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Knowledge Integration and Green Supply Chain Resource Management in NEV Manufacturing: A Practice-Informed View

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Abstract: Does knowledge integration actually make green supply chain resource management work better? This paper takes up that question in China's NEV manufacturing sector. Three contextual forces receive attention: ASEAN green standard adoption, Zhuang-Chinese bilingual knowledge transfer, and responses to technology iteration. The evidence is practice-based and conceptual. A mismatch appears. Firms have built fairly capable knowledge-integrating routines, and they also run a range of green resource programs. Yet the two do not line up closely. Integration capacity rarely converts directly into measurable sustainability performance. The bottleneck is not knowledge shortage but conversion. External standards, bilingual information, and technical updates become valuable only when they are translated into supplier requirements, shop-floor routines, and traceable material, energy, and carbon records. Knowledge integration is therefore treated as enabling infrastructure. Whether it pays off depends on downstream execution.

Keywords: Knowledge integration; Green supply chain; New energy vehicles; ASEAN standards; Bilingual knowledge transfer; Sustainable resource management

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1. Introduction

NEV supply chains operate under constant change. Standards shift, supplier networks have many tiers, material flows are complex, and environmental expectations keep becoming more detailed. In regions tied closely to ASEAN markets, these pressures are sharper. Knowledge must cross company borders, departmental lines, and language differences on the shop floor. China's New Energy Vehicle Industry Development Plan (2021–2035) also calls for industrial integration, technological upgrading, and greener resource use [1]. In daily practice, acquiring, interpreting, transferring, and updating knowledge is not an abstract organizational asset. It is part of supply chain work.

The knowledge-based view treats the firm as a mechanism for combining specialized knowledge [5].

Absorptive capacity research adds that outside information creates value only after recognition, assimilation, transformation, and application [3,8]. Green supply chains illustrate the point. Supplier specifications must reflect external standards. Production rules must carry energy requirements. Carbon and recycling information must stay intelligible as it crosses organizational boundaries. Hart's natural-resource-based view suggests that environmentally relevant capabilities can support competitive advantage [6], while green supply chain scholarship stresses coordinated practices rather than isolated technical fixes [7].

Still, mature knowledge management does not guarantee equally strong green operating outcomes. Circular and sustainable supply chain studies suggest that data and technology capabilities often require complementary routines before performance gains appear [2,4]. For NEV manufacturers, the practical issue is not whether knowledge integration exists. It is whether integration is converted into procurement, production, recovery, energy, and carbon decisions.

This paper explores that issue through a practice-informed framework centered on the link between knowledge integration capability and sustainable resource management performance. It identifies the capability-outcome gap and proposes conversion pathways. The aim is to give managers in export-oriented NEV clusters a more realistic basis for action.

2. Knowledge integration foundations in NEV green supply chains

2.1. ASEAN standards as external supply chain knowledge

ASEAN standards do not green a supply chain simply by being known. They matter when they are converted into controls. A firm may track carbon-label rules or energy-efficiency certificates, but unless procurement asks for particular evidence, production respects specific limits, and compliance can trace records, the standard remains external. This is why the ASEAN standard adoption dimension is treated here as a supply chain translation task, not a compliance checkbox. It covers identifying relevant regional green rules, pursuing overseas certifications, monitoring adoption, assessing conformity, and folding those requirements into internal workflows. The same logic runs through circular supply chain research: technology pays off when it helps actors coordinate and recover materials across interfaces [4].

2.2. Bilingual operational knowledge as internal translation infrastructure

Knowledge can also disappear inside an organization. The Zhuang-Chinese bilingual system deployment dimension measures perceived access to operating instructions, system notices, manuals, and feedback channels across language boundaries. Its role goes beyond interface translation. It signals whether information can move from management systems to frontline employees and whether operational feedback can return to the knowledge system.

This two-way movement matters for resource management because recycling procedures, equipment-energy rules, quality controls, and carbon-data requirements are enacted through repeated frontline decisions. Inconsistent terminology or delayed feedback can keep a formally correct policy from becoming a stable routine. Effective integration therefore depends on shared interpretation as much as on information availability.

2.3. Technology iteration as a supply chain learning mechanism

The technology iteration response dimension captures how quickly enterprises revise compliance processes,

update systems after technical-standard changes, adjust document templates, coordinate cross-departmental version changes, and monitor new technical requirements. It characterizes organizational learning in operational form. Its relevance to green supply chains is clear. Material specifications, energy rules, reporting templates, and cross-border requirements change over time. They must be absorbed without disrupting supplier or production coordination.

Absorptive-capacity theory implies that rapid learning matters only when new knowledge reaches the routines in which decisions are made [3,8]. Speed of updating and depth of operational embedding should therefore be treated as separate capabilities. This distinction becomes important when interpreting practical patterns of capability and performance.

3. Empirical context and the capability-outcome gap

3.1. Analytical framework and practice context

This section draws on operational features of NEV makers and their suppliers. Two constructs guide the analysis: how well firms integrate knowledge, and how well they manage green supply chain resources. The first covers ASEAN standard adoption, Zhuang-Chinese bilingual transfer, and technology iteration response. The second covers closed-loop aluminum recycling, energy use per product, and cross-border carbon account coverage. These dimensions fit the ASEAN-facing cross-border context. They span external standards, multilingual operations, and technology updates.

3.2. Core finding: the capability-outcome gap

A clear pattern emerges from practice. Firms tend to have solid knowledge integration and green management foundations. But the two are not tightly linked. Stronger integration does not automatically yield better green performance. A conversion gap separates capability from outcome.

This does not mean integration is useless. It points to translation barriers. Standard interpretation, bilingual transfer, and technology updating create a knowledge base. Yet without conversion mechanisms, they do not become material circularity, energy efficiency, or carbon management results.

3.3. Underlying mechanisms and dimensional differences

Why does this gap appear? Three mechanisms help explain it. First, a translation lag: firms spot new standards fast but update contracts, work instructions, or process parameters slowly. Second, an ownership gap: knowledge exists, but no function clearly owns the task of turning it into procurement, recycling, energy, or carbon changes. Third, a timing gap: knowledge capability shows current readiness, while resource outcomes build up over repeated cycles.

The three dimensions also behave differently. Technology iteration response links most consistently with green indicators. Knowledge matters when tied to active updating. ASEAN standard adoption relates positively to all three outcomes, but weakly. Recognizing standards is only a start. Bilingual deployment has the weakest tie to cross-border carbon coverage. Internal communication cannot replace verified supplier, production, and emissions data.

These results do not mean integration lacks value. Its role is infrastructural. It helps firms interpret, share, and revise knowledge. Operating effects appear only when that knowledge enters supplier selection, procurement rules, production scheduling, recycling procedures, energy controls, and carbon-data systems.

This echoes the knowledge-based view and absorptive-capacity theory [3,5,8].

4. Pathway design for converting knowledge integration into green supply chain value

4.1. Translate ASEAN standards into supplier and material control rules

Convert standards into operating controls, not information endpoints. Map each environmental, energy, labeling, or export provision to supplier documents, material parameters, inspection rules, or reporting fields. The unit of integration is the business rule changed, not the standard document. A carbon-label rule, for instance, links to supplier-data fields, product-material records, and verification duties. Energy-efficiency rules become equipment or production targets; material-origin rules define evidence procurement must obtain and retain. Such mappings shorten the gap between external knowledge and internal execution and strengthen traceability in circular supply chains [4,7].

4.2. Build bilingual knowledge nodes at operational interfaces

Place bilingual support where misunderstanding creates execution risk: incoming inspection, warehouse handling, production changeovers, recycling classification, energy monitoring, and exception reporting. Use controlled terminology, visual instructions, and feedback channels rather than general translation. This preserves technical meaning as green requirements cross functional and linguistic boundaries. A two-way node moves approved instructions to frontline employees while questions, deviations, and suggestions return to the knowledge base. Bilingual communication thus becomes organizational learning, consistent with absorptive-capacity logic that application and feedback matter as much as acquisition [3].

4.3. Close the loop between technical updates and material-energy-carbon records

Link technical change management directly to green resource records. Technology iteration response shows the most consistent tie to green performance, so rapid updating pays off when each technical or standards change is connected to material inputs, energy settings, recycling procedures, and carbon-account fields. A closed-loop update sequence has four steps: identify the change, translate it into operating requirements, revise affected digital records and work instructions, and verify implementation through resource-performance feedback. A material-standard revision should update procurement specifications, recycled-material rules, and carbon records; a production-technology change should trigger review of energy-consumption parameters and reporting logic. This converts learning speed into disciplined operational change.

5. Policy coordination and implementation recommendations

Knowledge integration works better as a cross-functional supply chain routine than as a task parked in compliance or IT. Procurement, production, quality, sustainability, logistics, and export teams need one controlled knowledge base. It should hold approved interpretations of standards, supplier requirements, bilingual terminology, technical-update histories, material records, and carbon-data definitions. Every knowledge item needs an owner and a way to verify it.

When standards, supplier demands, or technical specifications shift, a temporary cross-functional group

can be triggered. It does not add bureaucracy; it assigns conversion work fast. Procurement turns the change into supplier requirements. Production rewrites operating instructions. Sustainability updates resource and carbon fields. Quality or compliance checks consistency. A shared change log captures the source, affected processes, owners, implementation date, and verification evidence.

Lead manufacturers can cut interpretation gaps by giving suppliers standardized green-data templates and structured change notices. Smaller suppliers often bear disproportionate costs when standards are revised. Common terms, templates, and minimum data requirements reduce duplicated effort and improve material and carbon information consistency. This matters where closed-loop performance relies on traceability across firm boundaries.

Supplier segmentation makes governance more efficient. Strategic or high-impact suppliers may need detailed change packages and structured data templates. Lower-risk suppliers can follow simplified minimum requirements. This focuses attention on materials and components most relevant to circularity, energy use, export compliance, or carbon-account completeness. Supplier feedback should feed back into the shared knowledge base so recurring interpretation problems are solved once, not repeatedly.

Regional industry associations and public agencies can help with common interpretations, training, and cross-border green-compliance knowledge. The aim is not to centralize firm decisions but to reduce avoidable information asymmetry. In manufacturing regions tied closely to ASEAN markets, shared guidance on green standards, supplier documentation, and carbon information lowers the translation burden for individual firms and improves interoperability across the regional supply chain.

Evaluate implementation through conversion metrics, not counts of manuals, databases, or training sessions. Ask whether standard changes reached supplier requirements on time; whether bilingual instructions reduced misunderstanding; whether technical updates appeared in energy or carbon records; and whether frontline feedback entered revised procedures. These indicators focus attention on actual knowledge use rather than knowledge-management activity volume.

Knowledge creates operational value only when it changes a decision, a routine, or a data record. Applying that test offers a practical way to narrow the gap found in the empirical analysis and keeps knowledge management tied to supply chain execution.

6. Conclusion

Using operational evidence from NEV manufacturing, this study examined three dimensions of knowledge integration capability and three dimensions of green resource management. A consistent pattern appeared: firms had relatively mature knowledge-integration practices and green-management activities, but direct correlations between them remained limited.

That pattern is better read as a conversion gap than as a failure of knowledge integration. ASEAN standard adoption, bilingual operational communication, and technology-iteration response help firms understand, distribute, and update knowledge. Their performance effects depend on whether that knowledge is translated into supplier requirements, material specifications, production routines, recycling procedures, energy controls, and carbon-account records.

The framework's analytical contribution is to treat weak direct relationships as meaningful evidence. In supply chains, strong organizational capabilities and relatively mature green practices can coexist without a strong one-to-one association because value creation runs through intermediate conversion routines.

Separating knowledge possession from knowledge use matters for firms that have invested in standards, training, and communication systems but still struggle to show matching sustainability gains.

Future research could combine supplier-level records, objective energy and recycling data, and longitudinal standards-change events to trace how knowledge becomes measurable green supply chain outcomes. For managers, the next step is less about accumulating more information and more about shortening the distance between knowledge and execution.

Disclosure statement

The author declares no conflict of interest.

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