# A STUDY ON THE IMPACT OF DATA-DRIVEN AND ORGANIZATIONAL ROUTINE UPDATES ON THE OPERATIONAL PERFORMANCE OF SMES IN CHINA'S CROSS-BORDER E-COMMERCE INDUSTRY*

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## Abstract

This research article aims to: 1) analyze the impact of data-driven approaches on the operational performance of small and medium-sized enterprises (SMEs) in China's cross-border e-commerce industry; 2) examine the impact of data-driven approaches on organizational routine updates; 3) investigate the impact of organizational routine updates on the operational performance of cross-border e-commerce SMEs; and 4) test the mediating role of organizational routine updates in the relationship between data-driven approaches and operational performance. A quantitative survey design was employed. Data were collected from 439 SMEs in China's cross-border e-commerce sector using a structured questionnaire measuring data-driven approaches, organizational routine updates, and operational performance on a five-point Likert scale. The data were analyzed by descriptive statistics, reliability

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and validity tests, confirmatory factor analysis, regression analysis, and structural equation modeling with bootstrap mediation testing.

The results of the research were: 1) data-driven approaches have a significant positive effect on the operational performance of cross-border e-commerce SMEs; 2) data-driven approaches significantly promote organizational routine updates by encouraging process improvement, flexibility, and knowledge integration; 3) organizational routine updates significantly enhance the operational performance of cross-border e-commerce SMEs; and 4) organizational routine updates play a significant partial mediating role in the relationship between data-driven approaches and operational performance, revealing internal adaptability as a key mechanism through which data-driven development improves SME operational performance.

**Keywords:** Small and medium-sized cross-border e-commerce enterprises, data-driven approach, operational performance, organizational routine updates

## Introduction

China's leading data trade capabilities have inspired tens of thousands of small and medium-sized entrepreneurs, helping them participate more fairly and equally in the global digital economy, reap the benefits of entrepreneurship, and change their lives. In the future, China will further promote the global digitalization process and contribute to stabilizing foreign trade and the economy.

Currently, against the backdrop of the COVID-19 pandemic and export growth, cross-border e-commerce faces challenges such as low profit margins and rising labor costs, which will drive the transformation of import and export trade towards e-commerce (Liu, 2020). At the same time, cross-border e-commerce faces a more complex global market environment, and factors such as consumer preferences and legal systems also bring challenges to trade and

financial management and product operation in the business process (Jin & Dai, 2019).

Therefore, the role of digital technology in cross-border e-commerce has attracted widespread attention from the business community, and data-driven cross-border e-commerce development has become an important direction for many scholars studying business models. The value created by integrating digital technology into business processes has also been valued by the industry. However, the mechanisms by which data-driven approaches can improve the operational performance of cross-border e-commerce companies have not yet been systematically and deeply studied.

The growth challenges and transformation pressures commonly encountered by small and medium-sized cross-border e-commerce enterprises , the research findings and perspectives help to delve into the micro-level of organizational behavior , deepen the understanding of data-driven development from "possessing technology" to "being able to apply technology , " enhance the value of data-driven development at the micro-level of enterprises, expand its micro-level evidence in the field of small and medium-sized cross-border e-commerce, reveal the core mediating role of "organizational routine updates" as an internal adaptation mechanism, and provide theoretical reference for analyzing and understanding the potential mechanisms by which data-driven development affects the operational performance of small and medium-sized cross-border e-commerce enterprises.

## Objectives

Against the backdrop of the aforementioned research, this study sets forth the following four specific research objectives.

1. To analyze the impact of data-driven approaches on the operational performance of small and medium-sized cross-border e-commerce enterprises.

2. To analyze the impact of data-driven approaches on the updating of organizational routine for small and medium-sized cross-border e-commerce enterprises.

3. To analyze the impact of organizational routine updates on the operational performance of small and medium-sized cross-border e-commerce enterprises.

4. To analyze the mediating role of organizational routine updates in the process of data-driven impacts on the operational performance of small and medium-sized cross-border e-commerce enterprises.

## Literature Review

1. Resource-based theory

The Resource-Based View (RBV) posits that a firm's sustainable competitive advantage stems not from its product market positioning, but from its control of unique, valuable, scarce, inimitable, and irreplaceable heterogeneous resources. For cross-border e-commerce SMEs, data-driven operations are far more than simple technological tool applications; they involve a complex bundle of resources deeply embedded within the enterprise, comprised of technology, talent, and organizational processes (Lockett et al. 2009). Data-driven approaches for cross-border e-commerce SMEs are inherently dynamic.

2. Dynamic Capability Theory

In the typical "volatile, uncertain, complex, and ambiguous" environment of cross-border e-commerce (Tee et al., 2021) Simply possessing VRIO resources is far from sufficient; enterprises must possess dynamic capabilities. Teece et al. (1997) defined dynamic capabilities as "the ability to integrate, build, and reconfigure internal and external resources and capabilities to adapt to rapidly

changing environments," providing the core logic for explaining how enterprises can continuously gain a competitive advantage in volatile markets. Dynamic capability theory is closely linked to the resource-based view, explaining how enterprises dynamically manage their resource portfolio to adapt to change (Braganza et al., 2017). Data-driven approaches are the foundational resources and general capabilities, while organizational routine updates are the dynamic capabilities acting on these resources. Together, they drive enterprises to overcome organizational inertia and achieve performance improvements during digital transformation.

3. Organizational Learning Theory

Organizational learning theory (March, 1991) posits that organizations face two distinct learning activities: exploitative innovation and exploratory innovation. Data-driven approaches play a crucial role, fundamentally altering organizational practices through the analysis of existing operational data and the application of new knowledge—a process known as " organizational routine updates". This process creates new organizational knowledge and behavioral patterns, driving exploratory innovation and performance improvement. Therefore, the mediation pathway design in this study reflects the exploratory innovation path by which data-driven approaches impact the operational performance of small and medium-sized cross-border e-commerce businesses.

## Methodology

1. Literature Review

conduct a literature review on key variables such as cross-border e-commerce operational performance, data-driven operations, and organizational routine updates, further clarifying the conceptual connotations, analytical dimensions, measurement indicators, and basic trends in related research. Based on this, this study will review the literature and conduct theoretical analysis on

the research hypotheses from two aspects: the main effect of data-driven operations on the operational performance of small and medium-sized cross-border e-commerce enterprises and the mediating role of organizational routine updates on the main effect . Finally , this paper will construct its theoretical model.

2. Questionnaire Survey

This study collected data through a questionnaire survey. Including three aspects: process improvement orientation, flexibility and adaptability, and knowledge integration capabilities , with a total of 8 items. A 12-item scale was developed, covering aspects such as financial performance, customer performance, internal process performance, and innovation and growth performance. The questionnaire uses a 5-point Likert scale, where "1-5" represents from completely disagree to completely agree.

This study employed stratified random sampling to distribute questionnaires to SMEs within the Yunnan Provincial Cross-border E-commerce Comprehensive Pilot Zone and on major cross-border e-commerce platforms between May and July 2025. The questionnaires were primarily distributed online, supplemented by in-person visits . After collection, invalid questionnaires were rigorously screened, eliminating those with incomplete answers, illogical responses, or duplicate submissions. A total of 439 valid questionnaires were collected, representing an overall effective response rate of 62.7%.

3. Statistical Analysis

This study will conduct empirical analysis and verification of the theoretical model based on questionnaire survey data, using reliability and validity analysis, descriptive statistical analysis, correlation analysis, and regression analysis. Based on the conclusions of the empirical analysis, corresponding management implications and countermeasures will be proposed.

Data analysis will be conducted using advanced statistical software packages (SPSS and AMOS): descriptive statistics will be used for sample analysis; confirmatory factor analysis (CFA) will be used for structural validation; structural equation modeling (SEM) will be used for path analysis; regression analysis will be used to test predictive relationships; and a comprehensive reliability and validity evaluation will be performed.

4. Conceptual Model

The following research hypotheses are proposed.

H1: Approaches have a positive impact on the operational performance of cross-border e-commerce SMEs.

H2: Approaches have a positive impact on organizational routine updates of cross-border e-commerce SMEs.

H3: Organizational routine updates have a positive impact on the operational performance of cross-border e-commerce SMEs.

H4: Organizational routine updates play an intermediary role in the process of data-driven improvement of the operational performance of small and medium-sized cross-border e-commerce enterprises.

The following is a theoretical model diagram. Figure 1 shows the relationships between variables, the action path, and the research hypotheses.

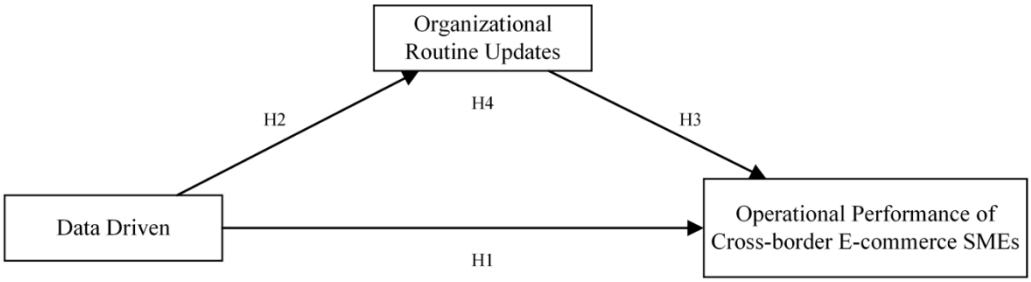


**Figure 1** Theoretical model of this study (Source: Constructed by the researcher)

## Results

1. The impact of data-driven approaches on the operational performance of small and medium-sized cross-border e-commerce enterprises

Statistical analysis results show that the regression coefficient for data-driven operations is 0.229, the t-value is 8.079, and the p-value is less than 0.001. This indicates that data-driven operations have a significant positive impact on operational performance. Compared with the model containing only control variables, the $R^2$ of the model increased from 0.007 to 0.138 after introducing data-driven variables, and the adjusted $\Delta R^2$ was 0.126. Furthermore, the F-statistic of the model also significantly increased from 0.652 to 11.503, with a p-value less than 0.001. This indicates that including data-driven variables significantly enhances the explanatory power of the model for operational performance. Therefore, these results support hypothesis H1, that is, data-driven operations have a significant positive impact on the operational performance of small and medium-sized cross-border e-commerce companies.

2. The Impact of Data-Driven Approaches on the Update of Organizational Routine of Small and Medium-Sized Cross-Border E-commerce Enterprises

Statistical analysis results show that the regression coefficient for data-driven approaches is 0.046, the t-value is 4.209, and the p-value is less than 0.001. This indicates that data-driven approaches have a significant positive impact on organizational routine updates. Compared with the model containing only control variables, the $R^2$ of the model increased from 0.009 to 0.048 after introducing data-driven variables, and the adjusted $\Delta R^2$ was 0.035. Furthermore, the F-statistic of the model also significantly improved, from 0.824 to 3.666, with a p-value less than 0.05. This indicates that adding data-driven variables significantly enhances the model's explanatory power for organizational routine updates. Therefore, these results support hypothesis H2, namely that data-driven approaches can significantly promote organizational routine updates for small and medium-sized cross-border e-commerce enterprises.

3. The impact of organizational routine updates on the operational performance of small and medium-sized cross-border e-commerce enterprises

Statistical analysis results show that the regression coefficient for organizational routine updates is 0.705, the t-value is 5.485, and the p-value is less than 0.001. This indicates that organizational routine updates have a significant positive impact on operational performance. Compared with the model containing only control variables, the $R^2$ of the model increased from 0.007 to 0.072 after introducing the organizational routine updates variable, and the adjusted $\Delta R^2$ was 0.059. Furthermore, the F-statistic of the model increased from 0.652 to 5.594, with a p-value less than 0.001. Therefore, these results support hypothesis H3, that is, organizational routine updates can significantly improve the operational performance of small and medium-sized cross-border e-commerce enterprises.

4. The Mediating Role of Organizational Routine Updates in the Data-Driven Impact on the Operational Performance of Small and Medium-Sized Cross-Border E-commerce Enterprises

This study used the Bootstrap method (95 % confidence level, 5000 replicates) to analyze the mediating effects hypothesized in the theoretical model. The results showed that the indirect effect of organizational routine updates was 0.024. The 90% confidence interval for this effect was [0.009, 0.041]. Since this interval did not include zero, it indicates that organizational routine updates play a significant mediating role in the impact of data-driven operations on operational performance, supporting Hypothesis 4. This mediating effect accounted for 10.462% of the total effect.

5. Descriptive Statistics and Reliability Tests

The survey respondents were evenly divided by gender, with 53.30% male and 46.70% female. The majority (79.70%) were aged 26-45, and the majority had a high level of education, with 91.30% holding a bachelor's degree or higher. A significant number (41.90%) of the respondents had backgrounds in economics and management, and a high proportion (63.30%) were senior employees. Detailed descriptive statistics are shown in Table 1.

**Table 1** Sample Characteristics

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 234 | 53.30 |
| | Female | 205 | 46.70 |
| Age | 25 years old and below | 43 | 9.80 |
| | 26-35 years old | 165 | 37.60 |
| | 36-45 years old | 185 | 42.10 |
| | 46 years old and above | 46 | 10.50 |
| Education Level | Associate Degree (Vocational College) | 38 | 8.70 |
| | Bachelor's Degree | 188 | 42.80 |
| | Master's Degree | 172 | 39.20 |

| | | | |
|---|---|---|---|
| | Doctoral degree or higher | 41 | 9.30 |
| Professional Background | Science and Engineering | 38 | 8.70 |
| | Economics and Management | 184 | 41.90 |
| | Humanities and Social Sciences | 166 | 37.80 |
| | Other | 51 | 11.60 |
| Employment Positions | Middle and senior management | 85 | 19.40 |
| | Senior employees | 278 | 63.30 |
| | New employees | 76 | 17:30 |

Note. n = 439

Confirmatory factor analysis of the main variables showed that the item loadings for all dimensions met the reliability and validity requirements, but the model fit for the organizational routine updates dimension was poor. Specifically, the sample size was 439, but the total number of items was only 39. This means the sample size was relatively small, but the number of items was large, which increased the complexity of the model and led to suboptimal fits in some dimensions. Therefore, to improve the significance of the model fit, this study merged the questionnaire items to reduce the number of model parameters, simplify the model structure, and effectively improve the model fit.

combined measurement items and the results of reliability and validity tests are shown in Table 2. Analysis of Table 2 shows that the $\alpha$ coefficients of the main variables are all higher than 0.7, indicating that the reliability test meets the requirements. Exploratory factor analysis shows that the factor loadings of all observed variables are greater than 0.5, with the lowest being 0.801 (significant at the $p<0.001$ level). Simultaneously, the combined reliability (CR) of each dimension of the variables is greater than 0.8, and the mean variance extracted (AVE) is greater than 0.5, indicating that the variables have good convergent validity. Furthermore, exploratory factor analysis shows that the cross-loadings of

all items are within a reasonable range, and no item has a loading higher than 0.4 on any other factor. Therefore, the measurement scale has good reliability and validity.

**Table 2** Combined Measurement Items and Reliability and Validity Test Results

| Factor | Indicator | Code | Cronbach's Alpha | Standardized Factor Loadings | CR | AVE |
|---|---|---|---|---|---|---|
| Data-driven | Technology and Infrastructure | TI | 0.968 | 0.955 | 0.968 | 0.910 |
| | Management and Process | MP | | 0.961 | | |
| | Talent and skills | TS | | 0.946 | | |
| Organizational routine updates | Process improvement orientation | PO | 0.866 | 0.832 | 0.867 | 0.685 |
| | Flexibility and adaptability | FA | | 0.849 | | |
| | Knowledge solidification ability | KS | | 0.801 | | |
| Operational performance of cross-border e- | Financial Performance | FP | 0.974 | 0.953 | 0.974 | 0.904 |
| | Customer Performance | CP | | 0.958 | | |
| | Internal process performance | IP | | 0.945 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| commerce SMEs | Innovation and growth performance | GP | | 0.948 | | |

Note. n = 439

6. Model Fitting Results

Confirmatory factor analysis was performed on the survey data using AMOS software. The results shown in Table 3 indicate that the complete model has a good fit ($\chi 2/df$ = 1.485, CFI, TLI, and IFI indices are all greater than 0.9, RMSEA = 0.033 < 0.1), indicating that the variables have good discriminant validity.

**Table 3** Fit Test Results of the Complete Model

| **Cut-off value** | | **Model Fit** |
|---|---|---|
| **Indices** | **Required Value** | |
| $\chi^2$/ df (801.79/696) | < 3 | 1.485 |
| TLI | ≥ 0.95 | 0.994 |
| CFI | ≥ 0.95 | 0.996 |
| RMSEA | < 0.06 | 0.033 |
| SRMR | < 0.08 | 0.005 |
| HOELTER (P=0.05) | ≥ 200 | 390 |

Note. n = 439

7. Path Analysis Results

Path analysis results show the impact of data-driven approaches on the operational performance of small and medium-sized cross-border e-commerce enterprises , the impact of data-driven approaches on the updating of organizational routine in small and medium-sized cross-border e-commerce enterprises , the impact of updating organizational routine on the operational performance of small and medium-sized cross-border e-commerce enterprises , and the mediating role of updating organizational routine in the process of data-

driven improvement of the operational performance of small and medium-sized cross-border e-commerce enterprises . All hypotheses passed the test.

**Table 4** Path Analysis Results

| Assumption | path | Standardized coefficient | p-value | in conclusion |
|---|---|---|---|---|
| H1 | Data-driven → Operational performance of small and medium-sized cross-border e-commerce enterprises | 0.229 | <0.001 | Significantly positive |
| H2 | Data-driven → Updates to organizational routine for small and medium-sized cross-border e-commerce enterprises | 0.046 | <0.001 | Significantly positive |
| H3 | Organizational Routine updates → Operational Performance of Small and Medium-sized Cross-border E-commerce Enterprises | 0.705 | <0.001 | Significantly positive |
| H4 | Data-driven approach → Organizational | 0.024 | <0.05 | Indirect effects |

| | | | | |
|---|---|---|---|---|
| | Routine Updates → Operational performance of SMEs in cross-border e-commerce | | | |

## Discussion

The results of research objective 1 found that data-driven approaches have a significant positive impact on the operational performance of small and medium-sized cross-border e-commerce enterprises. This is because data-driven approaches in this context are not isolated technical tools, but integrated strategic resources that combine technology and infrastructure, management and processes, and talent and skills. Such bundles allow firms to make faster and more accurate decisions, optimize processes, and improve customer and financial outcomes. This is consistent with the Resource-Based View, which emphasizes that unique, valuable, and difficult-to-imitate resource configurations can generate sustained performance advantages (Lockett et al., 2009), and supports recent evidence that big data analytics capabilities can enhance market and operational performance (Olabode et al., 2022).

The results of research objective 2 found that data-driven approaches significantly promote organizational routine updates in cross-border e-commerce SMEs. This is because the systematic collection, analysis, and use of data continuously challenge existing routines and stimulate the redesign of workflows, coordination mechanisms, and decision rules, thereby increasing flexibility and adaptability. This is consistent with dynamic capability theory, which argues that firms must integrate, build, and reconfigure internal and external competences to cope with rapidly changing environments (Mikalef & Krogstie, 2020). It also echoes organizational learning theory, which highlights that exploratory learning

and the incorporation of new knowledge into routines are essential for long-term adaptation and renewal (March, 1991). In this sense, data-driven approaches function as triggers that convert external and internal information into updated routines at the micro-organizational level.

The results of research objectives 3 and 4 found that organizational routine updates not only have a strong positive effect on the operational performance of cross-border e-commerce SMEs, but also play a partial mediating role in the relationship between data-driven approaches and operational performance. This is because routine updates transform data insights into concrete changes in processes, task division, and coordination patterns, thus turning potential digital resources into realized performance gains. This is consistent with dynamic capability and organizational learning perspectives, which stress that performance improvements depend less on “owning” advanced technologies and more on the ability to embed new knowledge into everyday organizational practices (Teece et al., 1997). The mediating role of organizational routine updates therefore clarifies that data-driven approaches improve SME performance both directly and indirectly, by stimulating internal adaptability and continuous process optimization, and provides a clear micro-level mechanism for understanding digital transformation in China’s cross-border e-commerce SMEs.

## Recommendation

1. General recommendations

For small and medium-sized cross-border e-commerce enterprises, the findings suggest that managers should treat data-driven approaches as a strategic capability rather than a set of isolated tools. Firms are advised to invest simultaneously in digital infrastructure, process redesign, and talent

development, ensuring that data use is embedded in daily decision-making routines. Managers should establish explicit mechanisms for organizational routine updates, such as regular data-review meetings, cross-functional improvement teams, and performance indicators linked to process innovation and learning outcomes. In addition, leadership should create a learning-oriented culture that encourages experimentation, timely adjustment of routines, and the codification of successful practices into standardized procedures.

2. Recommendations for further research

Future studies could adopt longitudinal designs to examine how data-driven capabilities and organizational routine updates co-evolve over time and across different stages of internationalization. Comparative research between industries, regions, or firm sizes would help to clarify boundary conditions and external validity. Qualitative case studies could deepen understanding of how managers actually redesign routines in response to data insights, and how organizational culture or leadership style moderates these processes. Furthermore, subsequent research may incorporate additional mediating or moderating variables—such as digital innovation climate, platform dependency, or environmental uncertainty—to construct a more comprehensive mechanism model.

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