Climatiq AI Carbon Computing Capabilities and Customer Enterprise Scope 3 Emission Reduction Potential Identification—a Single-Case Process Tracking Based on Climatiq Embedded in The Thyssenkrupp Rasselstein Logistics Process via Celonis.

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Abstract. This paper focuses on the cross-organizational carbon information transfer between carbon data provider Climatiq and client company thyssenkrupp Rasselstein. Based on organizational information processing theory, this paper aims to analyze how Climatiq's AI carbon computing capabilities are translated into thyssenkrupp Rasselstein's transportation and procurement processes via the Celonis platform, supporting the client company in identifying Scope 3 emission reduction potential. The study finds that Climatiq does not directly change physical emissions, but first transforms the client company's fragmented transportation data into system-accessible kgCO2e information assets, then embeds them into the client company's ERP/TMS and process intelligence scenarios, making them decision variables in areas such as route optimization. Public case data shows that this application can identify considerable carbon emission reduction potential for client companies. The theoretical contribution of this paper lies in extending organizational information processing theory from intra-organizational information processing to the cross-organizational carbon information transfer context between "AI carbon computing provider—client company," and proposing mechanisms for carbon information assetization, platform translation, and client decision embedding.

Keywords: Climatiq; client company Scope 3; AI carbon calculation; emission reduction potential identification; platform translation.

1. Introduction

Carbon governance in manufacturing enterprises is shifting from internal enterprise boundaries to value chain boundaries. Compared with Scope 1 and Scope 2, Scope 3 emissions are usually dispersed in activities such as supplier production, upstream transportation, procurement, distribution, product use and disposal, and have the characteristics of multiple data sources, blurred responsibility boundaries, long business chains and dispersed implementation entities. A report released by CDP and BCG in 2024 pointed out that the average Scope 3 emissions disclosed by enterprises in the supply chain are 26 times their direct operating emissions (Scope 1 and Scope 2), and only a few enterprises have set supply chain Scope 3 targets [1]. This shows that the Scope 3 issue is no longer just a disclosure issue, but also a cross-organizational information processing and operational execution issue [2]. Existing sustainable supply chain management research mostly starts with core enterprises and discusses how customers can promote upstream suppliers to reduce emissions through green procurement standards, supplier audits, contract terms and cooperative development. This perspective is consistent with the traditional supply chain power structure, but it is difficult to explain the new phenomenon of external digital technology or carbon management service providers actively providing Scope 3 data processing capabilities to customer enterprises. In this case, Climatiq is an external AI carbon computing provider rather than a traditional provider. Its core contribution is to transform fragmented logistics activity data of client companies into computable, auditable, and embeddable carbon information. Celonis serves as a translation channel connecting Climatiq's AI output with Rasselstein's client processes.

Therefore, this article further narrows "supplier AI" to "the capabilities of external AI carbon calculation suppliers." The suppliers referred to in this article are not raw material or component suppliers in the narrow sense, but rather digital technology suppliers that provide carbon calculation, emission factor matching, API interfaces, and data quality specifications to client companies. Taking Climatiq as the core observation object, its AI capabilities are mainly reflected in activity data identification, emission factor matching, automated carbon calculation, and system-callable kgCO2e output; Celonis acts as a platform intermediary; and thyssenkrupp Rasselstein serves as the carrier of Scope 3 business data, decision embedding, and emission reduction potential results.

This paper investigates how Climatiq, as an external AI carbon computing provider, integrates its carbon information processing capabilities into thyssenkrupp Rasselstein's logistics and procurement processes via the Celonis platform, enabling the client company to identify Scope 3 emission reduction potential. To address this question, this paper selects the tripartite collaboration between Climatiq, Celonis, and thyssenkrupp Rasselstein as a single case study, using process tracking methods to observe the transmission path of carbon information from the client company's underlying activity data to business decision variables.

2. Organizational Information Processing Theory and Scope 3 Governance

Organizational Information Processing Theory (OIPT) argues that organizational performance depends on the matching of information processing needs and processing capabilities [3]. In recent years, this theory has been extended to the field of supply chain carbon governance [4]. Information processing needs in the global supply chain have become a prerequisite for sustainable supply chain management [5]. Based on the information processing perspective, this paper empirically analyzes the mediating role of organizational practices in achieving supply chain carbon transparency [6]. However, there are two gaps in existing research: First, most literature assumes that information processing capabilities are endogenous to the organization and pays insufficient attention to the scenario that information processing capabilities may come from outside the organization—such as external AI carbon calculation suppliers; Second, sustainable supply chain management literature mostly starts from core customer enterprises and discusses how they exert pressure on traditional suppliers through green procurement and other mechanisms, presenting the inertial thinking of "one-way governance from customers to suppliers".

To address these research gaps, this paper focuses on three key aspects: First, shifting the analytical starting point from the governance pressures exerted by client companies on traditional suppliers to the capability provision of external AI carbon computing providers like Climatiq. Second, as shown in Figure 1, a framework based on the relationship between Climatiq and customer enterprises is constructed based on OIPT, and the macro relationship of "AI affects carbon performance" is broken down into four stages: the client data flow stage, where Rasselstein generates fragmented transportation activity data in ERP/TMS; the Climatiq information flow stage, where AI transforms activity data into standardized kgCO2e information assets; the client business flow stage, where the Celonis platform translates carbon information into business language, incorporating it into decision variables such as routes and load factors; and the client environmental flow stage, where client companies identify emission reduction potential through process improvements. Third, a strict distinction is made between "emission reduction potential identification" and "actual emission reduction achievement," avoiding the overinterpretation of simulation results as completed performance.

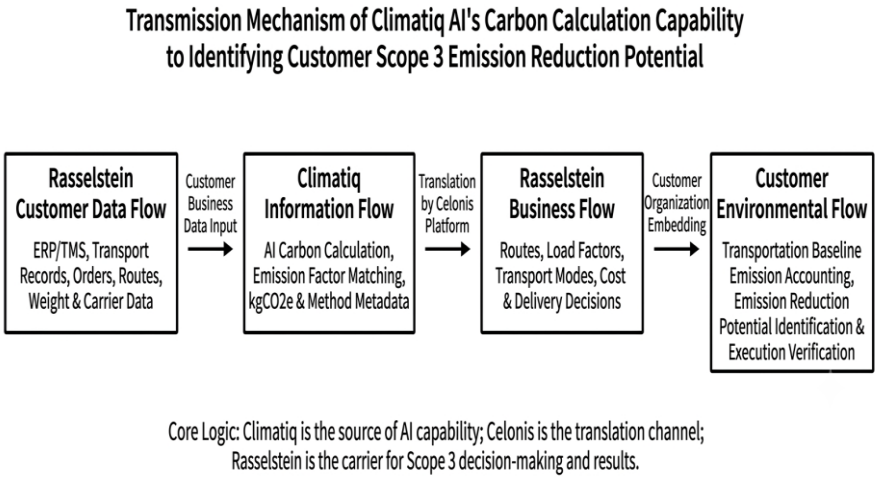


Fig 1. The four-stage transmission mechanism of Climatiq AI carbon calculation capabilities embedded into the Scope 3 process of customer enterprises through the platform

3. Research Design

3.1. Methodology Selection: Single-Case Process Tracking

This paper employs a single-case process tracing approach [7,8]. This is because it does not primarily address the large-sample effect question of "whether AI significantly reduces carbon emissions," but rather the process-oriented question of "how Climatiq's AI carbon information processing capabilities cross organizational boundaries and enter the client company's decision-making system." Process tracing is suitable for reorganizing scattered facts from publicly available case materials into causal chains and identifying key transformation links, bottlenecks, and boundary conditions within the mechanism [8].

The single case does not pursue statistical representativeness, but rather analytical generalization. This case has the characteristics of the "most likely scenario": Climatiq represents a relatively mature AI carbon computing provider, Rasselstein, as a manufacturing customer, has digital infrastructure such as ERP/TMS [9], and faces the pressure of Scope 3 compliance and customer low-carbon needs; Celonis represents a relatively mature process intelligence and system integration channel. If, under this relatively favorable condition, Climatiq's capabilities still require platform translation, business embedding, and execution capabilities to enter the customer's enterprise, then these conditions are likely to constitute key constraints in a more general scenario [7].

3.2. Case Subjects and Role Definition

This case study comprises three main entities. Figure 2 visualizes the ecological network and boundaries of these entities, clarifying the interactive loop between external technological input and internal business operations. Climatiq is the source and core supplier of AI capabilities, focusing on assetizing fragmented operational data to generate highly transparent kgCO2e emission data streams. Celonis acts as the platform intermediary connecting the two, responsible for deconstructing Climatiq's technical indicators and weaving them into the client's existing ERP/TMS process intelligence graph. Thyssenkrupp Rasselstein represents the client company and the result-carrying end. Together, these three parties form a transmission chain: "Climatiq AI carbon computing capabilities—Celonis platform translation—Rasselstein client company business embedding." Through a cyclical feedback loop of 'data input—information generation—platform translation—business embedding—environmental potential identification,' they collectively constitute a cross-organizational network for knowledge absorption and value transformation.

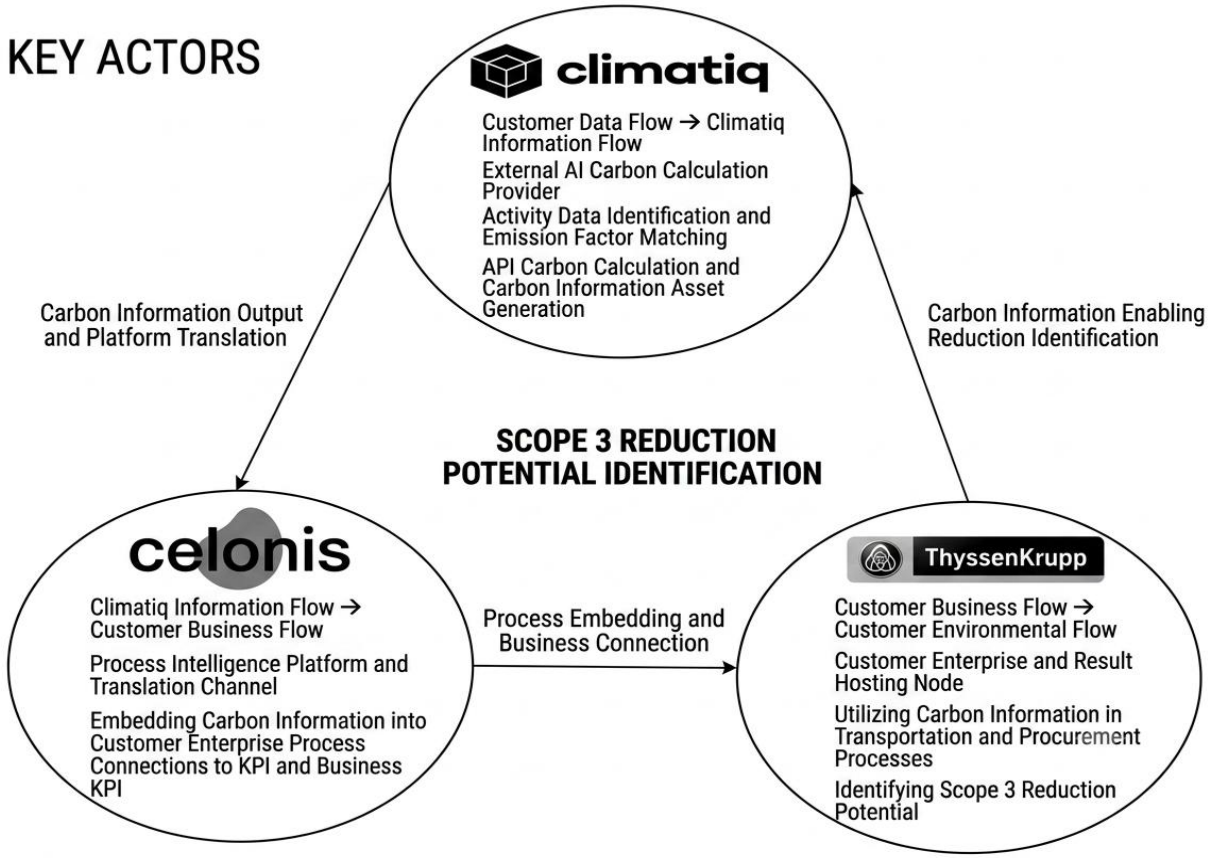


Fig 2. Climatiq-Celonis-Rasselstein tripartite interaction and Scope 3 governance role positioning.

3.3. Data Sources, Evidence Classification, and Risk Control

This paper uses publicly available materials, including Climatiq and Celonis customer case studies and descriptions, World Economic Forum industry net-zero case studies, GHG Protocol Scope 3 technical guidelines, CDP/BCG 2024 Scope 3 report, and literature on organizational information processing theory and case study methods. Key case facts are verified using source triangulation: data evidence supported by multiple sources is of high strength; materials that only describe product functions without disclosing actual application results are considered " supporting evidence " [1,7,10]. This study sorts out core operational data, theoretical mapping logic, and explanatory boundaries (see Table 1 for details). Direct evidence is based on a large sample of practice of over 49,000 factory truck transportation activities and ERP data, providing a foundation for customer data flow, Climatiq information flow extraction, and transportation baseline emission calculation. This study limits the boundaries of data inference, positioning 4.5 million+ kgCO2e as " emission reduction potential " driven by process optimization rather than " established performance, " which accounts for 7.8% of total transportation baseline emissions, isolating the risk of over-interpretation of data, and providing a quantitative benchmark for subsequent micro-causal chain tracing.

This paper implements four risk controls. 1. Carbon emission figures are uniformly expressed as identified emission reduction potential, rather than actual emission reductions. 2. " Platform translation " is described as an important facilitating condition, rather than an absolutely necessary condition. 3. AI technology actions are distinguished into direct case evidence, general platform capabilities, and theoretical inferences, avoiding the portrayal of technical processes not described in publicly available materials as actual events. 4. Celonis is positioned as a transmission mechanism for Climatiq capabilities to enter customer enterprises, rather than platform research centered on the expansion of the Celonis ecosystem.

Table 1. Key data, meanings, and interpretation boundaries of customer enterprise transportation data and Climatiq output.

Key data	meaning	Theoretical applications	Explaining boundaries
49,000+ factory truck transportation events	Rasselstein's clients have a large volume of transportation activity data that can be extracted by the system.	Support the "Customer Data Flow" stage	This does not encompass all Scope 3 categories; direct evidence primarily covers transportation scenarios.
58 million+ kgCO2e	Climatiq calculates transportation baseline emissions based on ERP activity data.	Support for the "Climatiq information flow" stage	Accuracy is affected by the completeness of input data, emission factors, and calculation boundaries.
4.5 million+ kgCO2e	Emission reduction potential identified by client companies through methods such as load factor optimization	Support potential identification in the "customer environment flow"	This is not an actual emission reduction; further implementation and verification are required.
Approximately 7.8%	The approximate ratio of 4.5/58 indicates the relative scale of the identification potential.	Used to visually demonstrate the identifiable potential of a client company.	The ratio is calculated based solely on publicly disclosed figures.

4. Process Tracking Analysis: From Rasselstein Data to Climatiq Carbon Information, and then to Customer Emission Reduction Potential

4.1. Data Flow → Information Flow: Generation of Carbon Information Assets

For Rasselstein, as a client company, the primary challenge in Scope 3 governance was data fragmentation. Transportation activity data was originally intended for order fulfillment, freight settlement, and logistics management, not carbon accounting. This data might be scattered across ERP systems, TMS systems, carrier records, and spreadsheets, containing fields such as origin, destination, mode of transport, weight, route, and order details. Even if this data objectively exists, it doesn't mean it can directly support carbon decisions; standardization, emission factor matching, and clarification of calculation methods are needed to bridge the gap between client company operational data and Scope 3 carbon information.

Climatiq was a key AI provider at this stage. Client companies possessed records of their transportation activities, but these records themselves were not Scope 3 carbon information. Climatiq, through its carbon calculation API, emission factor matching, and methodological metadata, transformed activity fields such as route, weight, distance, and mode of transport into kgCO2e estimates. This process is summarized in this article as "carbon information assetization": carbon data is no longer static numbers, but rather information assets that can be accessed by systems, connected to process platforms, and reused by client business departments [11].

It's important to note that while publicly available materials are sufficient to support the assertion that "activity data was converted into carbon emission estimates," they are not always sufficient to prove the specific underlying AI actions, such as whether PDF invoices, BOM texts, or certain unstructured fields were actually parsed in this case. Therefore, this article treats "AI/NLP parsing of unstructured data" as a capability or potential mechanism of the supplier's platform, rather than an unproven case fact. Nevertheless, this does not affect the core judgment of this article: within the scope of publicly available evidence, Climatiq provides clients with external carbon information processing capabilities that are difficult for them to quickly establish on their own and completes the first round of transformation from operational data to carbon information assets.

4.2. Information Flow → Business Flow: Platform Translation and Business Embedding

If Climatiq's carbon information output remains merely in API results and report forms, it will still be difficult to change the actual operations of client companies. Rasselstein's transportation and procurement managers do not directly work around kgCO2e in their daily work; they are more familiar with routes, delivery times, costs, load factors, and carrier and supplier selection. Therefore, carbon information needs to be translated into business language that client companies can use. Celonis is positioned as a translation channel in this paper, rather than the final research object: it embeds Climatiq's kgCO2e output into Rasselstein's process intelligence platform, allowing emission KPIs to appear alongside business KPIs such as transportation costs, load factors, and delivery efficiency [10,12].

The key to platform translation lies not in replacing Climatiq with a new "carbon calculation," but in helping client companies utilize Climatiq's results. Transportation activities can be mapped to specific routes, customer orders, and carriers; different transportation options can be simulated and compared; and load factor optimization, route adjustments, and mode of transport substitution can be presented as actionable options. In other words, Climatiq's role is to help client companies clarify the specific location and distribution of carbon emissions, Celonis's role is to embed carbon information into business processes, and Rasselstein's role is to determine which emission reduction opportunities are executable in the actual logistics and procurement decision-making process. Therefore, this article does not present the Celonis platform as an absolute necessity, nor does it present this case as a Celonis platform ecosystem case study. Theoretically, a client company's internal IT team, a supplier's own front-end system, or other system integrators could also perform similar translations. A more conservative proposition is that, in the process of transmitting Climatiq AI carbon information to client operational decisions, platform translation is a crucial facilitator in reducing the disconnect between technical and business language.

4.3. Business Flow → Environmental Flow: From Decision Variables to Emission Reduction Potential

At the client company's end, the evidence in this case primarily focuses on outbound transportation scenarios. Publicly available materials show that the application analyzed over 49,000 outbound truck transportation activities, calculated a baseline transportation emission of over 58 million kgCO2e based on ERP activity data, and identified an emission reduction potential of over 4.5 million kgCO2e through load factor optimization [10,13]. This demonstrates that the carbon information generated by Climatiq is not merely for disclosure but is embedded in the platform and used by Rasselstein to discover process improvement opportunities.

However, a "last mile" remains between identifying emissions reduction potential and actually achieving it. Increased load factors can be influenced by order volume, customer delivery times, and warehousing conditions; route adjustments can be affected by carrier networks, contract terms, and infrastructure; and mode of transport substitution may involve trade-offs between cost, timeliness, and service reliability. Therefore, OIPT can explain "how Climatiq helps customer companies know where emissions can be reduced," but it cannot solely explain "whether customer companies can necessarily achieve emissions reductions." This requires further research to incorporate theories such as organizational execution, contract governance, and supply chain power relations [5,14].

Sections 4.1 to 4.3 examine the three transformation links in the four stages. However, for a single case, whether the evidence in each link is sufficient to support the judgment that "the mechanism is established" still needs to be tested by a unified standard. The process tracking method requires researchers to presuppose "the type of evidence that can be observed if the mechanism is established" for each mechanism link and match it with the evidence in the actual case, while checking possible alternative explanations [8]. Based on this methodological requirement, Table 2 summarizes the analysis results of the above three sections into an evidence matrix and conducts a comparative evaluation of "expected observation - actual evidence - alternative explanation" for each of the four stages, so as to systematically demonstrate the robustness of the entire causal chain.

Table 2. Evidence Matrix for Process Tracking.

Mechanism stage	If the mechanism is valid, it should be observed that...	This case supports the evidence.	Alternative explanations/risks	Strength of evidence
Customer data flow	Rasselstein has transport activity data that can be extracted by the system.	49,000+ factory truck transportation activities; ERP activity data was used for calculations.	Data integrity and boundaries may affect the calculation results.	Strong
Climatiq Information Flow	Customer activity data is transformed into standardized kgCO2e information assets	Climatiq Carbon Calculation API, Emission Factor Matching, Metadata and Calculation Transparency	Some AI details are platform capabilities and may not all occur in this case.	Strong
Customer business flow	Climatiq outputs, when fed into ERP/TMS or workflow platforms, affect route, loading, and mode selection.	The Celonis Shipping Emissions Reduction App links Climatiq emissions KPIs to business KPIs.	The platform's contribution may outweigh that of AI itself; therefore, it's necessary to avoid over-attributing AI to AI.	Zhongqiang
Customer Environment Flow	Customer process reengineering creates quantifiable emission reduction potential or actual emission reductions.	Publicly available materials reveal that Rasselstein identified a potential emission reduction of 4.5 million+ kgCO2e.	Potential does not equal actual emissions reduction, and the disclosure of implementation results is limited.	medium

5. Mechanism Extraction and Theoretical Propositions

Based on the above process tracing, this paper elevates the transmission facts between Climatiq and client companies into four theoretical propositions that can be tested by subsequent research. This study follows the inductive logic of 'from data facts to theoretical constructs', abstracting the single-case micro-transmission facts of thyssenkrupp Rasselstein into four theoretical propositions that run through the 'Technology-Organization-Environment (TOE)' perspective, and clarifying the boundary conditions for their effectiveness (see Table 3). Table 3 not only condenses the synergistic effect between Climati carbon information assetization (P1) and platform translation (P2), further points out that whether carbon information can truly be transformed into a corporate decision-making variable depends on its gravitational structure with existing core business KPIs (P3), and the leap from 'potential' to 'reality' is highly dependent on execution boundaries such as vertical collaboration within the supply chain (P4). This set of propositions constitutes the core contribution of this paper to the theory of carbon governance in digital supply chains and provides testable theoretical targets for subsequent research.

Table 3. Revised Theoretical Propositions and Boundary Conditions

Proposition	content	Case basis	Boundary conditions
P1 Climatiq Carbon Information Assetization Proposition	AI vendors like Climatiq can only support cross-organizational transfer by transforming customer activity data into standardized, auditable, and system-accessible information assets.	Climatiq converts Rasselstein transport activity data into kgCO2e estimates and provides emission factors and methodological information.	The raw activity data must be complete enough; the emission factor standards must be acceptable to the client company.
P2 Customer Acquisition and Platform Translation Proposition	The platform intermediaries reduce friction in integrating AI carbon computing capabilities into customer operational decisions by translating Climatiq's technical language into the customer's business language.	Celonis connects Climatiq emission KPIs with transportation/procurement process KPIs and supports scenario simulation.	The platform is not the only path; internal IT or other system integrations may also serve as translation functions.
P3 Customer Decision Embedded Gravitational Structure Proposition	The depth to which carbon information is embedded in customer decision-making depends on its relationship with existing KPIs such as cost, delivery time, and quality. Resistance is lower when carbon and cost move in the same direction, and higher when trade-offs exist.	Rasselstein's optimized loading rate at the transportation end may reduce costs and emissions, and its integration level is higher than that of low-carbon alternatives at the procurement end.	Different companies have different KPIs and incentive structures, so the resistance to embedding will vary.
P4 The separation of emission reduction potential and actual emission reduction	Climatiq AI first helps customers identify process-level emissions reduction potential, but actual emissions reduction also requires customer organization to implement, contract governance, and supply chain collaboration.	The case disclosed a potential of 4.5 million+ kgCO2e, rather than the audited actual emission reduction.	If the client company subsequently discloses the actual implementation results, the question can be further refined.

6. Conclusion

This paper, based on a three-way collaboration between Climatiq, Celonis, and thyssenkrupp Rasselstein, employs a single-case process tracing approach to investigate how Climatiq, as an external AI carbon computing provider, translates and embeds its carbon information processing capabilities into the client company's logistics and procurement processes through the platform, supporting Scope 3 emission reduction potential identification. The study finds: First, Climatiq does not directly change the client company's physical emissions but rather transforms Rasselstein's fragmented transportation activity data into standardized, system-accessible kgCO2e information assets. Second, Celonis, acting as a platform channel, translates Climatiq's technical language into business language, allowing carbon information to appear alongside existing KPIs such as cost, delivery time, and load factor, becoming an actionable decision variable. Third, publicly available case data shows that the application identified an emission reduction potential of approximately 4.5 million kgCO2e (approximately 7.8% of total transportation baseline emissions), but this figure represents "emission reduction potential" rather than "realized performance." The key to Scope 3 governance is not how much carbon data a company "possesses," but whether carbon data can be upgraded from "dashboard level" to "decision variable level."

The theoretical contributions are reflected in three aspects. First, this paper extends organizational information processing theory from the internal organizational context to the cross-organizational carbon information transmission context of "external AI carbon computing providers—customer enterprises." Second, this paper decomposes the macro-relationship of "AI's impact on carbon emission reduction" into a micro-continuous process of "data input—information generation—platform translation—business embedding—potential identification," distinguishing the respective roles of AI carbon computing, process intelligence, and management execution. Third, this paper proposes an operational approach to the carbon information assetization hierarchy, providing an analytical framework for subsequent research on measuring the carbon information capabilities of suppliers.

This paper also acknowledges certain research limitations. First, this paper is based on publicly available secondary materials and conducts a single-case analysis, lacking firsthand interviews with Rasselstein's internal decision-makers. Therefore, the explanation for why "potential did not fully translate into actual emissions reductions" remains speculative. Second, the contributions of platform integration and AI computing are difficult to completely separate in the publicly available materials; future research can further differentiate them through multi-case comparisons or quasi-experimental designs. Third, this case study comes from a large manufacturing enterprise and represents the "most likely scenario." Whether the conclusions can be generalized to SMEs or low-digitalization supply chains requires further empirical testing. Future research could further track the transformation conditions from "potential identification" to "actual emissions reductions" and explore the cross-scenario application of AI carbon computing in procurement and supply chain network optimization.

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