**Case report**

**A STUDY ON THE COPING STRATEGIES OF TAIWAN'S SMES FACING THE FLUCTUATION OF RUBBER RAW MATERIAL PRICES: A CASE STUDY OF FIVE LOCAL MANUFACTURING COMPANIES**

**ABSTRACT**

*This study investigates how five representative small and medium-sized enterprises (SMEs) in Taiwan's rubber industry manage operational risks associated with the volatility of international raw material prices. Using a qualitative multiple case study method and semi-structured interviews, this research examines strategic practices such as diversified sourcing, flexible procurement, risk forecasting mechanisms, and business transformation. The objectives are to understand the coping strategies adopted during price surges and how firms build resilience through innovation and cooperation. The findings contribute to both academic discourse and practical policymaking, offering suggestions to enhance the overall risk resistance and sustainability of the industry.*

*This study focuses on five representatives small and medium-sized enterprises (SMEs) in Taiwan that operate in the rubber application field, exploring how they manage operational risks in the context of international raw material price fluctuations through strategic management, resource allocation, and market mechanisms. Through qualitative research and case interviews, this study finds that enterprises can establish resilient systems through diversified sourcing, flexible procurement, price forecasting, and transformation upgrades. The contribution of this research lies in supplementing the practical approaches of SMEs in high-risk environments and providing policy and industry-level suggestions, which are expected to enhance the overall risk resistance capability and sustainable operation of the industry.*

**Keywords:** rubber price fluctuations, small and medium enterprises, risk management, dynamic capability, Taiwan manufacturing industry

**INTRODUCTION**

Research Background and Motivation: Global raw material price volatility—especially in rubber—has intensified over the past decade due to a convergence of supply-demand imbalances, climate disruptions, and geopolitical factors (Hamilton, 2009; Ahmad & Ismail, 2021). For Taiwan’s small and medium-sized enterprises (SMEs), this volatility poses serious operational risks given their limited resources and weak bargaining power. Unlike large corporations, SMEs often lack the means to hedge or absorb price shocks. This study addresses this gap by examining the strategic adaptations SMEs in Taiwan employ to respond to such external threats. While prior research has explored risk management in SMEs (Herbane, 2010), few studies have focused specifically on the rubber sector in Taiwan. This research thus contributes by contextualizing risk resilience mechanisms within the unique structure and constraints of SMEs in the Taiwanese manufacturing sector.

Research Objectives and Questions

This study aims to explore how Taiwanese rubber-focused SMEs respond to raw material price volatility. The specific goals include:

1. Analyzing the mechanisms enterprises use to forecast and monitor raw material price fluctuations.

2. Exploring procurement, inventory, and financial strategies of enterprises during periods of price surges.

3. Evaluating how firms enhance their resilience through product innovation, brand upgrades, and market transformation.

4. Collecting practical experiences and providing recommendations with policy and managerial reference value.

Research Methods and Data Sources

A qualitative multiple-case study design was adopted. Five representative SMEs in Taiwan's rubber manufacturing sector were selected based on product diversity and export activity. Primary data was gathered through semi-structured interviews with strategic managers, supplemented by financial documents, market reports, and academic literature. This triangulated approach ensures data validity and provides nuanced insights into strategic responses.

**LITERATURE REVIEW**

The literature review integrates five major domains: (1) SME risk management theory, (2) volatility of commodity markets, (3) dynamic capability theory (Teece et al., 1997), (4) supply chain resilience (Christopher & Peck, 2004), and (5) recent empirical studies on rubber pricing. Notably, past research (Juliano et al., 2021; Zhang & Li, 2020) emphasizes the importance of material substitution and risk-sharing in volatile industries. This study builds on those frameworks to interpret adaptive practices among Taiwanese SMEs.

This chapter reviews the theoretical foundations and previous research achievements closely related to the topic of this study, covering aspects such as SMEs risk management theory, theories of raw material market price fluctuations, dynamic capability theory, supply chain management strategies, and resilience response theory, providing analytical perspectives and theoretical foundations for subsequent case discussions.

1. SME Risk Management Theory: The challenges SMEs face in risk management mainly stem from insufficient resources and incomplete institutional design. Herbane (2010) pointed out that SMEs often manage risks in informal and experience-oriented ways, such as relying on the intuition, past experiences, or trusting relationships of business owners when making decisions. However, this model often struggles to produce timely and effective responses when facing sudden or structural risks. Recent studies further indicate that if SMEs can institutionalize risk management and introduce simple risk assessment tools and processes, such as risk matrices, sensitivity analyses, or risk warning mechanisms, they can enhance their defensive and responsive capabilities within a manageable cost range. Particularly in scenarios of high volatility in raw material prices, institutionalized risk management can become an essential foundation for enhancing operational stability.

2. Fluctuations in Raw Material Price and Industrial: Impact Fluctuations in raw material prices are considered important external variables affecting the operational performance of the manufacturing industry. Hamilton (2009) analyzed that raw material prices are influenced by the interplay of multiple variables, including global supply and demand relationships, energy prices, geopolitical situations, and exchange rates. In the rubber industry, the main production areas of natural rubber are concentrated in Southeast Asian countries, which are susceptible to climate and political instability, while synthetic rubber is highly influenced by crude oil prices, resulting in extremely high price volatility. These price fluctuations often make it difficult for mid-to-low stream manufacturers to formulate stable budgets and production plans, thus affecting their ability to fulfill customer orders and profit margins. Scholars in the past have suggested that manufacturers could reduce risks through measures such as hedging in the futures market, signing long-term supply contracts, or expanding safety stock. However, these methods often face limitations in funding and negotiation capabilities in small and medium-sized enterprises (SMEs). Therefore, how to develop suitable response mechanisms based on their conditions is crucial.

3. Dynamic Capabilities and Strategic Adjustments: The theory of "dynamic capabilities" proposed by Teece et al. (1997) emphasizes that enterprises need to possess three key capabilities in a rapidly changing environment: sensing opportunities, seizing resources, and transforming organizations. This research applies this theoretical framework to explore how companies can strengthen their resilience to risks through internal learning and resource allocation when facing extreme fluctuations in raw material prices. For example, some companies, when faced with skyrocketing rubber prices, choose to expand their product mix by shifting some production capacity to non-rubber-dependent products to diversify risk; other companies introduce new technologies or materials, attempting to reduce cost volatility through alternative raw materials. These strategies reflect the companies' high sensitivity to and responsiveness to external environments, also showcasing the practical process of their dynamic capabilities.

4. Supply Chain Resilience and Risk Diversification: Christopher & Peck (2004) emphasize that supply chain resilience is an indispensable competitive factor for modern manufacturing, especially when facing raw materials with high uncertainty. Supply chain risk management strategies can be approached from two major aspects: one is "preventive strategies," such as supplier diversification, long-term contracts, and enhancing information transparency; the other is "responsive strategies," such as setting alternative raw materials, ad hoc transfer order mechanisms, and emergency inventory dispatching. For SMEs, although it is challenging to fully replicate the systems and technologies of large enterprises, they can establish stable cooperative relationships with specific suppliers and achieve partial flexibility through streamlined processes. For instance, by establishing a "dual supply model" for certain key raw materials, setting up abnormal price threshold notification mechanisms, or even forming strategic alliances with peers for joint procurement to enhance bargaining power and stability.

5. Conclusion: From the literature mentioned above, it can be understood that in the face of a highly volatile raw material market, small and medium-sized enterprises (SMEs) need to simultaneously strengthen their risk management systems, develop dynamic capabilities, and design supply chain flexibility. Due to the limitations of scale and resource conditions in SMEs, their response mechanisms must emphasize strategic flexibility and operational feasibility. This study will further examine the strategic practices and effectiveness under theoretical context through practical cases of five SMEs in Taiwan, aiming to bridge the gap between theory and practice.

**RESEARCH METHODOLOGY**

This chapter aims to detail the overall design and methodological foundation of this study, including the rationale for the selection of research methods, sources and methods of data collection, the logic of selecting research subjects, and their background characteristics. It further explores the data analysis procedures and considerations of research ethics. Given that the topic of this research involves how small and medium-sized enterprises (SMEs) respond to fluctuations in rubber material prices and risk management, a primarily qualitative approach supplemented by multiple case studies is adopted to gain an in-depth understanding of the decision-making logic and business strategies that company’s exhibit in a dynamic environment.

1. Research Design and Methodological Basis: The core objective of this research is to clarify the coping mechanisms of Taiwanese SMEs in response to fluctuations in rubber prices, thus utilizing qualitative research methods as the main research framework. Qualitative research emphasizes a deep understanding of phenomena and contextual meanings, making it particularly suitable for exploring how businesses adjust strategies, mobilize resources, and respond to external challenges within specific industry contexts (Miles & Huberman, 1994). Specifically, this study employs the case study method based on Yin's (2014) proposed 'Multiple-Case Design', conducting horizontal comparisons and vertical analyses across multiple companies to construct a strategically analytical model with theoretical depth and practical applicability. The applicability of case studies lies in their allowance for researchers to observe and analyze individual organizations' differentiated responses and internal logic when facing the same problem in real settings. Compared to quantitative research, which emphasizes breadth and generalizability, qualitative case studies focus more on depth and the clarification of complex relationships, making them particularly suitable for topics such as price fluctuations, risk management, and internal adjustment mechanisms that require a high degree of contextual understanding To enhance the credibility of the data and the theoretical applicability of the results, this study employs triangulation methods, including source triangulation (interviews, documents, secondary data), researcher triangulation (cross-discussion among multiple researchers), and method triangulation (in-depth interviews, document analysis, historical comparisons). This approach enhances the interpretability and consistency of the research findings.

2. Selection of Research Subjects and Background Introduction: This study conducts in-depth discussions on five representative small and medium-sized enterprises (SMEs) in Taiwan's rubber manufacturing related industries, with companies from various sectors, covering diverse application areas such as rubber components, tire manufacturing, sports equipment, automotive parts, and industrial applications. The companies include:

• **Chuan Hseng Co., Ltd**.: Established in 1969, specializes in the development and export of rubber seals and industrial rubber products, supplying the Southeast Asian and European markets for years, with stable quality control and R&D capabilities. In the face of price fluctuations, it tends to adopt long-term contracts and raw material inventory strategies to mitigate short-term impacts.

• **Kenda Rubber Industrial Co., Ltd.**: One of the leading tire manufacturers in Taiwan, its products cover bicycle, motorcycle, automotive, and industrial tires, having a large scale of raw material procurement and a global sales network. Kenda effectively manages cost fluctuation risks through raw material futures hedging, procurement diversification strategies, and agreements with suppliers on price ranges.

• **Chang Yung Industrial Co., Ltd.**: Mainly produces automotive components and industrial rubber molds, possesses internal rubber mixing and mold design capabilities. Its response strategies are flexible-oriented, including multi-supplier procurement, flexible order arrangements, production ratio adjustments, and the establishment of a raw material warning system.

• **U-Rong Golf Enterprise Co.**, Ltd.: Focused on the production of golf balls and sports rubber accessories, with higher demands on rubber properties and quality consistency. As most customers are overseas brands, its strategy emphasizes stable quality and proactive risk management, engaging in cooperative mechanisms with international suppliers and signing risk-sharing contracts.

• **Yun Kuan Industrial Co., Ltd.**: Products are applied in industrial and construction rubber materials, with high business flexibility and short delivery times. In response to price fluctuations, it focuses on flexibility and customization in production adjustments, using IT systems to track raw material inventory and pricing trends in real-time.

The selection of these five companies is based on their representativeness in the industry and the diversity of their strategic responses. This heterogeneous sample combination can help researchers capture the impact of different industry structures, product characteristics, and organizational capabilities on strategy adjustment, thereby deepening theoretical construction and strategic recommendations.

3. Data Collection Methods and Interview Design: This study primarily employs the "semi-structured depth interview method" as the main data collection tool, supplemented by document analysis and secondary data comparison. The interview subjects include key strategic positions such as general managers, operations managers, procurement managers, and R&D heads to ensure insights and practical perspectives from the decision-making level. The interview outline is designed based on theoretical and practical issues, covering the following eight key themes:

1. What are the foundations of a company's competitive advantage?

2. How does the internal early warning and information grasping mechanism operate within a company in the face of high volatility in rubber prices?

3. Are price thresholds, long-term contracts, or real-time responses used in procurement decisions?

4. How do supply chain relationships respond to drastic fluctuations in raw material prices?

5. What is the impact of rising rubber costs on product profit structures and customer strategies?

6. Are technological innovations and alternative materials considered as medium- to long-term solutions?

7. What adjustments are made in internal organizational systems and how is strategic flexibility demonstrated?

8. What expectations and suggestions do the respondents have regarding industry policies, government support, and market systems?

All interviews were recorded and transcribed with the consent of the interviewees, ensuring the privacy of respondents and the confidentiality of corporate secrets, with some data anonymized. Additionally, the research also collected publicly available financial statements from companies, internal presentation materials, and historical pricing data of rubber raw materials, industry analysis reports, and policy white papers as supplementary and cross-validation materials.

4. Data Analysis Strategy: To ensure the systematic and rigorous processing of data, the study employs thematic content analysis, guided by research questions to establish an initial classification framework. This is followed by repeated readings and coding to summarize core concepts and strategic patterns. During the analysis, continuous comparisons of internal logic within cases and across cases are conducted to identify common patterns and differing factors. Content analysis primarily focuses on three major aspects: (1) classification and types of corporate response strategies; (2) background and influencing factors of strategy formation; (3) evaluation of strategy effects and challenges. Ultimately, a response model for small and medium-sized enterprises facing raw material price risks is summarized and engaged in theoretical dialogue and extension with existing literature.

5. Research Limitations and Ethical Considerations: The main limitations of this study include: (1) constrained by research time and resources, the study only covers five companies, which cannot comprehensively reflect the overall industry structure; (2) the data primarily comes from subjective interviews, which may be influenced by the interviewees' memory and expression; (3) specific data such as procurement agreements and financial information involve sensitivity, and some cannot be fully disclosed, affecting the completeness of the analysis. To ensure research integrity and ethics, this study follows human research ethics principles, including obtaining interview consent, processing data anonymously, maintaining confidentiality in the research process, and committing to non-commercial use of research results, as well as undergoing ethical review and registration by the academic institution.

6. Conclusion In summary: This chapter provides a detailed explanation of the design logic, data collection, and analysis methods of this study, and elaborates on the background and selection criteria of the five small and medium-sized enterprises. Through qualitative multiple case studies, this research aims to establish a knowledge framework for how small and medium-sized enterprises in Taiwan's rubber industry respond to price fluctuations, providing a foundation for future policy recommendations and academic discussions. The next chapter will gradually reveal the actual response strategies and transformation actions of small and medium-sized enterprises based on interview and analysis results.

**EMPIRICAL RESULTS AND ANALYSIS**

This chapter will organize and analyze the data obtained from interviews and document analysis, focusing on the practical strategies and action contexts adopted by five case companies in response to fluctuations in rubber prices. It will systematically analyze three aspects: competitive advantage, strategic adjustment, and structural trends. Through horizontal comparison and vertical contextual understanding, it will summarize the specific practices and institutional responses of Taiwanese SMEs in the face of high volatility risks of raw materials.

1. Challenges of Price Fluctuations and Cost Structure: The price fluctuations in the rubber raw material market have always been affected by complex factors such as international oil prices, global supply and demand, and geopolitical issues. According to the interview results and international pricing data, the interviewed companies generally pointed out that over the past five years, rubber prices have repeatedly reached new highs, which not only puts pressure on production costs but also challenges traditional pricing models and profit distributions. Taking Chuan-Sheng Company as an example, this company produces technology-intensive rubber components, with the unit raw material cost accounting for 45% of the total cost. When rubber prices rise, even if internal efficiency improves, it is difficult to offset the external cost pressures. Kenda Tires, due to its long product line and intense market price competition, needs to adjust purchasing and pricing strategies more frequently, requiring high sensitivity in financial and inventory management systems. Chang-Yong Group pointed out that the past reliance on a single supplier for procurement posed high risks in the face of price increases and supply disruptions, which can lead to delivery delays and damaged customer relationships. Yu-Rong Golf and Yun-Kuan Industrial emphasized that stable quality and delivery times are crucial for their exports, while fluctuations in raw materials can cause inconsistent batches and cost fluctuations, necessitating control over quality and procurement rhythm from the source.

2. Analysis of Corporate Response Strategy Types: Based on the data analysis, the response strategies of the five companies to raw material price fluctuations can be summarized into the following four types:(1) Cost transfer and price adjustment strategies: Kenda Tires and Chuan-Sheng tend to transfer part of the cost pressure to customers through price adjustment mechanisms, especially when there is clear product differentiation or long-term cooperation with clients, where negotiating price adjustments is more feasible. However, this strategy must be built on brand trust and stable delivery; otherwise, it may lead to customer loss. (2) Inventory adjustment and procurement diversification strategies: Chang-Yong and Yun-Kuan Industrial emphasize flexible inventory management and diversified sourcing to reduce dependence on a single source of raw materials. The former has implemented an on-demand purchasing system and multi-supplier platform, while the latter has strengthened warning systems and established backup mechanisms with regional suppliers. (3) Cooperative agreements and risk-sharing models: Yu-Rong Golf and Chuan-Sheng both mentioned signing floating price contracts or risk-sharing agreements with key suppliers, which can reduce the immediate impact of drastic price changes on cash flow. This also enhances mutual willingness to cooperate and stability. (4) Technological innovation and material substitution solutions: Kenda and Chang-Yong are both investing in the development of synthetic materials that can replace natural rubber, or adjusting formulas to reduce the proportion of high-priced raw materials. Although the initial investment is high, it can enhance competitive flexibility in the long run and pave the way for green material trends.

3. Internal Conditions and External Constraints in Strategy Selection: The choice of corporate strategy is influenced not only by the industry environment but also by the dual effects of internal resource capabilities and external networks. Specifically:• Scale and financial structure of the company: Larger firms with ample capital can obtain cost advantages through futures hedging or bulk purchasing; smaller companies, such as Yun Guan, focus more on cash flow and short-term flexibility.• Technical capabilities and production flexibility: Chang Yong, which possesses independent mold and mixing capabilities, can quickly respond to variations in raw material properties and has a high degree of control over alternative strategies; on the other hand, Yu Rong is limited by high-quality demands from clients, leaving little room for alternatives.• Customer relationships and bargaining power: Companies with long-term stable customers or high-tech threshold products (such as Quan Sheng) find it easier to negotiate cost transfer or cost-sharing agreements; conversely, in a highly competitive market or price-driven scenarios (such as Yun Guan), strategic options are limited.

4. Organizational Learning and Institutional Adjustments: In response to environmental changes, all five companies have demonstrated internal adjustment actions and institutional innovation. This includes: Establishing cross-department raw material decision-making teams to regularly review procurement strategies and pricing policies; Strengthening ERP systems and raw material tracking modules to keep immediate track of price movement information; Establishing flexible budgeting systems and cost simulation models to cope with different pricing scenarios; Collaborating with suppliers to develop new materials and process technologies to enhance product substitution rates and cost reduction capabilities. Such institutional adjustments not only enhance the companies' adaptability but also form organizational assets that can resist future risks.

5. Trend Forecasting and Industry Recommendations: Based on corporate observations and industry data, respondents generally expect rubber prices to remain highly volatile in the future. Influencing factors include global renewable energy policies, supply control from major natural rubber producing countries, transportation costs, and climate change. Therefore, companies suggest:• The government could provide subsidies for technological upgrades and adjust import tax rates on raw materials to reduce cost pressures;• Encourage small and medium-sized enterprises to co-establish procurement platforms and information sharing mechanisms to enhance overall bargaining power;• Support the development of alternative materials and recycled rubber technologies and establish a market verification system;• Provide risk management education and consulting services to help companies establish internal risk awareness and mechanisms.

6. Conclusion: This chapter has revealed the diverse strategies adopted by Taiwanese small and medium-sized enterprises related to rubber in facing price volatility through a systematic analysis of data from five companies. The companies exhibit a high degree of strategic adaptability in areas such as cost control, procurement diversification, technological innovation, and organizational systems. The next chapter will integrate the findings of this study and propose recommendations for future corporate practices and policy design.

**RESEARCH CONCLUSIONS**

This study conducts an in-depth analysis of the response strategies of small and medium-sized manufacturing enterprises in Taiwan amidst the severe fluctuations in rubber raw material prices. Through practical case studies of five representative companies, it reveals their multi-faceted response mechanisms including risk forecasting, procurement management, organizational adjustments, and product upgrades. The results show that although small and medium-sized enterprises operate from a disadvantage due to limited resources, they can still develop a resilient and forward-looking business model through information integration, strategic alliances, and dynamic adjustments. This study not only verifies the feasibility of dynamic capability theory in the operational practices of small and medium-sized enterprises but also provides specific policy recommendations aimed at assisting relevant government agencies and industry organizations in strengthening the overall risk management framework. Future research can continue to expand the sample size and cover different industrial categories to further enhance the overall risk resistance and global competitiveness of Taiwan's manufacturing sector.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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