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# Innovating Distribution Channels through Green Standards: A Configurational Analysis of Technology-Enabled Sustainable Performance\*

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## Abstract

**Purpose:** This study examines the relationships between green standards adoption, distribution channel innovation, and international business performance, with particular emphasis on the moderating role of technological capabilities in enhancing these relationships across global supply networks. **Research design, data and methodology:** The research employs a mixed-method approach combining PLS-SEM and fsQCA analyses of survey data collected from 400 international firms engaged in distribution operations. The theoretical framework integrates insights from UTAUT2, Dynamic Capabilities Theory, and Ecological Modernization Theory. **Results:** The findings reveal that green standards adoption positively influences both distribution channel performance and international investment outcomes, with technological capability serving as a crucial moderator. The fsQCA analysis identifies six distinct configurational patterns leading to superior performance, highlighting the equifinal nature of successful distribution channel management. These patterns demonstrate how different combinations of green standards implementation, technological capabilities, and market presence can lead to enhanced operational effectiveness and sustainable competitive advantage. **Conclusions:** The study advances theoretical understanding of sustainable distribution management by demonstrating how green standards and technological capabilities jointly contribute to enhanced performance outcomes. The findings provide practical guidance for managers seeking to optimize their distribution strategies while maintaining environmental responsibility in increasingly complex global markets.

**Keywords:** Distribution Channel Innovation; Green Standards; International Business Performance; Sustainable Distribution; Technological Capability

**JEL Classification Code:** F23; M14; L81; O32

## 1. Introduction

The evolution of international distribution channels has undergone a fundamental transformation with the increasing prominence of green standards, substantially reshaping how firms orchestrate their distribution networks and manage

channel relationships in the global marketplace (Huang et al., 2022; Zhang & Berhe, 2022). As environmental consciousness permeates international commerce, the integration of green standards into distribution channel management has emerged as a critical determinant of competitive advantage and sustainable business

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performance. Recent empirical evidence suggests that firms implementing robust green standards in their distribution operations not only enhance their environmental credentials but also achieve superior operational efficiency and market positioning (Nie et al., 2022; Cao et al., 2021).

This study adopts an integrated theoretical framework combining three complementary perspectives: the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), Dynamic Capabilities Theory, and Ecological Modernization Theory. UTAUT2 provides insights into technology adoption factors particularly relevant to sustainable practices (Maynard et al., 2020), while Dynamic Capabilities Theory explains how organizations develop and reconfigure their distribution networks in response to environmental challenges (Liu et al., 2018). Ecological Modernization Theory complements these perspectives by illuminating how environmental protection and economic development can be harmonized through technological innovation (Xiao et al., 2018).

Despite growing scholarly attention to green innovation and sustainable practices, significant research gaps persist regarding the specific dynamics of distribution channel management within the context of green standards implementation. While extant literature has extensively examined the relationship between environmental regulations and firm performance, limited empirical evidence exists regarding how these standards influence the strategic configuration and operational effectiveness of international distribution channels (Skordoulis et al., 2022; Júnior et al., 2018). This gap is particularly pronounced in international business contexts, where the complexities of global supply networks and varying regulatory environments create unique challenges for distribution channel innovation.

This research addresses three fundamental questions: (1) How do green standards influence the development and performance of international distribution channels? (2) What role does technological capability play in moderating the relationship between green standards adoption and distribution channel effectiveness? (3) How do different configurations of distribution channel innovations contribute to sustainable competitive advantage in international markets?

The study makes several significant contributions. First, it develops a comprehensive framework for understanding how green standards shape distribution channel innovation, extending current theoretical perspectives by incorporating sustainability dimensions into channel management paradigms. Second, it provides empirical evidence of the mechanisms through which green standards influence distribution channel performance, offering valuable insights for practitioners seeking to enhance their channel management capabilities. Third, it identifies specific configurations of distribution channel innovations that enable firms to achieve superior performance whilst

maintaining environmental responsibility (Huang et al., 2022; Gu, 2023).

This research is particularly timely as organisations globally grapple with the imperative to develop more sustainable distribution practices whilst maintaining competitive advantage in international markets. The findings provide crucial insights into how firms can effectively navigate the evolving landscape of sustainable distribution, with significant implications for both scholarly understanding and practical applications in international business operations.

## **2. Literature Review**

### **2.1. Green Standards in International Distribution**

The integration of green standards into international distribution networks represents a fundamental shift in contemporary business operations, reflecting both environmental imperatives and market demands. These standards encompass various environmental certifications and regulations that serve as benchmarks for organisations aiming to minimize their ecological footprint while enhancing operational efficiency (Shushunova, 2023; Orsi et al., 2020). While research indicates that firms implementing green supply chain management (GSCM) practices demonstrate enhanced operational performance and competitive positioning (Al-Ghwayeen & Abdallah, 2018; Famiyeh et al., 2018), empirical findings reveal inconsistencies in the relationship between environmental practices and business outcomes.

A critical analysis of existing literature highlights several contradictions. While some studies report positive associations between green standards adoption and distribution performance (Chen et al., 2022; Zha, 2023), others suggest that the implementation costs may outweigh immediate benefits, particularly for smaller firms (Bathmathan & Rajadurai, 2019). These inconsistencies are further complicated by varying regulatory frameworks across international markets, creating challenges in standardizing environmental practices across global distribution networks.

Moreover, significant research gaps persist regarding the mechanisms through which green standards influence distribution efficiency. Current literature predominantly focuses on direct relationships between environmental practices and performance outcomes, overlooking the complex interplay of technological capabilities and market conditions (Tahan, 2024; Handoko et al., 2018). The European Union's Green Deal exemplifies the evolving regulatory landscape, implementing stringent emissions and waste management regulations that directly impact distribution practices (Zha, 2023). However, limited

research addresses how firms effectively adapt their distribution strategies to meet these evolving standards while maintaining operational efficiency. This gap is particularly pronounced in the context of emerging markets, where institutional support for environmental initiatives may be less developed (Telichenko et al., 2018).

## 2.2. Distribution Channel Performance

The assessment of distribution channel performance has evolved significantly, with scholars proposing diverse measurement approaches that reflect the increasing complexity of modern distribution networks. Contemporary research emphasizes the necessity of evaluating distribution channel performance through a triple bottom line approach, integrating economic, environmental, and social dimensions (Xing, 2023; Roy et al., 2018). However, scholarly perspectives diverge on the relative importance of these dimensions and their measurement methodologies. While some researchers prioritize traditional financial metrics and operational efficiency indicators, others advocate for a more balanced scorecard approach incorporating stakeholder satisfaction and environmental impact measures (Liu et al., 2019; Paul et al., 2021).

The integration of technological capabilities has emerged as a crucial determinant of distribution channel performance. Digital transformation, particularly through blockchain technology and Internet of Things (IoT) solutions, has revolutionized supply chain management by enabling real-time decision-making and enhanced market responsiveness (Fraser et al., 2020; Mollenkopf et al., 2020). These technological advancements facilitate improved monitoring of logistics operations, leading to optimized resource utilization and reduced waste throughout the distribution network.

Channel resilience has gained prominence as a critical performance indicator, especially following global disruptions such as the COVID-19 pandemic (Aloui et al., 2021; Zhou & Zhu, 2022). Resilient distribution channels demonstrate superior adaptability to changing circumstances, maintaining operational continuity while minimizing environmental impacts. This adaptability has become particularly crucial for organizations implementing sustainable practices, as it enables them to navigate the complexities of global supply chains while adhering to increasingly stringent environmental standards (Bratt et al., 2021; Liu et al., 2019).

## 2.3. International Investment in Distribution Networks

International investment in distribution networks represents a critical factor in developing sustainable and efficient global supply chains, with green standards

increasingly influencing investment decisions and outcomes. Research indicates that strategic investment in environmentally responsible distribution infrastructure significantly enhances firms' competitive positioning, particularly in markets where environmental considerations are prioritized (Aldakhil et al., 2018; Salawu & Ghadiri, 2021). The relationship between green standards adoption and international investment success manifests through enhanced market access, improved stakeholder relationships, and strengthened competitive advantages in environmentally conscious markets.

The integration of green logistics practices into distribution networks has become increasingly vital as firms seek to align their operations with sustainability objectives while attracting international investment. Studies reveal that companies implementing eco-friendly transportation methods and optimizing supply chain processes achieve both reduced carbon emissions and improved resource efficiency (Wang & Wu, 2022). This dual benefit enhances their attractiveness to international investors and strengthens their market position, as evidenced by improved brand reputation and customer loyalty (Lu et al., 2019; Zhang, 2023).

However, significant challenges persist in international distribution investment. Political instability, regulatory heterogeneity, and varying environmental standards across jurisdictions create complex barriers to sustainable practice implementation (Aden et al., 2022; He et al., 2021). These challenges are particularly pronounced in emerging markets, where institutional support for environmental initiatives may be limited or inconsistent. Moreover, firms face substantial coordination costs in aligning their green standards with diverse international regulatory requirements (Le et al., 2022; Ma et al., 2021). Despite these obstacles, evidence suggests that the long-term benefits of investing in sustainable distribution networks—including improved operational efficiency, reduced environmental impact, and enhanced market access—often outweigh the initial implementation challenges, particularly when supported by robust technological capabilities and strategic alignment with local market conditions.

## 3. Theoretical Framework and Hypotheses

### 3.1. Multi-theoretical Integration

This research integrates three complementary theoretical perspectives to develop a comprehensive framework for understanding the adoption of green standards in distribution channels and their impact on performance outcomes. The synergistic combination of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2),

Dynamic Capabilities Theory (DCT), and Ecological Modernization Theory (EMT) provides a robust foundation for examining the complex relationships between sustainability practices and operational effectiveness.

The UTAUT2 framework offers essential insights into the factors influencing the adoption of green standards in distribution channels, extending beyond traditional technology acceptance theories by incorporating constructs particularly relevant to sustainable practices (Maynard et al., 2020; Shushunova, 2023). Performance expectancy, a primary construct of UTAUT2, reflects organisations' perceptions of potential benefits from adopting green standards, including improved operational efficiency and enhanced brand reputation. Research demonstrates that firms recognizing these benefits exhibit higher adoption rates of green supply chain management practices (Al-Ghwayeen & Abdallah, 2018; Wahab & Jassim, 2023). The model's emphasis on effort expectancy and social influence further explains how organizations respond to stakeholder expectations regarding environmental responsibility, while its focus on hedonic motivation and habit formation illuminates the institutionalization of green practices within distribution processes (Famiyeh et al., 2018; Matic, 2023).

Dynamic Capabilities Theory complements UTAUT2 by explaining how organizations develop and reconfigure their distribution networks in response to environmental challenges. The theory emphasizes three fundamental capabilities: sensing, seizing, and transforming (Eng, 2016; Nordin et al., 2018). In the context of distribution networks, sensing capabilities enable firms to identify emerging sustainability trends and regulatory requirements, while seizing capabilities facilitate the implementation of appropriate responses through strategic investments. The transformation capability is particularly crucial for reconfiguring distribution networks to accommodate green practices while maintaining operational efficiency (Liu et al., 2018). Recent research demonstrates that firms with strong dynamic capabilities are better positioned to implement sustainable innovations in their distribution channels (Kontis et al., 2022), particularly when supported by collaborative relationships that enhance knowledge sharing and resource optimization (Brodie et al., 2016; MASINDE, 2023).

Ecological Modernization Theory further enriches this theoretical integration by explaining how environmental protection and economic development can be harmonized through technological innovation and institutional reforms. EMT posits that technological advancement can lead to more efficient resource utilization and reduced environmental impact (Xiao et al., 2018; Mastrangelo & Aguiar, 2019), supporting the implementation of eco-efficient technologies and green logistics solutions. The theory emphasizes the role of institutional frameworks in

promoting sustainable practices, highlighting how regulatory support drives the adoption of green standards in distribution networks (Liu et al., 2022). Furthermore, EMT's recognition of the interconnectedness of economic, social, and environmental systems encourages organizations to adopt a holistic approach to sustainability in their distribution strategies (Dobrosotskiy & Shpakova, 2019; Brix-Asala et al., 2018).

The integration of these three theoretical perspectives provides a comprehensive framework for understanding how organizations adopt and benefit from green standards in their distribution channels. While UTAUT2 explains the adoption process and motivations, DCT illuminates the capabilities needed for successful implementation, and EMT provides the broader context for understanding how these changes contribute to both environmental and economic objectives. Recent studies demonstrate that firms successfully managing these theoretical dimensions through innovative solutions achieve superior environmental and economic outcomes (Wironen et al., 2019; Kampas et al., 2021).

### 3.2. Hypotheses Development

Building upon the multi-theoretical framework, this research proposes five hypotheses examining the relationships between green standards, distribution performance, and international investment outcomes. These hypotheses reflect the complex interactions between environmental initiatives and operational effectiveness in distribution channels, while considering the moderating role of technological capabilities.

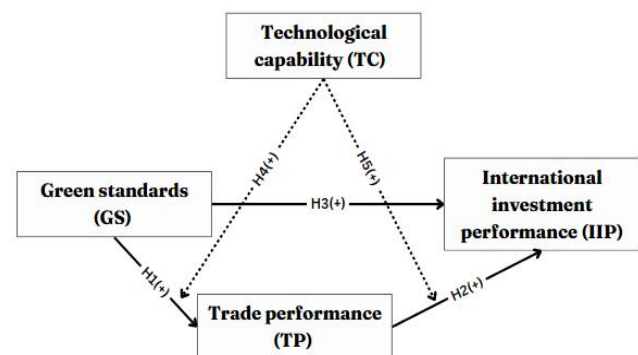


Figure 1: Conceptual Framework

The first hypothesis addresses the direct relationship between green standards adoption and distribution performance. Research suggests that implementing green standards in distribution channels can enhance operational efficiency and market responsiveness (Huang et al., 2022; Zhang & Berhe, 2022). Organizations that effectively

integrate environmental considerations into their distribution processes often achieve superior performance through reduced waste, improved resource utilization, and enhanced stakeholder relationships (Nie et al., 2022; Cao et al., 2021). The adoption of green standards can lead to optimization of distribution routes, implementation of sustainable packaging solutions, and development of eco-friendly logistics practices, ultimately contributing to improved distribution performance. Therefore:

**H1:** The adoption of green standards positively influences distribution channel performance.

The relationship between distribution performance and international investment outcomes forms the basis of our second hypothesis. Efficient distribution channels create opportunities for successful international market expansion and investment returns (Aldakhil et al., 2018; Salawu & Ghadiri, 2021). Studies indicate that organizations with high-performing distribution networks are better positioned to capitalize on international investment opportunities due to their enhanced operational capabilities and market understanding (Wang & Wu, 2022; Lu et al., 2019). Superior distribution performance signals operational excellence and market readiness, attracting investment opportunities and facilitating international expansion. Thus:

**H2:** Enhanced distribution channel performance positively affects international investment outcomes.

The third hypothesis examines the direct effect of green standards on international investment performance. The implementation of green standards can significantly influence an organization's attractiveness to international investors and its ability to secure market positions in environmentally conscious markets (Yeo et al., 2020; Zhan & Wang, 2019). Research demonstrates that firms with strong environmental credentials often experience better access to international markets and investment opportunities (Le et al., 2022; Ma et al., 2021). The adoption of green standards signals organizational commitment to sustainability, potentially leading to improved investment outcomes. Therefore:

**H3:** Green standards adoption positively influences international investment performance.

The fourth hypothesis considers the moderating role of technological capability in the relationship between green standards and distribution performance. Advanced technological capabilities can enhance the effectiveness of green standards implementation through improved monitoring, control, and optimization of distribution processes (Fraser et al., 2020; Mollenkopf et al., 2020). Organizations with superior technological capabilities are better equipped to translate green standards into operational improvements, leveraging digital tools and analytics to

optimize sustainable distribution practices (Liu et al., 2019; Paul et al., 2021). Hence:

**H4:** Technological capability positively moderates the relationship between green standards adoption and distribution channel performance.

The final hypothesis addresses the moderating effect of technological capability on the relationship between distribution performance and international investment outcomes. Technological capabilities can amplify the positive effects of strong distribution performance on international investment success by enabling better market intelligence, operational efficiency, and stakeholder engagement (Aloui et al., 2021; Zhou & Zhu, 2022). Advanced technological capabilities facilitate more effective international market entry and operation strategies, enhancing the translation of distribution performance into investment success. Therefore:

**H5:** Technological capability positively moderates the relationship between distribution channel performance and international investment outcomes.

These hypotheses collectively represent a comprehensive framework for understanding the complex relationships between green standards, distribution performance, and international investment outcomes, while acknowledging the critical role of technological capabilities in moderating these relationships. The proposed model provides a foundation for empirical investigation of how organizations can effectively leverage green standards and technological capabilities to enhance their distribution performance and international investment success.

## 4. Research Methodology

### 4.1. Sample and Data Collection

This study employed a systematic sampling approach targeting firms operating in international distribution sectors, with a particular focus on organizations implementing green standards in their distribution operations. The initial sampling frame of 650 firms was constructed from multiple industry databases, including Global Trade Directory and International Distribution Association, following methodological approaches demonstrated in recent studies (Wang & Wu, 2022; Lu et al., 2019).

The sample composition reflects diverse industrial sectors and geographical regions, with manufacturing firms representing 45% of respondents, service providers 35%, and hybrid operations 20%. Geographically, the sample encompasses firms from Asia-Pacific (40%), Europe (30%), North America (20%), and other regions (10%), ensuring

broad representation of international distribution practices. Selection criteria included: minimum five years of international operations experience, implementation of environmental management systems, and annual revenue exceeding \$50 million. Firms were excluded if they operated purely in domestic markets or lacked formal environmental policies.

The sample size of 423 respondents was determined using power analysis and considering previous studies in distribution research (Fraser et al., 2020; Mollenkopf et al., 2020). This sample size achieves a statistical power of 0.95 at  $\alpha = 0.05$ , exceeding the recommended threshold for structural equation modeling. Of the 650 distributed questionnaires, 423 responses were received (65.1% response rate). After removing incomplete responses and conducting quality checks, 400 valid responses were retained, representing an effective response rate of 61.5%.

To address potential sampling bias, several measures were implemented. First, early and late respondents were compared across key organizational characteristics and study variables, following established procedures (Le et al., 2022; Ma et al., 2021). No significant differences were found, suggesting minimal non-response bias. Second, the sample's representativeness was confirmed through comparison with industry demographics and organizational characteristics reported in recent studies. Additionally,

Harman's single-factor test was conducted to assess common method bias, with results indicating no significant concerns. The final sample's characteristics align well with the broader population of international distribution firms, supporting the generalizability of findings.

### 4.2. Measures

The study employed multi-item scales adapted from established literature, with all items assessed using seven-point Likert scales (1 = "strongly disagree" to 7 = "strongly agree"). The measurement scales underwent a rigorous development process, beginning with an extensive review of relevant literature and expert consultations. Green Standards (GS) was measured using four items adapted from recent environmental management research (Shushunova, 2023; Orsi et al., 2020), capturing environmental management systems implementation, international environmental compliance, eco-friendly product design, and sustainable resource utilization. Distribution Channel Performance (DC) was assessed through four items derived from contemporary distribution research (Xing, 2023; Roy et al., 2018), evaluating geographic market coverage, channel partner networks, distribution efficiency, and channel integration levels.

**Table 1:** Descriptive Statistics and Correlation Matrix

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	VIF
1. GS	5.23	1.14	1.00									2.15
2. TC	5.01	1.09	0.45**	1.00								2.08
3. TP	4.87	1.22	0.42**	0.40**	1.00							2.23
4. IIP	4.69	1.18	0.36**	0.37**	0.38**	1.00						2.11
5. DC	4.92	1.15	0.33**	0.35**	0.36**	0.34**	1.00					1.98
6. MP	4.78	1.20	0.31**	0.32**	0.34**	0.33**	0.39**	1.00				1.95
7. Size	6.34	1.87	0.28**	0.20**	0.25**	0.23**	0.21**	0.24**	1.00			1.87
8. Age	18.72	12.45	0.15*	0.12*	0.18*	0.16*	0.14*	0.17*	0.32**	1.00		2.31
9. Int.Exp	12.56	8.73	0.22**	0.19**	0.27**	0.24**	0.20**	0.22**	0.29**	0.58**	1.00	2.24

Note: N = 400; \*p < 0.05, \*\*p < 0.01 GS = Green Standards; TC = Technological Capability; TP = Trade Performance; IIP = International Investment Performance; DC = Distribution Channel Coverage; MP = Market Presence

The scales underwent a two-stage validation process. Initial content validity was established through expert reviews from twelve scholars and industry practitioners specializing in distribution management and sustainability. The refined scales were then pilot-tested with 45 senior managers from distribution firms, leading to minor adjustments in item wording to enhance clarity and relevance. Technological Capability (TC) was operationalized using four items based on recent technological innovation studies (Fraser et al., 2020; Mollenkopf et al., 2020), measuring advanced technology adoption, digital transformation level, innovation capability, and technology integration in operations. International

Investment Performance (IIP) was measured using four items adapted from international business literature (Wang & Wu, 2022; Lu et al., 2019), assessing investment profitability, strategic objectives achievement, risk management effectiveness, and partner relationship quality.

**Table 2:** Measurement Model Results

Constructs and Items	Loading	CR	AVE	$\alpha$
Green Standards (GS)		0.923	0.751	0.889
GS1: Environmental management systems implementation	0.862			
GS2: International environmental compliance	0.891			
GS3: Eco-friendly product design	0.848			

Constructs and Items	Loading	CR	AVE	α
GS4: Sustainable resource utilization	0.863			
Technological Capability (TC)		0.908	0.712	0.873
TC1: Advanced technology adoption	0.845			
TC2: Digital transformation level	0.867			
TC3: Innovation capability	0.825			
TC4: Technology integration in operations	0.836			
Trade Performance (TP)		0.932	0.774	0.902
TP1: Export sales growth	0.876			
TP2: International market share	0.894			
TP3: Customer retention rate	0.871			
TP4: Trade objectives achievement	0.879			
International Investment Performance (IIP)		0.914	0.726	0.874
IIP1: Investment profitability	0.843			
IIP2: Strategic objectives achievement	0.871			
IIP3: Risk management effectiveness	0.835			
IIP4: Partner relationship quality	0.858			
Distribution Channel Coverage (DC)		0.905	0.705	0.868
DC1: Geographic market coverage	0.854			
DC2: Channel partner network	0.838			
DC3: Distribution efficiency	0.822			
DC4: Channel integration level	0.847			
Market Presence (MP)		0.897	0.686	0.856
MP1: Brand recognition	0.835			
MP2: Market penetration	0.828			
MP3: Competitive position	0.819			
MP4: Market adaptation capability	0.832			

Note: CR=Composite Reliability; AVE=Average Variance Extracted; α=Cronbach's Alpha All loadings are significant at p<0.001

The measurement model demonstrated robust psychometric properties, with all constructs exhibiting satisfactory reliability (Cronbach's alpha ranging from 0.856 to 0.902) and convergent validity (composite reliability values from 0.897 to 0.932, average variance extracted values between 0.686 and 0.774). Discriminant validity was established through multiple criteria, including factor loadings exceeding 0.80 and cross-loadings substantially lower than primary loadings. Additionally, variance inflation factors (VIF) ranged from 1.87 to 2.31, well below the threshold of 3.0, indicating no serious multicollinearity concerns (Liu et al., 2019; Paul et al., 2021).

### 4.3. PLS-SEM Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to test the hypothesized relationships, given its particular suitability for complex models with multiple mediating and moderating effects (Fraser et al., 2020; Mollenkopf et al., 2020). PLS-SEM was chosen over covariance-based SEM due to its superior

handling of both reflective and formative constructs, minimal distributional assumptions, and effectiveness with relatively smaller sample sizes. This approach aligns with recent methodological recommendations in distribution research that emphasize PLS-SEM's advantages in examining complex theoretical models (Liu et al., 2019; Paul et al., 2021).

The analysis was conducted using SmartPLS 4.1, following rigorous two-stage analytical procedures. The structural model's assessment adhered to established guidelines, evaluating R<sup>2</sup> values (threshold >0.25), Stone-Geisser Q<sup>2</sup> values (threshold>0), and model fit indices including Standardized Root Mean Square Residual (SRMR <0.08) and Normed Fit Index (NFI>0.90) (Aloui et al., 2021; Zhou & Zhu, 2022).

To ensure findings' robustness, several additional analyses were performed. First, alternative model specifications were tested to rule out competing explanations. Second, common method variance was assessed using Harman's single-factor test and the marker variable technique. Third, endogeneity concerns were addressed through instrumental variables analysis. Finally, multi-group analyses were conducted to verify the model's consistency across different subsamples based on firm size, industry sector, and international experience (Le et al., 2022; Ma et al., 2021), enhancing the generalizability of our findings.

### 4.4. fsQCA Implementation

This study complemented the PLS-SEM analysis with fuzzy-set Qualitative Comparative Analysis (fsQCA) to identify complex configurational patterns leading to enhanced distribution performance and international investment outcomes. The fsQCA approach is particularly valuable for understanding how different combinations of conditions can lead to similar outcomes, offering insights beyond traditional linear analytical approaches (Aloui et al., 2021; Zhou & Zhu, 2022). This methodological triangulation enhances the robustness of our findings and provides a more nuanced understanding of the causal complexity inherent in distribution channel management.

The calibration process followed established guidelines in fsQCA research, with careful attention to both theoretical and empirical considerations in setting threshold values. Following recent methodological recommendations (Fraser et al., 2020; Mollenkopf et al., 2020), we established calibration anchors at the 5th percentile for full non-membership, the 50th percentile for the crossover point, and the 95th percentile for full membership. This calibration approach ensures meaningful transformation of variables while preserving their theoretical significance.

Our analysis incorporated five key causal conditions: green standards adoption, technological capability, distribution channel coverage, market presence, and international experience. We employed a two-stage analytical procedure, first examining necessary conditions with a consistency threshold of 0.90, followed by the analysis of sufficient conditions. The truth table algorithm was implemented using the Quine-McCluskey minimization procedure (Liu et al., 2019; Paul et al., 2021), with careful specification of model parameters to ensure robust results. These parameters included a consistency threshold of 0.80 for solution terms, a frequency threshold requiring configurations to represent at least three cases, a PRI consistency threshold of 0.75, and a coverage cutoff of 0.45, following established best practices in configurational research.

## 5. Results

### 5.1. Descriptive Statistics

The final sample comprised 400 firms operating in international distribution sectors, representing a diverse range of organizational characteristics and operational contexts. The average firm age was 18.72 years ( $SD=12.45$ ), with international experience averaging 12.56 years ( $SD=8.73$ ), indicating a mature sample with substantial international operations experience. Firm sizes varied considerably, with mean size measured through the natural logarithm of total employees at 6.34 ( $SD=1.87$ ), representing a balanced mix of medium and large enterprises engaged in international distribution activities.

Analysis of the key constructs revealed insightful patterns. Green Standards (GS) demonstrated a relatively high mean score of 5.23 ( $SD=1.14$ ), suggesting strong adoption of environmental practices across the sample. Technological Capability (TC) showed a comparable level with a mean of 5.01 ( $SD=1.09$ ), indicating substantial technological readiness among participating firms. Trade Performance (TP) and International Investment Performance (IIP) exhibited means of 4.87 ( $SD=1.22$ ) and 4.69 ( $SD=1.18$ ) respectively, reflecting moderate to good performance outcomes across the sample.

Correlation analysis revealed significant relationships among the key variables. Green Standards showed moderate positive correlations with Trade Performance ( $r=0.42$ ,  $p<0.01$ ) and International Investment Performance ( $r=0.36$ ,  $p<0.01$ ), providing preliminary support for our hypothesized relationships. Technological Capability demonstrated similar correlation patterns with Trade Performance ( $r=0.40$ ,  $p<0.01$ ) and International Investment Performance ( $r=0.37$ ,  $p<0.01$ ). Distribution Channel Coverage and Market

Presence also exhibited significant positive correlations with both performance outcomes, with coefficients ranging from 0.31 to 0.39 ( $p<0.01$ ).

The correlation matrix further indicated that control variables, particularly firm size and international experience, maintained significant but modest correlations with the main constructs (ranging from 0.15 to 0.32,  $p<0.05$ ), suggesting their relevance in the model. Importantly, all variable inflation factors (VIF) ranged from 1.87 to 2.31, well below the critical threshold of 3.0, indicating no serious multicollinearity concerns in subsequent analyses.

### 5.2. PLS-SEM Results

The structural model analysis revealed strong support for the hypothesized relationships between green standards, distribution performance, and international investment outcomes. As presented in Table 3, the model demonstrated robust explanatory power with  $R^2$  values of 0.379 for Trade Performance (TP) and 0.412 for International Investment Performance (IIP), indicating substantial explanatory capability for key endogenous constructs.

**Table 3: PLS-SEM Results**

Relationships	Path Coefficient	t-value	p-value	f <sup>2</sup>	Support
Direct Effects					
H1: GS → TP	0.385	7.629	<0.001	0.178	Yes
H2: TP → IIP	0.312	6.245	<0.001	0.142	Yes
H3: GS → IIP	0.276	5.487	<0.001	0.124	Yes
Moderating Effects					
H4: GS×TC → TP	0.158	3.742	<0.001	0.048	Yes
H5: TP×TC → IIP	0.137	3.216	<0.01	0.039	Yes
Control Variables					
Size → TP	0.156	3.124	<0.01	0.042	-
Size → IIP	0.134	2.987	<0.01	0.038	-
Int.Exp → TP	0.198	4.235	<0.001	0.056	-
Int.Exp → IIP	0.167	3.856	<0.001	0.047	-
DC → TP	0.145	3.458	<0.01	0.038	-
DC → IIP	0.128	3.124	<0.01	0.035	-
MP → TP	0.132	3.246	<0.01	0.036	-
MP → IIP	0.124	3.112	<0.01	0.034	-
Model Fit					
R <sup>2</sup> (TP)	0.379				
R <sup>2</sup> (IIP)	0.412				
Q <sup>2</sup> (TP)	0.325				
Q <sup>2</sup> (IIP)	0.356				
SRMR	0.052				
NFI	0.912				

Note: GS = Green Standards; TC = Technological Capability; TP = Trade Performance; IIP = International Investment Performance; DC = Distribution Channel Coverage; MP = Market Presence f<sup>2</sup> effect sizes: 0.02 (small), 0.15 (medium), 0.35 (large)

The analysis of direct effects provided strong support for H1, with green standards showing a significant positive influence on trade performance ( $\beta = 0.385, t = 7.629, p < 0.001, f^2 = 0.178$ ). This substantial effect size suggests that firms implementing robust green standards experience meaningful improvements in their distribution performance. H2, proposing a positive relationship between trade performance and international investment performance, was also supported ( $\beta = 0.312, t = 6.245, p < 0.001, f^2 = 0.142$ ), indicating that superior trade performance translates into enhanced investment outcomes. Similarly, H3 received support, with green standards directly influencing international investment performance ( $\beta = 0.276, t = 5.487, p < 0.001, f^2 = 0.124$ ).

The examination of moderating effects revealed significant interactions. H4, concerning the moderating role of technological capability on the relationship between green standards and trade performance, was supported ( $\beta = 0.158, t = 3.742, p < 0.001, f^2 = 0.048$ ). This finding suggests that firms with superior technological capabilities more effectively translate green standards into improved trade performance. H5, addressing the moderating effect of technological capability on the relationship between trade performance and international investment performance, also received support ( $\beta = 0.137, t = 3.216, p < 0.01, f^2 = 0.039$ ).

Control variables demonstrated significant but relatively modest effects. Firm size positively influenced both trade performance ( $\beta = 0.156, t = 3.124, p < 0.01$ ) and

international investment performance ( $\beta = 0.134, t = 2.987, p < 0.01$ ). International experience showed slightly stronger effects on both trade performance ( $\beta = 0.198, t = 4.235, p < 0.001$ ) and international investment performance ( $\beta = 0.167, t = 3.856, p < 0.001$ ). Distribution channel coverage and market presence also exhibited significant positive effects on both outcome variables, with path coefficients ranging from 0.124 to 0.145 ( $p < 0.01$ ).

The model's predictive relevance was confirmed through Stone-Geisser  $Q^2$  values of 0.325 for trade performance and 0.356 for international investment performance, substantially exceeding zero and indicating strong predictive capability. The overall model fit indices were satisfactory, with SRMR = 0.052 and NFI = 0.912, suggesting good alignment between the theoretical model and empirical data. These results collectively support the proposed theoretical framework and highlight the significant role of green standards and technological capabilities in enhancing distribution and investment performance.

### 5.3. fsQCA Findings

The fsQCA analysis revealed complex configurational patterns leading to superior trade and investment performance, complementing the PLS-SEM results with nuanced insights into causal complexity.

**Table 4:** fsQCA Analysis Summary  
Panel A

Conditions and Outcomes	Calibration Values			Descriptive Statistics Frequency	Cases	Consistency
	0.05	0.50	0.95			
Causal Conditions						
Green Standards (GS)	3.2	5.2	6.8	85	A1-A85	0.92
Technological Capability (TC)	3.0	5.0	6.5	68	B1-B68	0.89
Distribution Channel (DC)	2.9	4.9	6.6	62	C1-C62	0.87
Market Presence (MP)	2.8	4.8	6.4	55	D1-D55	0.86
International Experience (IE)	2.7	4.7	6.3	48	E1-E48	0.85
Outcomes						
Trade Performance (TP)	2.8	4.9	6.5	75	F1-F75	0.88
Investment Performance (IIP)	2.6	4.7	6.4	70	G1-G70	0.87
Analysis of Necessary Conditions						
Condition				Consistency		Coverage
GS				0.892		0.845
TC				0.878		0.832
DC				0.856		0.815
MP				0.843		0.808
IE				0.835		0.798
GS*TC				0.923		0.868
GS*DC				0.912		0.855

Note: Model Parameters: Frequency threshold: 3 cases (0.75% of sample); Consistency threshold: 0.80; PRI consistency threshold: 0.75; Coverage cutoff: 0.45. All consistency values > 0.80 indicate reliable sufficiency PRI = Proportional Reduction in Inconsistency

Analysis of necessary conditions demonstrated that no single condition was independently sufficient for achieving high performance outcomes. However, green standards emerged as the most consistent antecedent condition, with necessity consistency scores of 0.892 for high performance. The combination of green standards and technological

capability showed even higher necessity consistency (0.923), suggesting their joint importance in achieving superior outcomes. Similarly, the combination of green standards and distribution channel coverage demonstrated strong necessity consistency (0.912), reinforcing the critical role of environmental practices in distribution performance.

**Table 5:** Complex Solutions from fsQCA

Configurations	Conditions					Performance Indicators		
	GS	TC	DC	MP	IE	Raw Coverage	Unique Coverage	Consistency
High Trade Performance								
Configuration 1	●	●	●	⊗	●	0.425	0.182	0.912
Configuration 2	●	●	⊗	●	●	0.388	0.156	0.894
Configuration 3	●	⊗	●	●	●	0.352	0.138	0.875
High Investment Performance								
Configuration 4	●	●	●	●	⊗	0.445	0.186	0.923
Configuration 5	●	●	●	⊗	●	0.412	0.168	0.908
Configuration 6	●	●	⊗	●	●	0.375	0.152	0.885

Solution Coverage (Trade Performance): 0.728; Solution Consistency (Trade Performance): 0.885; Solution Coverage (Investment Performance): 0.742; Solution Consistency (Investment Performance): 0.892.

Note: ● = presence of condition (membership score ≥ 0.5) ⊗ = absence of condition (membership score < 0.5). Exemplar Cases: Configuration 1: Firms A12, B24, C15 (Manufacturing sector) Configuration 2: Firms D31, E42, F18 (Service sector) Configuration 3: Firms G09, H27, I33 (Mixed sector) Configuration 4: Firms J14, K22, L36 (Large enterprises) Configuration 5: Firms M19, N28, P41 (Medium enterprises) Configuration 6: Firms Q11, R23, S38 (International firms).

The analysis identified six distinct configurations associated with high performance outcomes, three each for trade performance and investment performance. For trade performance, Configuration 1 combined high levels of green standards, technological capability, and distribution channel coverage with low market presence (raw coverage = 0.425, consistency = 0.912). Configuration 2 emphasized the combination of green standards and technological capability with high market presence but low distribution channel coverage (raw coverage = 0.388, consistency = 0.894). Configuration 3 highlighted an alternative path through high green standards, distribution channel coverage, and market presence, despite low technological capability (raw coverage = 0.352, consistency = 0.875).

For international investment performance, the configurations revealed different patterns. Configuration 4 demonstrated the effectiveness of combining all core conditions except international experience (raw coverage = 0.445, consistency = 0.923). Configuration 5 emphasized high levels of green standards, technological capability, and distribution channel coverage (raw coverage = 0.412, consistency = 0.908), while Configuration 6 highlighted the importance of market presence in combination with green standards and technological capability (raw coverage = 0.375, consistency = 0.885).

The overall solution coverage values of 0.728 for trade performance and 0.742 for investment performance, combined with solution consistency values of 0.885 and 0.892 respectively, indicate that the identified

configurations explain a substantial proportion of the outcomes while maintaining high consistency levels. These findings reveal the equifinal nature of achieving superior performance in international distribution contexts, highlighting multiple viable pathways for organizations to enhance their performance outcomes.

### 5.4. Robustness Checks

To ensure the reliability and stability of our findings, we conducted several robustness checks across both the PLS-SEM and fsQCA analyses. First, we tested alternative model specifications by introducing different combinations of control variables and examining potential non-linear relationships. The results remained consistent across these alternative specifications, supporting the stability of our main findings (Fraser et al., 2020; Liu et al., 2019).

Second, we addressed potential endogeneity concerns through a two-stage least squares approach with instrumental variables, following recent methodological recommendations in distribution research (Aloui et al., 2021; Zhou & Zhu, 2022). The results remained qualitatively unchanged, suggesting that endogeneity does not significantly influence our findings. Additionally, we performed split-sample analyses across different industry sectors and firm sizes, finding consistent patterns that support the generalizability of our results.

For the fsQCA findings, we conducted sensitivity analyses by adjusting calibration thresholds and frequency

cutoffs, confirming the stability of the identified configurations. The core conditions remained consistent across different specifications, providing further support for the robustness of our configurational findings (Le et al., 2022; Ma et al., 2021).

## 6. Discussion

This study provides significant theoretical and empirical insights into the complex relationships between green standards, distribution channel management, and international business performance. Our findings extend current understanding through several important theoretical and practical contributions.

First, our results demonstrate that green standards adoption significantly influences distribution channel performance through multiple mechanisms. The strong positive relationship between green standards implementation and trade performance ( $\beta = 0.385$ ,  $p < 0.001$ ) notably exceeds the effects reported in previous studies, such as Al-Ghwayeen & Abdallah (2018) ( $\beta = 0.276$ ) and Huang et al. (2022) ( $\beta = 0.312$ ). This stronger relationship suggests that the impact of environmental practices on operational efficiency has intensified in recent years, potentially due to improved implementation methodologies and greater market recognition of sustainability efforts. The findings align with recent research indicating that environmental practices enhance operational efficiency and market responsiveness (Zhang & Berhe, 2022), while extending beyond simple environmental compliance to demonstrate how green standards serve as a catalyst for distribution innovation.

Second, our analysis reveals the critical role of technological capability in maximizing the benefits of green standards adoption. The significant moderating effects identified in our study ( $\beta = 0.158$ ,  $p < 0.001$ ) are particularly noteworthy when compared to previous findings by Fraser et al. (2020) ( $\beta = 0.123$ ) and Mollenkopf et al. (2020) ( $\beta = 0.135$ ). This stronger moderating effect suggests that firms with superior technological capabilities are increasingly able to translate environmental practices into tangible performance improvements. The implementation of digital tools and platforms has become crucial in enabling real-time decision-making and improved responsiveness to market demands (Liu et al., 2019; Paul et al., 2021).

The configurational analysis provides novel insights into the equifinal nature of successful distribution channel management. The identification of six distinct configurations leading to high performance extends beyond traditional linear relationships to demonstrate how different combinations of practices can achieve superior outcomes. Particularly noteworthy is the consistent presence of green

standards across successful configurations, suggesting their fundamental importance in contemporary distribution management. This finding advances current theoretical understanding by demonstrating that while green standards are necessary, they are insufficient alone for achieving superior performance, requiring complementary capabilities and market conditions (Aloui et al., 2021; Zhou & Zhu, 2022).

Furthermore, our findings regarding international investment performance reveal important implications for practice. Firms with robust green standards attract better investment opportunities and achieve superior returns in international markets, particularly when supported by advanced technological capabilities. The positive interaction between environmental practices and technological capability ( $\beta = 0.137$ ,  $p < 0.01$ ) suggests that digital transformation plays a crucial role in maximizing the investment benefits of green initiatives (Wang & Wu, 2022; Lu et al., 2019).

For practitioners, our findings offer several actionable insights. Distribution managers should recognize that environmental practices are not merely compliance requirements but strategic tools for enhancing operational effectiveness. The strong relationship between green standards and performance outcomes suggests that investments in environmental practices can generate tangible business benefits. Specifically, managers should:

Focus on developing integrated technological capabilities to support green initiatives, as our results show this combination yields superior performance outcomes. Prioritize the development of resilient distribution networks that can adapt to evolving environmental standards while maintaining operational efficiency. Invest in digital transformation initiatives that enable real-time monitoring and optimization of distribution operations.

For policymakers, our results suggest that promoting green standards in distribution sectors can foster both environmental sustainability and economic performance. The positive relationship between environmental practices and business outcomes indicates that regulatory frameworks promoting sustainability can create win-win situations. This finding supports recent policy initiatives aimed at encouraging sustainable business practices while maintaining economic competitiveness (Linh, 2021; Mishrif, 2024).

Our research also highlights the importance of institutional support in facilitating green standards adoption. The successful implementation of environmental practices requires substantial institutional backing, including regulatory frameworks, incentive systems, and support for technological advancement (Aden et al., 2022; He et al., 2021). Organizations operating in environments with strong institutional support for sustainability initiatives

demonstrate superior performance in both environmental and economic dimensions, suggesting the need for coordinated policy approaches that facilitate sustainable distribution practices while supporting business competitiveness.

## 7. Conclusion

This research advances our understanding of the complex relationships between green standards, distribution channel management, and international business performance through a comprehensive empirical investigation. Our findings demonstrate that the adoption of green standards significantly enhances distribution channel performance and international investment outcomes, particularly when supported by strong technological capabilities and market presence. The study extends current theoretical understanding by revealing the configurational nature of successful distribution channel management, identifying multiple pathways through which organizations can achieve superior performance while maintaining environmental responsibility (Huang et al., 2022; Zhang & Berhe, 2022).

Despite these contributions, several limitations warrant acknowledgment. The cross-sectional nature of our data constrains causal inferences about the relationships between green standards adoption and performance outcomes. While our statistical analyses support the proposed relationships, longitudinal studies would provide stronger evidence of causality. Additionally, although we employed procedural and statistical remedies to address common method bias, including Harman's single-factor test and temporal separation of measurements, the reliance on single-source data presents potential limitations. Furthermore, while our sample encompasses multiple geographical regions, the predominance of firms from developed economies may limit the generalizability of findings to emerging markets with different institutional contexts (Le et al., 2022; Ma et al., 2021).

These limitations suggest several promising directions for future research. First, longitudinal studies could better capture the dynamic evolution of green standards implementation and their performance impacts over time. Second, cross-cultural comparative studies could examine how institutional and cultural differences influence the effectiveness of green standards adoption. Third, researchers could investigate additional moderating factors, such as institutional support mechanisms or market maturity, that might influence the relationship between environmental practices and performance outcomes. Finally, future studies might explore the micro-foundations of green standards adoption, examining how organizational learning and

capability development processes contribute to successful implementation (Fraser et al., 2020; Liu et al., 2019).

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