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Factors Influencing the Sustainable Performance of Smoked Rubber Sheet Producer Cooperatives in Southern Thailand: The Mediating Role of Organizational Resilience

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ABSTRACT

This study aims to examine the factors influencing the sustainable performance of smoked rubber sheet producer cooperatives in Southern Thailand, with a particular focus on the mediating role of organizational resilience in the relationships between quality management, cost and process efficiency, and sustainable performance. A mixed methods research design was employed in two phases. The first phase involved qualitative research, consisting of in-depth interviews with executives from 30 cooperatives across six major rubber-producing provinces, to develop a measurement instrument for organizational resilience. The second phase employed a quantitative research approach, with the sample consisting of opinions obtained from 600 cooperative executives representing a total of 200 cooperatives. The data were analyzed using structural equation modeling (SEM). The results indicate that quality management has a significant positive effect on organizational resilience ($\beta = 0.472$, $p < .001$), while cost and process efficiency also exerts a significant positive effect on organizational resilience ($\beta = 0.361$, $p < .001$). Furthermore, organizational resilience has a direct positive effect on sustainable performance ($\beta = 0.344$, $p < .001$), and cost and process efficiency also directly influences sustainable performance ($\beta = 0.302$, $p < .001$). The analysis of indirect effects confirms that organizational resilience plays a mediating role in the relationship between quality management and sustainable performance ($\beta = 0.162$, $p < .001$), as well as between cost and process efficiency and sustainable performance ($\beta = 0.124$, $p < .001$). The model explains 46.5% of the variance in organizational resilience ($R^2 = 0.465$) and 31.7% of the variance in sustainable performance ($R^2 = 0.317$). These findings highlight organizational resilience as a critical mechanism through which operational capabilities are translated into the long-term sustainable performance of smoked rubber sheet cooperatives.

Keywords: Organizational resilience; Quality management; Cost and process efficiency; Sustainable performance

INTRODUCTION

Natural rubber is one of Thailand's most important economic crops, particularly in the southern region, which serves as the country's main production and processing base. Smoked rubber sheet cooperatives function as institutional mechanisms that collect outputs from smallholder farmers, add value through processing activities, and enhance members' market bargaining power (Thongchalerm, Nachairit, & Tontiset, 2016). However, over the past decade, the operations of smoked rubber sheet cooperatives have faced increasing structural uncertainty due to fluctuations in rubber prices, rising production and energy costs, as well as pressures from global markets and rapidly changing environmental conditions. These challenges have adversely affected the financial stability and operational continuity of cooperatives. Beyond price volatility, smoked rubber sheet cooperatives are exposed to multiple operational risks, including inconsistent raw material quality, volatility in energy and labor costs, production disruptions caused by extreme weather events, and market risks arising from dependence on a limited

number of trading partners (Ivanov & Dolgui, 2020). Recent empirical evidence indicates that flooding and climate variability in Southern Thailand have significantly affected rubber production, transportation, and processing activities, underscoring the vulnerability of the rubber supply chain. Under these circumstances, the success of smoked rubber sheet cooperatives should not be assessed solely in terms of short-term profitability. Instead, it should be examined through the lens of sustainable performance, which encompasses economic, social, and institutional dimensions. This includes the ability to generate profits and maintain liquidity, ensure income stability and quality of life for members, and sustain organizational continuity and legitimacy over the long term (WCED, 1987; Hourneaux Jr., 2018; Tseng et al., 2020). This perspective is consistent with the sustainability literature, which emphasizes that organizations operating in volatile markets must develop internal capabilities to cope with uncertainty rather than relying solely on technical efficiency (Ortiz-de-Mandojana & Bansal, 2016). Contemporary organizational management research highlights organizational resilience as a critical mechanism linking internal capabilities to long-term outcomes. Duchek (2020) conceptualizes organizational resilience as a dynamic capability comprising anticipation, coping, and adaptation. Recent literature reviews further confirm that resilience is the outcome of systematic capability development and serves as a fundamental foundation for organizational sustainability (Ciasullo et al., 2024). For production-oriented organizations such as smoked rubber sheet cooperatives, organizational resilience is closely associated with operational capabilities, particularly quality management and cost and process efficiency. Recent empirical studies indicate that these capabilities reduce process vulnerability, enhance operational stability, and improve decision-making quality under uncertainty, thereby contributing to sustainable performance (Lin et al., 2024; Koh et al., 2024). Despite the growing body of research on sustainability and organizational resilience, significant empirical gaps remain in the context of agricultural cooperatives, particularly smoked rubber sheet producer cooperatives. Many existing studies focus primarily on social factors, social capital, or governance, while the roles of operational capabilities and risk management as mechanisms that build resilience and transmit their effects to sustainable performance remain underexplored (Linnenluecke, 2017; Williams et al., 2017). This gap is especially evident with respect to the combined effects of quality management and cost and process efficiency within the context of smoked rubber sheet cooperatives.

Accordingly, this study aims to examine the factors influencing the sustainable performance of smoked rubber sheet cooperatives in Southern Thailand by proposing organizational resilience as a mediating variable linking quality management (QUAL) and cost and process efficiency (COST) to sustainable performance (SUS) across economic, social, and institutional dimensions. This framework is consistent with contemporary organizational resilience and sustainability research (Duchek, 2020; Ciasullo et al., 2024)

LITERATURE REVIEW AND DEVELOPMENT OF THE RESEARCH CONCEPTUAL FRAMEWORK

1) Resource-Based View and Dynamic Capabilities Theory

The Resource-Based View (RBV) is one of the most influential theoretical frameworks used to explain organizational competitive advantage and performance. It posits that organizations can achieve sustainable competitive advantage through internal resources and capabilities that are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991). Within this framework, resources are not limited to physical assets or financial capital but also include intangible resources such as knowledge, experience, management systems, and internal organizational processes. However, RBV has been criticized for its limited ability to explain organizational behavior and performance in rapidly changing environments. In response to this limitation, Teece, Pisano, and Shuen (1997), and later Teece (2007), advanced Dynamic Capabilities Theory, which emphasizes an organization's ability to *integrate, build, and reconfigure* internal and external resources and processes in response to environmental change. From the dynamic capabilities perspective, the capacities for sensing environmental changes, seizing emerging opportunities, and reconfiguring organizational resources constitute the core mechanisms underlying long-term organizational survival and growth. For smoked rubber sheet cooperatives operating under conditions of volatile rubber prices, rising energy costs, and increasing climate-related uncertainty, operational capabilities such as quality management and cost and process management can be conceptualized as both *strategic resources* and *dynamic capabilities*. These capabilities enable cooperatives to adapt to environmental turbulence, enhance organizational resilience, and sustain long-term performance.

2) Organizational Resilience Theory

Organizational resilience theory seeks to explain an organization's ability to withstand, recover from, and adapt to shocks or uncertainties arising from the external environment. This concept has gained increasing scholarly attention, particularly in the contexts of economic crises, natural disasters, and climate change. Duchek (2020) conceptualizes organizational resilience as a dynamic capability comprising three core dimensions: anticipation,

coping, and adaptation. Recent literature reviews confirm that organizational resilience does not emerge spontaneously but rather results from deliberate system design, internal capability development, and continuous organizational learning (Ciasullo et al., 2024). From this perspective, resilience functions as a process-based mechanism through which organizations transform internal resources and capabilities into long-term outcomes in an effective and sustainable manner. For smoked rubber sheet cooperatives, organizational resilience is particularly critical, as these organizations operate under persistent market and environmental uncertainty. The ability to anticipate trends, cope with disruptions, and adapt operational practices enables cooperatives to maintain stability and achieve sustainable performance over the long term.

3) Sustainable Performance (SUS)

The concept of sustainable performance (SUS) is grounded in the sustainable development framework and the Triple Bottom Line (TBL) approach, which proposes that organizational success should be evaluated across multiple dimensions rather than being limited to economic profitability alone. Specifically, sustainable performance encompasses economic outcomes, social impacts, and an organization's capacity for long-term continuity and legitimacy (WCED, 1987; Hourneaux Jr., 2018; Tseng et al., 2020). At the organizational level, this concept has evolved into the assessment of corporate or organizational sustainability performance, reflecting an organization's ability to create sustained value under resource constraints, stakeholder expectations, and environmental uncertainty (Ortiz-de-Mandojana & Bansal, 2016). Contemporary research further emphasizes that the measurement of sustainable performance should be tailored to the specific context of the organization and industry, as structural characteristics, strategic objectives, and institutional roles vary across settings (Damtoft et al., 2025). In the context of smoked rubber sheet cooperatives, sustainability extends beyond profitability to include the stability of member benefits, the continuity of operations, and the credibility of the cooperative as a community-based economic institution. Accordingly, sustainable performance in this study is defined as the cooperative's capacity to consistently maintain favorable operational outcomes over the long term across economic, social, and institutional dimensions under conditions of environmental volatility. These outcomes reflect the role of organizational resilience in transforming internal capabilities and operational management practices into long-term organizational sustainability (Lengnick-Hall et al., 2011; Lin et al., 2024; Ciasullo et al., 2024).

4) Factors Influencing Organizational Resilience and Sustainable Performance

In the context of smoked rubber sheet cooperatives facing uncertainty arising from rubber price volatility, rising energy costs, raw material quality risks, and climate-related disruptions, organizational resilience (RES) reflects the organization's ability to anticipate, cope with, and adapt to or recover from such shocks. Contemporary literature clearly indicates that organizational resilience is not an inherent attribute but rather the outcome of systematic internal capability development encompassing operational practices, managerial processes, and organizational learning (Linnenluecke, 2017; Williams et al., 2017; Duchek, 2020; Ciasullo et al., 2024). From the perspective of the Resource-Based View (RBV), operational capabilities such as quality management and cost and process efficiency can be regarded as valuable internal resources and capabilities that are difficult to imitate. However, research grounded in Dynamic Capabilities Theory emphasizes that these resources generate sustainable advantage and long-term survival only when organizations are able to continuously reconfigure, allocate, and deploy them in response to environmental change (Teece et al., 1997; Teece, 2007). Within this framework, organizational resilience serves as a critical mechanism linking internal resources to long-term organizational outcomes.

Quality Management (QUAL) and Organizational Resilience

Quality management plays a crucial role in stabilizing production processes by reducing variability, minimizing waste, and establishing standardized and traceable operational procedures. Prior research in quality management suggests that robust quality systems reduce operational risks, enhance process reliability, and strengthen an organization's capacity to recover when confronted with unexpected events (Flynn et al., 1994; Zu et al., 2008). Moreover, continuous improvement practices and standardized process management are widely recognized as key mechanisms that enable organizations to effectively cope with and recover from operational and supply chain disruptions (Tukamuhabwa et al., 2015; Mandal et al., 2016; Duchek, 2020; Ning & Gao, 2021).

Based on these theoretical arguments and empirical evidence, this study proposes the following hypothesis:

Hypothesis 1 (H1): Quality management has a significant effect on organizational resilience.

Cost and Process Efficiency (COST) and Organizational Resilience

Similarly, cost and process efficiency such as waste reduction, improved energy and machinery utilization, and continuous process improvement enhance operational and resource flexibility. Organizations that are able to

control unit costs and maintain flexible production processes are better positioned to absorb cost volatility and cope with process disruptions. Research in the fields of lean management and supply chain resilience consistently indicates that process efficiency constitutes a fundamental foundation for organizational coping and recovery capabilities, particularly in manufacturing and agri-processing industries (Scholten & Schilder, 2015; Ivanov & Dolgui, 2020; Pournader et al., 2020; Koh et al., 2024; Tortorella et al., 2024). Based on these findings from the literature, this study proposes the following hypothesis:

Hypothesis 2 (H2): Cost and process efficiency has a significant effect on organizational resilience.

Organizational Resilience and Sustainable Performance

Sustainable performance (SUS) is grounded in the sustainable development framework and the Triple Bottom Line (TBL) concept, which encompasses economic, social, and long-term organizational viability dimensions (WCED, 1987; Hourneaux Jr., 2018; Tseng et al., 2020). Empirical evidence across various industries, including agriculture and processing sectors, suggests that organizational resilience functions as a process-based mechanism that enables organizations to effectively transform internal capabilities into long-term outcomes (Lengnick-Hall et al., 2011; Ortiz-de-Mandojana & Bansal, 2016; Lin et al., 2024; Ciasullo et al., 2024; Liu & Zhang, 2024).

Accordingly, this study proposes the following hypothesis:

Hypothesis 3 (H3): Organizational resilience has a significant effect on sustainable performance.

The Mediating Role of Organizational Resilience

Contemporary literature consistently indicates that although quality management and cost and process efficiency enhance short-term operational performance and competitiveness, these capabilities do not automatically lead to sustainable performance if organizations lack the ability to cope with uncertainty and external shocks. Research on organizational resilience therefore emphasizes that resilience serves as a process-based mechanism through which operational capabilities are translated into long-term outcomes via an organization's capacity for anticipation, coping, and recovery or adaptation under crisis conditions (Lengnick-Hall et al., 2011; Duchek, 2020). From the perspective of the Resource-Based View (RBV), quality management and cost and process efficiency can be regarded as valuable internal resources and capabilities. However, Dynamic Capabilities Theory suggests that these resources generate sustained advantage only when organizations are able to continuously reconfigure and deploy them in response to environmental change. In this regard, organizational resilience reflects the organization's ability to "keep resources functioning" under conditions of uncertainty, thereby stabilizing economic outcomes, maintaining member confidence, and ensuring organizational continuity over the long term (Ciasullo et al., 2024). Recent studies further propose that organizational resilience acts as a mediating variable that transmits the effects of quality management and cost and process efficiency to sustainable performance. Specifically, quality management and cost control establish a foundation of operational efficiency, while organizational resilience enables organizations to leverage this foundation to cope effectively with market volatility, energy cost fluctuations, and production disruptions. As a result, sustainable performance across economic, social, and institutional dimensions can be maintained over time (Lengnick-Hall et al., 2011; Duchek, 2020; Ciasullo et al., 2024). Based on this conceptual framework, this study proposes the following hypotheses:

Hypothesis 4 (H4): Quality management has an indirect effect on sustainable performance through organizational resilience.

Hypothesis 5 (H5): Cost and process efficiency has an indirect effect on sustainable performance through organizational resilience.

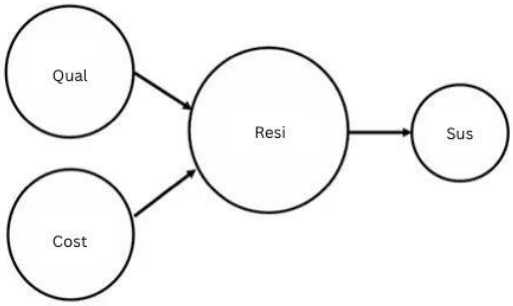

Figure 1 Research Conceptual Framework
Source: Author's own work.

RESEARCH METHODOLOGY

This study employed a mixed methods research design to investigate the factors influencing the sustainable performance of smoked rubber sheet cooperatives in Southern Thailand, with a particular focus on the mediating role of organizational resilience. The research was conducted in two sequential phases.

Phase 1: Qualitative Study In the first phase, 30 agricultural cooperatives were purposively selected from six major rubber-producing provinces Trang, Krabi, Surat Thani, Nakhon Si Thammarat, Phatthalung and Songkhla based on recommendations from provincial cooperative offices. The selected cooperatives had been operating continuously for at least five years, demonstrated profitability, and had received recognition as outstanding cooperatives. In-depth interviews were conducted with cooperative executives to explore quality management practices, cost and process efficiency, and organizational resilience influencing sustainable performance. The qualitative data were analyzed using content analysis, and data credibility was enhanced through triangulation following Denzin (2017). The findings were subsequently validated by 15 experienced rubber cooperative executives, purposively selected based on a minimum of five years of managerial experience and direct involvement in policy or strategic decision-making. This validation process served as a data validation procedure and informed the development of a nine-item organizational resilience measurement instrument.

Phase 2: Quantitative Study In the second phase, the sample consisted of 600 cooperative executives from 200 cooperatives (three respondents per cooperative). A combination of stratified random sampling by province and accidental sampling was employed. The research instrument comprised four sections: (1) quality management (3 items), (2) cost and process efficiency (3 items), (3) organizational resilience (5 items), and (4) sustainable performance (3 items). Content validity was assessed by three experts, and all constructs demonstrated satisfactory reliability, with Cronbach's alpha coefficients exceeding 0.70. Data were collected through both online and on-site surveys, with informed consent obtained from all participants. The data were analyzed using descriptive statistics and structural equation modeling (SEM) with Mplus version 8.7. Model fit was evaluated based on established criteria proposed by Hu and Bentler (1999) and Schermelleh-Engel et al. (2003).

Table 1 The development of measurement constructs for the provision of member welfare and the survival of agricultural institutions.

Variable	Dimension/Indicator	Based on interview data	Theoretical and Literature References
Quality Management	QUAL1: The cooperative has a quality control system for smoked rubber sheets covering latex procurement, the production process, and product delivery. QUAL2: The cooperative's smoked rubber sheet production process follows clear standards and is able to consistently maintain product quality in accordance with market grades and specifications. QUAL3: The cooperative continuously monitors, evaluates, and improves production quality when problems or customer complaints arise.	1. Nam Chan Samakkhi Rubber Farmers'Cooperative 2. Khlong Chang Rubber Farmers' Cooperative 3. Nong Khrok Rubber Farmers' Cooperative 4. Yan Ta Khao Agricultural Cooperative 5. Ratsadanu Son Rubber Farmers' Cooperative 6. Ban Khlong Chanuan Rubber Farmers' Cooperative 7. Phuang Phromkhra Agricultural Cooperative 8. Sai Krut Rubber Farmers' Cooperative 9. Sot Pracha Rubber Farmers' Cooperative 10. Song Phi Nong Khlong Sila Rubber Farmers' Cooperative 11. Ban Khuan Mo Thong Land Reform Area Rubber Plantation	Deming, W. E. (1986); Juran, J. M. (1988);Crosby, P. B. (1979); Flynn, Schroeder, & Sakakibara (1994); Barney, J. (1991); Tukamuhabwa et al. (2015); Mandal et al. (2016)

		Fund Cooperative Limited	
Cost and Process Efficiency	COST1: The cooperative is able to control smoked rubber sheet production costs (e.g., energy, labor, and materials) and maintain competitive unit costs, even during periods of rubber price volatility. COST2: The cooperative's production process is characterized by low levels of loss, both in terms of production waste and unnecessary energy consumption. COST3: The cooperative continuously improves work processes to reduce production time and costs.	1. Nong Pong Rubber Farmers' Cooperative 2. Nam Chan Samakkhi Rubber Farmers' Cooperative 3. Ban Nabo n Agricultural Cooperative 4. Khlong Chang Rubber Farmers' Cooperative 5. Nong Khla Rubber Farmers' Cooperative 6. Nong Khrok Rubber Farmers' Cooperative 7. Ban Pa Ko Agricultural Cooperative 8. Yan Ta Khao Agricultural Cooperative 9. Thung Yai Rubber Farmers' Cooperative 10. Ratsadanu Son Rubber Farmers' Cooperative 11. Ban Khlong Chanuan Rubber Farmers' Cooperative 12. Phuang Phromkhra Agricultural Cooperative 13. Sai Krut Rubber Farmers' Cooperative 14. Sot Pracha Rubber Farmers' Cooperative 15. Song Phi Nong Khlong Sila Rubber Farmers' Cooperative 16. Thung Song Settlement Cooperative 17. Ban Khlong Yai Phatthana Rubber Plantation Fund Cooperative Limited 18. Ban Khuan Mo Thong Land Reform Area Rubber Plantation Fund Cooperative Limited	Ghobakhloo, M., & Fathi, M. (2020); Queiroz, M. M., Telles, R., & Bonilla, S. H. (2019)
Organizational resilience	RESI1: The cooperative is able to anticipate fluctuations in rubber prices, costs, or external conditions and has the capability to cope and continue operations when unexpected events occur. RESI2: After experiencing problems or crises, the	1. Nam Chan Samakkhi Rubber Farmers' Cooperative 2. Khlong Chang Rubber Farmers' Cooperative 3. Nong Khla Rubber Farmers' Cooperative	Duchek, S. (2020); Ciasullo et al. (2024); Lengnick-Hall, Beck, & Lengnick-Hall (2011); Linnenluecke (2017); Williams et al. (2017)

	cooperative is able to recover to normal operations and adapt management approaches or production processes to changing circumstances.	4. Nong Khrok Rubber Farmers' Cooperative 5. Ban Pa Ko Agricultural Cooperative 6. Ban Nong Srichan Rubber Farmers' Cooperative 7. Thung Yai Rubber Farmers' Cooperative 8. Ratsadanu Son Rubber Farmers' Cooperative 9. 9.Ban Khlong Chanuan Rubber Farmers' Cooperative 10. Phuang Phromkhra Agricultural Cooperative 11. Sai Krut Rubber Farmers' Cooperative 12. Khlong Thom Nuea Rubber Farmers' Cooperative 13. Sot Pracha Rubber Farmers' Cooperative 14. Song Phi Nong Khlong Sila Rubber Farmers' Cooperative 15. Nong Khla Rubber Farmers' Cooperative *(duplicate)* 16. Thung Song Settlement Cooperative 17. Ban Khlong Yai Phatthana Rubber Plantation Fund Cooperative Limited 18. Ban Khuan Mo Thong Land Reform Area Rubber Plantation Fund Cooperative Limited	
Sustainable Performance	SUS1: The cooperative is able to sustain revenue generation, financial stability, and cost competitiveness over the long term. SUS2: The cooperative is able to ensure income stability and fair member benefits while continuously promoting member participation and engagement. SUS3: The cooperative is able to maintain long-term organizational continuity, gain the trust of stakeholders, and adapt its policies and management practices to future changes.	1. Nam Chan Samakkhi Rubber Farmers' Cooperative 2. Khlong Chang Rubber Farmers' Cooperative 3. Nong Khla Rubber Farmers' Cooperative 4. Nong Khrok Rubber Farmers' Cooperative 5. Yan Ta Khao Agricultural Cooperative 6. Ban Nong Srichan Rubber Farmers' Cooperative	**Economic Dimension** WCED (1987); Hourneaux Jr. (2018); Lin et al. (2024); Tseng et al. (2020); Ortiz-de-Mandojana & Bansal (2016) **Social Dimension** WCED (1987); Tseng et al. (2020); Hourneaux Jr. (2018); Ciasullo et al. (2024) **Institutional Dimension** WCED (1987); Duchek (2020); Ciasullo et al. (2024); Lin et al. (2024)

		7. Phuang Phromkhra Agricultural Cooperative 8. Sai Krut Rubber Farmers' Cooperative 9. Sot Pracha Rubber Farmers' Cooperative 10. Song Phi Nong Khlong Sila Rubber Farmers' Cooperative 11. Thung Song Settlement Cooperative 12. Ban Khuan Mo Thong Land Reform Area Rubber Plantation Fund Cooperative Limited	

Source: Author's own work.

Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a statistical technique originally developed by Sewall Wright (1921) and Trygve Haavelmo (1943), and later elaborated by Herbert A. Simon (1953), to examine causal relationships among variables. SEM integrates three major analytical approaches:

(1) Factor analysis, which examines the relationships between observed variables and latent constructs, including both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA);

(2) Path analysis, which identifies direct, indirect, and total effects among variables; and

(3) Multiple regression analysis, which predicts dependent variables based on independent variables. Model fit was assessed using multiple goodness-of-fit indices, including χ^2 ($p > .05$, $\chi^2/df < 2.00$), GFI and AGFI $\geq .90$, RMSEA and SRMR $< .08$, NFI, IFI, CFI, and TLI $\geq .90$, and PNFI and PGFI $> .50$ (Hair et al., 2019). In addition, the SEM assumptions require linear relationships, absence of multicollinearity among variables, and a minimum sample size of 200 observations to ensure reliable estimation results.

Research Results

The sample consisted of 600 respondents with complete data and no missing values. The majority of respondents were male (75.0%), while females accounted for 25.0%. Most respondents were aged between 41 and 60 years (70.1%), with the largest proportion in the 51–60 age group (29.9%). Descriptive statistics indicated that respondents perceived the study variables at a relatively high level. Quality management ($M = 4.45$, $SD = 0.46$) and cost and process efficiency ($M = 4.44$, $SD = 0.42$) exhibited the highest mean scores, whereas organizational resilience showed the lowest mean ($M = 3.43$), although still above the scale midpoint. Data distribution met normality assumptions, with skewness values ranging from 0.994 to 0.058 and kurtosis values ranging from 0.935 to 1.306. Median values were close to the means, indicating symmetrical distributions and suitability for advanced statistical analysis.

Exploratory Factor Analysis (EFA)

Exploratory factor analysis was conducted using Principal Axis Factoring (PAF) as the extraction method. The number of factors was determined based on eigenvalues greater than 1, in conjunction with scree plot examination. Factor rotation was performed using the Promax oblique rotation method. Factors with loadings of 0.40 or higher were retained (Stevens, 1999), and each factor was required to have at least three indicators to satisfy Kaiser's (1974) three-indicator rule.The results showed that the quality management construct had a Kaiser–Meyer–Olkin (KMO) value of .838, with Bartlett's test of sphericity = 1084.065 ($p < .001$), indicating sampling adequacy. A single factor was extracted, explaining 42.99% of the total variance. For cost and process efficiency, the KMO value was .711 and Bartlett's test = 765.731 ($p < .001$), yielding one dominant factor that explained 46.30% of the variance. The organizational resilience construct demonstrated a KMO value of .830, with Bartlett's test = 7380.061 ($p < .001$). One factor emerged, accounting for 59.29% of the variance. Similarly, sustainable performance exhibited a KMO value of .861 and Bartlett's test = 2552.930 ($p < .001$), with a single factor explaining 53.10% of the total variance. Overall, the EFA results indicated that the data were appropriate for subsequent confirmatory factor analysis (CFA).

Table 2 reports the results of the confirmatory factor analysis (CFA), including the standardized factor loadings.

Factor Loadings

Latent	Indicator	Std. estimate	Std. error	z-value	p	95% Confidence interval Lower	Upper
Cost & Process Efficiency	Cost3	0.664	0.042	15.97	< .001	0.583	0.746
	Cost2	0.846	0.033	25.47	< .001	0.781	0.911
	Cost1	0.763	0.031	24.53	< .001	0.702	0.823
Quality Management	Qual3	0.647	0.035	18.29	< .001	0.577	0.716
	Qual2	0.777	0.031	25.21	< .001	0.717	0.838
	Qual1	0.720	0.033	22.12	< .001	0.656	0.784
Resilience	Resi2	0.774	0.029	27.14	< .001	0.718	0.829
	Resi1	0.866	0.026	32.76	< .001	0.814	0.918
Sustainability	Sus3	0.894	0.035	25.31	< .001	0.825	0.964
	Sus2	0.991	6.328×10^{-4}	1,565.24	< .001	0.989	0.992
	Sus1	0.655	0.026	25.05	< .001	0.604	0.707

Source: Author's own work.

Note: *QUAL1: The cooperative has a quality control system for smoked rubber sheets covering latex procurement, the production process, and product delivery. QUAL2: The cooperative's smoked rubber sheet production process follows clear standards and is able to consistently maintain product quality in accordance with market grades and specifications. QUAL3: The cooperative continuously monitors, evaluates, and improves production quality when problems or customer complaints arise.*

COST1: The cooperative is able to control smoked rubber sheet production costs (e.g., energy, labor, and materials) and maintain competitive unit costs, even during periods of rubber price volatility. COST2: The cooperative's production process is characterized by low levels of loss, both in terms of production waste and unnecessary energy consumption. COST3: The cooperative continuously improves work processes to reduce production time and costs.

RESI1: The cooperative is able to anticipate fluctuations in rubber prices, costs, or external conditions and has the capability to cope and continue operations when unexpected events occur. RESI2: After experiencing problems or crises, the cooperative is able to recover to normal operations and adapt management approaches or production processes to changing circumstances.

SUS1: The cooperative is able to sustain revenue generation, financial stability, and cost competitiveness over the long term.

SUS2: The cooperative is able to ensure income stability and fair member benefits while continuously promoting member participation and engagement.

SUS3: The cooperative is able to maintain long-term organizational continuity, gain the trust of stakeholders, and adapt its policies and management practices to future changes.

Measurement Model Results

The results of the measurement model analysis, conducted to confirm the relationships between latent variables and their observed indicators, revealed that all indicators exhibited standardized factor loadings ranging from 0.647 to 0.991, all of which were statistically significant at $p < .001$. These values exceed the recommended threshold of 0.50, indicating that each indicator effectively represents its corresponding latent construct and demonstrates strong construct validity.

Discriminant Validity

To ensure that each latent construct was empirically distinct from the others, discriminant validity was assessed using the Heterotrait–Monotrait ratio (HTMT), a widely accepted criterion for evaluating construct distinctiveness. The results showed that all HTMT values were below the recommended threshold of 0.90 (Gold, Malhotra, & Segars, 2001), indicating satisfactory discriminant validity among the latent constructs. The HTMT results are presented in Table 3.

Table 3: HTMT Ratios for Assessing Discriminant Validity

Construct	**Qual**	**Cost**	**Resilience**	**Sustainability**
Quality Management	1.000			
Cost & Process Efficiency	0.742	1.000		
Resilience	0.695	0.731	1.000	
Sustainability	0.662	0.708	0.779	1.000

Source: Author's own work.

The HTMT correlation values among all constructs ranged from 0.662 to 0.779, which are below the recommended threshold of 0.85. Therefore, it can be concluded that the model demonstrates adequate discriminant validity, making it appropriate for subsequent structural equation modeling (SEM) analysis.

Assessment of Measurement Model Fit

The results of the measurement model fit assessment indicate that the model exhibits a good fit with the empirical data. The chi-square statistic (χ^2) was 133.30 with 37 degrees of freedom (df) and was statistically significant ($p < .001$), as reported in Table 4.

Model fit

				n(Parameters)		Baseline test		
	AIC	BIC	n(Observations)	Total	Free	χ^2	df	p
Model 1	7,916	8,035	450	29	29	133.3	37.00	< .001

Source: Author's own work.

Note. Fitting the model resulted in warnings. Check the 'Show warnings' box in the Output Options to see the warnings. Estimator is ML. Model test is standard. Information matrix is expected. Standard errors are standard.

With respect to incremental fit indices, the Comparative Fit Index (CFI) was 0.951 and the Tucker–Lewis Index (TLI) was 0.927, both exceeding the recommended minimum threshold of 0.90 as suggested by Hu and Bentler (1999), indicating a good model fit. Regarding absolute fit indices, the Root Mean Square Error of Approximation (RMSEA) was 0.076, with a 90% confidence interval ranging from 0.062 to 0.090, which falls within acceptable limits. The Standardized Root Mean Square Residual (SRMR) was 0.042, well below the recommended cutoff value of 0.08. In addition, the Goodness of Fit Index (GFI) was 0.950, further indicating an overall good fit of the model. Collectively, these results suggest that the measurement model fits the empirical data well and is appropriate for subsequent causal relationship testing.

Structural Equation Model Results

The results of the structural equation model analysis revealed statistically significant path coefficients representing the relationships among the variables as specified in the conceptual framework. The structural model testing results are presented in Table 5.

Table 5: Relationships among Variables in the Conceptual Framework and Structural Equation Model Results

Regression coefficients

				95% Confidence interval		
Outcome	Predictor	**Std. estimate**	Std. Error	z-value	p	Lower	Upper
Resilience	Qual	**0.472**	0.049	9.722	**< .001**	0.377	0.567
	Cost	**0.361**	0.048	7.549	**< .001**	0.267	0.454
Sustainability	Resilience	**0.344**	0.048	7.163	**< .001**	0.250	0.438
	Cost	**0.302**	0.047	6.428	**< .001**	0.210	0.394

Indirect effects

			95% Confidence interval		
	Std. estimate	Std. Error	z-value	p	Lower	Upper
Qual → Resilience → Sustainability	0.162	0.029	5.596	**< .001**	0.105	0.219
Cost → Resilience → Sustainability	0.124	0.024	5.234	**< .001**	0.078	0.170

R-Squared

	R^2
Resilience	0.465
Sustainability	0.317

Source: Author's own work.

Structural Equation Model Results

Based on Table 4, the results of the structural equation model analysis indicate that the proposed model fits the empirical data well, and all hypothesized relationships are statistically significant at the .001 level. The detailed findings are as follows. Quality management (QUAL) has a significant positive effect on organizational resilience (RES) ($\beta = 0.472$, $p < .001$). Similarly, cost and process efficiency (COST) also exerts a significant positive effect on organizational resilience ($\beta = 0.361$, $p < .001$). In addition, organizational resilience has a direct and significant effect on sustainable performance (SUS) ($\beta = 0.344$, $p < .001$). Cost and process efficiency further demonstrates a direct positive effect on sustainable performance ($\beta = 0.302$, $p < .001$). Regarding indirect effects, the results confirm that organizational resilience acts as a mediating variable between quality management and sustainable performance ($\beta = 0.162$, $p < .001$), as well as between cost and process efficiency and sustainable performance ($\beta = 0.124$, $p < .001$). The model explains 46.5% of the variance in organizational resilience ($R^2 = 0.465$) and 31.7% of the variance in sustainable performance ($R^2 = 0.317$), indicating a moderate to high explanatory power for the proposed causal relationships. The results of the structural model are illustrated in Figure 2.

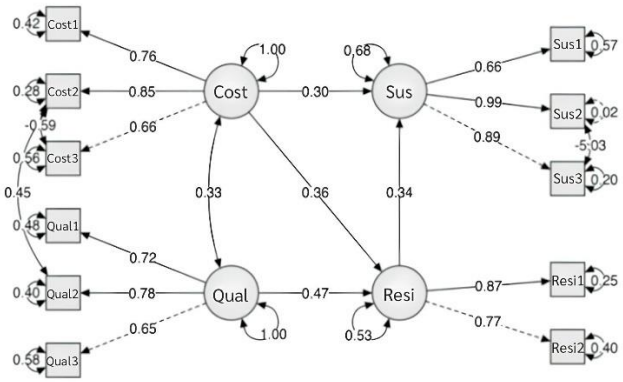

Figure 2: Results of the Structural Equation Model (SEM)
Source: Author's own work.

Based on the above analytical results, the research findings can be presented to address the research hypotheses, as shown in Table 6.

Table 6: Summary of Hypothesis Testing Results

Order	Hypothesis	Test Results
Hypothesis 1:	Quality management has a significant effect on organizational resilience.	Consistent with the hypothesis
Hypothesis 2:	Cost and process efficiency has a significant effect on organizational resilience.	Consistent with the hypothesis
Hypothesis 3:	Organizational resilience has a significant effect on sustainable performance.	Consistent with the hypothesis
Hypothesis 4:	Quality management has an indirect effect on sustainable performance through organizational resilience.	Consistent with the hypothesis
Hypothesis 5:	Cost and process efficiency has an indirect effect on sustainable performance through organizational resilience.	Consistent with the hypothesis

Source: Author's own work.

DISCUSSION OF RESEARCH FINDINGS

The findings of this study clearly demonstrate that quality management (QUAL) and cost and process efficiency (COST) are critical operational capabilities that play a significant role in strengthening organizational resilience (RES) among smoked rubber sheet cooperatives. These results are consistent with the Resource-Based View (RBV), which posits that valuable and difficult-to-imitate internal resources and management systems constitute the foundation of long-term organizational performance (Barney, 1991). However, the findings further indicate that, within the highly volatile rubber market context, these operational capabilities contribute to sustainability only when they are developed and deployed through the lens of Dynamic Capabilities Theory, which emphasizes an organization's ability to anticipate, cope with, and adapt to environmental change (Teece et al., 1997;

Teece, 2007). The structural equation model results reveal that quality management exerts a strong positive effect on organizational resilience (β = 0.472). The quality-related indicators suggest that the cooperative's ability to control quality throughout the entire value chain—from latex procurement and production processes to product delivery (QUAL1), the establishment of clear production standards and consistent compliance with market grades and specifications (QUAL2), and continuous monitoring, evaluation, and improvement of quality in response to problems or customer complaints (QUAL3) collectively reduce process variability and operational risk. These capabilities enhance the cooperative's capacity to cope effectively with unexpected events. This finding aligns with the quality management principles proposed by Deming (1986) and Juran (1988), as well as prior empirical studies highlighting quality systems as a foundational element of organizational resilience (Flynn et al., 1994; Zu et al., 2008; Duchek, 2020). Similarly, cost and process efficiency exhibits a significant positive effect on organizational resilience (β = 0.361). The indicators reflect the cooperative's ability to control production costs and maintain competitive unit costs even during periods of rubber price volatility (COST1), reduce losses related to production waste and unnecessary energy consumption (COST2), and continuously improve work processes to reduce production time and costs (COST3). These capabilities enhance resource flexibility and enable cooperatives to better absorb pressures arising from energy costs and market fluctuations. This finding is consistent with the literature on lean management and supply chain resilience, which emphasizes process efficiency as a key foundation of organizational coping and recovery capacity (Scholten & Schilder, 2015; Ivanov & Dolgui, 2020; Tortorella et al., 2024). The results further confirm that organizational resilience has a direct and significant effect on sustainable performance (β = 0.344) and functions as a mediating variable between operational capabilities and long-term outcomes. The resilience indicators capture both the ability to anticipate and cope with fluctuations in rubber prices, costs, and external conditions (RESI1), as well as the ability to recover and adapt management approaches or production processes following crises (RESI2). In this regard, organizational resilience operates as a process-based mechanism that transforms quality management and cost and process efficiency into sustainable performance across economic (SUS1), social and member-related (SUS2), and institutional and organizational continuity (SUS3) dimensions. These findings are consistent with the conceptualizations of organizational resilience proposed by Duchek (2020) and Ciasullo et al. (2024). Considering the explained variance values, the model accounts for 46.5% of the variance in organizational resilience (R^2 = 0.465) and 31.7% of the variance in sustainable performance (R^2 = 0.317), indicating a moderate to high level of explanatory power. These results underscore that the sustainability of smoked rubber sheet cooperatives does not stem solely from external factors but is strongly dependent on the development of internal operational capabilities and organizational resilience. Consequently, this study contributes to filling an important empirical gap in the organizational resilience literature within the context of agricultural cooperatives, where prior research has predominantly emphasized social capital or governance rather than operational mechanisms. Beyond direct effects, the mediation analysis further demonstrates that organizational resilience mediates the relationships between quality management and sustainable performance, as well as between cost and process efficiency and sustainable performance. This finding suggests that operational capabilities alone do not automatically lead to sustainability; instead, their effects must be channeled through the organization's capacity to anticipate, cope with, and adapt to uncertainty. These results support the arguments of Duchek (2020) and Ciasullo et al. (2024), who conceptualize resilience as a process-based capability that links internal resources to long-term outcomes. Moreover, the findings extend both RBV and Dynamic Capabilities Theory by providing empirical evidence that operational resources and efficiency contribute to sustainability only when organizations possess systematic resilience capabilities that enable effective responses to environmental uncertainty.

CONCLUSION

This study aimed to examine the factors influencing the sustainable performance of smoked rubber sheet producer cooperatives in Southern Thailand, with particular emphasis on the mediating role of organizational resilience between quality management and cost and process efficiency and sustainable performance. The research was grounded in the Resource-Based View (RBV) and Dynamic Capabilities Theory. The empirical findings confirm that quality management and cost and process efficiency are critical operational capabilities that significantly contribute to strengthening organizational resilience in smoked rubber sheet cooperatives. Moreover, organizational resilience exerts both direct and indirect effects on the long-term sustainable performance of cooperatives, allowing sustainability outcomes to be clearly explained across multiple dimensions. From an economic perspective, the results indicate that systematic quality management and effective control of production costs and processes enable cooperatives to maintain revenue generation, financial stability, and cost competitiveness over time, even under conditions of rubber price volatility, rising energy costs, and global market uncertainty. Organizational resilience functions as a key mechanism that allows cooperatives to absorb economic

shocks and adjust their operations to sustain financial stability in the long term. From a social and member-related perspective, the findings demonstrate that cooperative sustainability extends beyond financial performance to encompass income stability, fair member benefits, and sustained member participation and engagement. Organizational resilience enhances the cooperative's ability to fulfill its role as a community-based economic institution and to mitigate adverse impacts on members during periods of crisis. From an institutional and organizational continuity perspective, the results highlight that organizational resilience strengthens a cooperative's capacity for long-term survival, enhances credibility among stakeholders, and increases adaptability in terms of policies and management practices in response to future changes. Cooperatives with robust internal management systems and high levels of resilience are better positioned to reconfigure their structures, processes, and strategies in alignment with a changing environment. The analysis of indirect effects further confirms that organizational resilience serves as a crucial mediating mechanism through which quality management and cost and process efficiency are translated into sustainable performance across all dimensions. This finding underscores that operational capabilities alone are insufficient to achieve sustainability if organizations lack the capacity to anticipate, cope with, and recover from or adapt to systemic uncertainty.

In conclusion, this study demonstrates that the sustainability of smoked rubber sheet cooperatives is the result of integrating operational capabilities with organizational resilience as a process-based mechanism that links internal resources to long-term economic, social, and institutional outcomes. The findings contribute to filling an important knowledge gap in the organizational resilience literature within the context of agri-processing cooperatives and provide a valuable foundation for the formulation of policy and practical strategies aimed at enhancing the sustainability of rubber cooperatives under conditions of systemic uncertainty.

RECOMMENDATIONS

1. **Policy Implications**
   Public authorities should formulate policies that promote cooperative development by strengthening quality control systems throughout the entire production chain (QUAL1–QUAL3) and supporting improvements in cost and process efficiency (COST1–COST3), alongside the development of organizational capabilities related to anticipation and recovery (RESI1–RESI2). Such policy initiatives would enhance cooperatives' capacity to maintain income stability, member security, and long-term organizational survival across economic, social, and institutional dimensions (SUS1–SUS3).
2. **Practical Implications**
   Cooperative managers should utilize data related to quality, costs, and operational processes as a foundation for strategic decision-making, while also developing risk early-warning systems and organizational recovery plans. These practices would enable cooperatives to respond more effectively to rubber price volatility and rising energy costs, thereby sustaining competitiveness, strengthening member engagement, and enhancing organizational credibility over the long term.
3. **Academic Implications**
   Future research should extend the testing of the proposed model to different contexts and further refine measurement instruments that more comprehensively capture dimensions of anticipation, recovery, and long-term sustainable performance. In addition, integrating variables related to digitalization, technological capability, and governance would advance systematic research on organizational resilience in cooperative settings.

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