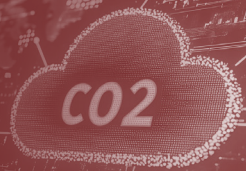


Planning, Establishment, and Verification of an AI Digital Carbon Management Platform



Background

Climate mitigation serves as a foundation pillar for the sustainable development. In 2024, the Legislative Yuan passed the Climate Change Response Act, which explicitly stipulates Taiwan's objective of achieving net-zero emissions by 2050. Facing global trends in sustainable development and the transition toward net-zero emissions by 2050, carbon control measures with substantive binding force—such as domestic greenhouse gas (GHG) emission regulations, the Green Finance Action Plan for publicly listed companies, supply chain management driven by strengthened procurement influence from brand owners, and international carbon border control measures—are becoming increasingly stringent.

The reduction of greenhouse gas emissions across supply chains is fundamentally linked to the final goods and services provided by enterprises or importers. As Taiwan's legal framework for greenhouse gas management has gradually taken shape, corporate greenhouse gas inventories and disclosures have largely followed internationally recognized accounting methodologies and standards. Establishing an AI-enabled digital carbon platform will streamline regulatory compliance, allowing businesses to track and report emissions with precision. By connecting with the organizational-level GHG inventory registry of the Ministry of Environment or international Carbon Border Adjustment Mechanism (CBAM) requirements, such a platform will help enterprises identify decarbonization opportunities and enhance their carbon management capabilities.

Current Domestic and International Development

Adjustment Trends of the GHG Protocol

As regulatory requirements across countries continue to become more stringent, the Greenhouse Gas Protocol (GHG Protocol) is undergoing a comprehensive review and revision of its existing standards. The draft revision for Scope 2 will introduce clearer and stricter requirements for both the Location-based Method and the Market-based Method. Regarding Scope 3, the revision emphasizes the use of activity data rather than relying solely on operational estimations for corporate operations and value chain decarbonization management. This development will encourage enterprises to establish more comprehensive data tracking mechanisms and to develop deeper data-sharing models with suppliers.

Development of Digital Carbon Management Platforms and AI-Driven Sustainable Supply Chains

An analysis of domestic and international digital carbon management platforms indicates that they currently provide functions such as:

- enterprise operational and value chain decarbonization management
- automated data collection or data input
- estimation of carbon emissions and identification of emission hotspots
- establishment of emission benchmarks for specific sectors or activities
- impact scenario simulation and analysis

Driven by the development of artificial intelligence, supply chain carbon management is expected to evolve in the following directions:

- (1) Transitioning supply chain information from static tracking to real-time transparency
- (2) Moving from reactive responses to proactive prediction, strengthening risk and carbon management capabilities
- (3) Transforming from linear supply chains to circular management systems
- (4) Utilizing digitalization and AI to automate Product Carbon Footprint (PCF) and Life Cycle Assessment (LCA) processes.

Importance of the Development of Digital Carbon Verification

In 2022, the World Bank issued the report “Digital Monitoring, Reporting, and Verification Systems and

Their Application in Future Carbon Markets,” which clearly outlined the framework for Digital Monitoring, Reporting, and Verification (D-MRV).

As carbon control measures with substantive binding force become increasingly stringent, the number of enterprises requiring verification continues to increase annually. Traditional greenhouse gas inventory methods are not only time-consuming and labor-intensive but may also be prone to human error. Therefore, adopting digital inventory systems is a feasible approach to ensuring the transparency and accuracy of carbon data.

Taiwan has a mature digital development environment, and the number of enterprises adopting digital carbon inventory tools is steadily increasing. However, greenhouse gas verification currently still relies primarily on traditional on-site verification methods. In order to better align verification procedures with digital inventory results, the adoption of digital verification mechanisms is therefore necessary.

Strategic Framework for Promotion

In response to global sustainability governance requirements and Taiwan’s net-zero transition policies, there is an urgent need to establish an integrated digital carbon management platform.

This platform should systematically consolidate emission factors associated with energy and resource use across various stages of production processes, and establish a standardized database covering Scope 1 to Scope 3 emission data, including raw materials, process energy use, waste treatment, and water resource use, in order to calculate and generate final product emission factors.

Through the effective integration of existing government carbon inventory calculation tools, the incorporation of third-party verification mechanisms, and the application of AI tools to improve emission management efficiency and reduce emissions more effectively, the platform will support more efficient carbon emission control and reduction targets, while enabling industries to respond more precisely to international sustainability requirements and strengthen their competitive advantages.

The proposed strategies are as follows:

Strategy 1: Establish a National Greenhouse Gas Reporting Platform to Improve GHG Management Efficiency

As national greenhouse gas management shifts from

the stage of emission reporting and management toward emission reduction management, it is recommended to establish a national greenhouse gas reporting platform jointly designed and implemented across ministries.

This platform will assist entities in reporting both emission sources and sinks, allow stakeholders to understand emissions across different levels, and digitize relevant information associated with carbon emission activities. In the future, the carbon management platform may also interface with relevant decarbonization activity data from various competent authorities. This will improve the efficiency and data quality of greenhouse gas emission reporting and management, and further support the implementation and refinement of carbon pricing mechanisms.

Strategy 2: Digital Carbon Management Systems for Energy Use and Forest Carbon Sinks

To ensure the integrity of energy consumption data within carbon management processes, it is recommended to promote a digitalized energy use emission management mechanism. Energy procurement records and energy usage documentation should be digitally managed to enable traceability of energy sources and accountability for energy consumption.

In addition, forest carbon sequestration enhancement is one of Taiwan’s key strategies for achieving net-

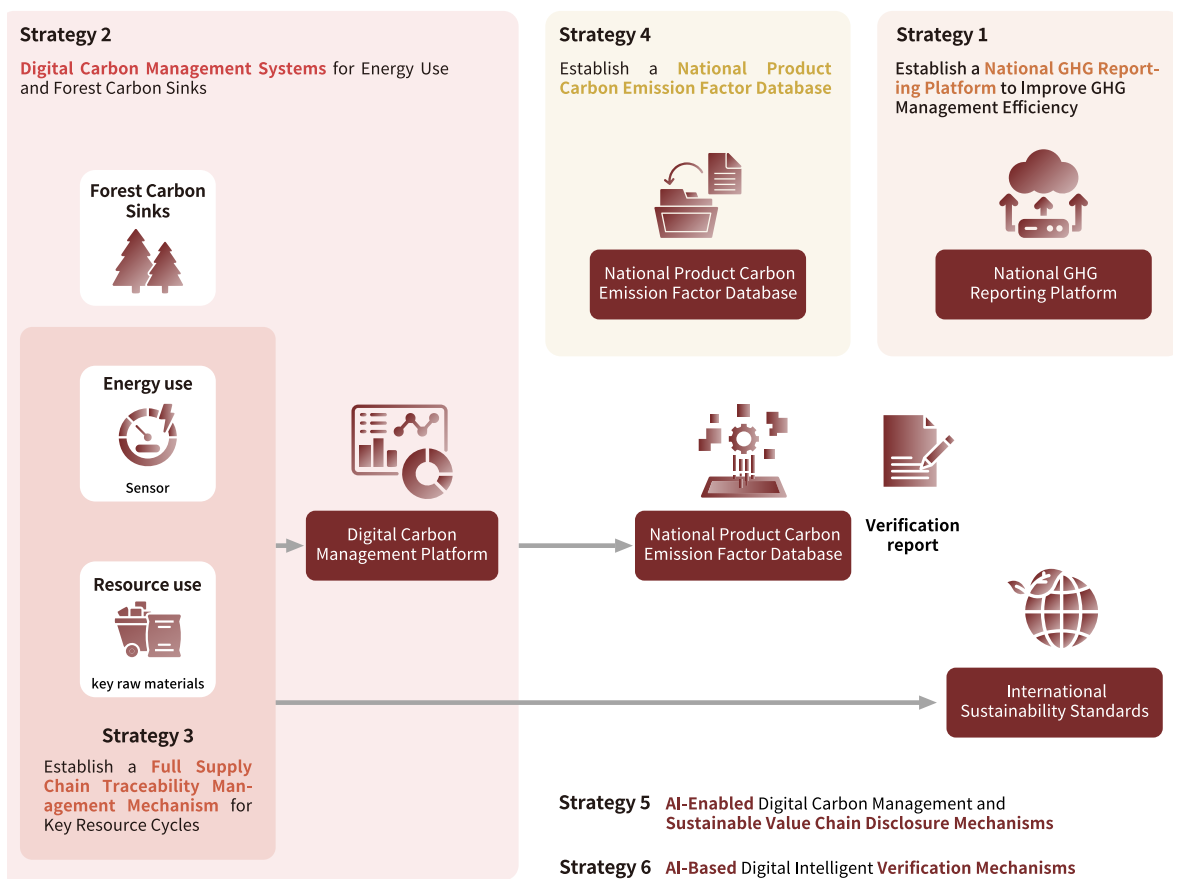


Figure 1 Framework for AI Digital Carbon Management Platform
Source: Taiwan Science and Technology Office for Net-zero Emission (2025)

zero emissions by 2050. It is recommended to integrate national forest inventory sample plot data and related forest growth modeling research results to establish a Digital Forest Carbon Sink Management Platform. This platform would provide accurate growth projections and carbon sequestration conversion factors for various tree species, thereby improving the scientific rigor and consistency of carbon sequestration calculations.

Strategy 3: Establish a Full Supply Chain Traceability Management Mechanism for Key Resource Cycles

Taiwan's manufacturing sector faces multiple challenges, including international order competition, carbon border tariffs, and tariff rate adjustments. Strengthening comprehensive traceability management capabilities is therefore essential.

Export-oriented sectors such as chemicals and key raw materials should be prioritized. Small and medium-sized enterprises should be supported in adopting advanced net-zero technologies such as Carbon Capture and Utilization (CCU) and bio-based feedstocks, while

establishing supply chain traceability systems aligned with international sustainability standards.

Through alignment with international certification systems, domestic enterprises can be assisted in conducting low-carbon product declarations and successfully integrating into global green supply chains.

Strategy 4: Establish a National Product Carbon Emission Factor Database

When enterprises conduct carbon inventories, they often face difficulties due to the lack of suitable localized emission factors or limited access to international database licenses. This can lead to inconsistencies and uncertainties in calculation results, thereby weakening the credibility of product carbon footprint declarations.

To accurately measure carbon emissions across Taiwan's industrial value chains and support enterprises in meeting international supply chain disclosure requirements, it is essential to establish an authoritative and localized carbon emission factor database.

By integrating resources from government, industry, academia, and research institutions, and utilizing diverse data sources and advanced technologies, a comprehensive carbon emission management database system can be developed to enhance corporate carbon management efficiency and data reliability, serving as a key data foundation for Taiwan's net-zero transition.

 Strategy 5: AI-Enabled Digital Carbon Management and Sustainable Value Chain Disclosure Mechanisms

In response to the urgency of global net-zero transitions and the complexity of supply chain decarbonization, Taiwan's industries must move beyond existing digital foundations toward intelligent carbon management systems.

It is recommended that AI optimization mechanisms be introduced into the national greenhouse gas reporting platform, corporate carbon management systems, and corporate sustainable value chain disclosure mechanisms, enabling AI technologies to support the entire process of emission monitoring, operational optimization, reporting, and verification.

 Strategy 6: AI-Based Digital Intelligent Verification Mechanisms

The design of digital carbon verification mechanisms should begin with the greenhouse gas inventory process and conclude with the delivery of verified reports to intended users. The implementation process can be divided into four stages:

- emission monitoring
- emission reporting
- emission verification
- submission to intended users

As digital technologies and AI applications continue to mature, digital carbon verification platforms may gradually expand their functional capabilities to assist verification institutions in conducting verification tasks.

Given that there is currently no unified international standard for digital carbon inventory software and hardware tools, Taiwan can take the lead in developing technical guidelines for D-MRV, which will contribute to the development of Green Finance MRVC databases and facilitate the realization of net-zero goals within Taiwan's industries.

Conclusions and Recommendations

In response to the development trends of domestic and international net-zero governance frameworks and anti-greenwashing initiatives, leaders must integrate artificial intelligence into sustainability strategies, product design, and organizational governance.

This transformation requires not only technological advancement, but also comprehensive upgrades in organizational culture, data governance systems, and cross-disciplinary collaboration networks.

Future industrial competitive advantages will no longer depend solely on cost control or market scale. Instead, they will be built upon the synergistic capabilities of data governance, sustainable value creation, and cross-domain collaboration.

As Taiwan's industries form an important part of the global technology supply chain, they are currently facing multiple challenges brought about by the elevation of global sustainability governance frameworks. By promoting the planning, establishment, and verification of an AI digital carbon management platform, Taiwan can transform challenges related to carbon disclosure, supply chain transparency, and ESG evaluation into opportunities for sustainable development.