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# Linking Internal Readiness, Distribution Factors, and Technology Adoption to Competitive Advantage

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## Abstract

**Purpose:** This study examines the effects of internal readiness, distribution factors, and technology adoption on competitive advantage in small-scale border retail firms. **Research design, data and methodology:** Data were collected through online questionnaires administered to store owners and managers, with reliability confirmed by Cronbach's alpha values ranging from 0.822 to 0.960. **Results:** Structural equation modeling with bootstrapping indicates that internal readiness has a strong positive effect on technology adoption ( $\beta = 0.876, p < 0.001$ ). However, internal readiness ( $\beta = 1.527, p = 0.269$ ) and distribution factors ( $\beta = 0.749, p = 0.081$ ) do not have a direct effect on competitive advantage. In addition, distribution factors do not significantly influence technology adoption ( $\beta = 0.135, p = 0.453$ ), and technology adoption alone does not directly enhance competitive advantage ( $\beta = -1.267, p = 0.435$ ). Mediation analysis further reveals that technology adoption does not mediate the effects of internal readiness or distribution factors on competitive advantage. **Conclusions:** The findings suggest that internal readiness is a key driver of technology adoption, while technology adoption functions primarily as an enabler rather than a direct source of competitive advantage. Distribution factors support the process, but achieving competitiveness requires the strategic integration of internal capabilities.

**Keywords:** Technology Adoption, Internal Readiness, Distribution Factors, Competitive Advantage, Border Retail Enterprises

**JEL Classification Code :** D11, D30, D70, M10, M31

## 1. Introduction

In today's hyper-competitive commercial landscape, enterprises across all sectors prioritize the pursuit and maintenance of a sustainable Competitive Advantage. This objective poses a formidable challenge for businesses in border economic zones, where the interplay of cross-border trade dynamics, regulatory ambiguity, and cultural diversity

simultaneously yields strategic opportunities and operational hurdles. Within Thailand's border provinces, retail firms serve as vital engines of regional economic growth; nevertheless, many struggle to sustain their market position due to resource scarcities, restricted market reach, and disjointed Technology Adoption (Kerepat & Thabhiranrak, 2024). These systemic issues necessitate a paradigm shift in research, moving beyond isolated firm-

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level analyses to investigate how internal capabilities and Distribution Factors collectively orchestrate Competitive Advantage in border retail environments.

Extensive scholarship underscores the capacity of Technology Adoption to bolster operational efficiency, deepen consumer engagement, and catalyze innovation (Pantano et al., 2020; Rahman et al., 2022). Yet, empirical evidence remains polarized, particularly in resource-constrained settings like border regions. In these areas, firms often lack the requisite infrastructure, managerial expertise, or institutional backing to fully exploit digital advancements (Al-Emran & Granić, 2020). Critically, the prevailing literature frequently examines Internal Readiness and Distribution Factors in silos, offering limited clarity on their interdependent influence on market dominance. Consequently, the precise mechanisms through which Technology Adoption translates—or fails to translate into tangible competitive outcomes remain theoretically underdeveloped.

Current research further indicates that Technology Adoption alone does not guarantee superior performance. Oliveira and Martins (2011), for instance, observe that companies often implement digital systems without achieving meaningful gains, primarily due to deficient managerial capabilities or low Internal Readiness. Similarly, Al-Emran and Granić (2020) argue that even sophisticated technologies yield marginal returns if the firm lacks an innovation-centric culture or fails to re-engineer its core processes. These inconsistent findings suggest that the link between adoption and performance is highly contingent, especially for small-scale, resource-limited firms. Despite this, scholars have seldom integrated Distribution Factors, such as supply chain volatility and cross-border regulatory shifts into this contingency perspective, notwithstanding their heightened relevance in border contexts.

A synthesis of the existing literature reveals three fundamental gaps. First, prior inquiries typically treat Internal Readiness and Distribution Factors as independent variables rather than exploring their synergistic interactions. Second, the relationship between Technology Adoption and Competitive Advantage remains empirically contested, particularly among small retailers navigating institutional barriers. Third, few studies utilize mediated frameworks to explain how Technology Adoption bridges the gap between internal assets and external logistics to drive success in border zones.

In Thailand's border provinces, these scholarly gaps have significant practical implications. Local retailers frequently operate with minimal staffing and constrained budgets while grappling with volatile trade regulations and inequitable access to digital infrastructure. Even when these firms adopt advanced solutions, such as omnichannel platforms or AI-driven services, the anticipated gains in

productivity or customer experience often fail to materialize. This suggests that Competitive Advantage in the border retail sector emerges not from Technology Adoption in isolation, but from the strategic alignment of Internal Readiness, Distribution Factors, and technological capabilities. Despite the border trade's immense economic weight, valued at approximately USD 16.04 billion in 2024, and its pivotal role in regional integration, empirical research into these interconnected dynamics remains sparse.

To address these deficiencies, this study integrates the Technology Acceptance Model (TAM), Resource-Based View (RBV), and Institution-Based View (IBV) to evaluate a mediated model of Competitive Advantage within Thailand's border retail sector. By concurrently analyzing Internal Readiness, Distribution Factors, and Technology Adoption, this research enriches theoretical discourse by clarifying the conditional nature of digital investments. Practically, the findings provide a roadmap for policymakers and entrepreneurs, emphasizing that successful digital transformation requires the harmonization of internal capability building with a supportive distribution environment.

## **1.1. Research Objectives**

This research investigates how Internal Readiness and Distribution Factors drive Technology Adoption among enterprises operating within border regions. Specifically, the study evaluates the capacity of Technology Adoption to foster a sustainable Competitive Advantage for these firms. Furthermore, the analysis explores the dual pathways to success by examining whether Internal Readiness and Distribution Factors influence Competitive Advantage through direct mechanisms or indirectly, utilizing Technology Adoption as a critical mediating variable.

## **2. Literature Review**

### **2.1. The Importance of Competitive Advantage in Border Retail Enterprises**

Competitive advantage represents an organization's capacity to generate superior value for its stakeholders compared to its rivals, primarily through operational cost-efficiency, superior quality of products and services, sustained market expansion, and strategic brand positioning (Porter, 1985). Within border retail environments, this advantage takes on a multifaceted nature as firms grapple with fragmented consumer demand, intricate regulatory frameworks, and aggressive competition from both local and international players. Consequently, this study conceptualizes Competitive Advantage as a holistic, multi-

dimensional outcome rather than a narrow, isolated metric.

Scholars emphasize that price competitiveness plays a pivotal role in border zones, where consumers can seamlessly transition between domestic goods and imported alternatives (Thirathanachaiyakul & Suanchupol, 2023). Furthermore, high standards of product and service quality foster consumer trust and encourage repeat patronage, which is essential in markets often defined by perceived risk and information gaps. While sales and market growth track a firm's agility in navigating volatile cross-border demand, brand image serves as a vital intangible asset that distinguishes a business within saturated markets (Lomprakon et al., 2021). Collectively, these elements encapsulate both the financial and reputational facets of market leadership.

In alignment with strategic management theory, this research treats Competitive Advantage as a higher-order latent construct that aggregates the collective impacts of pricing, quality, growth, and brand identity. Although the study employs a parsimonious measurement approach to maintain statistical model stability, the construct remains firmly rooted in a comprehensive theoretical understanding of how firms compete within the unique context of border retail.

## 2.2. Internal Readiness

This study conceptualizes internal readiness as a higher-order construct that characterizes a firm's proficiency in mobilizing, integrating, and reconfiguring its internal assets to facilitate Technology Adoption and secure a Competitive Advantage. Grounded in the Resource-Based View (RBV) and Dynamic Capability Theory, Internal Readiness transcends simple asset ownership; instead, it represents a synergistic bundle of organizational competencies that collectively boost a firm's effectiveness within volatile border environments (Amaya, 2024).

The framework categorizes six critical subdimensions, organizational technology, human resources, marketing and sales proficiency, supplier relationships, financial capital, and environmental adaptability, based on their shared capacity to help firms sense opportunities, seize value, and transform resources over time. While organizational technology and human capital establish the baseline for innovation and operational capacity (Zhang & Yang, 2021), marketing and sales capabilities convert these internal strengths into tangible market success, especially within cross-border contexts (Nguyen & Simkin, 2023). Furthermore, robust supplier relationships and financial resources provide the necessary continuity and investment agility, while environmental adaptability enables firms to recalibrate their routines in response to regulatory shifts and erratic demand (Wang & Ahmed, 2022).

Although these dimensions maintain theoretical distinctions, this study models them as a unified, cohesive construct to reflect their practical interdependence. This is particularly relevant for small retail enterprises, where internal resources are often tightly coupled. This holistic approach aligns with contemporary RBV scholarship, which argues that specific configurations of capabilities rather than isolated factors, serve as the true engines of competitive advantage.

## 2.3. Distribution Factors

This study defines distribution factors as a contextual and institutional construct that encapsulates the external conditions governing a firm's capacity to deliver products, penetrate markets, and sustain operations within border regions. Grounded in the Institution-Based View (IBV) and supply-chain scholarship, these factors represent environmental mechanisms that dictate strategic behavior yet remain largely outside the firm's direct control (Hossain & Chowdhury, 2021).

The framework organizes six critical dimensions, infrastructure and accessibility, market access, border consumer behavior, competitive intensity, government policy and institutional support, and risk-related conditions, based on their collective role in determining distribution efficiency and environmental pressure. While infrastructure and market access directly impact logistics costs and cross-border mobility, consumer behavior and competitive intensity drive demand volatility and pricing pressures (Nguyen, 2022; Rahman & Li, 2024). Furthermore, government policies and institutional frameworks establish the costs of regulatory compliance, whereas political, financial, and supply-chain risks introduce the systemic instability that firms must navigate (Wang & Ahmed, 2022).

Crucially, while these external conditions may drive or hinder technology adoption through regulatory mandates, competitive imitation, or supply-chain synchronization, their impact remains indirect and highly contingent on the specific context. In border retail environments, Distribution factors often act as a source of pressure, compelling firms to adopt digital tools out of necessity rather than choice. However, such pressures do not necessarily lead to effective utilization, particularly when a firm lacks sufficient internal readiness. This distinction proves vital in explaining why distribution factors do not consistently predict successful adoption or the attainment of a competitive advantage.

## 2.4. Technology Adoption

Scholars have extensively investigated Technology Adoption through the Technology Acceptance Model (TAM), which attributes adoption behavior to three primary

drivers: perceived usefulness, perceived ease of use, and behavioral intention (Davis, 1989; Venkatesh & Davis, 2000). While TAM serves as a robust predictor of whether a firm will implement new tools, it provides limited clarity on whether such adoption actually translates into organizational-level performance improvements, especially within small and resource-poor enterprises.

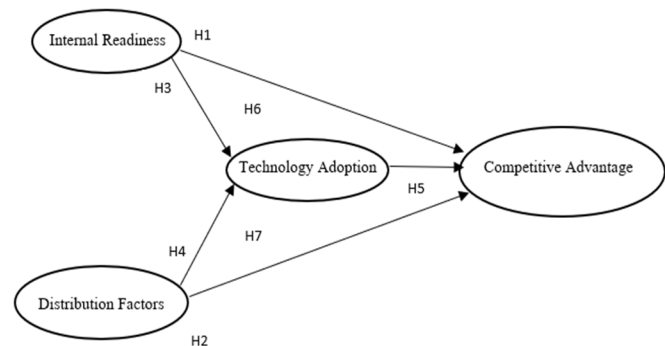
Although a significant body of research links Technology Adoption to heightened efficiency, increased innovation, and strategic agility (Bharadwaj, 2000; Al-Ansari et al., 2013), empirical data remain inconsistent. Numerous studies highlight weak or insignificant correlations between adoption and firm performance among SMEs, suggesting that implementing technology in isolation rarely secures a Competitive Advantage (Oliveira & Martins, 2011; Al-Emran & Granić, 2020). In these instances, firms often employ technology merely as a tool for operational support or immediate survival rather than as a vehicle for strategic differentiation.

From a Resource-Based View (RBV) perspective, technology catalyzes a Competitive Advantage only when firms pair it with complementary internal assets, such as managerial expertise, organizational learning routines, and a strong capacity for innovation. Similarly, Dynamic Capability Theory posits that technology bolsters a firm's market position only when the organization can effectively integrate and reconfigure these digital tools in response to shifting environments. Within border retail contexts, where institutional volatility and resource scarcity prevail, firms often find these vital complementary capabilities underdeveloped.

Furthermore, while distribution factors may increase a firm's exposure to digital solutions or amplify competitive pressures, such external conditions do not automatically ensure effective technology utilization. Consequently, researchers should view Technology Adoption as a contingent and potentially mediating mechanism rather than a guaranteed, direct driver of success.

Synthesizing the existing literature suggests that the relationship between adoption and performance depends heavily on both Internal Readiness and the external distribution environment. However, few empirical studies have tested this mediated logic specifically within border retail settings. Addressing this deficiency, the present study examines Technology Adoption as the conditional bridge linking internal readiness and distribution factors to a sustainable competitive advantage, thereby aligning the theoretical framework with the practical variability observed among small border firms.

## 2.5. Research Model



**Figure 1:** Research Model

- H1:** Internal readiness has a positive effect on competitive advantage of border retail firms.
- H2:** Distribution factors have a positive effect on competitive advantage of border retail firms.
- H3:** Internal readiness has a positive effect on technology adoption in border retail firms.
- H4:** Distribution factors have a positive effect on technology adoption in border retail firms.
- H5:** Technology adoption has a positive effect on competitive advantage of border retail firms.
- H6:** Technology adoption mediates the relationship between internal readiness and competitive advantage.
- H7:** Technology adoption mediates the relationship between distribution factors and competitive advantage.

## 3. Research Methods and Materials

### 3.1. Population

This study employed an online survey to examine the relationships among internal readiness, distribution factors, technology adoption, and competitive advantage in small-scale border retail firms. To ensure data quality and minimize common method bias, several procedural and methodological measures were implemented. Population data were obtained from the Statistical Yearbook Thailand 2024 published by the National Statistical Office (NSO, 2024), and data collection was conducted over a four-month period from January to April 2025. Proportional stratified sampling was applied to ensure adequate representation across the ten northeastern border provinces based on the number of registered retail establishments, with the sample size for each province calculated using the formula:

Sample size for province  $i$  = (Number of retail enterprises in province  $i$  / Total number of retail enterprises)  $\times$  Total sample size.

Potential respondents were contacted via email or social media, and participation was voluntary, with informed consent obtained electronically and assurances of anonymity and confidentiality. To confirm eligibility, initial filter questions were included, asking whether the respondent was the owner or manager of the retail business, directly involved in operational or technology-related decision-making, and operating in a designated border province; respondents failing any filter were automatically excluded from the survey. To further reduce common method bias, the survey separated measurement items for independent and dependent variables into different sections with clear instructions, included reverse-coded statements to detect response patterns, inserted attention check items such as requests to select “Strongly Agree” for a specific statement, and randomized the order of questions within constructs. Response completeness, response time, and consistency were monitored, and only respondents who passed attention checks and completed at least 95% of the survey were included in the final analysis. The study adhered to ethical standards for social science research, did not collect personally identifiable information, and emphasized voluntary participation throughout the data collection process.

### 3.2. Samples and Response Rate

A total of 520 questionnaires were distributed online using Google Forms. After screening for completeness and eligibility, 400 valid responses were retained for analysis, yielding a usable response rate of 76.9%. This sample size exceeds the minimum requirement suggested by Krejcie and Morgan (1970) and is adequate for structural equation modeling.

The final sample comprised retail enterprises such as convenience stores, mini-marts, and small independent shops selling directly to consumers, representing the core of border retail activity. Table 1 presents the proportional allocation of samples across the ten provinces.

**Table 1:** Sample Allocation of Retail Businesses Across Ten Northeastern Thai Border Provinces

Province	Estimated Population	Estimated Retail Stores	Sample Size
Srisaket	1,454,730	15,549	76 (14.62%)
Nong Khai	511,706	5,469	27 (5.19%)
Ubon Ratchathani	1,695,200	18,119	88 (16.92%)
Buriram	483,767	5,171	25 (4.81%)
Sakeao	562,902	6,017	29 (5.58%)
Surin	1,360,245	14,539	71 (13.66%)

Province	Estimated Population	Estimated Retail Stores	Sample Size
Bueng Kan	421,684	4,507	22 (4.32%)
Amnat Charearn	279,462	2,987	15 (2.88%)
Nakhon Phanom	559,000	5,975	29 (5.58%)
Mukdahan	342,200	3,658	18 (3.46%)

### 3.3. Measurement and Analytical Procedure Measurement Scales

All latent constructs were measured using established multi-item scales, with at least three items per construct, adapted from prior validated studies to enhance content validity. All items were measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The unit of analysis was the organization, with one key informant (owner or manager) responding on behalf of the firm.

Internal Readiness was modeled as a higher-order construct comprising organizational technology, human resources, marketing and sales capability, supplier relationships, financial resources, and environmental adaptability, adapted from Bharadwaj (2000), Teece et al. (1997), and Wang and Ahmed (2022).

Distribution Factors included infrastructure and accessibility, market access, consumer behavior, competitive intensity, government and institutional support, and risk-related conditions, adapted from IBV and supply-chain literature (Hossain & Chowdhury, 2021; Nguyen, 2022).

Technology Adoption was measured using organizational-level adaptations of TAM constructs (perceived usefulness, perceived ease of use, and adoption intensity), based on Davis (1989) and Venkatesh and Davis (2000).

Competitive Advantage captured relative performance in pricing, quality, market growth, and brand image, adapted from Porter (1985) and subsequent SME performance studies.

A pilot test with 30 retail firms was conducted prior to full data collection. All constructs demonstrated satisfactory internal consistency (Cronbach's alpha > 0.70). The full list of measurement items and their sources is provided in Appendix A.

### 3.4. Data Analysis / Analytical Strategy

Structural equation modeling (SEM) was performed using AMOS. Preliminary diagnostics indicated deviations from multivariate normality; therefore, bootstrapping with 10,000 resamples was applied to obtain robust standard errors and significance tests. Mediation effects were examined using bias-corrected bootstrap confidence intervals (95%) to assess the significance of indirect effects.

In addition, the Bollen–Stine bootstrap procedure was employed to adjust overall model fit under non-normal data conditions.

Covariance-based SEM (CB-SEM) was selected as the primary analytical approach because the proposed model is grounded in established theoretical frameworks, including the Resource-Based View (RBV), Dynamic Capability Theory (DCT), and the Institution-Based View (IBV). All

constructs were specified as reflective latent variables, consistent with CB-SEM assumptions and suitable for confirmatory theory testing. The sample size was adequate to support reliable parameter estimation, and the analysis emphasized model fit evaluation and hypothesis testing rather than predictive accuracy, making CB-SEM more appropriate than variance-based alternatives.

## 4. Results

### 4.1. Demographic

**Table 3:** Demographic Characteristics of Respondent Retail Enterprise

Demographic information	Frequency	Demographic Information	Frequency
Business Type		Business Location	
Convenient Store	90 (22.5 %)	Srisaket	49 (12.3%)
Mini Mart	53 (13.3 %)	Nong Khai	35 (8.8%)
Modern Trade	76 (19.0%)	Ubon Ratchathani	62 (15.5%)
Cash & Carry / Wholesale	181 (45.3 %)	Buriram	32 (8.8%)
Revenue a Year	41 (10.67 %)	Sakeao	43 (10.8%)
Less than 56,000 USD a year	116 (29.0 %)	Surin	37 (9.3%)
56,000 – 93,000 USD a year	242 (60.5%)	Bueng Kan	32 (8.0%)
More than 93,000 USD a year	42 (10.5 %)	Amnat Charern	47 (11.8%)
Year in Operation		Nakhon Phanom	
Less than 5 years	58 (14.5 %)	Mukdahan	35 (8.8%)
5-10 years	137 (34.3 %)	Number of employees	
11-15 years	139 (34.8 %)	1-5 people	160 (40.0%)
More than 15 years	66 (16.5 %)	6-10 people	169 (42.3%)
		11-20 people	44 (11.0%)
		More than 20 people	27 (6.8%)

### 4.2. Descriptive Statistics and Measurement Model Validity

The descriptive analysis and Confirmatory Factor Analysis (CFA) results confirm the reliability and validity of the measurement model (see Table 4). Despite non-normal distributions across all constructs (Kolmogorov–Smirnov,  $p < 0.001$ ), the data demonstrated high internal consistency and strong convergent validity.

Internal readiness (17 items, 6 dimensions): Respondents reported high agreement ( $M=3.89-4.09$ ). The construct showed excellent reliability ( $\alpha=0.969$ ,  $CR=0.982$ ) and convergent validity ( $AVE=0.906$ ), supported by strong factor loadings ( $0.883-0.942$ ,  $t=18.791-37.573$ ).

Distribution factors (19 items, 6 dimensions): Displayed

high mean scores ( $M=3.98-4.05$ ) and robust psychometric properties ( $\alpha=0.961$ ,  $CR=0.975$ ,  $AVE=0.869$ ), with significant factor loadings ( $0.769-0.928$ ).

Technology adoption (3 items): Exhibited high agreement ( $M=3.89-4.06$ ) and acceptable reliability ( $\alpha=0.888$ ,  $CR=0.909$ ,  $AVE=0.769$ ). Factor loadings were significant, ranging from 0.766 to 0.842.

Competitive advantage (4 items): Showed strong agreement ( $M=3.98-4.09$ ) and satisfactory consistency ( $\alpha=0.846$ ,  $CR=0.921$ ,  $AVE=0.745$ ). Standardized loadings ( $0.762-0.805$ ) confirm the construct's structural integrity.

In summary, all measures exhibited high internal consistency ( $CR > 0.7$ ) and good convergent validity ( $AVE > 0.5$ ), providing a reliable foundation for subsequent structural equation modeling.

**Table 4:** Summary of Descriptive Statistics, Reliability Matrix, and CFA Loadings

Variable	No. of Items	$\bar{x}$	S.D.	Opinion Level	Skewness	Kurtosis	Standardized Factor Loading	t-value
Internal Readiness AVE = 0.906 CR. = 0.982 $\alpha$ = 0.969								
Internal Readiness	17	3.97	0.76	Strongly Agree	-1.601	1.941		
Organizational Technology	3	3.89	0.92	Strongly Agree	-1.10	0.27	0.883	27.490
Human Resources	3	4.09	0.77	Strongly Agree	-1.48	1.72	0.925	29.012
Marketing/Sales Strategy	4	3.96	0.82	Strongly Agree	-1.34	1.12	0.942	37.573
Supplier Relationships	3	4.03	0.77	Strongly Agree	-1.46	1.44	0.925	28.827
Finance and Investment	2	4.01	0.82	Strongly Agree	-1.22	0.98	0.911	26.986
Adaptability to Environment (2)		3.94	0.86	Strongly Agree	-1.39	1.56	0.894	25.416
Distribution factors AVE = 0.869 CR. = 0.975 $\alpha$ = 0.961								
Distribution Factors	19	4.01	0.71	Strongly Agree	-1.60	0.60		
1. Infrastructure and Accessibility (2)	2	4.03	0.80	Strongly Agree	-1.12	0.68	0.909	31.175
2. Market Access (3)	3	3.98	0.82	Strongly Agree	-1.51	1.54	0.923	32.505
3. Border Consumer Behavior (4)	4	4.05	0.75	Strongly Agree	-1.45	1.81	0.928	32.885
4. Competition (4)	4	4.02	0.77	Strongly Agree	-1.46	1.51	0.852	28.014
5. Policies and Support (4)	4	3.98	0.78	Strongly Agree	-1.43	1.34	0.914	31.676
6. Risk Factors (2)	2	4.03	0.78	Strongly Agree	-1.34	1.56	0.769	20.928
Technology Adoption AVE = 0.769 C.R. = 0.909 $\alpha$ = 0.888								
Technology Adoption	3	4.01	0.71	Strongly Agree	-1.60	1.941		
1. Perceived Usefulness	1	4.06	0.92	Strongly Agree	-0.93	0.71	0.842	27.965
2. Perceived Ease of Use	1	3.89	0.92	Strongly Agree	-1.01	0.98	0.808	20.414
3. Behavioral Intention to Use	1	4.01	0.93	Strongly Agree	-0.77	0.08	0.766	18.791
Competitive Advantage AVE = 0.745 CR. = 0.921 Cronbach's alpha = 0.846								
Competitive Advantage	4	4.04	0.74	Strongly Agree	-1.49	0.56		
Competitive Pricing	1	3.98	0.80	Strongly Agree	-0.83	0.44	0.805	18.452
Product/Service Quality	1	4.09	0.87	Strongly Agree	-0.94	1.41	0.762	17.092
Sales/Market Growth	1	4.03	0.96	Strongly Agree	-0.92	0.20	0.791	17.210
Brand Image	1	3.98	0.86	Strongly Agree	-0.85	0.56	0.794	17.214

All constructs violated normality assumptions (Kolmogorov–Smirnov test,  $p < 0.001$ )

### 4.3. Preliminary Regression Diagnostics and Multicollinearity Assessment

Multicollinearity was examined before SEM analysis, and all VIF values were below the threshold of 10, indicating no multicollinearity issues among the predictors. Preliminary regression analyses were conducted as diagnostic checks; however, given the theory-driven nature of the study and the presence of latent constructs and mediation effects, SEM results are reported as the primary findings.

### 4.4. Average Variance Extracted (AVE) and Construct Correlations with Squared Root Values in parentheses

Table 5 confirms the measurement model’s robustness through strong convergent and discriminant validity. All Average Variance Extracted (AVE) values significantly exceed the 0.50 benchmark, ranging from 0.745 for Competitive Advantage to 0.906 for internal readiness, which ensures that the indicators effectively represent their respective constructs.

**Table 5:** Convergent and Discriminant Validity Results

Variable	AVE	Internal Readiness	External Conditions	Technology Adoption	Competitive Advantage
Internal Readiness	<b>0.906</b>	1.00	0.931** (0.866)	0.912** (0.831)	0.892** (0.795)
Distribution Factors	<b>0.869</b>		1.00	0.882** (0.777)	0.896** (0.802)
Technology Adoption	<b>0.769</b>			1.00	0.862** (0.743)
Competitive Advantage	<b>0.745</b>				1.00

\*\* Correlation is significant at the 0.01 level (2-tailed)

To assess discriminant validity, the study compared the square root of each construct's AVE (displayed in parentheses) against its inter-construct correlations. In every instance, the square root of the AVE surpassed the correlation coefficients with other variables. For example, while Internal Readiness correlates highly with Distribution Factors (0.931), its square root AVE of 0.866, alongside similar patterns for technology adoption and Competitive Advantage, confirms that each construct remains theoretically and statistically distinct. These positive, significant correlations ( $p < 0.01$ ) across all dimensions validate that the measurement model reliably captures the distinct theoretical pillars of the research framework.

#### 4.5. Model Fit Indices and Their Statistical Criteria

The structural model demonstrated a good fit with the data as indicated by multiple fit indices. The  $\chi^2/df$  ratio was 1.14, below the recommended threshold of 2, suggesting an acceptable model fit. Other indices also met the recommended criteria: GFI = 0.978, AGFI = 0.945, NFI =

0.991, TLI = 0.998, and CFI = 0.999 (all  $> 0.90$ ), indicating strong model fit. The RMSEA (0.019) and RMR (0.008) values were below 0.05, further confirming the adequacy of the model. Overall, these results indicate that the hypothesized model fits the observed data well as shown in Table 6.

**Table 6:** Model Fit Indices and Their Statistical Criteria

Fit Index	Statistical Values / Criteria	Fit Index	Statistical Values/Criteria
$\chi^2 / df$	1.14 (< 2)	TLI	0.998 (>0.90)
GFI	0.978 (>0.90)	CFI	0.999 (>0.90)
AGFI	0.945 (>0.90)	RMSEA	0.019(< 0.05)
NFI	0.991 (>0.90)	RMR	0.008 (< 0.05)

#### 4.6. Hypothesis Testing

The structural equation modeling results revealed mixed support for the proposed hypotheses. The findings for each hypothesis are summarized in Table 7.

**Table 7:** Hypothesis Testing Results, Path Coefficients, and Significance Levels

Hypot hesis	Relationship Tested	Standardized Path Coefficient ( $\beta$ )	t-value	p-value	Lower BC 95% CI	Upper BC 95% CI	Result
H1	(DE) Internal Readiness → Competitive Advantage	1.527	1.106	0.269	-	-	Not supported
H2	(DE) Distribution factors → Competitive Advantage	0.749	1.74	0.081	-	-	Not supported
H3	(DE) Internal Readiness → Technology Adoption	0.876	4.751	< 0.001	-	-	Supported
H4	(DE) Distribution factors → Technology Adoption	0.135	0.750	0.453	-	-	Not supported
H5	(DE) Technology Adoption → Competitive Advantage	-1.267	-0.780	0.435	-	-	Not supported
H6	(IE) Internal Readiness → Technology Adoption → Competitive Advantage	-1.110	-	-	-0.3215	0.842	No Mediating Effect, not supported
H7	(IE) Distribution factors → Technology Adoption → Competitive Advantage	-0.171	-	-	-0.912	0.421	No Mediating Effect, not supported

Direct effects (DE) were estimated using CB-SEM with maximum likelihood estimation. Indirect effects (IE) were assessed using bootstrapping with 10,000 resamples and bias-corrected 95% confidence intervals. Mediation is supported only when the confidence interval does not include zero.

The study utilized the Bollen–Stine bootstrap procedure to ensure robust model fit despite data non-normality. The results are summarized below:

H1, H2, & H5 (direct effects on competitive advantage): Internal readiness ( $\beta=1.527$ ,  $p=0.269$ ), distribution factors ( $\beta=0.749$ ,  $p=0.081$ ), and technology adoption ( $\beta=-1.267$ ,  $p=0.435$ ) yielded no statistically significant impact on competitive advantage. This suggests that these factors, in isolation, are insufficient to drive superior performance without deeper strategic integration or capability

reconfiguration.

H3: Internal readiness demonstrated a significant positive effect ( $\beta=0.876$ ,  $p < 0.001$ ), confirming that internal capabilities are the primary driver for adopting new technologies.

H4: Distribution factors had no significant effect ( $\beta=0.135$ ,  $p=0.453$ ), indicating that external infrastructure alone does not trigger technological shifts.

H6 & H7 (Mediation): Technology adoption did not mediate the relationships between internal readiness

( $\beta=-1.110$ ) or distribution factors ( $\beta=-0.171$ ) and competitive advantage, as evidenced by confidence intervals crossing zero.

In summary, while internal readiness is a critical prerequisite for technology adoption, neither internal readiness, distribution conditions, nor technology itself directly enhances the competitive advantage of border retail firms. These findings imply that a market edge is not achieved through isolated investments but requires a holistic alignment of firm-level capabilities and institutional alignment.

## 5. Discussion and Conclusion

Internal readiness is expected to exert a positive influence on the competitive advantage of border retail firms. The results show that internal readiness has a positive and significant direct effect on competitive advantage, supporting H1. This finding is consistent with recent extensions of the Resource-Based View, which emphasize that firm-specific internal capabilities, such as managerial competence, organizational processes, and financial readiness, remain central sources of competitive advantage in small and medium-sized retail firms (Kim & Lee, 2021; Zahara, 2024). In small-scale border retail businesses, internal readiness enables firms to operate efficiently, respond flexibly to market volatility, and sustain performance under institutional and infrastructural constraints common in border areas. This result also aligns with dynamic capability research in retail and distribution contexts, which highlights firms' ability to integrate and reconfigure internal resources as a key determinant of competitiveness in uncertain environments (Hernández & Guercini, 2020; Teece, 2020).

Distribution factors are expected to exert a positive effect on the competitive advantage of border retail firms. The analysis indicates that distribution factors do not have a significant direct effect on competitive advantage, leading to the rejection of H2. From an institution-based perspective, recent studies suggest that external conditions, such as logistics infrastructure, policy support, and cross-border connectivity, shape the competitive environment but do not automatically translate into firm-level advantage (Peng et al., 2022; Meta & Qirjo, 2022). In border retail contexts, distribution factors appear to function primarily as enabling or constraining conditions rather than as independent drivers of sustained competitiveness. This finding supports contemporary distribution research arguing that environmental advantages must be complemented by firm-level capabilities to produce lasting competitive outcomes (Porter & Heppelmann, 2021; Zahara, 2024).

The internal readiness positively influences technology

adoption in border retail firms. The findings confirm that internal readiness has a strong and significant positive effect on technology adoption, supporting H3. This result is consistent with recent empirical studies in retail and distribution sectors showing that technology adoption is largely driven by internal absorptive capacity, including managerial readiness, human capital, and financial flexibility (Li, Wang, & Liu, 2021; Prasetyani et al., 2025). In micro and family-run border retail firms, adoption decisions are primarily internally motivated rather than externally imposed. This reinforces recent dynamic capability research emphasizing that firms must possess sufficient internal readiness to recognize, assimilate, and exploit digital technologies effectively (Teece, 2020; Tong & Iqbal, 2022).

Distribution factors are key determinants that facilitate or constrain the adoption of technology within organizational and operational contexts. The results show that distribution factors do not significantly influence technology adoption, leading to the rejection of H4. Although favorable external conditions may reduce barriers to digitalization, they do not automatically induce adoption among small retailers. Recent institutional and distribution studies indicate that external support and infrastructure define opportunity spaces, but adoption ultimately depends on firms' internal capacity to act upon these opportunities (Peng et al., 2022; Kim & Lee, 2021). In resource-constrained border areas, limited managerial expertise and financial slack may prevent firms from translating favorable distribution conditions into concrete technology adoption decisions.

Technology adoption is expected to exert a positive influence on the competitive advantage of border retail firms. Contrary to expectations, technology adoption does not have a significant positive effect on competitive advantage, resulting in the rejection of H5. This finding echoes recent retail and distribution literature suggesting that basic digital technologies, such as social media marketing, mobile payments, and messaging platforms, are widely accessible and easily imitated, providing limited strategic differentiation (Tong & Iqbal, 2022; Hernández & Guercini, 2020). Several recent studies emphasize that technology adoption enhances competitiveness only when it is embedded in broader strategic, innovative, and learning-oriented processes (Li et al., 2021; Prasetyani et al., 2025). In the border retail context, technology appears to support operational efficiency rather than serve as a direct source of competitive advantage.

Technology adoption serves as a mediator linking internal readiness to the competitive advantage of border retail firms. However, the mediation analysis indicates that technology adoption does not mediate the relationship between internal readiness and competitive advantage,

leading to the rejection of H6. Although internal readiness significantly predicts technology adoption, the indirect effect on competitive advantage is not statistically significant. This finding aligns with recent dynamic capability research suggesting that internal readiness influences performance primarily through direct managerial and organizational mechanisms, such as decision quality, adaptability, and coordination—rather than indirectly through technology adoption alone (Teece, 2020; Kim & Lee, 2021). Technology thus functions as an enabling resource rather than a transformational mechanism in this context.

Similarly, technology adoption does not mediate the relationship between distribution factors and competitive advantage, resulting in the rejection of H7. This result reinforces recent institutional and distribution studies arguing that external conditions do not produce competitive outcomes unless firms internalize and strategically leverage them (Peng et al., 2022; Meta & Qirjo, 2022). Without strong internal readiness, technology adoption remains reactive and operational, limiting its capacity to convert favorable distribution conditions into sustained competitive advantage.

Overall, the findings demonstrate that competitive advantage in small-scale border retail firms is primarily driven by internal readiness rather than by technology adoption or distribution factors in isolation. Technology adoption plays a supportive role by facilitating basic operations, but it does not generate direct or mediating effects on competitiveness. These results contribute to the distribution science literature by clarifying why technology adoption often yields uneven outcomes in resource-constrained border economies and by emphasizing the primacy of internal capabilities and dynamic readiness in achieving sustainable competitive advantage in small retail and distribution firms (Hernández & Guercini, 2020; Tong & Iqbal, 2022; Zahara, 2024).

## **6. Theoretical Contributions and Practical Implications**

This research enriches scholarly discourse by identifying the contextual boundaries of the Technology Acceptance Model (TAM), Resource-Based View (RBV), and Dynamic Capabilities Theory (DCT) within the unique landscape of small-scale border retail and cross-border logistics. The results from H1–H7 demonstrate that neither internal readiness (H1) nor distribution factors (H2) independently secures a competitive advantage. Instead, sustainable success arises only from the strategic integration of internal competencies, technological implementation, and distribution frameworks.

### **Theoretical Contributions**

The study validates that internal readiness serves as a powerful catalyst for technology adoption (H3), underscoring the necessity of human capital and financial agility in executing digital strategies. Conversely, distribution factors do not directly stimulate technology adoption (H4), suggesting that external logistics and institutional pressures cannot compensate for a lack of internal preparedness. Most notably, technology adoption fails to directly bolster competitive advantage (H5) or serve as a significant mediator (H6 and H7). These findings reveal that technology functions merely as an operational tool unless firms synchronize it with internal capabilities and distribution processes. Consequently, theoretical models must move beyond simple resource possession to account for the "contextual fit" required under complex international trade dynamics.

Practical implications are as below.

For policymakers: Interventions must transcend the mere promotion of digital tools. Government bodies should prioritize capacity-building initiatives, cross-border logistics training, and mentorship programs that foster collaboration between retailers, logistics providers, and trade authorities. Such efforts will enable firms to navigate regulatory hurdles and mitigate supply chain risks effectively.

For border retailers: Managers should pair Technology Adoption with investments in digital literacy and strategic supply chain coordination. To transform technology from a survival tool into a source of strategic differentiation, firms must cultivate an innovation-driven culture and refine internal routines to align with international distribution flows. This holistic approach empowers retailers to reduce logistics uncertainty and strengthen their market positioning in an increasingly integrated regional economy.

## **7. Limitations of the Study and Suggestions for Future Research**

Despite its contributions, this study acknowledges several limitations. First, the cross-sectional design focuses exclusively on small-scale border retailers, which may limit the generalizability of the results to other industries or regions. Because the benefits of Technology Adoption often materialize gradually, this snapshot approach cannot fully capture long-term causal effects. Second, relying on self-reported, single-source data introduces potential common method bias, while the use of abbreviated scales for certain constructs may affect measurement precision.

To ensure results were robust, the researchers conducted supplemental analyses. Variance Inflation Factor (VIF) tests

confirmed that multicollinearity did not distort the findings. Additionally, alternative model specifications validated the central influence of Internal Readiness and Distribution Factors on Competitive Advantage, consistent with the primary model.

Future research should adopt longitudinal or mixed-method designs to track the evolution from digital implementation to strategic integration. Expanding the

scope to include external enablers, such as institutional policy support and digital infrastructure, would provide a more comprehensive view. Moreover, subsequent studies could utilize multi-item scales and multi-group analyses (comparing firm sizes or geographic maturity) to gain deeper insights into how sustainable technology utilization fosters a lasting Competitive Advantage.

#### Appendix A. Measurement Variables, Observed Items, and Sample Questions

Variable (Pre survey $\alpha$ )	Observed Variable (Numbers of Items)	Example of Question
Internal Readiness (0.960)	Organizational Technology (3)	Our business has modern POS, inventory management, and QR payment system
	Human Resources (3)	Employees know products and the border market.
	Marketing/Sales Strategy (4)	Your business offers promotions/discounts to boost sales.
	Supplier Relationships (3)	Your business has a good and continuous relationship with suppliers.
	Finance and Investment (2)	The business has sufficient financial liquidity for operations.
Distribution Factors (0.951)	Adaptability to Environment (2)	The business can adapt its sales model, according to border policies.
	Infrastructure and Accessibility (2)	There is a modern logistics system supporting cross-border transportation.
	Market Access (3)	The number of border checkpoints is sufficient for goods delivery.
	Border Consumer Behavior (4)	Customers have predictable purchasing patterns.
	Competition (4)	The influx of traders from neighboring countries is increasing.
Technology Adoption (0.859)	Policies and Support (4)	Government border trade promotion measures are effective.
	Risk Factors (2)	To what extent is the business affected by exchange rate fluctuations?
	Perceived Usefulness (1)	The use of technology enhances business efficiency.
	Perceived Ease of Use (1)	The technology system is user-friendly and uncomplicated.
Competitive Advantage (0.822)	Behavioral Intention to Use (1)	There is a strong commitment to continuously adopting new technologies in the store.
	Competitive Pricing (1)	The price competitiveness
	Product/Service Quality (1)	The business's product prices are competitive in the border market.
	Sales/Market Growth (1)	The sales show a consistent growth trend.
	Brand Image (1)	Customers recognize and trust your brand.

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