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Causal factors affecting quality improvement and ISO 9001 practices of industrial factories in the central region of Thailand

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Abstract: Many industrial factories in the Central Region of Thailand face challenges in maintaining competitiveness, adapting to rapidly changing business environments, and implementing ISO 9001 quality management practices effectively. These challenges are compounded by inadequate knowledge management, limited knowledge sharing, and insufficient employee competency development, which may reduce operational efficiency and hinder continuous quality improvement. Therefore, strengthening organizational capabilities through effective human resource management and total quality management (TQM) is essential for enhancing organizational effectiveness. This research aimed to: (1) examine the causal relationships among entrepreneurial orientation, business environment, knowledge management, total quality management, and organizational effectiveness; (2) investigate the influence of total quality management on organizational effectiveness; and (3) develop a causal model of total quality management affecting organizational effectiveness. Data were collected through interviews and online questionnaires from industrial factories in the Central Region of Thailand between February and April 2026, yielding 560 valid responses. The results indicated that entrepreneurial orientation, business environment, and knowledge management each had significant positive effects on total quality management and indirectly enhanced organizational effectiveness through total quality management. In addition, total quality management exerted a significant direct positive effect on organizational effectiveness. The findings highlight the importance of employee training and competency development, knowledge sharing, employee participation, and continuous quality improvement in strengthening TQM implementation and organizational effectiveness. The proposed causal model provides practical guidance for managers and human resource practitioners in developing employee capabilities, fostering knowledge sharing, and supporting effective quality management practices in industrial organizations.

Keywords: Entrepreneurial Orientation; Business Environment; Knowledge Management; Quality Improvement; ISO 9001 (ISO 9001 Practices)

1. Introduction

1.1 Background and Importance of the Problem

In today's highly competitive business environment, organizations face increasing uncertainty arising from globalization, digital transformation, technological advancement, and rapidly changing customer expectations. The emergence of Industry 4.0 technologies, artificial intelligence, big data analytics, and interconnected supply chains has transformed manufacturing operations and increased the need for organizations to improve operational

efficiency, product quality, and organizational responsiveness. Consequently, quality management has evolved from a traditional inspection-oriented approach into a strategic management philosophy emphasizing continuous improvement, customer satisfaction, process optimization, and organizational excellence [7]; [4]. Among the various quality management frameworks, the ISO 9001 Quality Management System is internationally recognized as one of the most widely adopted standards for establishing systematic quality management practices. ISO 9001 provides a structured framework emphasizing customer focus, leadership, employee engagement, process management, evidence-based decision-making, relationship management, and continual improvement through the Plan–Do–Check–Act (PDCA) cycle [11]. Organizations implementing ISO 9001 have reported improvements in operational efficiency, customer satisfaction, process consistency, and organizational competitiveness [7]. According to the ISO Survey, more than one million organizations worldwide have obtained ISO 9001 certification, demonstrating the continuing importance of ISO 9001 as an international benchmark for quality management.

However, effective implementation of ISO 9001 requires more than standardized procedures, documented processes, and formal certification. The effectiveness of a quality management system depends substantially on organizational capabilities and the people who develop, implement, and continuously improve organizational processes. From a human resource management (HRM) perspective, employee competencies, training and development, knowledge sharing, employee empowerment, participation, organizational learning, and leadership commitment are important mechanisms for translating quality management principles into actual organizational practices. Employees who possess appropriate knowledge and competencies are better able to understand quality requirements, identify process problems, participate in problem-solving, and contribute to continuous improvement. Similarly, knowledge-sharing practices enable employees to exchange experiences and organizational knowledge, while employee participation and empowerment encourage greater involvement in quality-related decision-making and improvement activities. Therefore, the successful implementation of quality management systems should be understood not only as a technical or procedural issue but also as an organizational and human resource capability.

This perspective can be explained through Systems Theory, which views an organization as an interconnected system in which different components interact to achieve common organizational goals. Within this perspective, entrepreneurial orientation, the business environment, knowledge management, employees, organizational processes, and quality management practices can be considered interrelated components of the organizational system. Changes in one component may influence the functioning and effectiveness of other components. In particular, organizational capabilities can provide the resources and conditions necessary for improving organizational processes, while quality improvement represents an important mechanism through which these capabilities are translated into effective quality management practices. The PDCA cycle provides a complementary mechanism for explaining how organizations can continuously plan, implement, evaluate, and improve their processes. Thus, Systems Theory provides the overarching perspective for understanding the relationships among organizational capabilities, quality improvement, and ISO 9001 practices, while the PDCA cycle explains the continuous improvement mechanism through which these relationships can be operationalized.

In Thailand, the manufacturing sector is an important contributor to economic growth, exports, and employment, particularly among industrial factories located in the Central Region. These organizations play an

important role in domestic and global supply chains while facing increasing challenges associated with technological disruption, rising production costs, labor shortages, environmental regulations, and intensified international competition. In response to these challenges, many industrial factories have adopted ISO 9001 as a framework for improving operational performance, maintaining process consistency, and strengthening competitiveness. Nevertheless, sustaining quality improvement and effectively complying with ISO 9001 requirements remain challenging for many organizations. Previous research indicates that difficulties in quality management implementation may be associated with inadequate organizational learning, ineffective knowledge sharing, insufficient employee competency development, weak managerial support, and limited employee participation in quality improvement initiatives [16]. These challenges demonstrate that effective quality management requires not only formal systems and procedures but also the development and effective management of human and organizational capabilities.

Among these capabilities, entrepreneurial orientation can encourage organizations to pursue innovation, proactive decision-making, risk-taking, and strategic responsiveness to changes in the business environment. Such characteristics can help organizations identify opportunities for process improvement and respond proactively to emerging customer and market requirements. The business environment also influences organizational decisions by creating pressures and opportunities arising from market competition, technological advancement, customer expectations, regulatory requirements, and other external changes. Organizations that effectively recognize and respond to environmental conditions are more likely to adapt their processes and quality practices to changing requirements. Knowledge management, meanwhile, supports organizational learning by facilitating the creation, acquisition, sharing, storage, and application of organizational knowledge. Effective knowledge management can strengthen employee capabilities, facilitate the dissemination of quality-related knowledge, support problem-solving, and improve organizational performance [1]; [15]; [14]. Collectively, these organizational capabilities can provide the foundation for quality improvement and contribute to the effective implementation of ISO 9001 practices.

From an HRM perspective, the relationships among these variables are particularly important because employees are the primary actors who convert organizational capabilities into operational practices. Entrepreneurial orientation may encourage employees to propose innovative solutions and proactively address quality problems. Changes in the business environment may require organizations to provide employees with appropriate training and competency development to respond effectively to new technologies, customer requirements, and regulatory conditions. Knowledge management can facilitate knowledge sharing, organizational learning, and the development of employee competencies. Quality improvement can therefore emerge from the interaction between organizational capabilities and employee participation in continuous improvement activities. This connection highlights the role of HRM in supporting quality management through employee development, knowledge sharing, empowerment, performance management, and participation.

Although previous studies have examined entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 implementation, relatively few studies have integrated these variables into a comprehensive causal model in the context of industrial factories in Thailand. Furthermore, existing research has tended to emphasize quality management systems and organizational processes, while providing comparatively limited attention to the HRM mechanisms through which employee knowledge

development, competency development, knowledge sharing, organizational learning, empowerment, and employee participation contribute to quality improvement and ISO 9001 practices. Consequently, an important theoretical and empirical gap remains concerning how organizational capabilities and HRM-related mechanisms interact within an integrated quality management system. Addressing this gap is particularly important for industrial factories operating in a rapidly changing environment, where the effectiveness of ISO 9001 practices depends not only on formal procedures but also on employees' ability and willingness to participate in continuous improvement.

Therefore, this study investigates the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices in industrial factories located in the Central Region of Thailand. Specifically, the study develops and validates a causal model explaining how organizational capabilities contribute to quality improvement and how quality improvement subsequently contributes to ISO 9001 practices. By integrating an organizational capability perspective with HRM considerations and a quality improvement mechanism based on the PDCA cycle, this study seeks to provide a more comprehensive explanation of the factors underlying effective quality management. The findings are expected to contribute to the quality management and human resource management literature by clarifying the organizational and human mechanisms supporting quality improvement and ISO 9001 practices. Practically, the findings may provide guidance for managers and HR practitioners in developing employee competencies, strengthening knowledge sharing, encouraging employee participation, supporting continuous learning, and improving quality management practices in industrial organizations.

1.2 Research Question

Based on the research problem, theoretical foundations, and review of the relevant literature, the following research questions were formulated:

- 1) What are the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices?
- 2) How does quality improvement influence ISO 9001 practices?
- 3) What causal model explains the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices?

1.3 Research Objective

The objectives of this study are:

- 1) To examine the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices.
- 2) To investigate the effect of quality improvement on ISO 9001 practices.
- 3) To develop and validate a causal model explaining the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices.

2. Literature Review

2.1 Related Concepts and Theories

This study investigates the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices in industrial factories in the Central Region of Thailand. The study is primarily grounded in Systems Theory [3], which serves as the overarching theoretical framework for explaining the relationships among

the variables. Systems Theory views an organization as an open system consisting of interdependent components that interact continuously with both internal and external environments. Organizational resources are transformed through interconnected processes into outputs, while feedback from these outputs enables organizations to adapt, learn, and improve continuously. From this perspective, organizational effectiveness depends on the interaction and alignment of inputs, transformation processes, outputs, and feedback mechanisms. Within this framework, entrepreneurial orientation, business environment, and knowledge management represent important organizational capabilities and contextual inputs that provide resources, information, and knowledge for organizational development. Entrepreneurial orientation provides the willingness and capability to pursue innovation, proactive action, and strategic responses to change. The business environment provides external pressures and opportunities arising from competition, technological development, customer requirements, and regulatory conditions. Knowledge management enables the organization to create, acquire, share, retain, and apply knowledge to support organizational learning and decision-making. These elements interact with organizational processes and employee capabilities to support quality improvement, which functions as a transformation mechanism through which organizational resources and capabilities are translated into improved processes and quality management practices. ISO 9001 practices represent the resulting organizational practices through which quality management principles are systematically implemented. Feedback from quality management activities can subsequently support organizational learning, corrective action, and further improvement, creating a continuous cycle of organizational adaptation and development [3].

The transformation and continuous improvement process within Systems Theory is further explained through Deming's Plan-Do-Check-Act (PDCA) Cycle (Deming, 1986), which serves as a complementary mechanism rather than a separate overarching theoretical foundation. The PDCA cycle consists of four interconnected stages: planning quality objectives and processes (Plan), implementing the planned activities (Do), evaluating results against established standards and objectives (Check), and taking corrective or improvement actions based on the evaluation results (Act). The repeated application of these stages enables organizations to identify problems, evaluate process performance, implement corrective actions, and continuously improve organizational processes. Accordingly, quality improvement in this study is conceptualized as a continuous transformation process that connects organizational capabilities with the effective implementation of ISO 9001 practices. The integration of Systems Theory and the PDCA cycle, therefore, provides a theoretical explanation of how organizational inputs and capabilities can be transformed through continuous improvement processes into effective quality management practices. Because this study is situated within the context of Human Resource Management (HRM), employee capability is considered an important organizational resource within the systems perspective. Employees are responsible for implementing organizational processes, applying knowledge, identifying quality problems, and participating in continuous improvement activities. Effective ISO 9001 practices, therefore, depend not only on documented procedures and formal quality systems but also on employee competencies, training and development, knowledge sharing, organizational learning, leadership support, empowerment, and employee participation. From this perspective, knowledge management contributes to HRM by facilitating the acquisition, sharing, retention, and application of knowledge, thereby strengthening employee competencies and organizational learning. Entrepreneurial orientation can encourage employees and organizations to demonstrate innovative and proactive behaviors, while changes in the business

environment can create new requirements for employee skills, knowledge, and capabilities. HRM consequently provides an important mechanism for developing the human capabilities necessary to translate organizational resources into quality improvement and effective ISO 9001 practices.

In addition to Systems Theory and the PDCA cycle, this study briefly draws upon the McKinsey 7-S Framework as a supporting organizational perspective. The framework proposes that organizational effectiveness depends on the alignment of seven interconnected elements: strategy, structure, systems, style, staff, skills, and shared values. In the context of this study, the framework provides supplementary support for understanding how organizational strategy, management systems, leadership style, employee capabilities, and shared values may facilitate quality improvement and ISO 9001 practices. However, the McKinsey 7-S Framework is not treated as a primary theoretical foundation; rather, it complements the systems perspective by highlighting the importance of alignment among organizational and human factors. Similarly, the administrative management principles proposed by [8], commonly referred to as POSDCoRB—Planning, Organizing, Staffing, Directing, Coordinating, Reporting, and Budgeting—are considered complementary managerial concepts. These functions emphasize the managerial activities required to coordinate organizational resources and implement organizational processes effectively. In the context of this study, POSDCoRB provides supplementary support for understanding managerial responsibilities related to planning, organizing, staffing, directing, coordination, reporting, and resource allocation in quality management. Nevertheless, POSDCoRB is not considered an additional primary theoretical foundation of the study. Its role is limited to supporting the interpretation of managerial and HRM activities that contribute to the implementation of quality improvement and ISO 9001 practices. Entrepreneurial Orientation (EO) represents an important organizational capability examined in this study. [12] described entrepreneurs as individuals who identify opportunities, create value, and undertake business activities under conditions of risk. Similarly, [18] emphasized the importance of innovation and the effective utilization of available resources under conditions of uncertainty. At the organizational level, entrepreneurial orientation reflects the strategic posture through which organizations demonstrate innovative, proactive, and risk-oriented behaviors in responding to opportunities and challenges. It is commonly associated with dimensions such as innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness.

Within the Systems Theory perspective, entrepreneurial orientation can be viewed as an organizational capability that provides an important input into the organizational system. Organizations with a stronger entrepreneurial orientation are more likely to identify opportunities for improvement, encourage innovative approaches to operational problems, respond proactively to environmental changes, and utilize organizational resources in new ways. These characteristics can facilitate employee involvement, organizational learning, process improvement, and adaptation to changing quality requirements. Therefore, entrepreneurial orientation is expected to contribute to quality improvement by strengthening the organization's capacity to respond proactively to internal and external challenges and to support the continuous improvement processes required for effective ISO 9001 practices. Overall, Systems Theory serves as the overarching theoretical foundation of this study, while the PDCA cycle provides the complementary mechanism explaining continuous quality improvement. HRM provides an important human-capability perspective within the organizational system, while the McKinsey 7-S Framework and POSDCoRB are used only as supporting organizational and managerial concepts. This integrated theoretical

structure provides a clearer basis for explaining how entrepreneurial orientation, business environment, and knowledge management interact with organizational and employee capabilities to promote quality improvement and ultimately strengthen ISO 9001 practices.

2.2 Literature Surveys

Previous empirical studies have consistently indicated that entrepreneurial orientation is an important organizational capability that can contribute to organizational performance by strengthening innovation, strategic flexibility, proactive decision-making, and continuous improvement. Organizations characterized by innovativeness, proactiveness, and appropriate risk-taking are more likely to identify new opportunities, respond to environmental changes, and develop innovative approaches to operational problems. [13] conceptualized entrepreneurial orientation as an organizational strategic posture that enables firms to respond proactively to market opportunities and competitive pressures. Similarly, [1] reported that entrepreneurial orientation can support organizational capabilities and performance through innovation and proactive organizational behavior. From a quality management perspective, these characteristics can encourage organizations to identify process deficiencies, introduce new approaches to problem-solving, and participate actively in continuous improvement. Thus, entrepreneurial orientation may provide an important organizational capability for strengthening quality improvement, particularly when organizations operate in uncertain and rapidly changing environments. The business environment is another important factor influencing organizational decision-making, adaptation, and quality management practices. Organizations operate within environments characterized by changing customer expectations, technological advancement, market competition, regulatory requirements, economic conditions, and other external pressures. These environmental conditions can influence the resources, strategies, processes, and capabilities required for maintaining organizational performance. Organizations facing dynamic environmental conditions may need to continuously adapt their internal processes, develop employee competencies, and improve their quality management practices to respond effectively to external changes. [15] highlighted the importance of organizational responses to changing environmental conditions in supporting organizational development and performance. Within the context of quality management, awareness of environmental changes can encourage organizations to review existing processes, identify opportunities for improvement, and adjust quality practices to meet changing customer and regulatory requirements. Therefore, the business environment can be expected to influence an organization's capacity to undertake quality improvement and strengthen the implementation of ISO 9001 practices.

Knowledge management represents another important organizational capability supporting organizational learning and continuous improvement. Knowledge management involves the creation, acquisition, sharing, storage, and application of knowledge within an organization. Effective knowledge management enables employees to access relevant information, exchange experiences, apply lessons learned, and use organizational knowledge in problem-solving and decision-making. [14] found that knowledge management contributes to organizational learning and performance by facilitating knowledge-related processes and strengthening organizational capabilities. From an HRM perspective, knowledge management is particularly important because employees are the primary participants in creating, sharing, and applying organizational knowledge. Knowledge-sharing practices can strengthen employee competencies, facilitate learning across organizational units, reduce the repetition of operational errors, and support employee participation in quality improvement

activities. Consequently, knowledge management can provide an important foundation for continuous quality improvement and effective quality management practices. The relationship between organizational capabilities and quality management can be further explained through quality improvement as a continuous organizational process. Quality improvement involves systematic efforts to identify problems, improve processes, reduce errors, enhance efficiency, and meet customer and organizational requirements. Organizations that possess strong organizational capabilities are better positioned to identify opportunities for improvement, allocate resources effectively, develop employee competencies, and implement corrective and preventive actions. The PDCA cycle provides a systematic mechanism through which organizations can plan improvement activities, implement them, evaluate their effectiveness, and take corrective actions for subsequent improvement [5]. Within ISO 9001, continual improvement is an important principle for maintaining the effectiveness of the quality management system. Accordingly, quality improvement can function as a mechanism through which organizational capabilities are translated into more effective quality management practices.

Empirical studies have also indicated that effective quality improvement contributes to the successful implementation of ISO 9001 practices. Organizations that systematically plan quality objectives, implement established processes, monitor performance, evaluate results, and undertake corrective actions are more likely to maintain consistency in their quality management systems. [16] emphasized the importance of systematic quality management practices and continuous improvement in supporting effective quality management implementation. The continuous application of improvement activities can help organizations identify process deficiencies, strengthen process control, reduce operational errors, and improve the consistency of organizational practices. Therefore, quality improvement is not only an outcome of organizational capabilities but also an important mechanism for translating these capabilities into effective ISO 9001 practices. The literature can therefore be viewed as a connected system rather than as a set of independent relationships. Entrepreneurial orientation provides an organizational disposition toward innovation and proactive action; the business environment creates external pressures and opportunities that require organizational adaptation; and knowledge management provides the knowledge resources and learning processes necessary for effective action. These organizational capabilities can strengthen quality improvement, while quality improvement can subsequently contribute to more effective ISO 9001 practices. This relationship is consistent with the Systems Theory perspective adopted in this study, in which organizational inputs and capabilities are transformed through organizational processes into desired outputs, with feedback supporting further adaptation and improvement. The PDCA cycle provides a complementary mechanism for understanding how this transformation can occur through systematic and continuous quality improvement.

Although previous studies have examined entrepreneurial orientation, business environment, knowledge management, quality improvement, and organizational performance or ISO 9001 implementation, relatively few studies have integrated these constructs into a single causal framework. Existing research has frequently examined direct relationships among individual organizational capabilities and organizational outcomes, while comparatively limited attention has been given to quality improvement as a mechanism linking organizational capabilities with ISO 9001 practices. In addition, the HRM dimension of these relationships has received insufficient attention, particularly regarding how employee competency development, knowledge sharing, organizational learning, and employee participation contribute to the transformation of organizational

capabilities into quality improvement. This limitation is particularly relevant because employees are responsible for implementing organizational processes and translating quality management principles into daily operational practices. Furthermore, empirical evidence examining these relationships within industrial factories in the Central Region of Thailand remains limited. The distinctive characteristics of this context, including technological change, competitive pressures, labor-related challenges, regulatory requirements, and the increasing need for standardized quality management systems, create a need for further empirical investigation. Understanding these relationships can provide greater insight into how organizational capabilities and employee-related mechanisms jointly support continuous quality improvement and ISO 9001 practices.

Therefore, this study addresses the identified theoretical and empirical gaps by developing and validating a causal model explaining how entrepreneurial orientation, business environment, and knowledge management contribute to ISO 9001 practices through quality improvement. The study further emphasizes the role of employee capability, knowledge sharing, organizational learning, and participation as important HRM considerations within the organizational system. By integrating organizational capabilities, quality improvement, and ISO 9001 practices within a Systems Theory perspective, the study seeks to provide a more comprehensive explanation of the mechanisms underlying effective quality management in industrial factories in the Central Region of Thailand.

2.3 Conceptual Framework

The conceptual framework of this study is developed based on Systems Theory, PDCA theory, and previous empirical findings. The framework proposes that entrepreneurial orientation, business environment, and knowledge management serve as exogenous variables influencing quality improvement and ISO 9001 practices. Research framework as shown in **Figure 1**.

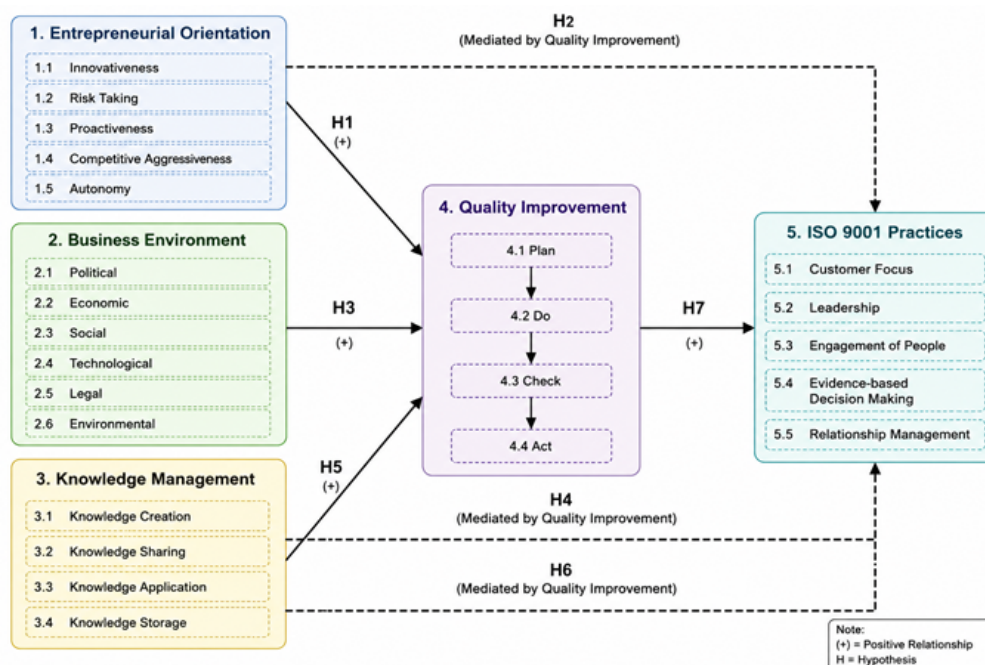


Figure 1. Research Framework

2.4 Research Hypothesis

Based on the theoretical framework and empirical literature reviewed in this study, the following hypotheses were proposed:

H1: Entrepreneurial orientation positively influences quality improvement.

Entrepreneurial orientation, characterized by innovativeness, proactiveness, risk-taking, competitive aggressiveness, and autonomy, enables organizations to identify opportunities, respond proactively to environmental changes, and develop innovative approaches to operational challenges. Organizations with a strong entrepreneurial orientation are more likely to encourage proactive problem-solving, employee participation, and continuous improvement of organizational processes. Such characteristics can strengthen the organization's capacity to identify quality deficiencies, implement innovative solutions, and improve operational performance. Therefore, entrepreneurial orientation is expected to have a positive influence on quality improvement.

H2: Entrepreneurial orientation positively influences ISO 9001 practices through quality improvement.

Organizations with a strong entrepreneurial orientation are more likely to encourage innovation, proactive problem-solving, organizational learning, and continuous improvement. These capabilities can facilitate the identification of process deficiencies and the development of appropriate quality improvement initiatives. Through continuous improvement, organizations can strengthen process control, employee involvement, and the systematic implementation of quality management activities required by ISO 9001. Therefore, quality improvement is proposed to mediate the relationship between entrepreneurial orientation and ISO 9001 practices.

H3: Business environment positively influences quality improvement.

The business environment encompasses external conditions that influence organizational strategies, decisions, and operations, including political, economic, social, technological, legal, and environmental factors. Changes in customer expectations, technological development, market competition, regulatory requirements, and economic conditions can create pressures for organizations to adapt their processes and improve operational performance. Organizations that effectively monitor and respond to changes in the business environment are more likely to identify areas requiring improvement and implement appropriate quality improvement initiatives. Therefore, the business environment is expected to have a positive influence on quality improvement.

H4: Business environment positively influences ISO 9001 practices through quality improvement.

Organizations that continuously monitor and respond to changes in their business environment are better positioned to identify emerging quality requirements, adapt organizational processes, and implement appropriate improvement activities. Quality improvement enables organizations to translate responses to environmental changes into systematic improvements in processes, performance monitoring, and corrective actions. These activities can subsequently facilitate the effective implementation of ISO 9001 practices. Therefore, quality improvement is proposed to mediate the relationship between the business environment and ISO 9001 practices.

H5: Knowledge management positively influences quality improvement.

Knowledge management encompasses the processes of creating, acquiring, sharing, storing, and applying organizational knowledge. Effective knowledge management facilitates organizational learning by enabling employees to access relevant information, share experiences, apply lessons learned, and use organizational knowledge in problem-solving and decision-making. From an HRM perspective, knowledge management can strengthen employee competencies and encourage employee participation in continuous improvement activities. Consequently, organizations with effective knowledge management are better able to identify operational problems, reduce errors, develop process improvements,

and enhance quality performance. Therefore, knowledge management is expected to have a positive influence on quality improvement.

H6: Knowledge management positively influences ISO 9001 practices through quality improvement.

Organizations with effective knowledge management are better able to facilitate organizational learning, knowledge sharing, employee competency development, and evidence-based decision-making. These capabilities support continuous quality improvement by enabling employees to identify problems, share quality-related knowledge, implement corrective actions, and develop improved processes. Quality improvement can subsequently strengthen the systematic implementation of ISO 9001 practices by supporting process consistency, performance evaluation, corrective action, and continual improvement. Therefore, quality improvement is proposed to mediate the relationship between knowledge management and ISO 9001 practices.

H7: Quality improvement positively influences ISO 9001 practices.

Quality improvement represents a systematic and continuous process of identifying problems, implementing improvements, evaluating performance, and taking corrective actions. Consistent with the Plan–Do–Check–Act (PDCA) cycle, organizations can use continuous improvement activities to plan quality objectives, implement processes, monitor performance, and take appropriate corrective or improvement actions. Organizations that systematically engage in quality improvement are therefore more likely to strengthen process control, maintain consistency, respond to quality problems, and meet established quality requirements. Consequently, quality improvement is expected to have a positive influence on ISO 9001 practices.

3. Research Methodology

3.1 Research Design

This study employed a quantitative, cross-sectional research design to investigate the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices in industrial factories located in the Central Region of Thailand. A quantitative approach was appropriate because it enabled the systematic collection of empirical data and the statistical examination of relationships among multiple latent constructs. The study adopted Systems Theory as its overarching theoretical foundation, while Deming's Plan–Do–Check–Act (PDCA) Cycle was employed as a complementary mechanism for explaining the continuous quality improvement process. The conceptual framework and research hypotheses were developed based on the theoretical framework and an extensive review of empirical literature concerning entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The study employed a structured questionnaire developed from established theoretical concepts and previously validated measurement scales. The questionnaire was reviewed by experts to establish content validity and was subsequently pilot-tested before being administered to representatives of industrial factories that had implemented ISO 9001 quality management systems. Data were analyzed using Structural Equation Modeling (SEM) to evaluate both the measurement model and the structural model. Confirmatory Factor Analysis (CFA) was conducted to assess the validity and reliability of the measurement model. Subsequently, the structural model was examined to test the hypothesized relationships among the latent constructs, including both direct and indirect effects. Model fit was evaluated using established goodness-of-fit indices to determine the extent to which the proposed theoretical model was consistent with the empirical data.

3.2 Population and Sample

The population framework for this study comprised 126,803 industrial factories registered with the Department of Industrial Works, Ministry of Industry, Thailand. From this population framework, the target population consisted of industrial factories located in the Central Region of Thailand, including the Bangkok Metropolitan Region, surrounding provinces, the Upper Central Region, and the northern boundary area of the Central Region. The unit of analysis was the industrial factory, with one knowledgeable representative selected from each participating factory. Eligible respondents included owners, executives, quality managers, production managers, and individuals directly responsible for ISO 9001 implementation, quality management, or related organizational processes. These respondents were selected because they were expected to possess sufficient knowledge of their organizations' quality management practices and organizational capabilities. The required sample size was determined using two established approaches. First, [21] formula was applied at a 95% confidence level with a sampling error of 0.05, resulting in a minimum sample size of 399 respondents. Second, following the recommendation of [10] for Structural Equation Modeling, a sample size of approximately 15–20 times the number of observed variables was considered appropriate. Because the proposed model contained 24 observed variables, the recommended sample size ranged from 360 to 480 respondents. To provide an adequate number of observations for estimating the model and evaluating the hypothesized relationships, data collection was conducted beyond the minimum recommended sample size. A multi-stage sampling technique was employed to obtain respondents from the target population. First, industrial factories were stratified according to the designated geographical areas within the Central Region of Thailand. Second, proportional allocation was used to determine the number of respondents to be obtained from each geographical stratum according to the distribution of the industrial factory population. Finally, respondents were selected from the identified factories using the specified sampling procedure to ensure appropriate representation across the geographical areas included in the study. A total of 560 valid questionnaires were obtained and used for the final analysis. This sample size exceeded both the minimum sample size determined by Yamane's formula and the recommended range based on the number of observed variables, thereby providing an adequate number of observations for the subsequent SEM analysis.

3.3 Research Instruments

The primary research instrument was a structured questionnaire developed from an extensive review of relevant literature and established measurement scales. The questionnaire consisted of six sections: (1) demographic information of the respondents, (2) entrepreneurial orientation, (3) business environment, (4) knowledge management, (5) quality improvement, and (6) ISO 9001 practices. All items measuring the research constructs were assessed using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The measurement items were adapted from established studies to ensure conceptual consistency and relevance to the research context. Entrepreneurial orientation was measured using 14 items. Business environment was measured using 16 items. Knowledge management was measured using 12 items. Quality improvement was measured using 19 items, while ISO 9001 practices were assessed using 19 items. Minor modifications were made to the wording of selected items to ensure their clarity and suitability for industrial factories in the Central Region of Thailand while maintaining the original conceptual meanings of the measurement items. To establish content validity, the questionnaire was evaluated by a panel of experts with expertise in quality management, industrial management, human resource management, and research methodology. The evaluation produced an Index of Item–Objective Congruence (IOC) of 0.8744, exceeding the recommended

minimum criterion of 0.60 and indicating satisfactory content validity. Following the expert evaluation, a pilot study involving 30 representatives of industrial factories was conducted to assess the clarity, appropriateness, and reliability of the questionnaire. Internal consistency was evaluated using Cronbach's alpha coefficients. All constructs achieved Cronbach's alpha coefficients greater than 0.70, indicating satisfactory internal consistency reliability. The results of the content validation and pilot testing confirmed that the questionnaire was sufficiently valid and reliable for use in the main data collection.

3.4 Data Collection

Data were collected from representatives of industrial factories located in the Central Region of Thailand between February and April 2026. Before the main data collection, the questionnaire was evaluated by a panel of experts to establish content validity and was subsequently pilot-tested with 30 representatives of industrial factories to assess clarity, appropriateness, and reliability. Necessary revisions were made based on the experts' recommendations and pilot-test results before the final questionnaire was administered. The final questionnaire was distributed using both online and paper-based survey methods to respondents selected through the multi-stage sampling procedure described in Section 3.2. Eligible respondents included owners, executives, quality managers, production managers, and individuals responsible for ISO 9001 implementation and quality management activities within their organizations. Before completing the questionnaire, participants were informed of the purpose and procedures of the study, the voluntary nature of participation, and their right to withdraw from participation without consequences. The study was conducted in accordance with applicable ethical principles for research involving human participants. The researcher completed the required research ethics training and complied with the requirements of the relevant Human Research Ethics Committee. To protect participants' privacy, respondents were informed that their responses would be treated as confidential and used exclusively for academic research purposes. No personally identifiable information was collected, and the findings were reported only in aggregate form.

3.5 Statistics Used for Data Analysis

The collected data were analyzed using descriptive and inferential statistical techniques. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize the demographic characteristics of the respondents and describe the levels of entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. Before conducting the main inferential analyses, the suitability of the data for multivariate analysis was examined. Pearson's correlation analysis was conducted to examine the relationships among the observed variables and to identify potential multicollinearity. The suitability of the data for factor analysis was assessed using the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The measurement model was subsequently evaluated using Confirmatory Factor Analysis (CFA). Internal consistency reliability was assessed using Cronbach's alpha and Composite Reliability (CR). Convergent validity was evaluated based on standardized factor loadings and the Average Variance Extracted (AVE). Discriminant validity was assessed by comparing the square root of the AVE for each construct with its correlations with the other constructs. After establishing the adequacy of the measurement model, Structural Equation Modeling (SEM) was employed to test the proposed hypotheses and examine the direct and indirect relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. In particular, the

structural model was used to examine whether quality improvement mediated the relationships between entrepreneurial orientation, business environment, knowledge management, and ISO 9001 practices. The overall fit of the proposed structural model was evaluated using multiple goodness-of-fit indices, including the chi-square statistic (χ^2), relative chi-square (χ^2/df), Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). These indices were considered collectively to assess the extent to which the proposed theoretical model adequately represented the observed empirical data. The statistical analyses were therefore conducted in three sequential stages: (1) descriptive analysis of the sample and study variables, (2) evaluation of the measurement model through reliability and validity testing, and (3) evaluation of the structural model through SEM to test the hypothesized direct and indirect relationships. This analytical procedure provided a systematic basis for evaluating the proposed causal model and determining the extent to which the empirical findings supported the theoretical framework of the study.

4. Data analysis and findings

4.1 Introduction

This chapter presents the findings of the study examining the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices in industrial factories located in the Central Region of Thailand. The findings are presented in accordance with the research objectives and are based primarily on quantitative analysis, with qualitative findings from in-depth interviews used to provide contextual insights and support the interpretation of the quantitative results. The chapter is organized into four main parts. First, the qualitative findings obtained from in-depth interviews with six representatives of small, medium-sized, and large industrial factories are presented to provide contextual insights into organizational capabilities, quality improvement, and ISO 9001 practices. Second, the demographic characteristics of the respondents and descriptive statistics of the study variables are presented using frequency, percentage, mean, and standard deviation. Third, the measurement model is evaluated using Confirmatory Factor Analysis (CFA), including assessments of reliability, convergent validity, and discriminant validity. Finally, Structural Equation Modeling (SEM) is employed to examine the hypothesized direct and indirect relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices and to assess the overall fit of the proposed causal model. The findings are presented in accordance with the three research objectives: (1) to examine the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices; (2) to investigate the effect of quality improvement on ISO 9001 practices; and (3) to develop and validate a causal model explaining the relationships among these constructs.

4.2 Data Analysis of the Qualitative Data

To complement the quantitative findings, in-depth interviews were conducted with six representatives of industrial factories comprising small, medium-sized, and large enterprises in the Central Region of Thailand. The interview data were analyzed using thematic analysis to identify recurring patterns and perspectives concerning entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The qualitative findings are presented according to four major themes that emerged from the interview data. These themes provide contextual evidence concerning how organizational capabilities and employee-related practices contribute to

quality improvement and how continuous quality improvement supports the implementation of ISO 9001 practices.

Theme 1: Entrepreneurial Orientation Promotes Continuous Quality Improvement

The interview participants consistently described entrepreneurial orientation as an important organizational capability supporting quality improvement. They emphasized that organizations that encourage innovation, proactive decision-making, employee participation, and appropriate risk-taking are better able to identify operational problems and develop solutions for improving work processes. Participants also indicated that management support for innovation can encourage employees to propose ideas and participate in initiatives aimed at improving operational performance. According to the participants, these practices can contribute to improved production efficiency, reduced operational errors, enhanced product quality, and greater organizational adaptability. The interview findings, therefore, suggest that entrepreneurial orientation can create an organizational environment that encourages proactive problem-solving and continuous improvement.

Theme 2: Business Environment Encourages Organizational Adaptation and ISO 9001 Implementation

The participants indicated that changes in the external business environment influence organizational quality management activities. Market competition, technological advancement, customer expectations, economic conditions, and regulatory requirements were identified as important external factors requiring organizations to adapt their production processes and management systems. Participants explained that organizations capable of monitoring and responding to changes in their business environment are better positioned to modify internal processes, improve operational performance, and maintain appropriate quality management practices. They also indicated that changing customer and regulatory requirements can encourage organizations to strengthen their quality management systems and maintain compliance with ISO 9001 requirements. These findings suggest that environmental conditions create pressures and opportunities that influence organizational adaptation and quality improvement.

Theme 3: Knowledge Management Strengthens Quality Improvement and Employee Capability

Knowledge management emerged as an important factor supporting quality improvement and employee capability. Participants emphasized the importance of knowledge sharing, employee training, documentation of best practices, and systematic knowledge transfer within their organizations. These activities were perceived as contributing to employee competency development and improving the consistency of operational procedures. The participants further explained that effective knowledge sharing enables employees to learn from previous experiences, access relevant information, and apply organizational knowledge when addressing operational problems. The availability of documented procedures and accessible organizational knowledge was also considered important for reducing operational errors, supporting organizational learning, and maintaining standardized work practices. These findings highlight the HRM-related role of employee development and knowledge sharing in supporting continuous quality improvement and ISO 9001 practices.

Theme 4: Quality Improvement Facilitates Effective ISO 9001 Practices

Quality improvement was consistently identified by the interview participants as an important mechanism supporting effective ISO 9001 practices. Participants described continuous improvement activities in terms of systematic planning, implementation, performance monitoring, evaluation, and corrective action. These

activities were perceived as helping organizations identify process problems, improve operational efficiency, reduce unnecessary costs, enhance product and service quality, and respond to customer requirements. The participants also emphasized the importance of maintaining a culture of continuous improvement rather than treating ISO 9001 as solely a certification or documentation requirement. Organizations that continuously review their processes, monitor performance, address deficiencies, and implement corrective actions were perceived as better able to maintain their quality management practices over time. These findings are consistent with the conceptualization of quality improvement as a continuous transformation process that supports effective ISO 9001 implementation.

Overall Summary of the Qualitative Findings

Overall, the qualitative findings indicate that entrepreneurial orientation, business environment, and knowledge management are perceived as important organizational factors supporting quality improvement, while quality improvement is perceived as an important mechanism supporting effective ISO 9001 practices. The interviews also highlight the importance of employee training, competency development, knowledge sharing, employee participation, and management support in translating organizational capabilities into quality improvement activities. The qualitative findings provide contextual support for the proposed causal framework and help explain the organizational processes underlying the relationships examined in the quantitative analysis. However, the causal relationships among the study variables are formally evaluated through the quantitative SEM analysis presented in the subsequent sections. The qualitative findings, therefore, serve primarily to enrich the interpretation of the empirical results rather than to establish causal effects independently.

4.2 Data Analysis of the Qualitative Data

To complement the quantitative findings, in-depth interviews were conducted with six representatives from industrial factories, comprising small, medium-sized, and large enterprises in the Central Region of Thailand. The interview data were analyzed using thematic analysis to identify common patterns related to entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The findings are presented according to the major themes that emerged from the analysis.

Theme 1: Entrepreneurial Orientation Promotes Continuous Quality Improvement

The interview participants consistently indicated that entrepreneurial orientation plays an important role in driving quality improvement within industrial factories. They emphasized that organizations encouraging innovation, proactive decision-making, employee participation, and appropriate risk-taking are better able to identify operational problems and implement continuous improvement initiatives. Such practices contribute to improved production efficiency, reduced operational errors, enhanced product quality, and increased organizational adaptability. Several participants further noted that management support for innovation creates a culture in which employees actively contribute ideas for improving work processes and operational performance.

Theme 2: Business Environment Encourages Organizational Adaptation and ISO 9001 Implementation

The participants agreed that changes in the external business environment significantly influence organizational quality management practices. Market competition, technological advancement, customer expectations, economic conditions, and regulatory requirements were identified as key factors motivating organizations to continuously improve their production processes and management

systems. Respondents explained that organizations capable of adapting to these environmental changes are better positioned to strengthen their quality management systems and maintain compliance with ISO 9001 requirements while sustaining long-term competitiveness.

Theme 3: Knowledge Management Strengthens Quality Improvement and Employee Capability

Knowledge management emerged as another critical factor supporting quality improvement and ISO 9001 practices. Participants highlighted that effective knowledge sharing, employee training, documentation of best practices, and systematic knowledge transfer enhance employee competencies and improve the consistency of operational procedures. These activities reduce operational errors, facilitate organizational learning, and promote continuous improvement. Furthermore, respondents emphasized that accessible organizational knowledge enables employees to perform their responsibilities more effectively while supporting compliance with standardized operating procedures required under ISO 9001.

Theme 4: Quality Improvement Facilitates Effective ISO 9001 Practices

All interview participants consistently recognized quality improvement as the central mechanism supporting successful ISO 9001 implementation. They explained that continuous improvement activities based on systematic planning, implementation, performance monitoring, evaluation, and corrective action enable organizations to improve process efficiency, reduce production costs, enhance customer satisfaction, and strengthen organizational competitiveness. The participants further emphasized that organizations maintaining an organizational culture of continuous improvement are more successful in sustaining ISO 9001 practices and achieving long-term operational excellence.

Overall, the qualitative findings indicate that entrepreneurial orientation, business environment, and knowledge management collectively contribute to quality improvement, which subsequently supports effective implementation of ISO 9001 practices. These findings are consistent with the proposed conceptual framework and provide contextual evidence supporting the quantitative results presented in the following sections.

4.3 Data Analysis of the Quantitative Data

This section presents the quantitative findings based on data collected from 560 representatives of industrial factories in the Central Region of Thailand. The analysis was conducted to examine the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices in accordance with the proposed conceptual framework and research hypotheses. The quantitative data were analyzed using descriptive and inferential statistical techniques. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize the demographic characteristics of the respondents and describe the levels of the study variables. Preliminary analyses were subsequently conducted to assess the suitability of the data for multivariate analysis and Structural Equation Modeling (SEM). The SEM analysis followed the two-step approach recommended by [2]. In the first step, the measurement model was evaluated using Confirmatory Factor Analysis (CFA) to assess the reliability and validity of the latent constructs. Internal consistency reliability was assessed using Cronbach's alpha and Composite Reliability (CR), while convergent validity was evaluated using standardized factor loadings and Average Variance Extracted (AVE). Discriminant validity was subsequently assessed to determine whether the constructs were empirically distinct from one another. In the second step, the structural model was evaluated to examine the hypothesized relationships among entrepreneurial

orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The analysis examined both direct and indirect effects, with particular attention to the mediating role of quality improvement in the relationships between entrepreneurial orientation, business environment, knowledge management, and ISO 9001 practices. The overall model fit was also assessed using established goodness-of-fit indices to determine the extent to which the proposed causal model was consistent with the empirical data. The quantitative findings are presented in the following sequence: (1) demographic characteristics of the respondents; (2) descriptive statistics of the study variables; (3) preliminary analysis of the data; (4) evaluation of the measurement model; (5) assessment of the structural model and path coefficients; and (6) hypothesis testing, including the examination of direct and indirect effects. The findings are presented in accordance with the research objectives and are subsequently used to evaluate the proposed causal model and determine the extent to which the empirical evidence supports the research hypotheses.

4.3.1 Results of Demographic Characteristics of Respondents

The demographic characteristics of the respondents were analyzed using frequency and percentage to describe the composition of the sample. The respondents were representatives of industrial factories located in the Central Region of Thailand and included owners, executives, quality managers, production managers, and personnel responsible for ISO 9001 implementation and quality management activities.

Table 1. Demographic Characteristics of Respondents

Characteristics	Frequency	Percentage
Small factory	205	42.71
Medium factory	210	43.75
Large factory	65	13.54
Total	480	100.00

Table 1 presents the demographic characteristics of the respondents according to organizational size. Of the 480 respondents, 210 (43.75%) were from medium-sized factories, representing the largest proportion of the sample, followed by 205 (42.71%) from small factories and 65 (13.54%) from large factories. The distribution of respondents across small, medium-sized, and large industrial factories provided a broad representation of organizations with different operational characteristics and management practices. This diversity enabled the study to capture a wide range of perspectives regarding quality improvement and ISO 9001 practices across different organizational contexts. Furthermore, the inclusion of 480 respondents, which exceeded the minimum sample size recommended for Structural Equation Modeling (SEM), provided sufficient statistical power for testing the proposed measurement and structural models and enhanced the reliability of the study findings.

4.3.2 Results of Descriptive Analysis of Research Variables

Descriptive statistics were employed to examine the respondents' perceptions of the five research constructs: entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The analysis was based on the mean and standard deviation to determine the overall level of each construct.

Table 2. Descriptive Statistics of Research Variables

Variable	Mean	S.D.	Level
Entrepreneurial Orientation (EPOT)	4.33	0.69	Very High
Business Environment (BSEV)	4.40	0.59	Very High
Knowledge Management (KLMM)	4.13	0.75	High
Quality Improvement (QLIP)	4.31	0.73	Very High
ISO 9001 Practices (ISOP)	4.35	<i>S.D.</i>	Very High

As shown in **Table 2**, respondents perceived all research variables at high to very high levels, indicating that the participating industrial factories demonstrated strong organizational capabilities and quality management practices. Among the five constructs, Business Environment recorded the highest mean score (Mean = 4.40), suggesting that respondents recognized the significant influence of external factors, including market competition, technological advancement, regulatory requirements, and changing customer expectations, on organizational operations. ISO 9001 Practices obtained the second-highest mean score (Mean = 4.35), indicating that the participating organizations actively implemented ISO 9001 principles, including process management, customer focus, continual improvement, and compliance with quality management standards. Entrepreneurial Orientation also achieved a very high level (Mean = 4.33), reflecting that the organizations emphasized innovation, proactive decision-making, risk-taking, and employee participation to enhance organizational performance. Quality Improvement was perceived at a very high level (Mean = 4.31), indicating that respondents considered continuous improvement activities, including planning, implementation, performance evaluation, and corrective actions, to be well established within their organizations. Knowledge Management recorded the lowest mean score among the five constructs (Mean = 4.13); however, it remained at a high level, suggesting that the organizations had developed effective practices for knowledge creation, sharing, storage, and application to support continuous learning and operational improvement.

4.3.3 Results of Preliminary Data Examination Before SEM Analysis

Prior to evaluating the measurement and structural models, preliminary analyses were conducted to determine whether the data were appropriate for factor analysis and Structural Equation Modeling (SEM). The adequacy of the sample was assessed using the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy, while the suitability of the correlation matrix was evaluated using Bartlett’s Test of Sphericity.

Table 3. KMO Measure of Sampling Adequacy and Bartlett’s Test of Sphericity

Test	Value
Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy	0.963
Bartlett’s Chi-square	9,658.689
Degrees of Freedom (df)	105
Significance (p-value)	< 0.001

As presented in **Table 3**, the KMO value was 0.963, which exceeds the recommended minimum value of 0.80, indicating excellent sampling adequacy for factor analysis. This result suggests that the observed variables shared sufficient common variance to justify the application of Confirmatory Factor Analysis

(CFA). Furthermore, Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 9,658.689$, $df = 105$, $p < 0.001$), indicating that the correlation matrix was not an identity matrix and that significant relationships existed among the observed variables. These findings confirm that the data satisfied the assumptions required for factor analysis and provided an appropriate basis for evaluating the measurement model through CFA prior to testing the structural model using Structural Equation Modeling (SEM).

4.3.4 Results of Path Analysis

The structural model analysis was performed to examine the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The significance of each relationship was evaluated using t-values. A t-value greater than 1.96 indicates statistical significance at the 0.05 level.

Table 4. Path Analysis Results

Relationship	t-value	Result
Entrepreneurial Orientation → Quality Improvement	7.23	Significant
Entrepreneurial Orientation → ISO 9001 Practices	1.99	Significant
Knowledge Management → Quality Improvement	2.96	Significant
Knowledge Management → ISO 9001 Practices	2.12	Significant
Quality Improvement → ISO 9001 Practices	5.57	Significant

As presented in **Table 4**, the path analysis results demonstrate that entrepreneurial orientation has a strong influence on quality improvement ($t = 7.23$). This indicates that organizations with stronger innovation capability, proactive behavior, and willingness to take risks are more likely to achieve higher quality performance. Knowledge management also significantly affects quality improvement ($t = 2.96$). This suggests that knowledge creation, sharing, and application contribute to organizational learning and operational improvement. The relationship between quality improvement and ISO 9001 practices showed a strong significant effect ($t = 5.57$). This confirms that continuous improvement is a key mechanism supporting ISO 9001 implementation.

4.3.5 Results Responding to Research Objectives

The results of the Structural Equation Modeling (SEM) analysis were used to address the three research objectives of this study. The findings provide empirical evidence concerning the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices in industrial factories in the Central Region of Thailand.

Objective 1: To examine the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices.

The SEM results demonstrated that entrepreneurial orientation, business environment, and knowledge management each had a significant positive direct effect on quality improvement. These findings indicate that organizations with stronger entrepreneurial capabilities, greater ability to respond to changes in the business environment, and more effective knowledge management are better positioned to develop and sustain continuous quality improvement. Entrepreneurial orientation supports proactive problem-solving and innovation, the business environment encourages organizational adaptation, and knowledge management facilitates knowledge sharing, organizational learning, and employee capability development. Collectively, these organizational capabilities contribute

to the strengthening of quality improvement processes.

Objective 2: To investigate the effect of quality improvement on ISO 9001 practices.

The SEM results revealed that quality improvement had a significant positive direct effect on ISO 9001 practices. In addition, quality improvement significantly mediated the relationships between entrepreneurial orientation and ISO 9001 practices, business environment and ISO 9001 practices, and knowledge management and ISO 9001 practices. These findings indicate that quality improvement represents an important mechanism through which organizational capabilities are translated into effective ISO 9001 practices. In particular, organizational capabilities alone may not be sufficient to ensure effective quality management; their influence is strengthened when they are translated into systematic processes of planning, implementation, performance evaluation, corrective action, and continuous improvement.

Objective 3: To develop and validate a causal model explaining the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices.

The proposed causal model was supported by the empirical findings. The measurement model demonstrated satisfactory levels of reliability, convergent validity, and discriminant validity, indicating that the constructs were measured adequately. The structural model provided empirical support for the hypothesized relationships examined in the study, including the direct effects of entrepreneurial orientation, business environment, and knowledge management on quality improvement, the direct effect of quality improvement on ISO 9001 practices, and the indirect effects of the three organizational capabilities on ISO 9001 practices through quality improvement.

Overall, the findings indicate that entrepreneurial orientation, business environment, and knowledge management contribute to effective ISO 9001 practices primarily through quality improvement, while quality improvement itself has a significant direct effect on ISO 9001 practices. The validated causal model therefore provides empirical support for the theoretical proposition that organizational capabilities function as important inputs, quality improvement serves as a transformation mechanism, and ISO 9001 practices represent an important outcome of the organizational quality management process. This interpretation is consistent with the Systems Theory perspective and the complementary role of the PDCA cycle in explaining continuous organizational improvement.

4.3.6 Results of Hypothesis Testing

The hypotheses were tested using SEM path coefficients and significance values.

Table 5. Summary of Hypothesis Testing

Hypothesis	Relationship	Effect Tested	Result
H1	Entrepreneurial Orientation → Quality Improvement	Direct	Accepted
H2	Entrepreneurial Orientation → ISO 9001 Practices	Indirect (Mediated)	Accepted
H3	Business Environment → Quality Improvement	Direct	Accepted
H4	Business Environment → ISO 9001 Practices	Indirect (Mediated)	Accepted
H5	Knowledge Management → Quality Improvement	Direct	Accepted
H6	Knowledge Management → ISO 9001 Practices	Indirect (Mediated)	Accepted
H7	Quality Improvement → ISO 9001 Practices	Direct	Accepted

Table 5 presents the summary of the hypothesis testing results. All

proposed hypotheses were supported by the empirical data. The findings indicate that entrepreneurial orientation, business environment, and knowledge management each have a significant positive effect on quality improvement. Furthermore, quality improvement significantly mediates the relationships between entrepreneurial orientation, business environment, and knowledge management and ISO 9001 practices. In addition, quality improvement has a significant positive direct effect on ISO 9001 practices. These findings suggest that organizations can strengthen the implementation of ISO 9001 by fostering entrepreneurial capabilities, responding effectively to changes in the business environment, enhancing knowledge management practices, and promoting continuous quality improvement throughout the organization. Overall, the findings highlight the important role of quality improvement as a mechanism for translating organizational capabilities into effective ISO 9001 practices.

4.4 Summary of the Results

The findings from the qualitative and quantitative analyses consistently supported the proposed research model and addressed the three research objectives. The qualitative findings provided contextual evidence indicating that entrepreneurial orientation, business environment, and knowledge management are important organizational capabilities that support quality improvement and effective ISO 9001 practices. In particular, the interview findings emphasized the importance of innovation, organizational adaptation, knowledge sharing, employee competency development, and continuous improvement in strengthening quality management practices. The quantitative findings provided empirical support for all seven proposed hypotheses. Entrepreneurial orientation, business environment, and knowledge management each had a significant positive effect on quality improvement, supporting H1, H3, and H5. Furthermore, quality improvement significantly mediated the relationships between entrepreneurial orientation and ISO 9001 practices, business environment and ISO 9001 practices, and knowledge management and ISO 9001 practices, supporting H2, H4, and H6. Quality improvement also had a significant positive direct effect on ISO 9001 practices, supporting H7. Taken together, the findings indicate that organizational capabilities contribute to effective ISO 9001 practices through a continuous quality improvement process. Entrepreneurial orientation enables organizations to encourage innovation and proactive problem-solving, the business environment provides pressures and opportunities that require organizational adaptation, and knowledge management supports organizational learning and the effective use and sharing of knowledge. These capabilities strengthen quality improvement activities, which subsequently facilitate the systematic implementation of ISO 9001 practices. Overall, quality improvement represents the central mechanism linking organizational capabilities with ISO 9001 practices. The validated structural model, therefore, provides empirical support for the proposed theoretical framework, in which organizational capabilities function as important inputs, quality improvement serves as a transformation process, and ISO 9001 practices represent an important organizational outcome. The findings also highlight the importance of employee competency development, knowledge sharing, employee participation, and continuous learning in translating organizational capabilities into effective quality improvement. These findings provide both theoretical and practical insights for strengthening quality management and organizational performance in industrial factories in the Central Region of Thailand.

5. Conclusion, Discussion, and Recommendation

5.1 Conclusion

This study examined the causal relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement,

and ISO 9001 practices in industrial factories located in the Central Region of Thailand. A mixed-method research approach was employed by integrating qualitative interviews with quantitative analysis using Structural Equation Modeling (SEM), providing both contextual insights and empirical evidence for the proposed causal model. The findings demonstrate that entrepreneurial orientation, business environment, and knowledge management are important organizational capabilities that contribute to quality improvement. The qualitative findings highlighted the importance of innovation, proactive decision-making, organizational adaptation, knowledge sharing, employee competency development, and continuous learning in supporting improvements in organizational processes. These findings were supported by the quantitative analysis, which demonstrated significant positive relationships between entrepreneurial orientation, business environment, knowledge management, and quality improvement. Thus, organizations that are able to develop these capabilities are better positioned to identify operational problems, respond to changing conditions, utilize organizational knowledge, and implement continuous improvement activities. The findings further demonstrate that quality improvement has a significant positive effect on ISO 9001 practices and serves as an important mechanism through which organizational capabilities contribute to effective quality management. Quality improvement significantly mediates the relationships between entrepreneurial orientation and ISO 9001 practices, business environment and ISO 9001 practices, and knowledge management and ISO 9001 practices. This indicates that organizational capabilities do not operate independently of quality management processes; rather, their effects are translated into ISO 9001 practices through systematic and continuous quality improvement. The findings therefore highlight the central role of quality improvement in connecting organizational capabilities with the effective implementation of ISO 9001.

The study also developed and validated a causal model explaining the relationships among entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices. The SEM results provided empirical support for the proposed relationships and demonstrated the adequacy of the model in explaining the observed relationships among the study constructs. The findings are consistent with Systems Theory, which conceptualizes organizational capabilities as interconnected elements within an organizational system, and with the PDCA cycle, which provides a mechanism for transforming organizational capabilities into continuous quality improvement and improved quality management practices. From an HRM perspective, the findings indicate that effective quality management requires more than formal procedures and compliance with ISO 9001 requirements. Employee competency development, training, knowledge sharing, organizational learning, employee participation, and management support are important conditions for translating organizational capabilities into continuous quality improvement. Consequently, HRM should be integrated with quality management by developing employee capabilities and creating an organizational environment that encourages learning, knowledge sharing, participation, and continuous improvement. Overall, the study concludes that effective ISO 9001 practices are supported by the interaction of organizational capabilities, employee capabilities, and continuous quality improvement. Entrepreneurial orientation encourages innovation and proactive action, the business environment creates pressures and opportunities for organizational adaptation, and knowledge management facilitates organizational learning and knowledge utilization. These capabilities strengthen quality improvement, which subsequently enhances the effectiveness of ISO 9001 practices. The study contributes to the quality management and HRM literature by providing an integrated causal model that explains these relationships

and offers practical guidance for managers and HR practitioners seeking to strengthen employee capabilities, improve quality management processes, and sustain effective ISO 9001 practices in industrial factories in the Central Region of Thailand.

5.2 Discussion

The discussion of the findings is presented according to the proposed research hypotheses. The findings are interpreted in relation to the theoretical framework, qualitative evidence, and the organizational context of industrial factories in the Central Region of Thailand.

H1: Entrepreneurial Orientation Positively Influences Quality Improvement

The findings supported H1, indicating that entrepreneurial orientation has a significant positive direct effect on quality improvement. This finding suggests that organizations characterized by innovativeness, proactiveness, risk-taking, competitive aggressiveness, and autonomy are more likely to develop an organizational climate that supports continuous improvement. Such characteristics encourage organizations and employees to identify operational problems, respond proactively to challenges, develop new solutions, and improve existing work processes. The qualitative findings further support this interpretation, as interview participants emphasized the importance of innovation, proactive decision-making, employee participation, and management support in improving operational processes. In the context of industrial factories, entrepreneurial orientation can therefore contribute to quality improvement by encouraging organizations to move beyond routine problem-solving toward proactive identification and prevention of quality-related problems. The finding is consistent with the argument that entrepreneurial orientation strengthens organizational adaptability and supports organizations in responding to changing operational and competitive conditions. Accordingly, industrial factories should foster an entrepreneurial organizational culture that encourages innovation, employee participation, proactive problem-solving, and continuous learning as part of their quality improvement efforts.

H2: Entrepreneurial Orientation Positively Influences ISO 9001 Practices through Quality Improvement

The findings supported H2, demonstrating that entrepreneurial orientation has a significant indirect effect on ISO 9001 practices through quality improvement. This finding indicates that the contribution of entrepreneurial orientation to ISO 9001 practices operates through the organization's ability to translate entrepreneurial capabilities into systematic quality improvement activities. Organizations that encourage innovation, proactive decision-making, employee involvement, and appropriate risk-taking are better positioned to identify opportunities for improving operational processes. These improvement activities can subsequently strengthen the implementation of ISO 9001 practices by helping organizations identify deficiencies, implement corrective actions, monitor performance, and continuously improve their processes. Thus, quality improvement serves as an important mediating mechanism linking entrepreneurial orientation with ISO 9001 practices. The finding also suggests that entrepreneurial orientation alone does not guarantee effective quality management; its value is realized when entrepreneurial capabilities are converted into systematic and continuous improvement activities.

H3: Business Environment Positively Influences Quality Improvement

The findings supported H3, indicating that the business environment has a significant positive direct effect on quality improvement. This result demonstrates that external conditions can influence organizations' decisions to improve their operational and quality management processes. Market competition,

technological advancement, customer expectations, economic conditions, and regulatory requirements create pressures that require industrial factories to adapt their operations and continuously improve performance. The qualitative findings reinforce this interpretation, as participants identified changes in customer requirements, technology, competition, and regulatory conditions as important factors influencing organizational adaptation. Organizations that actively monitor and respond to changes in their external environment are, therefore, better positioned to identify emerging requirements and adjust their internal processes accordingly. In this context, responsiveness to the business environment represents an important organizational capability for maintaining quality performance and supporting continuous improvement.

H4: Business Environment Positively Influences ISO 9001 Practices through Quality Improvement

The findings supported H4, demonstrating that the business environment has a significant indirect effect on ISO 9001 practices through quality improvement. This finding suggests that changes in the external environment influence ISO 9001 practices primarily by encouraging organizations to strengthen their quality improvement processes. Competitive pressures, technological developments, changing customer requirements, and regulatory expectations can motivate organizations to review their existing processes and implement improvement activities. These activities subsequently support the systematic implementation and maintenance of ISO 9001 practices. Therefore, quality improvement functions as the mediating mechanism through which organizations translate environmental pressures and opportunities into improvements in their quality management systems. The finding emphasizes that ISO 9001 implementation should be viewed as a dynamic organizational process that requires continuous adaptation rather than merely maintaining documented procedures for certification purposes.

H5: Knowledge Management Positively Influences Quality Improvement

The findings supported H5, indicating that knowledge management has a significant positive direct effect on quality improvement. Effective knowledge creation, acquisition, sharing, storage, and application can strengthen organizational learning and employee capabilities, enabling organizations to use relevant knowledge to identify problems and improve operational processes. The qualitative findings particularly emphasized knowledge sharing, employee training, documentation of best practices, and knowledge transfer as important practices within industrial factories. These practices enable employees to access organizational knowledge, learn from previous experiences, apply standardized procedures, and contribute to problem-solving activities. Consequently, effective knowledge management can reduce operational errors, support evidence-based decision-making, and facilitate continuous improvement. The finding highlights the importance of integrating knowledge management with employee development and organizational learning as part of an effective quality improvement system.

H6: Knowledge Management Positively Influences ISO 9001 Practices through Quality Improvement

The findings supported H6, demonstrating that knowledge management has a significant indirect effect on ISO 9001 practices through quality improvement. This result indicates that knowledge management contributes to ISO 9001 practices by enabling organizations to transform knowledge resources into continuous quality improvement activities. Organizations with effective knowledge management practices are better able to share organizational knowledge, disseminate best practices, develop employee competencies, retain organizational experience, and apply relevant knowledge to operational problems. These activities support the improvement and standardization of organizational

processes, which subsequently facilitate effective ISO 9001 practices. Thus, quality improvement functions as the key mediating mechanism through which knowledge management contributes to ISO 9001 implementation. From an HRM perspective, this finding highlights the importance of employee training, knowledge sharing, organizational learning, and employee participation in translating organizational knowledge into measurable improvements in quality management.

H7: Quality Improvement Positively Influences ISO 9001 Practices

The findings supported H7, indicating that quality improvement has a significant positive direct effect on ISO 9001 practices. This finding confirms the central role of continuous quality improvement in supporting effective implementation of ISO 9001. Organizations that systematically plan, implement, monitor, evaluate, and improve their operational processes are better positioned to establish and maintain quality management practices consistent with ISO 9001 requirements. Continuous improvement enables organizations to identify process deficiencies, implement corrective actions, improve process consistency, and respond to customer and organizational requirements. The finding is also consistent with the PDCA approach, in which continuous cycles of planning, implementation, evaluation, and corrective action provide a systematic mechanism for organizational improvement. Importantly, the finding positions quality improvement as the central mechanism within the proposed causal model. Entrepreneurial orientation, business environment, and knowledge management provide organizational capabilities that support improvement, while quality improvement translates these capabilities into systematic quality management practices. Consequently, effective ISO 9001 implementation depends not only on compliance with formal requirements but also on the organization's ability to establish a sustained culture and process of continuous improvement.

5.3 Recommendation

5.3.1 Practical Recommendation

Based on the findings of this study, industrial factories should prioritize the development of organizational capabilities that support continuous quality improvement and effective implementation of ISO 9001 practices. First, organizations should strengthen entrepreneurial orientation by fostering a culture that encourages innovation, proactive decision-making, employee empowerment, and continuous learning. Management should provide employees with opportunities to participate in quality improvement activities, contribute ideas, identify operational problems, and develop solutions collaboratively. Such practices can enhance employee involvement and organizational responsiveness while supporting continuous improvement. Second, organizations should continuously monitor and respond to changes in the business environment, particularly technological advancement, market competition, customer expectations, economic conditions, and regulatory requirements. Management should conduct regular environmental assessments and use the information obtained to adjust organizational strategies, operational processes, and quality management practices. Timely adaptation can help organizations identify opportunities for improvement, respond to changing stakeholder requirements, maintain competitiveness, and strengthen the effectiveness of ISO 9001 practices. Third, organizations should strengthen knowledge management by establishing systematic processes for knowledge creation, acquisition, sharing, storage, and application. This should include employee training and development, knowledge-sharing activities, documentation of best practices, organizational learning, and accessible knowledge repositories. Particular attention should be given to transferring knowledge between experienced and less-experienced

employees so that important organizational knowledge is retained and applied consistently. These practices can strengthen employee competencies, support evidence-based decision-making, reduce operational errors, and contribute to continuous quality improvement. Fourth, organizations should recognize quality improvement as the central mechanism supporting effective ISO 9001 implementation, rather than treating ISO 9001 primarily as a certification or compliance requirement. Management should integrate continuous improvement into routine organizational activities through systematic application of the Plan–Do–Check–Act (PDCA) cycle. Regular process evaluation, performance monitoring, identification of deficiencies, corrective action, and follow-up should be incorporated into quality management activities. This approach can help organizations improve process consistency and efficiency, enhance customer satisfaction, and sustain effective ISO 9001 practices over the long term. Finally, from an HRM perspective, managers should integrate employee development with quality management by providing continuous training, encouraging knowledge sharing, supporting employee participation, and recognizing employees' contributions to quality improvement. Developing employees as active participants in the quality management process can help translate organizational capabilities into practical improvements and strengthen the sustainability of ISO 9001 practices.

5.3.2 Recommendations for Future Research

Future research should extend the proposed model by examining additional organizational factors that may influence quality improvement and ISO 9001 practices, including leadership, organizational culture, employee engagement, digital transformation, and organizational learning. Examining these factors could provide a more comprehensive understanding of the organizational conditions that support continuous quality improvement and effective ISO 9001 implementation. Future studies should also conduct comparative research across different industrial sectors and geographical regions to examine whether the relationships identified in this study remain consistent across different organizational and environmental contexts. Such studies could help assess the generalizability of the proposed model and identify contextual factors that may influence quality improvement and ISO 9001 practices. In addition, longitudinal research is recommended to examine how entrepreneurial orientation, business environment, knowledge management, quality improvement, and ISO 9001 practices develop and change over time. A longitudinal approach could provide a deeper understanding of the temporal relationships among these constructs and offer stronger evidence regarding the sustainability of quality improvement and ISO 9001 implementation. Future researchers may also consider applying mixed-method and multi-group analytical approaches to obtain deeper insights into the proposed relationships. Multi-group analysis could be used to compare differences among industrial factories based on organizational characteristics, while qualitative approaches could provide further explanations of how organizational capabilities are translated into quality improvement practices. Finally, future studies should further validate and refine the proposed causal model using samples from different organizational contexts and larger populations. Replication studies would help assess the robustness of the findings, strengthen the generalizability of the model, and contribute to a more comprehensive understanding of the relationships among organizational capabilities, quality improvement, and ISO 9001 practices.

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