attribution rules is crucial to prevent double-counting, ensuring accurate division and reporting of emissions from shared services by only one party or in accordance with agreed metrics.

Calculation Guidance and Considerations

in selecting a calculation approach, organisations should apply the location-based method as the default, capturing regional energy grid impacts for a transparent view of actual energy use. When renewable energy procurement practices are in place—such as Power Purchase Agreements (PPAs) or Renewable Energy Certificates (RECs)—the market-based approach can supplement this by reflecting the impact of these purchases. Standardised emission factors, drawn from recognised sources, should be used to enhance accuracy in emissions calculations.

Data Quality and Assurance

high-quality, verifiable data is paramount in emissions measurement. A tiered approach to data quality helps organisations improve the accuracy and reliability of reported emissions. Periodically reviewing and updating emission factors to reflect changes in energy intensity, grid composition, and other variables will ensure that emissions measurement practices remain current and aligned with best practices. Implementing data verification processes and feedback loops enables organisations to make regular updates and improvements to emissions tracking.

Adopting this structured, standards-aligned measurement framework approach, with clear maturity pathways to cater for all members, enables organisations within the digital payment ecosystem to build a comprehensive understanding of the carbon emissions related to the digital payments value chain, which will help them meet regulatory expectations and drive meaningful emissions reductions across their operations. We invite all members to review the framework, and we welcome feedback to support ongoing collaboration from across the industry to enhance this over time.

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11. *Source: GHG Protocol Corporate Standard, Chapter 5. Available at: https://ghgprotocol.org/corporate-standard*
12. *Source: SO 14064-1:2018, Greenhouse gases — Part 1: Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. Available at: https://www.iso.org/standard/66453.html*
13. *CDP Reporting Guidance. Available at: https://www.cdp.net/en*

About the Author

Eric Zie, CR&A, is a globally recognised leader in sustainable digital transformation, with a 30-year career in technology and innovation. He is the Founder and CEO of GoCodeGreen, a certified B-Corp that provides pioneering IT environmental measurement solutions, and the GCG Learning Academy, which promotes digital sustainability education. Eric's influence extends to his role as Vice Chair of TechUK's Climate Council and partner to the United Nations ITU, where he collaborates to shape sustainable practices in the digital sector.

He is the author of the Decarbonise Digital guidebooks, which provide actionable insights into reducing digital carbon footprints, further exemplifying Eric's thought leadership. His academic contributions as Visiting Professor of Practice in the Department of Informatics at King's College London, Honorary Professor at the University of East Anglia (UEA) School of Computer Science, and Visiting Professor in Digital and ICT Sustainability at the University of Suffolk strengthen his influence in bridging industry and research. Eric also holds a strategic board position at the University of Suffolk/BT DigiTech Centre, which plays a critical role in advancing digital sustainability education and practice.

ESG Working Group Committee Members

Imran Ali
Payments Consulting Director
KPMG
ESG Working Group Lead

Charlie Bronks
Group Head of Sustainability
Crown Agents Bank
ESG Working Group Lead

Chris Bowsher
Senior Business Architect
Lloyds Banking Group

Sarah Bridget-Dees
CEO
My EU Pay

Hugh Coughlan
CTO Data & Applied Intelligence
Fujitsu

Matthias Gelze
Field Marketing
Thales Group

Hazel Gillings
Sustainability and EDI Manager
Trust Payments

Sam Harrison
Managing Director
Tectivo

Anyalemma Igwe
Compliance Analyst
AMEX

Karine Martinez
Head of Sales
Edenred

Maja Trajanoska
Member of Sustainability Center of Excellence
Netcetera

James Turner
Knowledge Counsel
Travers Smith

https://thepaymentsassociation.org/working-groups/esg/

the payments association

About The Payments Association

The Payments Association is the largest community in payments. Founded in the UK in 2008, the association now operates communities in the UK, EU and Asia, helping almost 300 companies enhance their commercial interests, solve societal problems such as financial exclusion and evaluate new opportunities for innovation in payments.

Our purpose is to empower the most influential community in payments, where the connections, collaboration and learning shape an industry that works for all.

We operate as an independent representative for the industry and its interests, and drive collaboration within the payments sector in order to bring about meaningful change and innovation. We work closely with industry stakeholders such as the Bank of England, the FCA, HM Treasury, the Payment Systems Regulator, Pay.UK, UK Finance and Innovate Finance.

Through our comprehensive programme of activities for members and with guidance from an independent Advisory Board of leading payments CEOs, we facilitate the connections and build the bridges that join the ecosystem together and make it stronger.

These activities include a programme of monthly digital and face-to-face events including our annual conference PAY360 and awards dinner, CEO roundtables and training activities.

We run seven stakeholder working groups: Cross-Border, Digital Currencies, ESG, Financial Crime, Inclusion, Open Banking and Regulatory. The volunteers within these groups represent the collective view of The Payments Association members at industry critical moments and work together to drive innovation in these areas.

We conduct exclusive industry research. This research is not legal advice. It is made available to our members through our Insights knowledge base to challenge and support their understanding of industry issues. This includes whitepapers, insightful interviews and tips from the industry's most successful CEOs.

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the payments association

St Clement's House, 27-28 Clement's Lane, London EC4N 7AE
Tel: +44 20 3540 9760
Web: www.thepaymentsassociation.org
Email: info@thepaymentsassociation.org
@ThePAssoc
The Payments Association