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RESEARCH PAPER

Integrating Quality Culture into Sustainable Agricultural Practices: A Statistical Assessment of Organizational Performance Drivers in the Iranian Input Industry

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Abstract

This study investigates the role of quality culture in enhancing continuous improvement and decision-making within Iran's agricultural sector, using Behrooyesh Pars Company as a case study. Focusing on key pillars—management commitment, customer orientation, and fact-based thinking—it reveals a strong empirical link between quality culture and operational performance. Notably, fact-based decision-making shows a 60% positive correlation with continuous improvement, underscoring their mutual reinforcement when embedded in a robust cultural framework. The research also demonstrates that management support and customer focus significantly influence decision-making quality and organizational adaptability. Unlike prior studies that primarily conceptualize quality culture, this work offers empirical insights into how these cultural elements directly impact operational outcomes. Ultimately, the study proposes a practical framework tailored for agricultural input manufacturers, connecting quality culture values to measurable outcomes such as improved decision-making, continuous improvement, and enhanced organizational performance. This research advances the understanding of quality culture's practical benefits in agricultural operations. It is seen that the companies must emphasize "continuous improvement" in order to consistently develop quality products and services while also reducing costs to enhance customer satisfaction. "Continuous improvement" focuses on service, product, and production processes, creating achievement levels that are continuously elevated, assisting in the correct execution of current tasks and their future improvement.

Keywords:
Quality Culture, Continuous Improvement, Decision-Making, Agricultural Industry, Iran, Quality Values.

1. Introduction

Quality culture plays a pivotal role in shaping how organizations pursue excellence, manage complexity, and respond to customer needs. While the term is often treated as a general concept, its influence can be observed in two key areas of operational performance: the organization's ability to continuously improve its processes, and the extent to which it bases its decisions on evidence and data rather than intuition or hierarchy. In this sense, quality culture is more than a collection of shared values—it is a foundational enabler of strategic agility and long-term competitiveness.

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Despite the critical importance of quality culture in improving the quality of an organization's products and services, a comprehensive and practical examination of this concept in industries has largely been overlooked. While there are abundant resources, information, and knowledge available on quality, all of which emphasize its necessity, one of the most significant factors identified in related studies is the concept of quality culture. The notion of quality culture becomes especially relevant when quality programs in organizations are implemented in a superficial manner without delivering real impact.

Culture can be defined as a set of ways of life, arts, beliefs, and institutions passed down from generation to generation within a society. Some also define culture as the "way of life of a society," which includes customs, attire, language, religion, rituals, and art [1]. On the other hand, the modern definition of quality, as described by Juran, is "fitness for use" [2]. This definition essentially means that quality is about meeting or exceeding customer expectations. The common thread in all definitions of quality is the necessity for the product or service to align with the needs and expectations of the customer. In other words, quality is achieved when a product or service satisfies the expectations of both internal and external customers.

Quality culture comprises a set of attributes that are easily recognizable and observable. As individuals cultivate an inclination toward innovation and continuous improvement, ethical and collaborative behaviors become a core value. From entry-level employees to senior leaders, and from supply chain partners to customers, everyone collaborates to achieve goals and improve operations.

Ken Sheed describes one of the key strategies in promoting a quality culture: "Ensure that all employees know their product or service, know their customer, understand customer expectations of quality, and have a metric to measure that quality" [3]. Accordingly, the quality culture has several identifiable components:

- Senior management clearly supports quality initiatives, visions, and associated values.
- Active and ongoing engagement with customers to identify and address current and evolving needs is conducted.
- Quality goals are explicitly stated.
- Performance expectations for all individuals within the organization are clearly tied to quality objectives.
- Appropriate incentives for employees are provided.

While the overall state of quality culture in an organization may seem intangible, the value of taking steps toward creating a quality-focused culture can be highly impactful [3]. Consequently, quality culture is a subset of the broader organizational culture, reflecting the organization's approach, values, and attitudes toward quality in its operations.

After the 1940s, prominent figures such as Deming, Juran, and other quality management pioneers in Japan helped establish a quality culture system in the country, fundamentally improving the quality management level of Japanese companies. This development enabled Japan to dominate the global market in less than 20 years [4]. The first comprehensive definition of quality culture was provided by the European University Association (EUA), describing it as an organizational culture that continually strives for quality improvement. This culture is characterized by two elements: on the one hand, a cultural/psychological element that encompasses shared values, beliefs, expectations, and a commitment to quality; and on the other, a structural/managerial element that focuses on improving quality through defined processes, with the aim of aligning individual efforts [5].

Organizational leaders face a complex challenge: responding to market demands, meeting customer expectations, and anticipating and adapting to market changes to maintain a competitive edge. This challenge drives the need for improved efficiency and performance while also requiring the preservation of a healthy work environment [6]. However, many

organizations fail to meet these challenges. One of the reasons for this failure is the insufficient focus on quality management tools and processes, as well as a weak understanding of the importance of quality culture [7].

Given the importance of improving quality across all organizations and the central role of organizational culture in this process, the implementation of continuous improvement cycles is not possible without considering organizational culture, or in other words, quality culture. Therefore, before taking any steps to improve quality and initiate continuous improvement projects, it is essential to focus on and strengthen the quality culture. Since the first step in achieving this goal is to evaluate and assess the current state of quality culture, it is necessary to examine and evaluate quality culture across various industries using effective and efficient methods. To embed quality culture as a permanent value in the mindset and actions of individuals and organizational units, a correct understanding of the concept of quality must first be established, followed by the development and completion of a quality assurance system within the organization. This system includes management, operational documentation, strategies, policies, and quality assurance programs [5].

One of the most important and strategic industries in any country is the agricultural and agricultural inputs industry. Agricultural inputs refer to products used in organic farming, including seeds, equipment, fertilizers, plant protection products, as well as cleaning agents and additives used in food production.

The world's largest agricultural producers are China, India, the United States, and Brazil, respectively [8]. China, despite having only 10% of the world's arable land, produces a quarter of the world's grain and leads in the production of fruits, vegetables, grains, cotton, eggs, and poultry. According to the Food and Agriculture Organization of the United Nations (FAO), Iran ranks between third and nineteenth globally in the production of 20 key agricultural products. These products include honey (3rd), pistachios (3rd), walnuts (3rd), almonds (4th), watermelon (4th), kiwifruit (5th), eggplants (6th), onions (7th), tomatoes (7th), spinach (8th), Iranian oranges (9th), grapes (11th), sugar (11th), wheat (12th), tea (12th), barley (13th), olives (18th), potatoes (19th), and pears (19th) [9].

Over the past two decades, numerous scholars have investigated the concept of quality culture across various industries. For example, Sinclair and Collins [10] and Dellana and Hauser [11] laid the foundation by conceptualizing quality culture and proposing theoretical frameworks. Later, researchers like Woods [12] and Cameron & Sine [13] introduced key cultural values and measurement models, often linking quality culture with organizational performance and behavioral norms. More recent works, such as those by Cronemyr et al. [14] and Friedli et al. [15], have aimed to operationalize quality culture using behavioral indicators and surveys, particularly in manufacturing and pharmaceutical contexts. However, these studies largely focus on Western or industrialized economies and do not address the unique characteristics of sectors like agriculture, especially in emerging markets such as Iran.

Moreover, although existing instruments such as the EFQM model, ISO-based assessments, and behavioral surveys provide useful insights, they often lack industry-specific customization. Few studies have attempted to integrate multi-dimensional frameworks (e.g., Kano, importance-exchange, synthesis models) into a unified assessment tool. Most importantly, there is a notable gap in empirical applications of quality culture assessment in the agricultural inputs sector, which plays a critical role in food security and rural development but has received limited scholarly attention.

This study addresses these limitations by proposing a tailored, empirically validated quality culture assessment model specifically designed for the agricultural inputs industry in Iran. By integrating behavioral dimensions with statistical validation techniques such as confirmatory factor analysis (CFA) and regression analysis, the research fills a methodological and contextual gap in current literature.

Iran possesses a diverse agricultural sector due to its varied climate zones, which allow for the production of both tropical and cold-climate crops. However, this sector faces several structural and operational challenges. These include water scarcity, outdated farming techniques, fragmented land ownership, inconsistent government policies, and limited access to global agricultural innovations. The agricultural inputs industry — encompassing fertilizers, seeds, pesticides, and equipment — plays a crucial role in supporting agricultural productivity but is often underregulated and fragmented.

From a quality management perspective, Iran has made strides in adopting standards such as ISO 9001 in larger organizations and export-oriented firms. Nonetheless, widespread implementation of structured quality systems across industries remains uneven. In the agricultural sector, especially among small and medium enterprises (SMEs), quality management tends to be informal, reactive, and personality-driven rather than systemic. A lack of managerial training, limited access to modern quality tools, and insufficient emphasis on customer-centric values further complicate quality assurance efforts. Therefore, cultivating a strong quality culture is not only timely but essential for sustaining competitiveness, increasing productivity, and meeting both domestic and international market demands. This study contributes to this effort by analyzing how quality culture influences decision-making and continuous improvement within the Iranian agricultural inputs industry.

Thus, it can be stated that the agricultural input production industry is a vital and foundational sector that has a wide-ranging impact on many aspects of human life. Consequently, neglecting quality improvement in this industry, and prior to that, assessing and enhancing the quality culture in agriculture-related industries, is of utmost importance.

Agriculture serves as the backbone of many economies, particularly in developing countries such as Iran, where a significant portion of the population relies on agricultural activities either directly or indirectly. The quality of agricultural inputs—such as seeds, fertilizers, and pesticides—has a profound impact on crop yields, food security, and ultimately, the stability of rural economies. A lack of quality control or poor decision-making in this sector can lead to large-scale inefficiencies, environmental damage, and food loss. Therefore, promoting a strong quality culture among agricultural input manufacturers is not only essential for improving organizational performance but also has far-reaching implications for national agricultural productivity and economic sustainability. This study, by focusing on a representative case from Iran's agricultural input industry, contributes to bridging this critical gap and offers insights that can be generalized to similar sectors across developing economies.

In recent years, both academic literature and industry experience have increasingly emphasized the connection between quality culture and process improvement. When quality values—such as management commitment, customer focus, data-driven thinking, and employee participation—are internalized, organizations tend to make more informed decisions and sustain improvements over time. However, few empirical studies have directly measured this relationship in context-specific industries like agricultural input manufacturing. Despite extensive research on quality management and organizational culture, few studies empirically investigate how specific dimensions of quality culture influence managerial decision-making and continuous improvement practices, particularly in the context of the Iranian agricultural sector. This study addresses this gap by analyzing the impact of quality culture dimensions—such as leadership commitment, employee engagement, customer focus, and process orientation—on decision-making and continuous improvement at Behrooyesh Pars, a leading agricultural company in Iran.

This research provides empirical evidence on the relationship between quality culture and organizational performance in an under-studied context; develops a practical framework for managers to leverage quality culture for more effective decision-making and continuous improvement; and offers actionable insights for both policymakers and practitioners seeking to

enhance quality practices in agricultural organizations. Therefore, the main contributions of the current study are categorized as follows:

- ✓ **Development of a Specialized Quality Culture Assessment Tool**: The study contributes by designing a questionnaire uniquely tailored to agricultural input manufacturing, incorporating the Kano model, synthesis model, and importance-exchange model, offering a novel approach for evaluating quality culture in this sector.
- ✓ **Empirical Insights from an Industry-Specific Case Study**: By focusing on Behrooyesh Pars Company, the research provides real-world data and insights specific to the agricultural input manufacturing industry, filling a gap in quality culture studies within this vital sector.
- ✓ **Identification of Key Quality Culture Drivers**: The research reveals a strong correlation between fact-based decision-making and continuous improvement (60%), offering significant theoretical contributions by pinpointing critical factors that influence organizational performance in agricultural industries.
- ✓ **Application of Advanced Statistical Methods in Quality Culture Assessment**: The study employs confirmatory factor analysis, correlation, and regression techniques to rigorously examine relationships between quality culture attributes, showcasing the use of sophisticated analytical tools in quality management research.
- ✓ **Practical Framework for Enhancing Quality Culture**: The research provides actionable recommendations for industry leaders, suggesting strategies to improve quality culture through management commitment, customer-centric practices, and data-driven decision-making, offering valuable guidance for fostering continuous improvement in the agricultural manufacturing industry.

By clarifying these contributions, the study not only advances the theoretical understanding of quality culture in non-Western, sector-specific settings but also provides tangible managerial benefits, such as improved process efficiency, enhanced employee engagement, and more informed strategic decisions.

The remainder of the study is organized as follows: The next section reviews the literature on quality culture assessment and related experiences in various industries in Iran. Section three outlines the four key steps for assessing quality culture, including preliminary activities, questionnaire design and distribution, data analysis, and discussion, under the methodology section. Section four presents a case study on a company producing agricultural inputs and the implementation of the four quality assessment steps. Finally, section five is dedicated to the research conclusion.

2. Literature Review

The topic of quality culture has attracted the attention of many researchers and has been examined from various perspectives. Sinclair and Collins [10] were the first to study quality culture. Following their work, Delana et al. [11] conducted a study in which they defined and analyzed the frameworks of quality culture. Woods [12] introduced six key values in quality culture, offering a novel and insightful perspective on the subject. Cameron and Sine [13] proposed a framework for organizational quality culture and evaluated its validity through empirical analyses. They demonstrated how individuals define and reflect quality through their behaviors, decision-making, and attitudes. Their primary goal was to make the concept of quality culture more tangible for organizational researchers and managers responsible for managing or improving quality within organizations. Harvey and Stensaker [16] examined the connections, interdependencies, and boundaries of quality culture in their research.

Several scholars have studied the dynamic relationship between quality culture and organizational performance outcomes for example, Heber et al. [17] found that strong quality culture significantly enhances the success of Total Quality Management (TQM) practices and

continuous improvement initiatives. Fredley et al. [18] studied the positive relationship between quality culture and the maturity of quality systems. Rigby and Bildow [19] also demonstrated that maintaining quality culture requires as much attention as large-scale organizational strategies for success.

Roushou and Salirosas [20] presented a theoretical model for determining the impact of quality culture on managerial performance in hospitals. Their study, conducted in hospitals in Argentina, Brazil, and Peru, found that quality culture can significantly influence the successful adoption of management software. Sariklay and Tirvinen [21], in a study on a software development organization, found that agility alone could not resolve identified issues, but quality culture, combined with agility metrics, had a significant impact on performance improvement.

Verscheuren et al. [22] examined quality assurance in higher education from the perspective of quality culture and proposed a conceptual model that includes structural/managerial elements as well as individual and interpersonal dynamics. Kartini et al. [23] investigated the impact of quality culture on the quality of services and infrastructure. They found that quality culture positively affects both service quality and infrastructure, with infrastructure quality acting as a positive mediator for service quality.

Alzate Ibañez et al. [24] explored quality culture in project management in Colombia and analyzed four main dimensions of quality culture: customer focus, leadership and communication, human talent, and project performance. Their study showed that factors such as documentation, effective communication, soft skills, professional development, and leadership play key roles in project success.

Wiedente et al. [25] examined the quality of life for workers during the COVID-19 pandemic. They found that quality of life was directly influenced by safety culture and indirectly influenced by quality culture. Claro and Africano [26] conducted a comprehensive study on quality culture, presenting their results using bibliometric tools. Moon et al. [27] established that a culture oriented toward quality improves not only job creativity but also customer orientation and decision-making effectiveness. In the context of decision-making, Amah and Ahiauzu [28] argued that shared quality values foster environments where data is trusted and used consistently in managerial decisions. More recently, Vanegas-Merchán et al. [29] emphasized that leadership commitment and human-centered values—key quality culture traits—are central to enabling consistent, fact- based decision-making.

ISO 9001 is still the most widely used international standard for quality management systems (QMS). The next revision, ISO 9001:2025, will focus on being flexible, thinking about risks, and integrating digital technology. These standards provide a structured way for businesses to instill a culture of quality. The seven Quality Management Principles (QMPs) that make up ISO 9001 are: putting the customer first, being a good leader, getting people involved, using a process approach, making decisions based on evidence, and managing relationships. The core values that were looked at in this study, such as management commitment, customer focus, process focus, and continuous improvement, are very similar to these principles. Studies have shown that companies that follow ISO 9001 standards tend to have stronger quality cultures, especially when it comes to strategic alignment, documentation, and accountability [30].

Recently, Sahdat et al. [31] conceptualized quality culture as the cornerstone of educational quality, linking it to the practical application of shared beliefs, values, and continuous improvement processes within educational institutions. Their findings suggested that a strong quality culture fosters a quality work culture, which in turn enhances teacher performance and student outcomes, thus ensuring sustainable educational quality. Huisman [32] critically reviewed the concept of quality culture from a research quality perspective, highlighting both empirical studies that refine the concept and those that contribute little to its scholarly

understanding. He identified conceptual confusion and a lack of reliability in many studies, suggesting that clearer definitions and more rigorous methodologies are needed to advance the field. Sutono [33] examined the role of quality culture in vocational tourism education in Indonesia, particularly in the post-pandemic context. His study reveals that institutions with a strong commitment to quality improvement—evidenced through curriculum innovation, teaching practices, and industry engagement—are better equipped to produce globally competitive graduates. Fundin [34] extended the framework of quality culture by linking it to employee performance and organizational values, suggesting that aligning quality culture with organizational behaviors and preferences can help organizations assess and improve their progress in cultural transformation. Wulandari and Darma [35] and Parura et al. [36] also explored the role of quality culture in healthcare and construction industries, respectively, shown that accreditation and a robust quality culture significantly contribute to improving the quality of services in both fields. Silva et al. [37] applied the DEMATEL method to identify the critical elements of quality culture in a tire manufacturing company in Sri Lanka. They found that leadership and employee empowerment are the most influential drivers of quality culture, and suggested that organizations should prioritize these areas to strengthen their quality culture and sustain competitiveness. Ulkhaq et al. [38] focused on the relationship between internal and external quality assurance systems and quality culture in Indonesian universities, finding that these factors collectively enhance teaching, research, and community service outcomes, further boosting the performance of higher education institutions. Qureshi et al. [36] explored staff perceptions of quality assurance in Omani higher education institutions, finding that staff face various challenges in conceptualizing and implementing quality assurance practices, and that overcoming these challenges is essential for fostering a sustainable quality culture. Chung et al. [40] focused on the corporate sector, specifically examining the relationship between quality culture and product recalls. Their results indicated that companies with a stronger quality culture are less likely to face product recalls, with the effect being more pronounced in high-tech and globalized industries

In addition, these principles create a common language for quality that makes it easier to compare and learn from other industries. Adding the ISO framework to the evaluation of quality culture not only makes the organization more cohesive, but it also makes sure that it follows international best practices. The agricultural inputs industry needs more and more traceability, customer responsiveness, and operational excellence. Evaluating quality culture with ISO 9001:2025 in mind is useful for both academics and managers. This alignment makes sure that the proposed model is not only based on theory but can also be put into practice within a quality framework that is accepted around the world.

These studies suggest that quality culture is not only a theoretical construct but a strategic enabler of two essential practices in modern organizations: continuous improvement and evidence-based decision-making. Building on this foundation, our study examines how this relationship plays out in the agricultural input manufacturing sector of Iran. In other words, given the existing literature, it is evident that a combined approach of descriptive and inferential statistics has not yet been used to assess and develop a quality culture model in the agricultural sector. Furthermore, in Iran, quality culture has only been studied in the education sector. Therefore, this research, focusing on assessing quality culture in the agricultural sector in Iran, utilizes both descriptive and inferential statistics and conducts its analyses using a questionnaire designed based on Kano models.

Also, Prior research predominantly focuses on manufacturing or service sectors in Western contexts, with limited attention to how quality culture affects organizational decision-making and continuous improvement in Iranian agricultural companies. This research bridges this gap by applying established quality culture frameworks in a novel industrial setting, providing insights that are both contextually relevant and theoretically meaningful.

3. Methodology

This research uses a case study method that is based on numbers. The study only looks at one company, Behrooyesh Pars Company, but it uses structured data collection methods like surveys and statistical methods like correlation, regression, and factor analysis. This design enables in-depth insight into the company's quality culture while maintaining a rigorous analytical framework. The proposed analytical approach in the current study is illustrated in Figure (1). The following sections will provide a detailed explanation of the four key steps of the current research methodology.

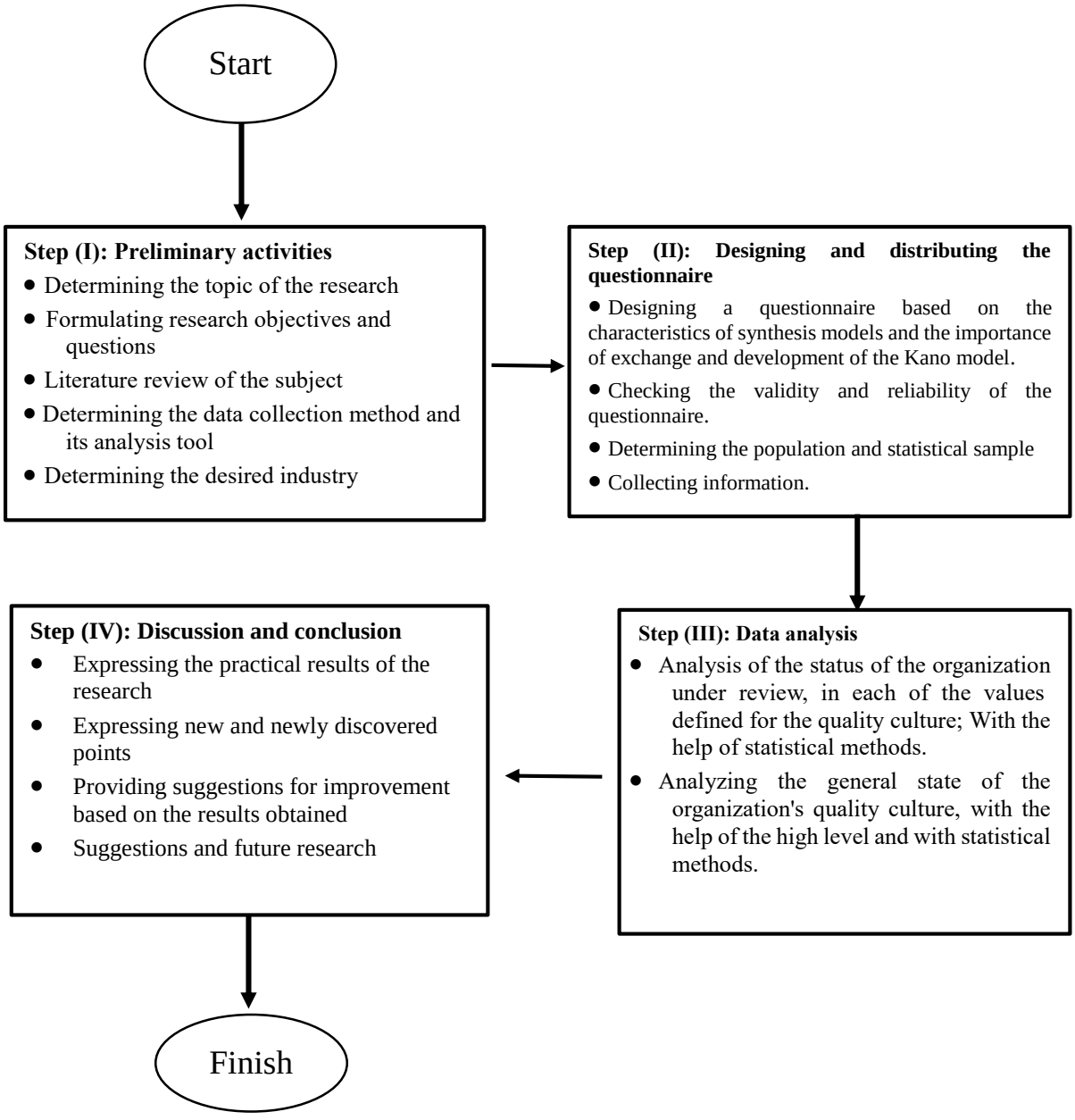


Figure 1: The structured methodological framework for assessing quality culture in study's problem

Step (I): Preliminary Activities

One of the most important tasks in this phase is selecting the appropriate industry for evaluating quality culture. Additionally, based on the type and amount of available and stored data in data warehouses, an appropriate method for data collection will be identified. If relevant data on quality culture is not available, questionnaires will be distributed to gather the required information.

Step (II): Questionnaire Design and Distribution

In this study, a quantitative case study design was adopted, focusing on Behrooyesh Pars Company as a single organizational unit. Even though the study only looked at one company (which is a common feature of case study design), it used quantitative survey methods and statistical analysis to gather data, which makes it a quantitative case study approach. The Kano and Taguchi synthesized and developed models were used to design the questionnaire. For each value, a pair of behaviors — supportive and opposing behaviors related to quality culture — were identified. Employees of the organizations under study were then asked to specify the existing behaviors based on their experiences.

It is worth noting that the questionnaire is designed in such a way that, from the respondents' perspective, there are no "right" or "wrong" answers. Instead, the questions are intended to describe the current situation, avoiding any potential bias. In this questionnaire, none of the quality values are directly mentioned. Instead, statements related to various behaviors are used. The ranking of these values is calculated based on the ranking of behaviors provided by the respondents [14].

In this research, the following values were used to assess and evaluate quality culture:

1. Committed Management (*CM*)
2. Customer-Oriented (*CO*)
3. Focus on the Process (*FP*)
4. Decision-making Based on Truth (*DT*)
5. Participation and Cooperation (*PC*)
6. Continuous Improvement (*CI*)

For each of these values, supportive and obstructive behaviors were defined and quantified. These behaviors were identified through literature reviews and Delphi analysis, in collaboration with organizational experts and quality management professors. The final questionnaire consists of twelve questions, with two questions designed for each value. Each question is rated on a seven-point Likert scale, and if the respondent has no observation of the behavior in question, they can select an option outside the scale (which is scored as -1).

The validity of the questionnaire was assessed using face validity. To achieve this, the questionnaire was presented to academic professors and industry experts. After multiple reviews and incorporating expert recommendations, the final version of the questionnaire was developed. Cronbach's alpha was used to measure reliability [41]. A random sampling method was employed for distributing the questionnaire to ensure that all employees had an equal chance of being selected.

To determine the appropriate sample size, Cochran’s formula [42] was applied and respondents were chosen from among employees with sufficient knowledge and experience to answer the questionnaire**.**

$$n = \frac{Nz^2pq}{Nd^2 + z^2pq} \tag{1}$$

In this formula:

- *N* represents the population size.
- The statistic *p* denotes the proportion of the population possessing the characteristic under study, while *q* represents the proportion of individuals without the characteristic (if *p* and *q* are unknown, 0.25 or their maximum value of 0.5 is used).

Cochran’s formula was applied to calculate the sample size because it provides a robust method for determining sample size when the population is large and the proportion of attributes in the population is unknown. This formula ensures an optimal balance between precision and confidence level, thereby minimizing sampling error.

At the time of the study, Behrooyesh Pars had 34 employees (N). We figured out that the sample size needed to be 30, with a maximum variability of 0.5, a confidence level of 95% ($z = 1.96$), and a margin of error of 5% ($d = 0.05$). To get a wide range of responses, questionnaires were randomly given to employees in different departments, such as production, quality control, sales, and administration. All 30 of the questionnaires that were sent out were returned, which means that everyone answered. Respondents were selected based on their knowledge of the company's quality-related practices and processes, and all had at least one year of organizational tenure.

Step (III): Data Analysis

In this study, descriptive statistics were initially used to conduct a preliminary review of the questionnaire and analyze the respondents' characteristics to assess the potential for bias. Inferential statistics were then applied for a detailed analysis of the data. After extracting the questionnaire data, demographic analyses were conducted using descriptive methods such as frequency, mean, percentage, and standard deviation. To evaluate quality culture within the industry and to examine the relationships between different items, inferential statistical methods such as confirmatory factor analysis, correlation analysis, and regression were used. Once the item network was established, the current state of the industry's quality culture level could be assessed.

Step (IV): Discussion

The final step of the research process involves presenting the novel findings and insights discovered after the data analysis.

4. Case Study

To assess the quality culture based on the methodology introduced in the previous section, the company Behrooyesh Pars, a leading company in the agricultural inputs industry, was selected as the subject of study. This company began its operations in 2011 in Isfahan Province, Iran. Behrooyesh Pars is involved in several areas, including the supply and distribution of high-quality greenhouse and open-field seeds, top brands of fertilizers and pesticides, as well as premium varieties of turfgrass and ornamental plants. Moreover, the company has ventured into international trade, aiming to export Iranian agricultural products to global markets. Behrooyesh Pars is responsible for supplying inputs to over 400 hectares of greenhouses and overseeing more than 2,000 hectares of farmland, including watermelon and melon fields.

Among its key products, the company offers agricultural tools such as pruning saws, trowels, gardening axes, knives, and pruners, along with various types of seeds like turfgrass and ground cover seeds, cactus and ornamental flower seeds, medicinal plant seeds, open-field and greenhouse seeds, and a range of pesticides and fertilizers.

In the following, the case study is reviewed by applying the four steps outlined:

Step (I): Preliminary Activities

In this research, the agricultural inputs industry was studied with a focus on Behrooyesh Pars. Since no data related to quality culture metrics was available within the company, a custom-designed questionnaire was used to collect data.

Step (II): Questionnaire Design and Distribution

Using Cochran's formula, the required sample size for this study was determined to be 30 employees. A random sampling method was employed to distribute the questionnaires among the employees of Behrooyesh Pars, ensuring that every employee had an equal chance of

selection. As mentioned earlier, the validity of the questionnaire was assessed through face validity, and its reliability was evaluated using Cronbach's alpha test. After the questionnaires were completed, Cronbach's alpha was calculated to be 0.85. Since an alpha coefficient above 0.7 indicates sufficient reliability, the questionnaire was deemed to have adequate reliability. Additionally, the split-half test results were 0.72 for the first half and 0.81 for the second half, both of which exceed the 0.7 threshold.

Table (1) represents the alpha values for each question related to the values, representing the various dimensions of the questionnaire:

Table 1: The results of Cronbach's alpha test to check the reliability of the research tool

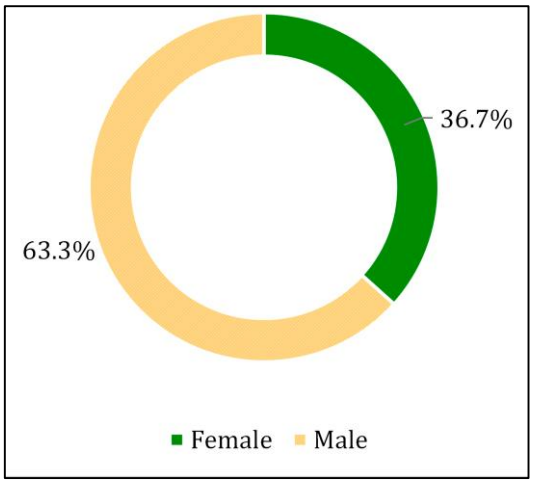
Criteria	***CM***	***CO***	***FP***	***DT***	***PC***	***CI***	**Questionary**
Cronbach's alpha	0.755	0.734	0.862	0.749	0.743	0.855	0.853

Step (III): Data Analysis

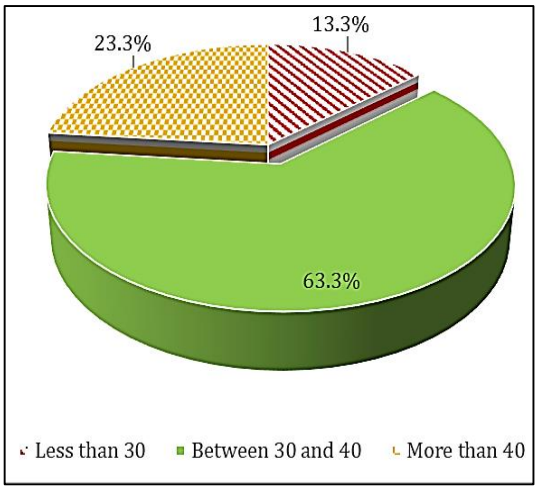
Initially, descriptive statistics were employed to analyze the demographic data. Subsequently, inferential statistical methods, including CFA, Spearman's correlation coefficient, and regression analysis, were used to assess the quality culture within Behrooyesh Pars. For this purpose, SPSS software was utilized.

A) Descriptive Statistics

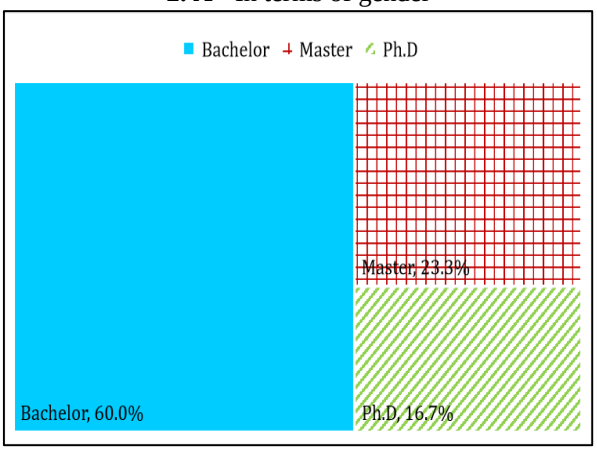
Figure (2) presents the descriptive statistics related to the demographic characteristics of the study participants.



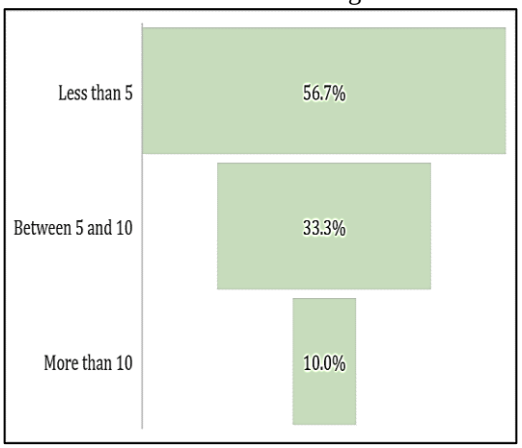
2. A - In terms of gender



2. B - In terms of age



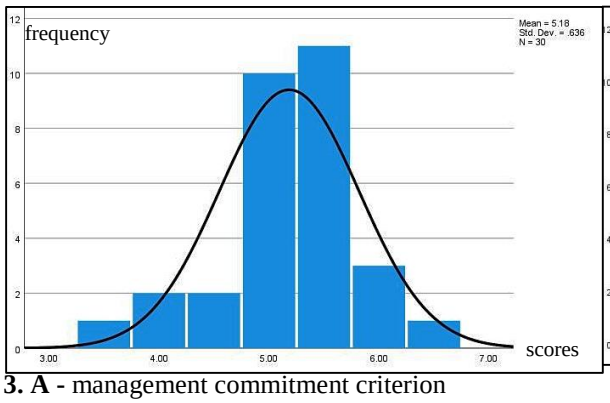
2. C - In terms of academic degree



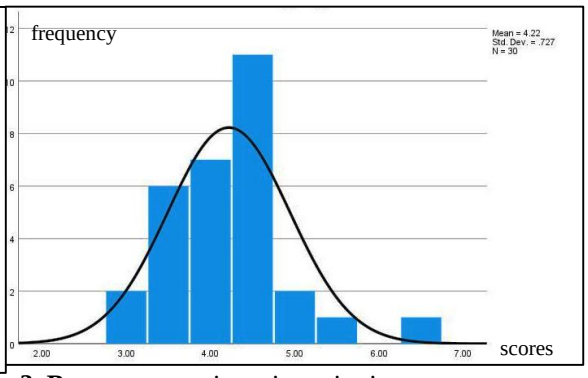
2. D - In terms of service history

Figure 2: Demographic profile of respondents participating in the quality culture assessment

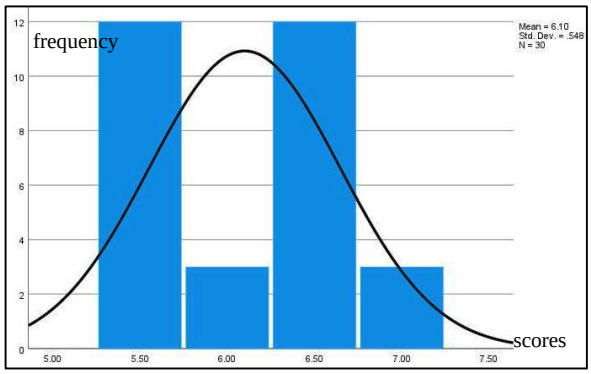
Figure (3) shows the distribution of answers provided by the sample to each of the questionnaire items:



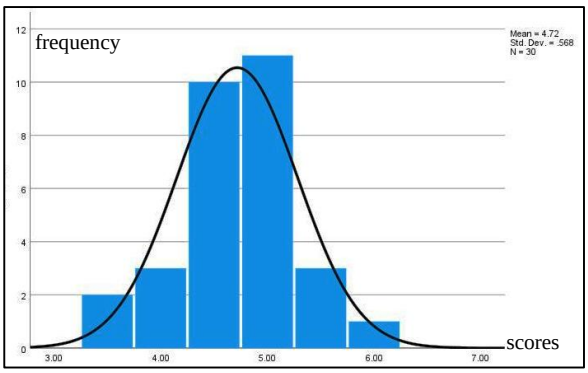
3. A - management commitment criterion



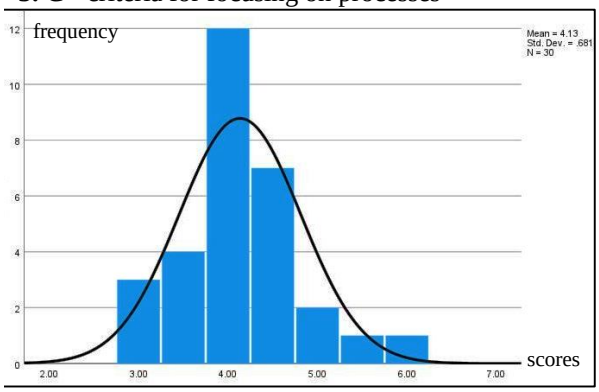
3. B - customer orientation criterion



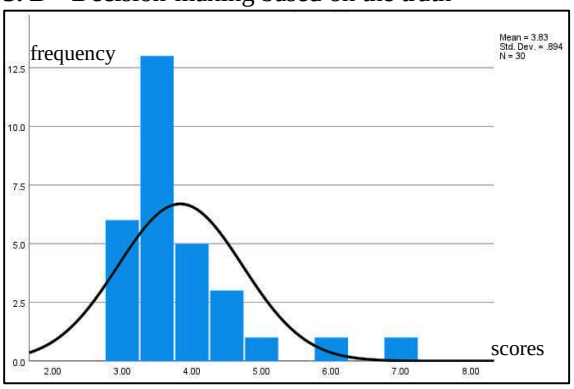
3. C - criteria for focusing on processes



3. D - Decision-making based on the truth



3. E- The criterion of participation and cooperation



3. F - the criterion of continuous improvement

Figure 3: Response Distribution Across Quality Culture Dimensions in Behrooyesh Pars Company

Table (2) shows the descriptive statistics including the mean and standard deviation of the sample answers. It is seen that, the FP component exhibits the highest mean among all components, followed by the CM and DT components. These three components exceed the overall mean score obtained from the questionnaire assessment. In terms of standard deviation, the lowest variability is associated with FP, followed by DT and CM, all of which show dispersion values lower than the overall standard deviation of the questionnaire.

Table 2: Central dispersion statistics of questionnaire components

Criteria	***CM***	***CO***	***FP***	***DT***	***PC***	***CI***	**Questionary**
Mean	5.18	4.22	6.10	4.71	4.13	3.83	4.69
Std. Error	0.63	0.72	0.54	0.58	0.68	0.89	0.67

B) Descriptive Statistics

According to the statistical results, the highest to lowest averages were observed in the components of "*Process Orientation*", "*Management Commitment*", "*Decision-making Based on Facts*", "*Customer Orientation*", "*Participation and Cooperation*", and "*Continuous Improvement*", respectively. The values of "*Process Orientation*" and "*Management Commitment*" were significantly above average and are considered to be in a favorable state. However, the values for "*Decision-making Based on Facts*", "*Customer Orientation*", and "*Participation and Cooperation*" were approximately at the average level, indicating a relative weakness in these areas. Lastly, the component of "*Continuous Improvement*" scored below average, serving as a warning signal for the organization.

C) Inferential Statistics (Confirmatory Factor Analysis)

Factor analysis is a statistical technique based on the assumption that correlations between a set of observed variables can be modeled using a smaller number of unobserved or latent variables, known as factors. The goal of this analysis is to identify the underlying factors based on the observed variables. In this process, new factors are extracted as linear combinations of the scores of the observed variables.

Factor analysis can be exploratory or confirmatory. In exploratory factor analysis, the researcher seeks to uncover the underlying structure of the variables without any prior hypothesis. In CFA, however, the researcher has a prior hypothesis about the structure. CFA is a part of structural equation modeling (SEM) and aims to achieve two main objectives:

1. Evaluating the fit of the proposed model with the data.
2. Estimating factor loadings, variances, covariances, and residuals of the observed variables.

In CFA, it is assumed that each factor is associated with a specific set of variables. To perform CFA, the researcher must have a hypothesis about the number of factors. This analysis ultimately determines whether the proposed factors can adequately explain the variance of the observed variables.

In this study, the questionnaire data were examined using CFA to assess the fit of the hypothetical model with the data. The prerequisites for this analysis include having a sufficient sample size (typically 5 to 20 samples), normally distributed data, no outliers, and complete data. Based on the collected data, the sample size was 30, and no outliers or missing data were detected, meeting three of the four conditions. However, for the normal distribution of data, it should be noted that the Likert scale often does not yield favorable results in tests like the Kolmogorov-Smirnov (KS) test, which may lead to rejecting the normality assumption. Therefore, it is recommended not to use this test for Likert scale data.

Instead, skewness and kurtosis analyses are preferable for checking normality. According to the book *Practical Statistics for Managers* by Keller and Levine [43 and 44], if the ratio of skewness and kurtosis to the standard error falls within the range of -2 to 2, the data can be considered normally distributed.

Table (3) displays the SPSS output, which includes the analysis of skewness, kurtosis, and their ratio to the standard deviation.

According to Table (3), it is observed that all ratios fall within the range of -2 to 2. Therefore, it can be concluded that the recorded data are normally distributed and can be used in the factor analysis. Beyond verifying normality through skewness and kurtosis, the results demonstrate that the distribution of responses across all items is largely symmetric and mesokurtic, supporting the assumption of normality. The overall mean skewness (0.11) and kurtosis (0.59) values indicate a well-balanced data pattern without extreme tails. This confirms that respondents' perceptions are evenly distributed across the scale, minimizing bias in parametric tests. Furthermore, the low variability in normality indices across items implies consistency in participants' understanding of the questionnaire items. Hence, the dataset satisfies the

conditions necessary for correlation, regression, and factor analyses applied later in the study.

Table 3: Normality test results based on Skewness and Kurtosis for survey responses

	Skewness		Kurtosis		Skewness (Kurtosis)/Std. Error	
Query	**Statistics**	**Std. Error**	**Statistics**	**Std. Error**	**Skewness**	**Kurtosis**
Q1	-0.327	0.427	-0.232	0.833	-0.765	-0.278
Q2	0.087	0.427	1.083	0.833	0.203	1.3
Q3	-0.612	0.427	0.237	0.833	-1.433	0.284
Q4	0.000	0.427	1.627	0.833	0	1.953
Q5	0.385	0.427	-0.609	0.833	0.901	-0.731
Q6	0.000	0.427	1.148	0.833	0	1.378
Q7	-0.327	0.427	-0.232	0.833	-0.765	-0.278
Q8	0.000	0.427	1.122	0.833	0	1.346
Q9	0.261	0.427	0.263	0.833	0.611	0.322
Q10	0.774	0.427	0.587	0.833	1.812	0.704
Q11	0.568	0.427	1.015	0.833	1.33	1.218
Q12	0.544	0.427	1.110	0.833	1.274	1.332

The first step in CFA is to draw the model. After constructing and fitting the model, the next step involves reviewing the factor loadings and removing items with low factor loadings. In the factor analysis model, the numbers shown on the arrows represent the estimated factor loadings, indicating the correlation between the observed and latent variables. Additionally, the small arrows pointing toward the observed variables represent the error associated with each variable.

In the diagram, if the factor loadings on the arrows (between the values and the questions) are greater than 0.4, it means that the items in question are appropriate measures for the latent variable. If there is any item with a factor loading of less than 0.4, it should be carefully removed, and the CFA should be conducted again.

Figure (4) displays the drawn model using AMOS software:

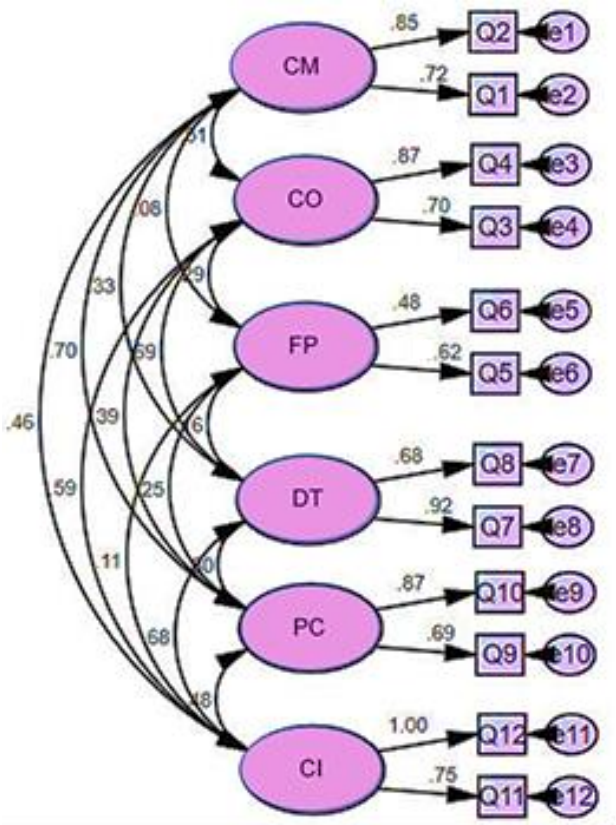


Figure 4: Confirmatory factor analysis model for quality culture dimensions and behavioral indicators

Based on Figure (4), it is observed that none of the factor loadings are below 0.4. Therefore, there is no need to remove any items, and the pre-designed model is confirmed to be valid and reliable.

D) Inferential Statistics: Correlation Analysis

Although Spearman's correlation coefficient is more suitable for analyzing the correlation of Likert-scale survey data (as these data are often non-normally distributed and may include outliers), in this study, due to the absence of outliers and the normal distribution of the data, Pearson's correlation coefficient has been used for correlation analysis.

The aim of this analysis is to provide the organization's management with insight into whether there is a relationship between the values of quality culture within the organization, and if so, the strength of that relationship. The results of this analysis can reveal how changes (either weakening or improvement) in one of these values might affect the other values and to what extent. This information, along with the organization's policies and priorities, assists leadership and management in guiding future actions, decisions, and plans towards enhancing the organization's quality culture.

In correlation analysis, values close to 1 indicate a strong positive relationship, while values close to -1 indicate a strong negative relationship. Table (4) presents the output of the calculated correlation between the values.

Table 4: Correlation matrix of quality culture dimensions in Behrooyesh Pars company

	CM	***CO***	***FP***	***DT***	***PC***	***CI***
CM	-	-	-	-	-	-
CO	0.27	-	-	-	-	-
FP	0.06	0.27	-	-	-	-
DT	0.23	0.52	0.23	-	-	-
PC	0.42	0.16	0.17	0.24	-	-
CI	0.36	0.42	-0.12	0.57	0.34	-

As shown in Table (4), the highest correlation exists between the two values of "*Decision-Making Based on Truth*" and "*Continuous Improvement*." Following that, the strongest association is observed between the values of "*Customer Orientation*" and "*Decision-Making Based on Truth*". Finally, there is a nearly identical correlation between the values of "Committed Management" and "*Participation and Cooperation*," as well as between "*Customer Orientation*" and "*Continuous Improvement*".

Table (5) presents the significance levels for the two-tailed tests. If this value is less than 0.05, the null hypothesis of no relationship between the two variables is rejected.

Table 5: Significance levels of Two-Tailed tests for correlations among quality culture dimensions

	CM	***CO***	***FP***	***DT***	***PC***	***CI***
CM	-	-	-	-	-	-
CO	0.145	-	-	-	-	-
FP	0.724	0.137	-	-	-	-
DT	0.219	0.003	0.213	-	-	-
PC	0.012	0.398	0.355	0.188	-	-
CI	0.051	0.019	0.52	0.001	0.064	-

E) Inferential Statistics: Regression Analysis

In the previous section, the values that exhibited a high correlation with one another were identified. In this section, regression analysis will be utilized to examine the degree of influence these values have on each other. For this analysis, the data must be randomly distributed and normally distributed, and there should be a linear correlation among the data. To assess this

correlation, Pearson coefficients, as presented in Table (5), are employed.

While regression analysis can be conducted between two variables across any correlation range, it is advisable for a linear correlation to fall within the range of 0.4 to 0.6 to obtain acceptable results. If the linear correlation is very weak or nonexistent, the reliability of the regression analysis results will be compromised. Conversely, if the linear correlation is very strong, the regression analysis may yield inaccurate results due to non-linear effects and interactions with other variables. Therefore, it is recommended that the linear correlation between the two variables remains moderate.

In this context, the beta coefficients derived from the regression analysis in *SPSS Statistics* 27.0.1 will be of particular interest. Table (6) displays the values of these coefficients for the various values examined.

Table 6: Impact analysis of quality culture values using standardized regression Beta coefficients

	CM	***CO***	***FP***	***DT***	***PC***	***CI***
CM	-	-	-	-	-	-
CO	-	-	-	-	-	-
FP	-	-	-	-	-	-
DT	-	0.592	-	-	-	-
PC	0.558	-	-	-	-	-
CI	-	0.535	-	0.60	-	-

As observed, the Beta coefficient between the values of "*truth-based decision-making*" and "*continuous improvement*" is equal to 0.6. This means that for every 1-point increase or decrease in the value of "*truth-based decision-making*", there is a corresponding 0.6-point increase or decrease in the value of "*continuous improvement*", and vice versa. The beta coefficient for the values of "*truth-based decision-making*" and "*customer orientation*" is 0.592, for "*continuous improvement*" and "*customer orientation*" it is 0.535, and for "*participation and collaboration*" and "*management commitment*" it is 0.558.

Through this analysis, in addition to understanding how changes in each of the correlated values affect the dependent value, it becomes possible to prioritize those values that have a greater impact on others when implementing organizational policies. It is important to note that improving any of these paired values will enhance the other, ultimately leading to an overall improvement, or the enhancement of quality culture within the organization. Therefore, this analysis enables the identification of correlated values, assessment of their mutual impact, and the formulation of necessary decisions for their improvement.

Step (IV): Discussion

The results of this questionnaire clearly indicate which dimensions the Behrooyesh Company excels in and which ones it lacks strength. This information can assist in maintaining strengths and addressing weaknesses by prioritizing appropriately in accordance with organizational conditions. Additionally, it was determined which values within the organization are correlated and to what extent.

In previous sections, it was noted that Behrooyesh Company achieved the lowest score in the value of "*continuous improvement*". In other words, the company does not pay much attention to "*continuous improvement*" and tends to favor a steady state. However, current research trends indicate that companies must emphasize "*continuous improvement*" in order to consistently develop quality products and services while also reducing costs to enhance customer satisfaction. "*Continuous improvement*" focuses on service, product, and production processes, creating achievement levels that are continuously elevated, assisting in the correct execution of current tasks and their future improvement.

It was also observed that the values of "*customer orientation*" and "*truth-based decision-*

making" exhibit a high degree of correlation. Therefore, to strengthen customer orientation and develop its business, Behrooyesh Company must pay greater attention to customer feedback, thoroughly examining it without bias, and implementing changes when necessary. Research findings indicate that intrinsic motivation has a positive relationship with employees' job creativity, while job creativity positively affects customer orientation. In other words, work motivation influences employee performance through job creativity, ultimately affecting customer orientation. Thus, it can be asserted that one effective strategy for improving the value of "*customer orientation*" is to enhance employee motivation by improving their working conditions.

5. Method Validation

To enhance the scientific rigor and reliability of the proposed structured framework, its validity was examined from two complementary perspectives, namely conceptual validation and structural/statistical validation. This multilayered validation approach enabled the simultaneous assessment of the framework's theoretical coherence, statistical adequacy, and the validity of its measurement structure.

5.1. Conceptual Validation of the Framework

Conceptual validation was conducted to evaluate the comprehensiveness, logical consistency, clarity, and practical applicability of the proposed framework [45]. For this purpose, a panel of 30 experts, consisting of university faculty members, specialists in quality management, and industrial managers and experts from the agricultural industry, was employed to assess the framework. The evaluation was performed based on four principal criteria: conceptual clarity, completeness, logical consistency, and applicability. Conceptual clarity referred to the degree of transparency in the framework's stages, dimensions, and interrelationships. Completeness assessed the extent to which the framework comprehensively covered the dimensions of quality culture without omitting key components. Logical consistency examined the coherence among the four major stages of the framework, including preliminary activities, instrument design, data analysis, and managerial interpretation. Applicability evaluated the feasibility of implementing the framework within the real operational environment of the agricultural input industry.

The evaluation results indicated that the proposed framework possesses a coherent, practical, and industry-compatible conceptual structure. Furthermore, the expert panel emphasized that the integration of statistical analyses with managerial interpretation substantially enhances the practical utility of the research findings for organizational decision-making processes.

5.2. Structural and Statistical Validation

Structural validation was performed to assess the adequacy of the measurement model and to confirm the six-dimensional structure of quality culture [46]. In this stage, reliability, convergent validity, discriminant validity, and internal consistency of the model were systematically examined.

The reliability of the measurement instrument was evaluated using Cronbach's alpha coefficient and the split-half reliability test. The overall Cronbach's alpha value was calculated at 0.853, indicating a satisfactory level of questionnaire reliability. In addition, the split-half reliability coefficients (0.72 and 0.81) further confirmed the acceptable internal consistency of the instrument.

Moreover, prior to conducting CFA, the normality of the data distribution was assessed using skewness and kurtosis indices. The results demonstrated that all values were within the acceptable range of ±2, indicating that the data distribution was suitable for parametric analyses

and CFA procedures.

To evaluate the measurement structure of the model, CFA was conducted. The findings revealed that all measurement items exhibited factor loadings above the minimum acceptable threshold of 0.40; therefore, no items were removed from the model. The standardized factor loadings ranged from 0.48 to 0.92, demonstrating adequate relationships between the observed variables and their corresponding latent constructs. The highest factor loading was associated with the "DT" construct, whereas the lowest loading belonged to one of the indicators related to the "FP" dimension.

Convergent validity was assessed using two widely accepted indicators, namely Average Variance Extracted (AVE) and Composite Reliability (CR). The AVE index measures the extent to which a construct explains the variance of its indicators, with values above 0.50 considered acceptable. Similarly, CR evaluates the internal consistency of constructs, with values exceeding 0.70 indicating satisfactory reliability [47]. The results of AVE and CR are presented in Table (7).

Table 7: results of AVE and CR

	CM	***CO***	***FP***	***DT***	***PC***	***CI***
AVE	0.620	0.623	0.307	0.654	0.599	0.659
CR	0.765	0.766	0.466	0.787	0.747	0.794
Result	Acceptable	Acceptable	Needs Improvement	Acceptable	Acceptable	Acceptable

As shown in the Table (8), five out of the six principal constructs achieved AVE values above 0.50 and CR values above 0.70, indicating satisfactory convergent validity and composite reliability. These findings suggest that the indicators of each construct adequately captured their intended latent concepts.

However, the "FP" construct exhibited AVE and CR values below the recommended thresholds. The primary reason for this issue can be attributed to the relatively low factor loading of one of its indicators (0.48), implying weaker convergence between that specific item and the underlying construct. From a methodological perspective, this issue may stem from several factors, including differences in employees' perceptions of process orientation, the specific contextual characteristics of the industry under investigation, or sample size limitations.

Nevertheless, since all factor loadings remained above the minimum acceptable level of 0.40 and the "FP" construct is strongly supported within the quality culture literature, the construct was retained in the final model.

Discriminant validity was further examined using the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio (HTMT) [48]. These indices evaluate the extent to which each construct is empirically distinct from the others. In the HTMT criterion, values below 0.85 indicate adequate discriminant validity, while in the Fornell–Larcker criterion, the square root of the AVE for each construct should exceed its correlations with other constructs.

Based on the correlation matrix, the relationships among the constructs were found to be within acceptable limits, and no substantial overlap among the dimensions was observed. Therefore, the model demonstrated an acceptable level of discriminant validity.

Overall, the findings of both conceptual and structural validation indicate that the proposed framework possesses adequate reliability in terms of theoretical coherence, industrial applicability, satisfactory reliability, acceptable convergent validity, and a relatively stable statistical structure.

6. Sensitivity Analysis

To examine the robustness and sensitivity of the relationships derived from the regression

model, a sensitivity analysis was conducted on the most influential dimensions of quality culture. In this analysis, gradual changes were applied to the independent variables including DT and CO. The sensitivity analysis was performed under three distinct scenarios, including conservative (+10%), moderate (+20%), and aggressive (+30%) increases in the independent variables, in order to evaluate the magnitude of their effects on the dependent variable (CI).

As illustrated in the Table (8), the model demonstrates a high degree of sensitivity to the DT dimension. Even a limited increase in DT leads to a substantial improvement in CI. This finding indicates that DT represents the most influential driver of quality culture within Behrooyesh Pars Company. From a managerial and strategic perspective, the result underscores the critical role of evidence-based and analytical decision-making processes in strengthening organizational quality culture and enhancing continuous improvement capabilities.

Furthermore, the findings reveal that CO also exerts a significant positive effect on continuous improvement; however, its sensitivity level is comparatively lower than that of DT. This observation suggests that, within the context of the Iranian agricultural industry, data-driven decision-making or DT plays a more central and determining role than CO in shaping and reinforcing quality culture dimensions. Such a finding may reflect the increasing importance of analytical capabilities, operational data utilization, and fact-based managerial practices in improving organizational performance and sustaining competitive advantage in agricultural supply-chain environments.

Table 8: Sensitivity analysis results

	DT Change			**CO Change**		
Scenario	Conservative	Moderate	Aggressive	Conservative	Moderate	Aggressive
Change in CI	+6.4%	+6.4%	+6.4%	+6.4%	+6.4%	+6.4%

7. Practical Discussions and Managerial Insights

The main practical discussions and managerial insights of the proposed integrated approach and analyses are as follows:

1. **Prioritizing Fact-Based Decision-Making for Continuous Improvement**: Managers should emphasize data-driven decision-making processes, as this study identifies a strong correlation (60%) between fact-based decisions and continuous improvement. Implementing this approach will enhance operational efficiency and support sustainable growth in agricultural input manufacturing. Organizations should promote a culture of fact-based thinking, where decisions are made based on data and evidence rather than intuition or assumptions. This practice improves decision-making accuracy, leading to more informed and strategic choices.
2. **Fostering a Culture of Management Commitment**: Leadership's visible commitment to quality initiatives is essential for embedding a quality culture across all levels of the organization. Managers should ensure that quality goals are integrated into strategic planning and supported by clear communication and resource allocation. Also, managers should demonstrate a strong, consistent commitment to quality by providing resources, setting strategic objectives, and leading by example. This ensures a clear alignment between quality culture initiatives and organizational goals.
3. **Enhancing Customer-Centric Practices**: The study highlights the importance of aligning customer feedback with operational decision-making. Managers should actively gather and respond to customer insights to strengthen customer satisfaction, thereby driving both product quality and organizational reputation in the competitive agricultural sector. In other words, it is essential to integrate a customer-first approach throughout the organization. By consistently gathering and analyzing customer feedback, organizations can adapt their products and services to meet evolving customer needs, improving overall satisfaction and

loyalty.

4. **Investing in Employee Collaboration and Participation**: Promoting an environment where employee involvement and teamwork are encouraged can significantly improve quality outcomes. Managers should facilitate open communication channels, incentivize collaboration, and involve employees in quality improvement initiatives. Also, Training programs should be designed to educate employees on the principles of quality culture and its benefits. Engaged employees, who understand the importance of quality, are more likely to contribute to the improvement process and adopt best practices.
5. **Embedding Continuous Improvement in Organizational Processes**: Continuous improvement scored below average in the case study, signaling the need for targeted interventions. Managers must adopt systematic improvement frameworks, such as Lean or Six Sigma, to ensure ongoing enhancement of processes, products, and services, ultimately driving long-term competitiveness.
6. **Fostering Continuous Improvement:** Managers should create an environment that encourages continuous improvement through regular assessment of processes and outcomes. This could include implementing systems for tracking quality performance, setting measurable targets, and ensuring that improvement initiatives are sustained over time.
7. **Integration of Quality Culture Across All Departments:** Quality culture should not be confined to specific areas such as production or customer service. It must be a cross-departmental effort, where all organizational functions (e.g., R&D, marketing, logistics) are aligned with the principles of quality culture, ensuring consistency and a holistic approach to operational excellence.

These insights provide actionable guidance for industry leaders, linking key findings from the study to practical strategies for improving organizational performance.

7. Conclusion and Future Works

This research provides a comprehensive analysis of the quality culture in the agricultural input manufacturing sector, with a specific focus on Behrooyesh Pars Company. The study successfully developed a tailored assessment framework based on the Kano model, synthesis model, and importance-exchange model. Through advanced statistical methods, key drivers of quality culture were identified, such as fact-based decision-making and continuous improvement, which showed the strongest correlations. These findings highlight the critical role of quality culture in enhancing organizational performance, offering valuable insights for the agricultural industry.

Despite the contributions made by this study, there are several limitations that warrant further exploration. The research focused on a single company within a specific region, which may limit the generalizability of the results across different organizations and geographic locations. Additionally, while the study employed both descriptive and inferential statistics, the potential impact of external market conditions on quality culture was not fully examined. Expanding the research scope to include other companies and broader environmental factors could provide more robust conclusions. Furthermore, the research process itself was subject to inherent constraints and challenges that, at times, impeded or delayed progress. Significant hurdles were encountered during the data collection phase, compounded by the analytical complexities of the chosen model. Additionally, the pursuit of feasible and high-quality solutions presented ongoing challenges throughout the study's duration. Addressing these methodological and practical constraints in future endeavors could streamline the research process and potentially lead to more efficient and effective outcomes.

Future research should explore the application of this quality culture framework in other sectors beyond agriculture, such as manufacturing and service industries, to validate its

effectiveness across diverse contexts. Additionally, examining the influence of emerging technologies like artificial intelligence and automation on quality culture would offer new perspectives on how modern tools can enhance decision-making and continuous improvement processes.

Future studies could focus on longitudinal analyses to track the evolution of quality culture over time, particularly in response to organizational changes, market shifts, or global crises. Such research would provide deeper insights into the dynamic nature of quality culture and its long-term impact on organizational resilience, innovation, and competitiveness. By addressing these gaps, future work can further advance the understanding and application of quality culture across industries.

Finally, scholars can apply and refine the proposed quality culture framework across multiple sectors—including food production, pharmaceutical manufacturing, and service industries—to evaluate its generalizability and adaptability across distinct operational environments, conduct comparative research among organizations in different cultural and geographical contexts to understand how socio-economic and institutional factors mediate the development of quality culture, explore how digital transformation, artificial intelligence, automation, blockchain, and data analytics influence quality culture formation, decision-making speed, and continuous improvement processes in organizational systems, implement longitudinal studies that track changes in quality culture over time, particularly in response to leadership transitions, market disruptions, or global crises such as pandemics, investigate individual-level factors—such as employee motivation, trust, and perceived organizational support—that contribute to sustaining a robust quality culture, expand the current assessment framework by incorporating structural equation modeling (SEM), machine learning approaches, or fuzzy logic techniques to capture complex interdependencies among quality drivers, and assess how a strong quality culture interacts with sustainability goals and innovation performance, particularly in organizations striving to align profitability with environmental and social responsibility.

Declarations

All authors declare that they have no conflicts of interest.

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