

A Conceptual Framework for Studying the Relationship between the Total Quality Management and Food Safety Management on the Organizational Performance in the Thai Food Industry

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ABSTRACT

The integration of Total Quality Management (TQM) and Food Safety Management (FSM) has become essential for enhancing the operational performance and ensuring the product quality in the Thai food industry. This study proposes and validates a conceptual framework linking key TQM and FSM practices to organizational performance. Data were gathered from 304 ISO 9001 and ISO 22000-certified companies across multiple sectors, using structured questionnaires and stratified random sampling. Structural Equation Modeling (SEM) was applied to examine both the direct and indirect effects. The results demonstrate that TQM significantly influences both the FSM practices and organizational performance, while FSM also exerts a positive mediating effect. Significant barriers identified include the limited knowledge, insufficient commitment, and a lack of internal training. These findings highlight the strategic importance of integrated management systems for improving the quality, compliance, and competitive advantage in the food sector.

Keywords-total quality management; food safety management; firm performance; conceptual framework

I. INTRODUCTION

Culinary SMEs play an essential role in the Thailand economy because they absorb labor, increase income, and meet the community's consumption needs. However, they also face challenges in maintaining the product quality and food safety, which are essential aspects in gaining the customer trust and satisfaction [1]. The product quality and food safety are closely related to the management applied by the culinary SMEs. One management concept that is widely used and has been proven effective in improving the product quality is TQM. The latter is a comprehensive and integrated approach that involves all organizational components required to achieve the quality goals [2]. FSM is also an important aspect to ensure that the food products are safe and suitable for consumption. FSM includes the planning, implementation, monitoring, and evaluation of procedures related to food safety [3-5]. It has been shown that the implementation of TQM and FSM in SMEs can provide many benefits, such as increasing customer

satisfaction, reducing risk, improving performance, and increasing competitiveness [6, 7]. However, in practice, the implementation of TQM and FSM in culinary SMEs often encounters obstacles, such as a lack of understanding, skills, commitment, and support from the related parties [7, 8]. Based on these problems, this research aims to analyze the implementation of TQM and FSM in culinary SMEs in Makassar City, as well as the supporting and inhibiting factors in their implementation.

II. CONCEPTUAL FRAMEWORK

A. Total Quality Management

Many businesses adopt TQM as a key approach to quality improvement and commercial success; however, its implementation is not always successful. TQM is a comprehensive management method deployed to achieve total customer satisfaction at every level of the organization. It enables companies to operate more effectively and enhance

their competitiveness [7, 13]. The former constitutes an enhancement of the traditional business practices and is considered a proven technique for ensuring the organizational survival in a highly competitive global market [14].

TQM offers a wide range of benefits, including improved quality and reduced rework, enhanced processes and services, greater customer satisfaction, increased employee involvement, higher productivity, lower costs associated with poor quality, and strengthened organizational performance and competitive advantage [15–17]. TQM and the key practices required for its successful implementation in organizations have been examined [18–20]. Many studies have focused on identifying the critical success factors of TQM and their relationship with the firm performance. However, the findings remain inconclusive due to the varying definitions and dimensions of TQM, as well as the differences in the considered social and technical aspects [7]. The TQM critical success factors comprise management values, principles, practices, and

techniques necessary to yield the desired effects on organizational performance. These studies provide different sets of quality practices crucial for successful TQM implementation, leading to an inconclusive approach regarding its implementation. Although several quality award models exist, including the Malcolm Baldrige National Quality Award, Thailand Quality Award, and Deming Prize [21–23], they provide a valuable benchmark framework for industries, aiding in TQM implementation and evaluating the firm performance results. This study reviewed 39 TQM-related articles published between 2003 and 2024, sourced from six academic databases. A total of 34 factors were identified from the TQM literature, as presented in Tables I and II and Figure 2. This study identified seven important TQM factors that affect the firm performance: Leadership, Customer Focus, Process Management, People Management, Information and Analysis, Strategic Planning, and Continuous Improvement, respectively, as shown in Table III.

TABLE I. CRITICAL FACTORS IDENTIFIED FROM TQM LITERATURE REVIEW

No	TQM factors identified from TQM literature	No	TQM factors identified from TQM literature
1	Leadership (management leadership)	18	Quality assurance
2	Customer focus	19	Project design
3	Process management	20	Product/service design
4	People management (employee relation and management, HR focus)	21	Technology management (tool)
5	Information and analysis	22	Product innovation
6	Strategy management (strategic planning)	23	System approach
7	Continuous improvement	24	Process improvement
8	Education and training (training)	25	Process innovation
9	Supplier quality management	26	Development of customers and market
10	Planning management and improvement of human resources	27	Human resource and knowledge management
11	Employee involvement	28	Operation performance (operation focus)
12	Quality data and reporting	29	Knowledge sharing/ management
13	Product quality (designing quality into the product)	30	Factual approach
14	Quality management	31	Customer satisfaction
15	Research and development	32	Supplier involvement
16	Process approach	33	Process and data quality management
17	Benchmarking	34	Reward and recognition

TABLE II. SUMMARY OF CRITICAL FACTORS IDENTIFIED FROM TQM LITERATURE

Factor	Citations																																Frequency										
	[2]	[3]	[5]	[9]	[10]	[11]	[15]	[18]	[20]	[21]	[22]	[23]	[25]	[26]	[27]	[28]	[29]	[30]	[31]	[32]	[33]	[34]	[35]	[36]	[37]	[38]	[39]	[40]	[41]	[42]	[43]	[44]		[45]	[46]	[47]	[48]	[49]	[50]	[2]			
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	35		
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	30	
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	19
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	16
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	12
8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9
10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	7
12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	6
13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	4
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	4
15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3
16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3

and verification mechanisms, further complicate implementation [17, 53]. Conversely, motivations for adopting HACCP include the regulatory compliance, quality assurance, economic benefits, legal obligations, and corporate reputation. Additional drivers involve the desire to improve the product quality, access the foreign markets, reduce waste, increase the profits, and achieve third-party certifications [54, 55]. Key effectiveness factors for monitoring food safety management in the food industry were identified and are summarized in Table IV. In this study, six food safety management factors were selected for use: Hazard Identification, Hazard Assessment, Hazard Control, GMP, HACCP Team, and HACCP Knowledge. GMP is a foundational hygiene standard essential for food safety. It ensures that the products are consistently produced and controlled following quality standards, minimizing the risk of contamination, and protecting the consumer health [12, 56]. HACCP plays a vital role in identifying and managing critical control points in food production, addressing biological, chemical, and physical hazards throughout the supply chain. Implementing a risk-based approach helps prioritize inspections and control measures based on the likelihood and severity of the risks, thereby optimizing the resource allocation. Employee knowledge, involvement, and commitment are also critical to the successful implementation of food safety systems. Well-trained and motivated employees play a significant role in maintaining the food safety standards and ensuring consistent compliance across the organization [12, 56, 57].

C. Firm Performance Measurement

Firm performance is considered a multidimensional construct, dealing with the quality of an organization's outcomes. It serves as an indicator of how effectively a firm achieves its objectives [18]. Firm performance indicators are models or tools used to measure the outcomes or evaluate the operations across various organizational areas. These indicators typically present the results in the form of quantitative data and are used to demonstrate both the efficiency and effectiveness of an organization's operations [24, 31, 59]. Tools and methods have been proposed to measure the firm performance using sub-dimensions, such as financial performance, non-financial performance, innovation performance, and product or service quality performance. A review of previous studies has been conducted to determine the positive, negative, or non-

significant relationships between the TQM practices and various performance measures, as well as between the FSM systems and firm performance. The most significant outcome of effectively combining TQM and food safety systems is the overall improvement of the organizational performance [8]. This section presents an overview of various performance measurement indicators. A comprehensive review of studies on TQM and FSM systems regarding the firm performance suggests the existence of diverse performance measurement indicators [4, 18, 20, 34, 50, 60]. These indicators are summarized in Table V and Figure 2. Additional indicators identified in previous studies are shown in Table VI. Based on Tables V and VI, this study selected three dominant performance indicators: Financial Performance, Product Quality, and Operational Performance.

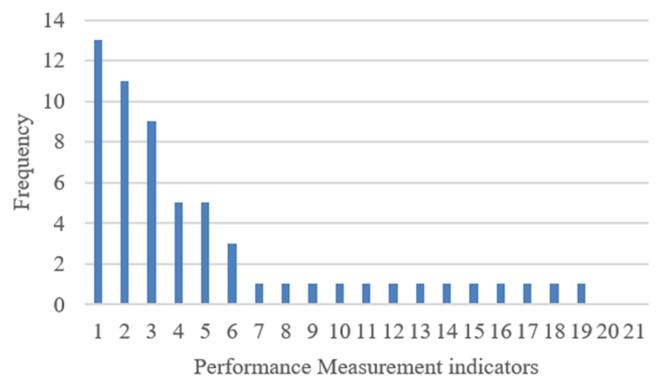


Fig. 2. Frequency of performance measurement indicators.

D. Proposed Research Model

A conceptual framework is developed and a research model is proposed to explore the relationship between the key variables of the TQM practice and FSM on a firm's performance by measuring multiple performance indicators. The proposed conceptual framework is displayed in Figure 3. The TQM and FSM practices act as independent variables. The measurement of the organizational performance is the dependent variable.

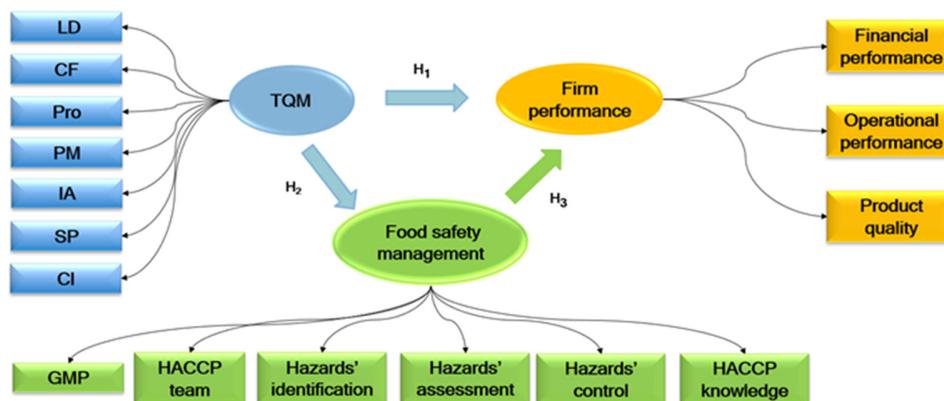


Fig. 3. Conceptual framework of the relationship between TQM and FSM on organizational performance for this study.

TABLE IV. LITERATURE REVIEW ON FACTOR EFFECTIVENESS OF FOOD SAFETY MANAGEMENT

Citations	Factor in the effectiveness of FSM																					
	HACCP team	Prevention of nonconformities	Hazard identification	Hazard assessment	Hazardscontrol	HACCP knowledge	GMP	External environment	Organization attributes	Employee attributes	System requirements	Continuous improvement	Prevention of nonconformities	Customer satisfaction focus	Management	Man	Environment	Material-relate	Method	Machine	Raw material	
Citations			✓	✓	✓																	
Citations		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓								
Citations							✓								✓	✓	✓	✓	✓	✓	✓	✓
Citations	✓		✓	✓	✓	✓																
Citations	1	1	3	3	3	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

TABLE V. LITERATURE REVIEW OF PERFORMANCE MEASUREMENT INDICATORS

Factors	Citations																			Frequency					
	[2]	[4]	[9]	[11]	[18]	[20]	[24]	[25]	[29]	[31]	[34]	[44]	[47]	[48]	[59]	[60]	[61]	[62]	[63]		[64]	[65]	[66]	[67]	[68]
1		✓	✓		✓	✓			✓					✓		✓		✓		✓	✓	✓	✓	✓	13
2	✓	✓				✓	✓	✓		✓		✓			✓		✓	✓	✓	✓					11
3		✓	✓	✓							✓			✓	✓			✓	✓	✓					9
4		✓			✓											✓			✓	✓			✓		5
5		✓			✓			✓							✓			✓							5
6		✓					✓		✓																3
7		✓				✓																			1
8							✓																		1
9							✓																		1
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11					✓																				1
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13															✓										1
14																			✓						1
15		✓																							1
16																								✓	1
17												✓													1
18												✓													1
19								✓																	1

TABLE VI. PERFORMANCE MEASUREMENT INDICATORS IN THE LITERATURE

No.	Performance measurement indicators	No.	Performance measurement indicators
1	Financial and market performance (financial performance, financial and market outcome, return on investment, market performance)	11	Leadership and governance outcomes
2	Product quality (quality performance)	12	Internal business process performance
3	Operational performance	13	Learning and growth performance
4	Employee performance (workforce-focused outcomes)	14	Customer retention
5	Customer service (customer-focused outcomes, customer performance, customer satisfaction)	15	Society result
6	Innovation performance	16	Return on equity
7	Inventory management performance	17	Satisfaction result
8	Product innovation	18	Business result
9	Process innovation	19	Employee moral
10	Product and process outcomes		

The hypotheses from the conceptual framework are:

- Null hypothesis
 Ho: There is no significant relationship between the TQM practices and FSM affecting the aggregate organizational performance.
- Alternate hypothesis
 H1: There is a significant positive relationship between the key factors of the TQM practices and aggregate firm performance of Thai food industries.
 H2: The key factors of the TQM practices have a direct effect on the aggregate FSM.
 H3: The key factors of FSM have a direct effect on the firm's performance.

E. Research Methodology and Data Collection

The Thai food industry comprises both semi-processed products (e.g., meat, poultry, and fishery) and advanced processed goods, including canned, frozen, sugar-based, and flour-based products. According to the Federation of Thai Industries, 1,127 companies are registered in this sector [69]. This study focuses on firms certified under ISO 9001 and/or ISO 22000 standards, following the guidelines provided in [70].

A structured questionnaire was developed to ensure the data quality and instrument reliability. The content validity was confirmed through an Item-Objective Congruence (IOC) assessment, yielding a score of 0.97. A pilot study with 30 respondents (n = 30) produced a Cronbach's alpha coefficient of 0.896, indicating high internal consistency.

A total of 304 companies were selected using stratified random sampling, with proportional allocation applied to reflect the structure of the target population (Table VII) [71]. A quantitative, survey-based approach was employed, targeting senior personnel, including plant managers, quality managers, production managers, R&D managers, and sales executives. Data collection was conducted over a three-month period via both online and printed questionnaires.

TABLE VII. SAMPLE SIZE ALLOCATION

Industry Group	Population	Samples
Canned food industry	233	63
Frozen food industry	230	62
Seafood industry	143	39
Meat and poultry industry	106	29
Sugar industry	105	28
Flour industry	310	83
Total	1,127	304

III. DATA ANALYSIS

The data were analyzed using SEM with LISREL 8.80. SEM is a powerful multivariate statistical technique used to analyze the complex relationships between the observed (measured) and unobserved (latent) variables. It combines the elements of factor analysis and multiple regression, allowing researchers to test hypotheses about the direct and indirect

relationships among variables within a single, comprehensive model. Prior to conducting SEM, an analysis of the correlation coefficients was performed to evaluate the linear relationships among the observed variables related to TQM, FSM, and organizational performance. Spearman rank correlation coefficients were calculated to determine the strength and direction of associations. Four observed variables (FSM3, FSM4, FSM5, FSM6) were removed to improve the model parsimony.

Confirmatory Factor Analysis (CFA) was conducted to evaluate the validity and reliability of the measurement model. The CFA of TQM obtained Chi-Square (χ^2) = 0.08, df = 3, p = 0.99385, RMSEA = 0.000, GFI = 1.00, AGFI = 1.00, indicating that the TQM measurement model was consistent with the empirical data. In terms of the food safety management, the Chi-Square (χ^2) = 0.21, df = 1, p = 0.64923, RMSEA = 0.000, GFI = 1.00, AGFI = 1.00 showed that the FSM measurement model was consistent with the empirical data. Similarly, the organizational—performance aspect indicates that the PER measurement model has a good fit with the empirical data consisting of Chi-Square (χ^2) = 0.66, df = 1, p = 0.41534, RMSEA = 0.000, GFI = 1.00, and AGFI = 0.99.

The hypothesized paths between the TQM, FSM, and organizational performance were tested. The proposed model was adjusted and demonstrated an excellent fit with the empirical data, with model fit indices of: χ^2 = 5.20, df = 12, χ^2 /df = 0.433, CFI = 1.00, GFI = 1.00, AGFI = 0.98, RMSEA = 0.000, and SRMR = 0.0066. The results indicated that TQM had a statistically significant direct positive influence on both the FSM (β = 0.77, p < 0.01) and organizational performance (β = 0.67, p < 0.01), along with a significant indirect influence on the performance mediated by FSM (β = 0.10, p < 0.01). Furthermore, FSM exerted a statistically significant direct positive effect on the organizational performance (β = 0.14, p < 0.01).

After performing the above tests to confirm or refute the hypotheses presented earlier, overall, the Null hypothesis H0 is rejected, and the Alternate hypotheses (H1, H2, H3) are supported, as illustrated in Table VIII.

TABLE VIII. RESULTS OF THE RESEARCH HYPOTHESES

Relationship	p-value	Hypothesis test results
H0: No significant relationship between TQM FSM and Organizational Performance	0.95107	Reject hypothesis
H1: TQM = Organizational Performance		Accept hypothesis
H2: TQM = FSM		Accept hypothesis
H3: FSM = Organizational Performance		Accept hypothesis

IV. DISCUSSION AND CONCLUSION

This study investigated the relationships between the Total Quality Management (TQM), Food Safety Management (FSM), and organizational performance within the Thai food

industry using Structural Equation Modeling (SEM). The findings provide empirical evidence that both the TQM and FSM practices have significant positive effects on the organizational performance, particularly in terms of the financial outcomes, product quality, and operational efficiency [3, 10, 11, 18, 44]. Furthermore, the results confirm that TQM has a direct influence on FSM implementation, highlighting the complementary nature of these management systems. Ensuring food security is crucial for maintaining the food quality and enhancing the consumer services by guaranteeing both safety and satisfaction [16, 27, 53, 62].

It was also revealed that FSM partially mediates the relationship between the TQM and organizational performance, suggesting that the integration of food safety practices enhances the overall effectiveness of the quality management initiatives. These findings emphasize the importance of aligning the quality improvement efforts with food safety strategies to strengthen the competitiveness and regulatory compliance in the Thai food sector [12, 45, 49, 50, 72].

From a practical perspective, this research provides valuable insights for managers and policymakers aiming to enhance the firm performance through systematic quality and safety management. The results underscore the need for leadership commitment, continuous improvement, and employee involvement to ensure the successful integration of TQM and FSM [18, 25, 29, 47, 73].

Future research is proposed to validate the introduced model in other sectors of the food industry and across different national contexts, to further generalize the obtained findings. Additionally, longitudinal studies could provide deeper insights into the long-term effects of TQM and FSM on the organizational sustainability and competitive advantage.

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