Enhancing Quality in Peru's Craft Sector: The Impact of Environmental Sustainability Practices

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ABSTRACT

Purpose: The study compares the quality performance of craft SMEs in Peru based on their adoption of environmental sustainability practices, using Total Quality Management (TQM) dimensions.

Methodology/Approach: A comparative analysis was conducted using 262 responses from craft SMEs, evaluating six TQM dimensions.

Findings: SMEs oriented towards environmental sustainability practices outperformed others in all quality dimensions, except for Process Control and Improvement.

Research Limitation/Implication: The study is limited to craft SMEs in Peru.

Originality/Value of paper: This study highlights the positive link between environmental sustainability and quality performance in the craft sector. It not only advances the current knowledge but also provides policy recommendations to promote quality and sustainability in SMEs.

Category: Research paper

Keywords: TQM; QMS; ISO 9001; sustainability; SMEs

Research Areas: Quality by Sustainability, Quality Management

1 INTRODUCTION

In Latin America, micro, small, and medium-sized enterprises (SMEs) constitute nearly 90% of the business market, significantly contributing to local economic and sustainable development (De Sousa et al., 2020; Vives, 2022). During the COVID-19 pandemic, these SMEs were particularly vulnerable due to limited financial resources, resulting in a lower recovery capacity compared to larger enterprises (Farani et al., 2022). This disruption notably affected the quality management processes of craft SMEs, leading to reduced customer satisfaction.

Craft refers to the production of handmade goods using traditional skills, reviving cultural practices, traditions, and other elements of craftspeople 's societies (Edgar, 2024). This sector is typically situated within cultural entrepreneurship and is regarded as a component of the creative economy (Pret and Cogan, 2019). It contributes to societal growth by safeguarding cultural legacy and promoting sustainable progress (Mousa et al., 2024). Cultural businesses have become increasingly prevalent globally, leading to a heightened focus on craft entrepreneurship in current discussions on entrepreneurship and management (Hasanah et al., 2023). Approximately three hundred million individuals worldwide, primarily women, earn their livelihoods from the craft sector, significantly contributing to the global economy (Edgar, 2024). These businesses not only foster economic development but also create employment opportunities and help preserve cultural heritage (Shafi et al., 2019).

The craft sector, involving the small-scale production of visual and functional art using traditional skills, is deeply connected to the cultural values, traditions, identities, history, and religion of specific communities (Sarashima, 2013). Craft refers to the process of producing handmade goods by employing traditional skills and reviving the cultural practices, traditions, and other elements of craftspeople's society (Edgar, 2024). Craft SMEs foster local community development through job creation, cultural identity strengthening, and the promotion of sustainable tourism (García-Rosell and Mäkinen, 2013). Enhancing competitiveness and excellence in this sector is fundamentally linked to effective quality management, yet addressing quality management in the craft sector poses a major challenge for public policy due to the scarcity of empirical evidence (Kharub and Sharma, 2020). While extensive literature exists on quality management in SMEs (El Manzani et al., 2024), the distinctive attributes of the craft sector warrant further research. Craft SMEs employ practices that differ from the standardised operations commonly used by other SMEs (Sutrisno and Kumar, 2021).

Similarly, environmental sustainability remains a topic of ongoing debate. Both producers and consumers acknowledge the environmental impact of business activities. As a result, companies worldwide are increasingly adopting environmental strategies to enhance efficiency and sustainability, thereby mitigating pollution in response to climate change (De Sousa et al., 2020; Madrid-Guijarro and Duréndez, 2023; Seroka-Stolka, 2023; Vives, 2022). Some recent studies conducted in manufacturing industries shows that environmental

sustainability was significantly impacted by TQM practices within SMEs (Jum'a et al., 2023; Lepistö et al., 2023; Mohsin et al., 2024) Based on these studies, SMEs can achieve environmentally sustainable operations by strictly following TQM practices, aiming to minimise emissions of toxic gases and liquids while minimising the consumption of natural resources. However, the literature has not examined the reverse effect, namely, whether SMEs oriented towards environmentally sustainable practices perform differently in the various dimensions of TQM.

In this context, the study aims to ascertain whether significant differences exist in the implementation of quality practices, evaluated across the six dimensions of TQM, between SMEs oriented towards environmental sustainability practices and those that are not. SMEs prioritising environmental sustainability are expected to attain higher levels of quality across all TQM dimensions. The study was conducted in Peru, and the sample consists of craft SMEs located in various regions of Peru. This research aims to be a contribution to the literature on quality practices and to improve our understanding of the relationship between environmental sustainability orientation and total quality management.

The sections of this paper are organised as follows: Section 2 provides the theoretical framework and hypotheses. Section 3 presents the methodology, including data collection, sampling, measures, and data analysis. Section 4 presents the study's findings. Section 5 discusses the implications. Finally, Section 6 concludes the research study, highlighting its limitations and suggesting directions for future research.

2 THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 Total Quality Management

Quality is closely related to the superiority of the final product and is often regarded as a measure of excellence. It should surpass customer expectations by providing value that exceeds the price paid (ASQ n.d.). Additionally, quality is crucial for enhancing the competitiveness and efficacy of companies (Ali and Yusuf, 2021). Total Quality Management (TQM) incorporates the fundamental principles of Deming, Juran, and Crosby, which converge on essential concepts related to improving quality. Deming emphasised meeting customer needs through consumer research, Juran focused on planning, controlling, and improving quality processes, and Crosby introduced “zero defects” as a standard (Gupta et al., 2023). Thus, TQM includes using analysis and control tools to enhance an organisation's performance and competitive advantage (Ali and Yusuf, 2021; Gupta, 2017). TQM is a philosophical approach aimed at developing a culture of continuous improvement within organisations. It involves all levels of a company, including top management, employees, suppliers, and customers. TQM promotes worker empowerment, secures top management support, fosters teamwork, implements transformational leadership, provides incentives, and effectively manages

suppliers (Al-Rawi, 2022). Its objective is to consistently enhance the quality of products (goods or services) and processes to meet and exceed customer needs and expectations.

Scholars have studied the constituent elements of quality management and their impact on organisational performance, innovation processes (Al-Rawi, 2022), company reputation, and customer loyalty (Othman et al., 2019). The adoption of TQM offers the opportunity to create enduring advantages regardless of the company's scale and industry (Talapatra et al., 2020), fostering a culture of continuous improvement and engaging all stakeholders in enhancing operations (Hudnurkar et al., 2023). Several authors have highlighted the benefits of TQM for SMEs (Georgiev and Ohtaki, 2020). In particular, top management commitment, continuous process improvement, and stakeholder focus have proven key to TQM's success in SMEs. TQM can potentially benefit SMEs in the craft sector by providing a robust structure for enhancing quality, maximising efficiency, and fortifying relationships with stakeholders. However, the implementation of TQM in the craft sector has not been thoroughly studied.

Synthesising the philosophies, principles, and dimensions of TQM proponents into measures of quality in SMEs, such as those in the craft sector, has yielded six key elements for TQM implementation: Leadership, Product Design, Process Control and Improvement, Supplier Quality Management, and Customer Satisfaction (Benzaquen and Narro, 2023; Gupta et al., 2023). In this study, these six dimensions are grouped into three themes: top management commitment, continuous process management, and stakeholders focus (Figure 1). The Top Management theme includes the Leadership and Product Design dimensions. Leadership denotes the extent to which top management can guide companies in implementing quality management practices and set goals for higher performance. Efficient company performance is achieved when leadership across top management aligns with TQM practices (Lepistö et al., 2022). Product Design encompasses a company's capacity to integrate high standards of excellence into its products and utilise innovation as a distinguishing element in the market. It involves methods that enhance product design in terms of functional diversity, reliability, and manufacturing processes (Silva et al., 2014).

Likewise, the Process Management theme includes Process Control and Improvement, and Education and Training. Benzaquen and Narro (2023) stated that process control and improvement enable companies to assess the proper functioning of their facilities and operating equipment and ensure alignment with customers' requirements. This leads to a culture of innovation and efficiency, driving continuous enhancements to processes, systems, and methodologies to achieve higher performance and customer value (Jum'a et al., 2023). Education and Training involve providing instruction in quality management tools relevant to the quality system, offering opportunities for employees to expand their understanding and expertise in quality-related matters. The goal is to improve teamwork efficiency, foster individual development, and contribute to organisational performance (Jun et al., 2006). Finally, the Stakeholders theme

includes Customer Satisfaction Approach and Supplier Quality Management. Within the TQM framework, customer satisfaction refers to the emotional reaction of the customer, either positive or negative, arising from comparing the perceived quality of a product or service to their expectations. The customer satisfaction approach represents the endeavours made by an organisation to fulfil and surpass customer expectations by consistently providing high-quality goods or services (Anil and Satish, 2019). This approach involves a continuous commitment to understanding customer requirements and preferences. Supplier Quality Management involves actions by top management to ensure suppliers adhere to the company's quality standards, thereby enhancing organisational performance (Liu et al., 2021). Activities include defining supplier selection criteria, monitoring supplier quality costs, evaluating supplier performance, conducting supplier audits, and establishing effective communication with suppliers.

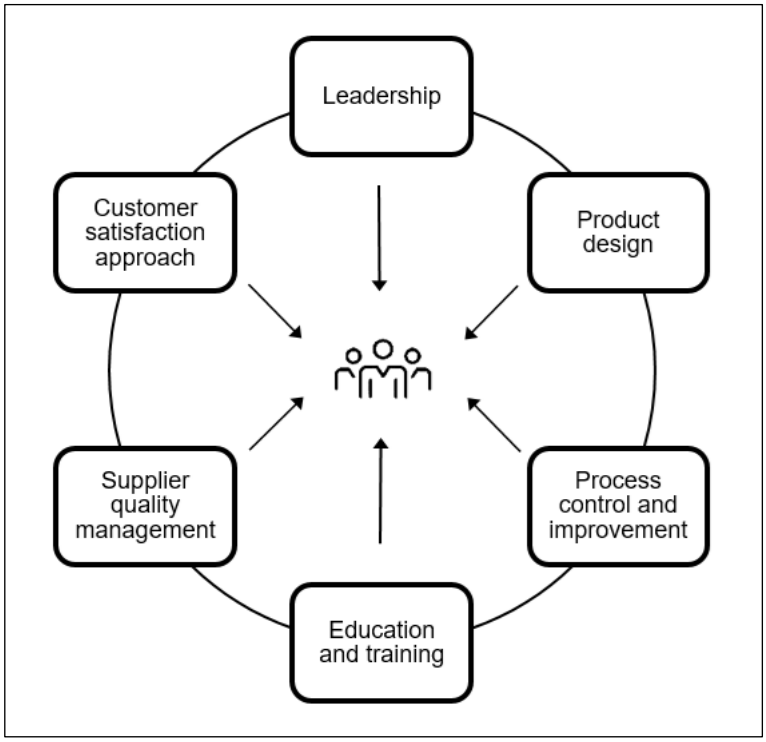

Figure 1 – TQM proposed model

2.2 Environmental sustainability and TQM

On the other hand, sustainability is the concept of fulfilling current needs without jeopardising the ability of future generations to fulfil their own (Brundtland, 1987). Within this framework, environmental sustainability is particularly significant as it pertains to the long-term conservation of ecosystems and natural resources. Environmental sustainability involves safeguarding natural resources, minimising air, land, and water pollution, optimising energy use with a focus on non-renewable sources, and preserving both natural resources and cultural heritage (Hudnurkar et al., 2023; Hessel et al., 2011). Scientific evidence highlights the

substantial influence of human activities on the environment, emphasizing the need for immediate and proactive measures to reduce negative consequences. Central to these discussions are externalities, which refer to the costs or benefits of activities that impact third parties, often leading to environmental harm (Gorvett, 2012). Therefore, it is imperative for companies to promptly implement measures to safeguard the environment, as economic expansion driven by excessive resource utilisation and pollution is not environmentally viable.

Several studies have explored the relationship between sustainability practices in SMEs, such as pollution control and material recycling, and the financial performance of these businesses, highlighting the economic benefits of adopting environmentally responsible practices. For example, Jayeola (2015) examined the notable connections between sustainability practices in SMEs, such as pollution control and material recycling, and the financial performance of these businesses, highlighting the economic benefits of adopting environmentally responsible practices. Tasleem et al. (2019) affirmed that TQM can enhance financial performance and generate additional benefits in sustainability efforts. Arora and De (2020) demonstrated that the adoption of environmental sustainability practices by companies enhances their performance in foreign markets, improves their reputation with clients, and reduces gas pollution through recycling measures. Moreover, Del Pilar Rodríguez-García et al. (2022) found a direct correlation between the reduction of CO2 emissions and the financial performance of companies in Brazil, Chile, and Colombia. Similarly, Moscoso et al. (2019) affirmed that implementing circular economy practices in companies leads to financial gains by enabling them to minimise waste, reuse materials, recycle resources, and extract value from them. These practices align with ISO 14001:2015 standards, addressing the requests of final consumers for sustainable development.

Recent studies in manufacturing industries indicate that environmental sustainability is significantly influenced by TQM practices within SMEs. The implementation of TQM can facilitate the adoption of environmental sustainability practices in these businesses (Jum'a et al., 2023; Lepistö et al., 2023; Mohsin et al., 2024). These studies suggest that SMEs can achieve environmentally sustainable operations by rigorously adhering to TQM practices, which aim to minimise emissions of toxic gases and liquids while reducing the consumption of natural resources. Additionally, Hudnurkar et al. (2023) analysed the relationship between TQM and environmental sustainability in SME manufacturing industries in India and found a positive correlation. The study highlights that a focus on continuous improvement, operational efficiency, and customer experience ensures the reduced use of natural resources, thus contributing to environmental sustainability. Furthermore, Fok et al. (2022) found that a strong organisational culture supporting quality improvement practices leads to positive sustainability outcomes. Finally, Tasleem et al. (2019) emphasise the necessity of integrating TQM with environmental strategies, as the combination of both enhances effective, sustainable performance in business outcomes. TQM focuses on waste

elimination by removing process inefficiencies, while the environmental management system effectively reduces pollution, air emissions, and hazardous waste.

Based on these considerations, this study aims to analyse whether craft SMEs that engage in environmental sustainability practices exhibit significant differences and higher levels of quality across various dimensions compared to those that do not. It suggests that SMEs prioritising environmental sustainability can achieve improved levels of the TQM model. Consequently, six research hypotheses are formulated, considering the implementation of quality practices assessed through six dimensions of TQM, with a focus on sustainability in craft SMEs, as follows:

Hypothesis 1: *Craft SMEs oriented towards environmental sustainability practices exhibit significant differences in the Leadership TQM dimension compared to those that are not oriented towards such practices.*

Hypothesis 2: *Craft SMEs oriented towards environmental sustainability practices exhibit significant differences in the Product Design TQM dimension compared to those that are not oriented towards such practices.*

Hypothesis 3: *Craft SMEs oriented towards environmental sustainability practices exhibit significant differences in the Process Control and Improvement TQM dimension compared to those that are not oriented towards such practices.*

Hypothesis 4: *Craft SMEs oriented towards environmental sustainability practices exhibit significant differences in the Education and Training TQM dimension compared to those that are not oriented towards such practices.*

Hypothesis 5: *Craft SMEs oriented towards environmental sustainability practices exhibit significant differences in the Supplier Quality Management TQM dimension compared to those that are not oriented towards such practices.*

Hypothesis 6*: Craft SMEs oriented towards environmental sustainability practices exhibit significant differences in the Customer Satisfaction TQM dimension compared to those that are not oriented towards such practices.*

3 METHODOLOGY

3.1 Data collection and sample

The present study was conducted in Perú. In Perú, SMEs play a crucial role in the economy; micro and SMEs comprise 99.5% of all companies in Peru and employ 91% of the private sector's economically active population (Peruvian Ministry of Production, 2024). SMEs play a crucial role in the developing market economy, serving as a substantial workforce for specific social demographics, such as women. Within the micro and SMEs sector, the presence of craft businesses stands out, where craft serves as a means of artistic expression, embodying the cultural heritage, historical narratives, belief systems, and natural surroundings of various communities throughout history (Ministry of Culture, 2023). There is growing acknowledgment of the significance of handmade goods and fair trade,

accompanied by the use of technology to enhance efficiency and excellence, opening opportunities to enter new markets and reach potential customers. Governmental bodies, such as the Ministry of Culture and the Ministry of Foreign Trade and Tourism, foster innovation and excellence in the craft sector. According to the National Registry of Craftspeople in 2023, there were 64,945 independent craftspeople, 517 craft associations, and nine cooperatives focused on crafts (MINCETUR, 2023).

In September 2023, fifty surveys were conducted at a fair organised by the Ministry of Foreign Trade and Tourism in various regions of Peru to assess the reliability of the TQM model dimensions for craft SMEs. Fifty surveys were collected, and the results were used to validate the model for SMEs in the crafts sector. The survey included an analysis of Cronbach's alpha to assess the reliability of the relationship between the evaluated questions and dimensions. The survey demonstrates higher reliability and validity compared to grouping the questions in a correlated manner for each evaluated dimension. According to Nunnally (1978), a Cronbach's alpha of 0.6 is considered acceptable in the initial stages of research or exploratory studies. The obtained Cronbach's alpha results ranged from 0.69 to 0.746.

After the validation process, the study was conducted on a sample of craft SMEs in Peru. The sample was selected from a population of 64,945 SMEs, as recorded in the National Registry of Craftspeople. The survey questionnaire applied was written in Spanish. This sample size ensures a confidence level of 95% and a margin of error of 6%. The SMEs in the craft sector in Peru are organised as associations, cooperatives, family businesses, or independent businesses. A single response per SME was considered and carefully organised to ensure regional diversity. The profile of the respondents can be seen in Table 1. There were 262 respondents, with roughly equal proportions of women (51%) and men (49%). Most respondents fell within the age range of 48-60 years (45%). A significant number of interviewees were experts (60%) with over 15 years of experience in craft production (66%). Additionally, most craft SMEs conducted their activities through associations (53%), with ceramics (45%) and textiles (26%) being the most crafted items.

Table 1 – Respondents' Profile

Characteristic	**Frequency**	**Percentage**
Gender		
Women	133	50.76%
Men	129	49.24%
Age range		
19 to 25 years	11	4.20%
26 to 36 years	28	10.69%
37 to 47 years	56	21.37%
48 to 60 years	119	45.42%
61 years or older	48	18.32%

Characteristic	Frequency	Percentage
Level of experience		
Expert	158	60.31%
Worker	80	30.53%
Instructor	11	4.20%
Others	13	4.96%
Number of years in the craft sector		
Less than 1 year	4	1.53%
1 to 4 years	16	6.11%
5 to 10 years	52	19.85%
11 to 15 years	16	6.11%
More than 15 years	174	66.41%
Types of crafts		
Ceramics	118	45.04%
Textile	69	26.34%
Wood	22	8.40%
Costume jewellery	14	5.34%
Others	39	14.89%
Type of business		
Association	140	53.44%
Cooperative	30	11.45%
Family business	50	19.08%
Independent	42	16.03%

Note: There are additional levels of experience, such as “amautas” (sages or philosophers), apprentices, and craftspeople. Other types of crafts include filigree, jewellery, silverware, etc.

3.2 Measures and data analysis

The model comprises six dimensions containing nineteen variables (Appendix 1) related to the quality practices implemented by Peruvian craft SMEs. Respondents provided their answers using a Likert scale, with a rating of 5 indicating “I always do it,” 4 indicating “I usually do it,” 3 indicating “I sometimes do it,” 2 indicating “I almost never do it,” and one indicating “I never do it.” The quality of the craft SMEs was assessed by calculating the average of each survey question and the average of each dimension of the model. The Cronbach's alpha reliability criterion was utilised again to assess the internal consistency of the sample, applying it to the six dimensions of the instrument (Table 2).

This research study aims to investigate whether craft SMEs that are oriented towards implementing environmental sustainability practices exhibit higher levels of quality compared to those that do not adopt such practices. To evaluate a SMEs orientation towards environmental sustainability, Alemayehu and Bekele (2023) suggested using an index that considers crucial aspects such as the use of renewable energy, environmental preservation practices, sustainable product offerings, the capacity of the local environment, and the adoption of suitable technology. Using this index in a survey question are listed in Appendix 2. Respondents answered using a three-option scale: 1 = “I do not do it,” 2 =

"Sometimes (more than 50% of the time)," and 3 = "I always do it." Each aspect was assigned equal importance, and the average of the scales chosen for the five questions was calculated, giving each question the same weight. If the average score is 2 or higher, the SMEs are classified as oriented towards environmental sustainability; otherwise, it is considered to lack such orientation.

The Mann-Whitney U test was used to evaluate the null hypothesis that the distributions of SMEs oriented towards environmental sustainability practices and those not oriented towards such practices are statistically identical. A p-value lower than 0.05 leads to rejection of the null hypothesis, suggesting that the samples do not come from the same distribution. This test was chosen because the Shapiro-Wilk normality test indicated that the quality data do not follow a normal distribution in most dimensions. The non-parametric nature of the Mann-Whitney U test makes it suitable for analysing heterogeneities in distributions between the groups with minimal restrictions.

Table 2 – Cronbach's alpha

Dimension	**Cronbach's alpha**
Leadership	0.842
Product design	0.817
Process control and improvement	0.660
Education and training	0.752
Supplier's quality management	0.785
Customer satisfaction approach	0.715

3.3 Quality assessment results

Peruvian craft SMEs exhibit various levels of quality across the six TQM dimensions and nineteen variables. According to Table 3, the dimensions of Product Design and Education and Training were mostly satisfied, with values of 4.23 and 4.03, respectively. Leadership (3.79) and Supplier Quality Management (3.73) also showed relatively high levels of satisfaction. However, lower scores in Process Control and Improvement (3.57) and focus on Customer Satisfaction (3.04) indicate that craft SMEs are less inclined to engage in quality enhancement activities in these areas.

Table 3 – Results: TQM dimensions

Dimension	**Average**
Leadership	3.79
Product design	4.23
Process control and improvement	3.57
Education and training	4.03
Supplier quality management	3.73
Customer satisfaction focus	3.04

Note. Values ranging from 4 to 5 indicate that craft SMEs are effectively fulfilling their assigned tasks. Values ranging from 1 to 2 indicate that craft SMEs are not adhering to the instructions or requirements specified in the variable. Values of 3.7 or above indicate that craft SMEs generally conduct the activities indicated in the question, while values below 3.7 suggest that craft SMEs are less likely to do so.

3.4 Environmental sustainability

Table 4 indicates that 156 (59.5%) craft SMEs marginally implement environmental sustainability practices. Specifically, renewable energy sources, environmental conservation activities, and contamination-preventing technology are not widely utilised by this group. Craft SMEs occasionally implement practices to provide sustainable products to customers and manufacture products without harming the environment. Contrastingly, 106 (40.5%) craft SMEs frequently utilize environmental practices. In this instance, strategies such as environmental conservation activities, offering sustainable products, preventing harm to the environment, waste management with recycling practices, and utilizing appropriate technology are implemented more than 50% of the time. Solar, wind, hydraulic, marine, geothermal, and biomass energy sources are rarely used in the production process by this group. In both instances, neither group was consistently practices implemented.

Table 4 – Results:Environmental sustainability

Variables	Average	Not oriented towards sustainability practices (156)	Oriented towards environmental sustainability (106)
Average	1.91	1.61	2.36
1. In the production process, you use renewable energy sources such as solar, wind, hydro, marine, geothermal, or biomass.	1.34	1.12	1.66
2. Incorporating environmental conservation practices, such as minimizing air and water pollution, preserving water quality, and conserving natural resources, is a crucial aspect of your production process.	1.82	1.43	2.40
3. You provide your customers with sustainable products, which are manufactured with a commitment to environmental preservation and consideration of your ecological footprint.	2.41	2.15	2.79
4. You produce your products without harming the environment, using appropriate waste management, and recycling practices.	2.29	2.04	2.66
5. To prevent contamination, minimize waste, and save time, you use suitable technology during the production process.	1.71	1.31	2.30

Note: a three-option scale is used: 1= “I don't do it”, 2 = “Sometimes (more than 50% of the time),” and 3= “I always do it.”

3.5 Quality assessment and environmental sustainability

Analysing the quality levels of craft SMEs oriented towards prioritizing environmental sustainability compared to those not oriented towards such practices reveals that SMEs focusing on sustainable practices demonstrate superior performance across all quality dimensions (Table 5). SMEs prioritizing environmental care excel in Product Design (4.41), Education and Training (4.25), Supplier Quality Management (4.08), and Leadership (4.08). However, they need to enhance their capabilities in Process Control and Improvement, and their focus on Customer Satisfaction. The test results indicate significant differences in all quality dimensions except for Process Control and Improvement, which lacks statistical significance. This assessment confirms that implementing environmental strategies can enhance the quality of craft SMEs, leading to improved market performance through sustainable and environmentally friendly development. This assessment confirms that implementing environmental strategies can enhance the quality of craft SMEs, leading to improved market performance through sustainable and environmentally friendly development. The results for each dimension in the three themes and environmental sustainability are discussed below.

Leadership dimension has an average value of 3.79, indicating a commitment from top management to quality practices. For craft SME committed to environmental sustainability practices, this value rises to 4.08, confirming the first hypothesis (H1). Craft SME engaged in environmental sustainability practices demonstrate their commitment by actively participating in leader-facilitated activities, such as providing necessary resources and conducting regular meetings on quality-related matters. Implementing environmental sustainability practices enhances leadership factors, underscoring the importance of adopting these practices to improve organisational quality. The Product Design dimension, with an average value of 4.23, is the highest among the quality dimensions, highlighting its significance. Craft SME oriented towards environmental sustainability practices score 4.41, compared to those without, confirming the second hypothesis (H2). Both environmentally conscious and non-environmentally conscious craft SME incorporate customer feedback in product development, aiming to introduce innovative and enhanced designs. This commitment to quality is further motivated by implementing environmental sustainability practices, encouraging craft SME to elevate quality standards.

Process Control and Improvement dimension have an average value of 3.57. It is worth noting that the average values are similar between those oriented towards implementing environmental sustainability practices and those who are not. The actions of craft SME, whether implementing environmental sustainability practices or not, show minimal impact, leading to the rejection of the third hypothesis. An important characteristic of this dimension is that the craft SME adhere to the specified delivery deadlines, but they typically do not keep track of the percentage of faulty products they produce.

Education and Training dimension holds significant relevance with an average value of 4.03. Craft SMEs oriented towards environmental sustainability practices achieve a higher average value of 4.25 compared to those that do not implement such practices. Therefore, the fourth hypothesis (H4) is confirmed. The results demonstrate that craft SMEs oriented towards environmental sustainability practices enhance their expertise through training, recognizing the importance of both skill development and employee satisfaction. Conversely, the other group solely concentrated on conducting these verifications. This illustrates the impact that implementing these environmental sustainability practices has on enhancing quality in relation to this dimension.

Supplier Quality Management dimension has an average value of 3.73 in the sample. However, craft SME more likely towards environmental sustainability practices score higher (4.08) compared to their counterparts (3.50). The Mann-Whitney U test confirmed the fifth hypothesis (H5), suggesting that the distributions of these groups are significantly not identical. Regardless of their environmental practices, craft SME consider the quality of materials significant. Craft SME oriented toward environmentally sustainable practices tend to establish reciprocal relationships with their suppliers and monitor their performance, unlike their counterparts who lack strategic approaches. This demonstrates the positive impact of environmental sustainability on enhancing business quality. Encouraging improvements in this dimension fosters strong relationships between businesses and suppliers, yielding mutual benefits.

Customer Satisfaction dimension has an average value of 3.04, indicating a very low and concerning score, the lowest among all dimensions. When comparing craft SMEs that actively practice environmental sustainability with those that do not, the latter tend to neglect this aspect. The statistical analysis confirms that these differences are indeed significant, thereby confirming the sixth hypothesis (H6). Craft SME oriented toward environmentally sustainable practices recognize the significance of effective communication with their customers. A concerning aspect in this sector is the lack of counterparties' diligence in monitoring customer complaints. This negligence may adversely affect customer satisfaction and lead to financial losses.

Table 5 – Results: TQM and environmental sustainability

Dimension/Variables	Overall average	No oriented towards sustainability practices	Oriented towards environmental sustainability	Mann-Whitney U test
Leadership	**3.79**	**3.59**	**4.08**	***** (Yes)**
X_{11}	3.94	3.74	4.25	
X_{12}	3.81	3.65	4.05	
X_{13}	3.78	3.58	4.08	
X_{14}	3.62	3.40	3.93	

Dimension/Variables	Overall average	No oriented towards sustainability practices	Oriented towards environmental sustainability	Mann-Whitney U test
Product Design	**4.23**	**4.10**	**4.41**	***** (Yes)**
X_{21}	4.25	4.13	4.43	
X_{22}	4.02	3.88	4.24	
X_{23}	4.40	4.30	4.56	
Process control and improvement	**3.57**	**3.56**	**3.58**	**0.600 (No)**
X_{31}	3.99	3.96	4.03	
X_{32}	4.36	4.30	4.44	
X_{33}	2.36	2.26	2.43	
Education and training	**4.03**	**3.89**	**4.25**	***** (Yes)**
X_{41}	3.93	3.81	4.11	
X_{42}	4.21	4.08	4.39	
X_{43}	3.96	3.77	4.25	
Supplier's quality management	**3.73**	**3.50**	**4.08**	***** (Yes)**
X_{51}	3.70	3.47	4.04	
X_{52}	3.22	2.99	3.56	
X_{53}	4.27	4.03	4.63	
Customer satisfaction focus	**3.04**	**2.85**	**3.32**	***** (Yes)**
X_{61}	3.93	3.68	4.29	
X_{62}	1.81	1.76	1.88	
X_{63}	3.39	3.12	3.78	

Note: *** implies significant difference at 1%. Values of 4–5 indicate that craft SMEs are oriented towards fulfilling the requirements stated in the item. Values of 1–2 suggest that craft SMEs are not oriented towards meeting what is stated in the variable. Scores equal to or higher than 3.7 indicate that craft SMEs are oriented towards fulfilling the requirements, while scores lower than 3.7 indicate that they are not.

4 DISCUSSION AND IMPLICATIONS

This study examines the differences in the implementation of quality practices across six TQM dimensions between craft SMEs focused on environmental sustainability and those that are not. The six dimensions assessed were Leadership, Product Design, Process Control and Improvement, Education and Training, Supplier Quality Management, and Customer Satisfaction. The results suggest that craft SMEs oriented towards environmental sustainability practices tend to exhibit

higher levels across all these TQM dimensions, underlining the importance of integrating sustainability strategies with total quality practices.

The initial analysis focused on evaluating the quality levels in each of the six dimensions within craft SMEs and those oriented towards sustainability practices. The findings reveal high levels of Product Design and Education/Training, along with Leadership and Supplier Quality Management. These results align with previous literature, which emphasises the significance of innovation and continuous learning in improving quality (Lim et al., 2022). Both Product Design and Education/Training scored the highest, reflecting an emphasis on continuous improvement of products, processes, and employee development. This focus on training and innovation is essential for the success of any SME, particularly in the craft sector, where adaptability and creativity are key. However, there is considerable room for improvement in the Process Control and Improvement and Customer Satisfaction dimensions. While craft SMEs implement basic quality control practices, the results suggest that there is a lack of systematic process management and a limited focus on improving customer satisfaction. This may be attributed to a lack of resources and a limited long-term focus on quality management. The Customer Satisfaction dimension, with a score of 3.04, is particularly concerning as it indicates a lack of focus on customer retention and the effective management of complaints, which could negatively impact competitiveness and profit margins.

The study also reveals that craft SMEs focused on environmental sustainability tend to implement product design for sustainability, environmental harm prevention, and waste management through recycling more frequently than those not oriented towards sustainability. However, renewable energy sources, environmental conservation activities, and contamination-prevention technologies are less commonly utilised. This could be attributed to the substantial financial investment required for implementing such sustainability practices, coupled with the limited financial resources available to smaller enterprises. The lack of technological infrastructure and the high costs associated with these practices are significant barriers that hinder widespread adoption in the craft sector. Although craft SMEs focused on sustainability show clear improvements in quality across almost all dimensions, the Process Control and Improvement dimension did not exhibit significant differences between sustainable and non-sustainable SMEs. This indicates that, despite the adoption of sustainability practices, process control and improvement are areas where both types of SMEs face similar challenges. It suggests that while sustainability practices are being implemented, they have not yet been fully integrated into the production processes in a way that would lead to systematic and continuous process management. Without a structured and consistent focus on process improvement, it is difficult to observe measurable differences in this dimension between the two groups.

The results of this study provide significant theoretical contributions to the understanding of TQM and sustainability integration within small-scale enterprises. The study highlights that craft SMEs oriented towards sustainability

tend to exhibit higher quality levels across most dimensions of TQM, which is in line with the findings of Tasleem et al. (2019) and Fok et al. (2022), who assert that integrating sustainability strategies with TQM practices can enhance organisational performance. Tasleem et al. (2019) found that the implementation of sustainability practices often leads to improvements in product quality and process efficiency, supporting the notion that sustainability is not just an ethical consideration but also a strategic driver of competitive advantage. Furthermore, Fok et al. (2022) emphasised the role of leadership commitment and employee training in ensuring the successful integration of sustainability practices into the broader TQM framework.

Existing research suggests that sustainability-driven quality practices can lead to innovations in product and service delivery that align with consumer expectations, which have increasingly shifted towards environmentally responsible consumption (Seroka-Stolka, 2023). The evidence from this study supports these claims, showing that SMEs focused on sustainability consistently perform better in product design and training dimensions, thereby fostering higher levels of innovation and adaptation to market demands. Additionally, the study points to the Process Control and Improvement dimension, where no significant differences were found between sustainability-oriented and non-sustainability-oriented SMEs. This result aligns with Jum'a et al. (2023), who argue that while environmental sustainability practices are linked to better quality outcomes, the direct impact on process control might be less pronounced. The study by Jum'a et al. (2023) observed that statistical process control may not be strongly linked to sustainability practices, suggesting that process management still remains underdeveloped in SMEs, even those adopting sustainability strategies.

The findings of this study have important implications for practitioners in the craft sector. First, craft SMEs that adopt both TQM and environmental sustainability practices can experience significant improvements in product and service quality, which will lead to better market performance. Integrating sustainability strategies not only improves quality but also enhances long-term competitiveness, especially in a market where consumers are increasingly valuing environmentally responsible and sustainable practices. A key implication is that leadership in craft SMEs plays a crucial role in the successful implementation of both TQM and sustainability practices. The results show that sustainability-oriented SMEs have stronger and more committed leadership, enabling them to effectively implement quality and sustainability practices. Leadership should be proactive, provide necessary resources, and foster an organisational culture that supports both innovation and continuous improvement. Craft SMEs must focus on developing leadership capacities that drive the adoption of both sustainable and quality practices within the organisation.

Another important implication is the need for investments in Education and Training. The sustainability-oriented SMEs scored higher in this dimension, suggesting that continuous training is a key factor for the successful implementation of both practices. SMEs should ensure that their employees

receive ongoing training in quality management, sustainability, and process improvement. Ongoing training is crucial not only for maintaining product quality but also for enhancing customer satisfaction. Finally, Supplier Quality Management demonstrated itself as an area where sustainability-oriented SMEs perform significantly better. This suggests that SMEs should strengthen their relationships with suppliers, implementing shared quality strategies and monitoring supplier performance. Strategic supplier management not only enhances product quality but also contributes to more sustainable production practices, ensuring that the materials and resources used are also environmentally responsible.

Overall, craft SMEs that implement environmental sustainability practices tend to demonstrate higher levels of quality across various TQM dimensions, suggesting that sustainability can be a key differentiator in business performance. To improve long-term performance, craft SMEs need to invest in innovation, continuous training, and the establishment of strategic supplier relationships. Integrating these practices will not only strengthen their competitiveness but also contribute to the sustainable development of the craft sector. By fostering a culture of continuous innovation and leadership commitment, SMEs can thrive in a market that increasingly values sustainability.

5 CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

This study analyses differences in quality practices between craft SMEs oriented towards environmental sustainability practices and those not oriented towards such practices, using a model based on Total Quality Management (TQM) dimensions. Data were collected from craft SMEs in Peru, focusing on six dimensions: Leadership, Product Design, Process Control and Improvement, Education and Training, Supplier Quality Management, and Customer Satisfaction. Findings reveal that craft SME demonstrate high proficiency in the dimensions of Product Design and Education/Training, and satisfactory proficiency in Leadership and Supplier Quality Management. However, there is potential for improvement in Process Control and Improvement, and Customer Satisfaction focus.

Furthermore, the Mann–Whitney U test rejects the null hypothesis of identical distributions between craft SMEs oriented towards environmental sustainability practices and those that are not. Particularly, firms practising sustainability excel in Leadership, Product Design, Education/Training, Supplier Management, and Customer Satisfaction. All hypotheses are confirmed except for the Control and Process Improvement dimension, where no significant differences were observed between environmentally conscious and non-conscious businesses. Notably, SMEs oriented towards environmental sustainability exhibit superior quality across all aspects. To enhance quality standards, craft SMEs should adopt innovative environmental strategies and prioritise understanding consumer needs to align their offerings accordingly. Developing strong supplier relationships is recommended to bolster product offerings and mutual benefits. Engaging leaders

is crucial for achieving organisational goals, enhancing total quality management, and promoting the adoption of sustainable practices.

A significant limitation in assessing quality within the craft industry is the lack of a dedicated measurement tool. To overcome this challenge, the authors developed and validated a survey-based instrument drawing on relevant literature on quality assessments. Furthermore, the distinctive characteristics of the craft sector, including its unique production methods and techniques, constrain the generalizability of study findings to other sectors. The nature of craft production implies that perceptions of quality and management practices may vary considerably compared to more industrialised or mass-produced sectors. Hence, careful consideration and adaptation are necessary to apply these results effectively to broader market dynamics in future research endeavours.

Regarding future research, quality in craft businesses remains a relatively underexplored topic in the literature. Despite this, the craft sector, much like other industries, profoundly influences the economic development of regions, particularly in Latin America. Future studies should aim to propose enhancements that boost the competitiveness of craft SMEs, improve business performance, and contribute to regional growth by raising living standards. Future research could employ an experimental design to test the effectiveness of an intervention program aimed at increasing the quality and environmental sustainability across SMEs in the craft sector. In this context, the intervention program should focus on those variables with lower values reported in this study. The questionnaire-based research offers a comprehensive overview of the complex and dynamic nature of environmental and quality management systems. However, the methodology represents a useful reference point for future studies to examine the intersection between environmental sustainability and quality management.

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APPENDIXES

Appendix 1 – TQM questionnaire

Dimensions	Variable	Question
Leadership	X_{11}	Craft SMEs consider quality when manufacturing their goods
	X_{12}	Craft SMEs meet with his workers to discuss quality-related issues
	X_{13}	Craft SMEs use the data obtained to make decisions to improve quality
	X_{14}	Craft SMEs provide the appropriate resources to increase the level of product quality
Product design	X_{21}	Based on customer feedback, modifications are implemented in the craft activity to enhance its goods or services.
	X_{22}	New designs are implemented in the production of craft goods.
	X_{23}	New ideas for improving goods or services are considered when developing craft goods.
Process control and improvement	X_{31}	The craft activity involves documenting the time between placing an order and receiving the product.
	X_{32}	The craft activity meets the promised delivery dates
	X_{33}	The craft activity has a percentage of defective products
Education and training	X_{41}	Craft SMEs know the workers' level of satisfaction and commitment
	X_{42}	The craft SMEs level of knowledge and skills to produce the product is adequate
	X_{43}	Craft SMEs improve their work after receiving training
Supplier quality management	X_{51}	An effective and cooperative relationship has been established with suppliers.
	X_{52}	Information regarding the performance of suppliers is accessible in the craft activity.
	X_{53}	The quality of the materials used in the craft activity is important.
Customer satisfaction approach	X_{61}	Effective communication with customers is crucial in the craft activity.
	X_{62}	The craft activity involves monitoring the quantity of customer complaints
	X_{63}	The craft activity involves monitoring the response time to customer inquiries

Note: The Likert scale is a measurement tool that assigns values from 1 to 5, where 1 represents “I never do it,” 2 represents “I almost never do it,” 3 represents “I sometimes do it,” 4 represents “I usually do it,” and 5 represents “I always do it.”

Appendix 2 – Environmental sustainability questionnaire

1	In the production process, you use renewable energy sources such as solar, wind, hydro, marine, geothermal, or biomass.
2	Incorporating environmental conservation practices, such as minimizing air and water pollution, preserving water quality, and conserving natural resources, is a crucial aspect of your production process.
3	You provide your customers with sustainable products, which are manufactured with a commitment to environmental preservation and consideration of your ecological footprint.
4	You produce your products without harming the environment, using appropriate waste management and recycling practices.
5	To prevent contamination, minimise waste, and save time, you use suitable technology during the production process.

Note: A three-option scale is used: 1= "I don't do it", 2 = "Sometimes (more than 50% of the time)," and 3= "I always do it."

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CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study, in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.