

Uncertain Supply Chain Management

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Quality in Peruvian service companies in the context of COVID-19

Jorge Benzaquen^{a*}, Juan O'Brien^a, and Eduardo Pardo-Piñashca^a

^a*CENTRUM Católica Graduate Business School; Pontificia Universidad Católica del Perú, Peru*

ABSTRACT

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The motivation of this study is to provide empirical evidence of service companies' performance regarding nine dimensions in a total quality management model during the COVID-19 pandemic. The nine dimensions highlight strategic company activities, and it allows a comparative analysis of the overall effect of having a QMS such as ISO 9001:2015 on Peruvian service companies. A total of 630 Peruvian service companies were surveyed for this study. The questionnaire included 35 Likert-scale items that were further classified into nine (9) dimensions. The Mann-Whitney U test was used to estimate any significant differences between the ISO 9001 certified and non-certified companies. Our findings showed that the performance of ISO 9001:2015 certified companies was significantly higher than that of non-certified companies in all dimensions. Moreover, our findings showed that managers in ISO 9001:2015 certified companies effectively implemented the nine dimensions of the model. The originality of this study lies in proving the positive effect of having a QMS in service companies in a context of slow economic growth and decline of consumer demand such as the COVID-19 pandemic. The findings might encourage service companies, especially those in developing countries, to allocate the necessary resources to obtain a QMS such as the ISO 9001:2015.

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1. Introduction

Quality management system (QMS) represents a satisfactory alternative for companies to focus on the continuous improvement of the quality of goods, service, and processes to meet customers' expectations (Junior & de Oliveira, 2019; Jacas & Psomas, 2015). The ISO 9001:2015 is an international standard specifying requirements for QMS, and its implementation can be considered the first step in the application of the total quality management (TQM). TQM is a commitment to continuous process improvement at all levels, and it is widely used by organizations seeking a competitive advantage (Hung et al., 2010). Martínez-Acosta et al. (2009) indicated that obtaining the ISO 9001 should help companies to improve their TQM-related practices as well as their performance. Moreover, it promotes commitment, training, and responsibility among employees in quality-related topics (Prajogo & Brown, 2006). ISO 9001 standards are globally accepted programs to provide companies with QMS (Barata & Cunha, 2015). In this regard, the ISO 9001:2015 also provides basic components for a successful implementation of TQM (Rahman, 2001).

During the last decades, economic growth in developing countries has been connected with the implementation of quality methods. This is because the increasing competition in international markets has forced developing countries to review their internal processes and focus on quality (Mergenthaler et al., 2009). However, the COVID-19 crisis negatively affected the global economy due to a contraction of international commerce. Due to the economic crisis, consumers and producers experienced an immediate negative shock around the world (Ikram et al., 2021). According to Abdallah (2021), quality approaches, such as the Kaizen and Lean management approaches, made improvements in the operational performance across companies during the initial phases of the COVID-19 pandemic. However, literature on ISO 9001:2015, and its strategic advantages in the COVID-19 crisis, is limited. In fact, the empirical evidence indicates that the implementation of quality

* Corresponding author

E-mail address jbenzaq@pucep.pe (J. Benzaquen)

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methods during the COVID-19 pandemic has been studied mainly in developed countries (Zarei et al., 2019). In order to address this knowledge gap in academic literature, and provide practitioners with insightful information, the motivation of this research was to provide evidence regarding the effects of having a QMS (ISO 9001:2015) in the context of the economic slowdown generated by the COVID-19 pandemic.

This study attempts to answer the following research question: Were Peruvian service companies with ISO 9001:2015 significantly different from non-certified companies in terms of TQM practices during the COVID-19 pandemic? To answer this question, we implemented a TQM model of nine dimensions and four blocks to determine if there were any significant differences between ISO 9001:2015 certified and non-certified service companies. The dimensions in the TQM model were Top Management, Quality Planning, Quality Audit and Evaluation, Product Design, Supplier Quality Management, Control and Improvement of Processes, Education and Training, Quality Circles, and Customer Satisfaction. We used a TQM model with thirty-five variables to prepare the questionnaire. The sample included 630 high-ranking executives (CEO or president, area managers, or departmental heads) of Peruvian companies in the consulting, commercial, education, financial, and logistics sectors. In terms of the data analysis, we calculated the reliability of the instrument and then applied a two-step process including descriptive and inferential tools to test for any difference between certified and non certified companies.

The novelty of this study lies in providing empirical evidence on the effects of implementing quality methods during the pandemic. The results of this study identified opportunities for improvement as well as competitive advantages among service companies with ISO 9001:2015 during a health and economic crisis generated by the COVID-19. This paper is divided into eight sections. Section 2 includes a review of the academic literature on quality and its association with business management. Section 3 addresses the study context of this research. Section 4 presents the hypotheses development. Section 5 details the research methodology, and Section 6 reports the study results. The discussion of each dimension is included in Section 7. Finally, Section 8 corresponds to the conclusions, limitations, and recommendations for future research.

2. Literature review

2.1. Total quality management

During the 1990s, quality became relevant for the American industry. In this context, Quality Assurance evolved into TQM. A context of tight competition and increasing international trade contributed TQM to be focused on the whole organization instead of only on the operational process. This stage of quality management literature is focused on all company members. According to Baheshti and Lollar (2003), TQM is considered a managerial philosophy that has received attention among practitioners during the past years. In addition, empirical evidence has shown that TQM improves profitability and productivity (Kumar et al., 2020; Anil and Satish, 2019; Tanninen et al., 2010).

Companies of various sizes and sectors around the world have implemented the TQM. Different authors have provided evidence of the positive effects of having a TQM. According to the TQM, the final product should reflect the top management commitment to quality (D'Alessio, 2017). Particularly, TQM improves product quality (Kumar & Sharma, 2018; Hassan et al., 2014), customer satisfaction (Mosadeghrad, 2015; Kaur & Sharma, 2014; Poksinska et al., 2010), financial performance (Shaikh, 2012), employee satisfaction (Babu & Thomas, 2021; Bajaj et al., 2018), operational efficiency (Xiong et al., 2017; Sadikoglu & Olcay, 2014), and cost reduction (Sajjad & Amjad, 2012). Thus, TQM creates a competitive advantage that represents a considerable difference to increase business productivity in a context of limited resources (Ferdousi et al., 2018).

2.2. Quality management system

QMS is a defined set of fundamental principles toward delivering products and service with high standards which derive from and resemble TQM (Sedevich-Fons, 2018). It is also defined as a mode of operation that ensures customer satisfaction (Naveen et al., 2021). This formalized system integrates mandatory procedures so that the organization and its employees identify, develop, produce, and meet customers' requirements (Talapatra et al., 2019).

Companies invest in QMS consulting because it is considered essential for increasing customer satisfaction, and it is a source of continuous improvement of the value chain (Kuei et al., 2011). Companies have also realized that having a QMS certification generates trust, recognition, and opens new markets. Nowadays, any type of organization can implement QMS (Galletto et al., 2017). In this context, the ISO 9001 family of QMS standards has gained relevance. ISO 9001 standards focus on strategic features of quality management that any organization needs in order to increase product quality (Kumar et al., 2018).

Over the years, ISO 9001 standards have gone through five versions: the first version was the ISO 9001:1987; the second version was the ISO 9001:1994; the third version was the ISO 9001:2000; the fourth version was the ISO 9001:2008; and the fifth version was the ISO 9001:2015. ISO 9001:2015 is the latest version across Peruvian service companies. The main change in the latest version of ISO 9001 standards was the addition of risk-based thinking which ensures the identification and control of risks throughout the use of QMS (Cagnin et al., 2019).

3. Study context

This study considered the quality in the Peruvian service industry during the period of COVID-19 pandemic. Particularly, consulting, commercial, education, financial and logistic companies were included in the research.

3.1. *The period of COVID-19 pandemic*

COVID-19 is a respiratory illness caused by a coronavirus called SARS-CoV-2, mainly affecting the human respiratory system. It is transmitted mainly between people in close contact with each other. The first transmission was reported in Wuhan, the city at the epicenter of the original outbreak in China during 2019 (Dhand & Li, 2020). The World Health Organization declared COVID-19 outbreak had become a pandemic on March 11, 2020. This made authorities worldwide implement specific measures to prevent it, from social distancing to economic shutdown. The COVID-19 pandemic has aggravated several problems in healthcare systems worldwide causing a negative effect on the quality of the healthcare sector (Leite et al., 2020). In this context, all sectors had to implement operational excellence approaches to deal with disruptions and increase organizational performance (McDermott et al., 2021; Mishra et al., 2021). In Latin American markets, the deceleration in economic activity in the US and China, the interruption of global markets, and the devaluation represented significant effects of COVID-19 (United Nations Economic Commission for Latin America and the Caribbean, 2022).

Peruvian authorities ordered mandatory social isolation due to the COVID-19 on March 15, 2020. In this context, the guideline for preventing and controlling COVID-19 was developed by the national health authority (Ministry of Health, 2020). At the same time, a specialist working group proposed a plan for the economic reactivation for each sector in accordance with international standards for the control and prevention of COVID-19 (Ministry of the Economy and Finance, 2020). Following specialists' suggestions, authorities implemented measures to promote economic activity while preventing and controlling the spread of COVID-19 during March 2020. However, Perú failed to solve several problems identified in the first wave. These problems were mainly caused by the fragility of the Peruvian health system and therefore worsened the second wave scenario (Herrera-Añazco et al., 2021). In fact, Perú was the worst hit in the deaths per million and total excess deaths during the second wave of COVID-19 (Fraser, 2020). In these circumstances, most sectors shut down and reopened during the second phase established by the multisector working group in June 2020.

3.2. *Quality in the Peruvian service industry (consulting, commercial, education, financial and logistic sectors)*

Lee (2021) defines consulting as an independent professional advisory service that helps managers and companies achieve various objectives by solving business problems and discovering new opportunities. In Peru, the participation of this activity in the economy has increased as a result of greater competitiveness in international markets. The turnover of these consulting companies in the Peruvian market reached US\$3.17 billion in 2018, and the five largest companies in this sector increased 22% in revenues (Spanish Institute of Foreign Trade, 2019). Source Global Research (2020) classified the consulting needs in Peru based on the size and sector where the company operates. Large companies tend to demand strategic business consulting and specialized consulting (e.g., consulting on transportation, engineering, and human resources issues). Instead, small-sized companies tend to demand consulting service for more urgent matters, such as tax or legal advice or information technology service.

In Peru, the evolution of the commercial sector, with the support of new distribution channels, has increased the competition and the interest to build customer loyalty. Alcaide (2015) noted that commercial processes include the delivery of products and services, along with the perception of value generated in clients based on the quality of their procurement. Quality in Peruvian companies have also evolved with the growth of the commercial sector. Particularly, both Japanese and American models and methodologies have been implemented in Peru. This came as part of an era characterized by the economic growth in the region (UNECLAC, 2018). A higher percentage of Peruvian companies in the commercial sector adapt their quality standards according to their line of business. However, only a small percentage choose to go through an international quality standard certification process like that of ISO 9001 standards.

To promote development in Peru, the education sector plays a fundamental role by promoting equality and social inclusion (Organisation for Economic Co-operation and Development, 2016). Even though Peru has experienced economic progress in recent decades, the World Bank (2018) pointed out that there are large gaps in the quality of teaching and the coverage of education in the country. In fact, although Peru has shown great progress compared to other Latin American countries, it has not been enough to guarantee a high-quality education sector. The Organization for Economic Co-operation and Development (2016) reported that the quality of Peruvian higher education is heterogeneous and below international standards. The consequences have been reflected in the low performance of public and private Peruvian universities at the international level. In 2020, only three were among the top hundred universities around the world (QS World University Ranking, 2020).

Some underlying problems with the Peruvian financial sector are the degree of coverage at the national level, since banking agencies are located in only 44% of the country's districts, and the fact that this sector is distant from small and micro-

enterprises (Boitano & Abanto, 2020). In this context, financial institutions have to prioritize service quality to be competitive and reach a large number of clients (Yaya et al., 2011). Thus, ISO 9001 implementation is relevant to achieve the standardization of processes and documentation, and create an organizational culture that values process as key factors for success.

The logistics sector has grown gradually in Peru during the last decades due to an attractive service provision that has consolidated an extensive market (Sanchez, 2018). Due to this economic growth, the logistics sector has also achieved significant results. In 2019, around 800 Peruvian companies specialized in customs, warehousing, and distribution generated approximately 1.6 billion PEN annually (World Bank, 2016). According to Imagen Group (2019), in 2012, there were only 68 logistic companies with the ISO 9001 certification; however, by 2019, there were 168. This increase of 147% shows clear progress in the competitiveness of the logistics sector.

4. Hypothesis development

ISO 9001 implementation requires the commitment of the top management to involve the company and improve the employees' appropriation and perception of the certification (Eve & Sprimont, 2016). The ISO 9001:2015 promotes the strengthening of this dimension, which motivates employees to contribute to the QMS process (Almeida et al., 2018). According to Low and Teo (2014, pp.10), the commitment of the top management reflects QMS performance. Therefore, a committed top management could strength QMS benefits in the company performance. This led us to propose the following research hypothesis:

H₁: *Peruvian service companies with ISO 9001:2015 were significantly different in the top management (leadership) dimension compared to companies without it during the COVID-19 pandemic.*

Quality planning makes it possible to analyze and define objectives focused on quality improvement. Savic et al. (2013) emphasized the important role of quality planning in the design of quality policies and strategic company goals. According to Yeung (2008), the appropriate application of QMS creates a higher level of development of quality planning, which led us to propose this research hypothesis:

H₂: *Peruvian service companies with ISO 9001:2015 were significantly different in the quality-planning dimension in comparison with companies without it during the COVID-19 pandemic.*

Quality audit refers to monitoring whether the maintenance of the QMS complies with the ISO 9001 requirements. Alič and Rusjan (2010) stated that the results of an audit provide relevant information for choosing the correct measures to guarantee that the QMS is aligned with the standards, and the company is improving. The proper training of quality auditors increases the benefits of the ISO 9001 implementation (Maglic et al., 2009). Therefore, the research hypothesis is the following:

H₃: *Peruvian service companies with ISO 9001:2015 were significantly different in the quality audit and evaluation dimension in comparison with companies without it during the COVID-19 pandemic.*

ISO 9001:2015 certification considers the customer requirements regarding the design of the product and operational process while providing a suitable product cost. What's more, the design process strengthens the quality of the output and leads to competitive advantages (Ferdousi et al., 2018). Fernandes et al. (2014) found that companies' efforts to use QMS tools related to product design positively influence innovative behavior in companies. In that sense, we proposed the following research hypothesis:

H₄: *Peruvian service companies with ISO 9001:2015 were significantly different in the product design dimension compared to companies without it during the COVID-19 pandemic.*

Supplier Quality Management involves managing and responding to the changes of suppliers to fulfill customers' needs in a timely manner in accordance with the established quality standards (Furterer & Wood, 2021). Prajogo et al. (2012) noticed that the supplier management of ISO 9001 certified companies has a positive effect on operational performance. Moreover, these companies are expected to have suppliers with greater quality maturity than non-certified companies (Dellana & Kros, 2018). These findings led us to propose this research hypothesis:

H₅: *Peruvian service companies with ISO 9001:2015 were significantly different in the supplier quality management dimension compared to companies without it during the COVID-19 pandemic.*

Process control and improvement includes companies' operational processes. Additionally, this dimension proposes the use of the seven tools of quality control for the improvement of process. Controlling the characteristics of the output through quality control is a fundamental task of QMS, which leads to the reduction of non-quality costs (Sanchez-Marquez et al.,

2020). ISO 9001:2015 has a significant impact on quality control, which leads to a higher company performance especially in the procurement processes (Zimon, 2017). This led us to propose this research hypothesis:

H₆: *Peruvian service companies with ISO 9001:2015 were significantly different in the dimension of process control and improvement compared to companies without it during the COVID-19 pandemic.*

Employees should receive education and training related to quality management tools regardless of their place in the company hierarchy. Many authors have provided evidence of the significant improvement in employee training as a consequence of the implementation of ISO 9001 standards (Budayan and Okudan, 2022; Santos et al., 2011). Thus, we proposed the following research hypothesis:

H₇: *Peruvian service companies with ISO 9001:2015 were significantly different in the education and training dimension in comparison with companies without it during COVID-19.*

Quality circles are one of the tools required by ISO 9001:2015 certification. They consist of small groups of employees that carry out similar tasks and meet periodically to share, analyze, and solve work-related issues (Holzer et al., 2009). Quality circles can improve employee morale and productivity, and also reduce employee turnover (Harman et al., 2002). According to Pereira and Osburn (2007), quality circles are considered a way of allowing employees to make suggestions, and thus positively affects job performance. This led us to propose the following research hypothesis:

H₈: *Peruvian service companies with ISO 9001:2015 were significantly different in the quality circles dimension compared to companies without it during the COVID-19 pandemic.*

One of the key objectives of ISO 9001 standards is to increase customer satisfaction (Gotzamani et al., 2007). According to Castro-Silva and Rodriguez (2017), the effort of companies to obtain ISO 9001:2015 certification generates a positive impact on their performance, especially in product planning and design, along with customer satisfaction. Particularly, Siltori et al. (2021) reported insightful benefits from ISO 9001:2015 implementation among Brazilian companies. These benefits were related to operational processes and achieving higher customer satisfaction. Therefore, the following research hypothesis was proposed:

H₉: *Peruvian service companies with ISO 9001:2015 were significantly different in the customer satisfaction dimension compared to companies without it during the COVID-19 pandemic.*

5. Research methodology

5.1. Data collection process

Based on their operations, service companies can be classified into the following economic sectors: consultancy, commercial, education, finance and insurance, and logistics (D' Alessio, 2017). The study sample included 8,226 Peruvian service companies specialized in the following sectors: logistics (522), consulting (89), banking (40), insurance (260), higher education (93), and commercial (7,222). Logistics companies were registered in the Integrated Foreign Trade Information System as freight forwarders for international trade in Peru, in accordance with the National Superintendency of Tax Administration. Banking and insurance companies were selected from the system of the Superintendency of Banking, Insurance, and AFP (SBS) in 2020. The selected universities had the basic quality conditions, according to the National Superintendence of Higher University Education. Consulting companies were selected from the National Environmental Certification Service and the Peruvian Association of Consultants. Finally, the commercial companies were selected from the 2020 publication of the Association of Shopping and Entertainment Centers of Peru.

For the estimation of the ideal sample, we included a population of 8,226 service companies (logistics, banks, insurance, commerce, universities, and consulting). The confidence level used in this research was 99%, the probability of occurrence was 50%, and the margin of error was 5%. The results suggested using a sample of 616 service companies in order to obtain accurate information of the study population. Based on this information, we sent an invitation to participate in the questionnaire to CEOs, presidents, area managers and heads of department. In total, 644 high-ranking executives participated in the study, but 14 questionnaires were excluded as some responses about the company's characteristics were missing. The final sample of the study included 630 service companies. Table 1 shows their general characteristics.

Table 1

General characteristics

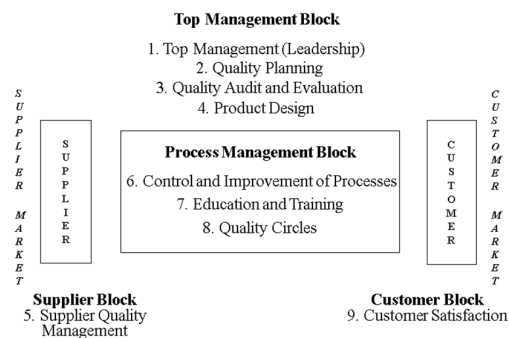
Factor	Variable	Amount
Location	Province	151
	Lima	590
Type of Company	Public	33
	Private	708
Number of workers	1 to 10	265
	11 to 50	177
	51 to 200	147
	201 to more	152
Position in the company	Chairman of the board or General Manager	101
	Area Manager or Department Head	422
	Other	218
Age of the company (years)	0 to 5	172
	6 to 10	152
	11 to 15	111
	16 to 20	96
	More than 20	209
QMS	No	590
	Yes	140
Years implementing QMS	1 to 3	12
	4 to 7	34
	More than 8	7

5.2. Measurements

Each questionnaire was composed of seven closed questions about the characteristics of the company, and 35 closed questions about the implementation of TQM (see Appendix 1). One specialist in quality research and two specialists in statistics and research reviewed and validated all the answers. Participants gave their opinions using a five-point Likert scale where 5 indicates that the individual totally agrees with the statement, 4 agree, 3 neutral, 2 disagree, and 1 for totally disagree.

To elaborate on the questions, we considered nine dimensions based on previous literature. These dimensions formed the four blocks that include all members of an organization. The first block is called Top Management and includes four dimensions: Quality Audit and Evaluation, Quality Planning, Leadership, and Product Design. Leadership contributes to improving quality management to achieve the objectives of each department. Quality Planning is responsible for analyzing organizational goals for quality management. Quality Audit and Evaluation includes the ongoing assessment of quality policies and plans. Product Design considers the adoption of innovative processes as a differentiating aspect in comparison with other companies. Top management represents a key element in this dimension, who must guarantee that customer requirements are included in the product design.

The second block is called Process Management and is focused on the management of processes within the organization. This block emphasizes the management of all interrelated processes as a single system. This block has three dimensions: Control and Improvement of Processes, Education and Training, and Quality Circles. Control and Improvement of Processes is responsible for verifying the operating processes (e.g. correct functioning of facilities and operating equipment), as well as for determining whether said processes satisfy the customer requirements. Education and Training measure the education, training and commitment of employees with regard to the implementation of QMS. Quality Circles promote communication across all employees, and improve job performance (Pereira and Osburn, 2007). The third block is called Supplier and includes the Supplier Quality Management dimension. This dimension evaluates the Supplier Quality Management and how it influences the goods or service they produce. Finally, the fourth block includes Customer Satisfaction. This dimension evaluates customer satisfaction in relationship with the service offered, and the way in which customer needs are integrated. Figure 1 shows the blocks and dimensions previously discussed.

**Fig. 1.** TQM model in service companies

5.3. Data analysis

Once data were collected, we calculated Cronbach's alpha to evaluate internal consistency of the measurements. Then, the results of each dimension were analyzed based on the criterion value recommended by Lance et al. (2006) to determine if any dimension should be removed from the analysis. The authors suggested using a 0.70 cutoff to indicate an adequate reliability. Then, we followed a two-step process to determine significant differences between ISO 9001:2015 certified companies and those without it. In the first step, we calculated separately the average of each dimension across all companies. In the second step, we included inferential tools to determine if the differences between companies were significant. The second step started with the application of the Kolmogorov-Smirnov test (KS test). The KS test is a nonparametric test that allows us to determine whether a group behaved according to a normal distribution. This test has the advantage of having no restrictions in the sample size and measures the distribution functions cumulatively (Dodge, 2008). Based on the KS test results, we selected the test to determine the existence of significant differences between ISO 9001:2015 certified and non-certified companies. If the sample had a normal distribution, we applied the independent t-test. On the other hand, when a non-normal distribution was identified in the sample, we applied the Mann-Whitney U test. This test is often referred to as a non-parametric alternative to the independent t-test (Korneev and Krichevets, 2011). The main advantage of the Mann-Whitney U test is that it does not require large, normally distributed samples, to identify differences between two samples (Nachar, 2008).

6. Results

Table 2 displays the results corresponding to Cronbach's alpha for the nine dimensions of the study. According to the results, all dimensions obtained acceptable levels of reliability. Thus, we confirmed the reliability of the measurement scales.

Table 2
Results of Cronbach's alpha coefficient

Factor	Cronbach's Alpha
(X1) Top Management	0.862
(X2) Quality Planning	0.785
(X3) Quality Audit and Assessment	0.685
(X4) Product Design	0.799
(X5) Quality Management of the Supplier	0.783
(X6) Process Control and Improvement	0.757
(X7) Education and Training	0.846
(X8) Quality Circles	0.922
(X9) Customer Satisfaction Approach	0.804

In the first step, the average score of each dimension was computed. We found that the average of all dimensions was 4.16 for certified companies and 3.68 for non-certified companies. In the case of each dimension, ISO 9001:2015 certified companies obtained higher averages than non-certified companies across all dimensions. This information represented a bias towards the implementation of quality practices by service companies. Likewise, we noted that the Leadership dimension obtained the greatest score across all service companies, while the Quality Circles dimension scored the lowest average.

After we established internal consistency of the instrument and computed the averages, we determined if the sample was distributed normally to decide if we needed to use a parametric or nonparametric approach to test the significant differences between the studied dimensions.

We applied the KS test to determine the non-normality of the sample distribution. The results suggested that the null hypothesis of sample normality of the sample should be rejected, since the p-value was lower than the conventional level of significance 0.05 (Table 3.).

Table 3
Results of Kolmogorov Smirnov test

	N°	Normal parameters		Maximum extreme differences			Test statistic	Asymptotic significance (bilateral)
		Mean	Standard Deviation	Absolute	Positive	Negative		
Total TQM	724	3.7807	0.55061	0.113	0.085	-0.113	0.113	0.00

Once the non-normality of the sample was verified, we implemented the Mann-Whitney U test. It enabled testing for heterogeneity across all the dimensions across ISO 9001:2015 certified and non-certified companies (Table 4). That is, to test whether there was any significant difference in the performance of the nine dimensions analyzed. The null hypothesis of the Mann-Whitney U test stated that the distributions of the two groups were significantly similar.

Table 4
Results of U de Mann Whitney test

Factor	Ranges				Test Statistics		
	QMS	N°	Average Range	Total Range	U de Mann Whitney	Z	Asymptotic Significance (bilateral)
(X1) Top Management	Without	590	337.31	19011	24666	-7.47	0
	With	140	484.31	67804			
(X2) Quality Planning	Without	590	343.34	202573	28227.5	-5.92	0
	With	140	458.88	64243			
(X3) Quality Audit and Assessment	Without	589	324.99	191421	17665.5	-10.46	0
	With	138	530.49	73208			
(X4) Product Design	Without	590	348.56	205649	31303.5	-4.51	0
	With	140	436.9	61167			
(X5) Quality Management of the Supplier	Without	590	346.13	204216	29870.5	-5.14	0
	With	140	447.14	62600			
(X6) Process Control and Improvement	Without	590	339.54	200331	25985.5	-6.76	0
	With	140	473.05	65755			
(X7) Education and Training	Without	590	338.88	199939	25594	-7.06	0
	With	140	477.69	66876			
(X8) Quality Circles	Without	589	325.84	191918	18162.5	-10.27	0
	With	139	528.33	73439			
(X9) Customer Satisfaction Approach	Without	589	338.09	199136	25380.5	-7.05	0
	With	139	476.41	66221			

For all dimensions, the results rejected the null hypothesis. In that sense, this indicated that there was enough statistical evidence to conclude that the sample of certified and non-certified companies were not homogeneous. In other terms, there were significant differences across ISO 9001:2015 certified and non-certified Peruvian service companies. Table 5 shows these results and evidence of the impact of the TQM on service companies.

Table 5
Means of service companies with and without QMS

Factor	Average		Total
	With QMS	Without QMS	
Top Management	4.284	3.858	3.94
X11	4.31	3.82	3.91
X12	4.28	3.82	3.91
X13	4.09	3.68	3.76
X14	4.27	3.85	3.93
X15	4.46	4.11	4.18
Quality Planning	4.167	3.801	3.871
X21	4.29	3.88	3.96
X22	4.19	3.76	3.84
X23	4.01	3.76	3.81
Quality Audit and Assessment	4.234	3.531	3.664
X31	4.24	3.74	3.83
X32	4.17	3.07	3.28
X33	4.28	3.78	3.88
Product Design	4.157	3.884	3.937
X41	4.21	3.93	3.99
X42	4.19	3.88	3.94
X43	4.06	3.84	3.88
Quality Management of the Supplier	4.061	3.756	3.814
X51	3.97	3.79	3.82
X52	4.14	3.81	3.87
X53	4.12	3.75	3.82
X54	4.01	3.68	3.74
Process Control and Improvement	4.191	3.818	3.889
X61	4.24	4.06	4.1
X62	4.31	4.06	4.11
X63	4.2	3.95	4
X64	3.99	3.2	3.35
X65	4.23	3.82	3.9
Education and Training	4.136	3.711	3.793
X71	4.19	3.63	3.73
X72	4.09	3.68	3.76
X73	4.15	3.79	3.86
X74	4.11	3.75	3.82
Quality Circles	3.995	3.012	3.295
X81	4.1	3.06	3.26
X82	3.89	2.95	3.13
X83	4	3.03	3.22
X84	3.99	3	3.19
Customer Satisfaction Approach	4.214	3.801	3.88
X91	4.22	3.81	3.89
X92	4.16	3.82	3.88
X93	4.26	3.69	3.8
X94	4.21	3.87	3.94

7. Discussion

7.1. Top Management block

The Top Management block included four dimensions: Top Management (Leadership), Quality Planning, Quality Audit and Evaluation, and Product Design. In the Top Management (Leadership) dimension, ISO 9001:2015 certified companies recorded a greater score (4.28) than non-certified companies (3.86). According to the Mann-Whitney U test, there was a significant difference between both groups of companies. In this way, research hypothesis 1 was validated. In other words, it states that Peruvian service companies with ISO 9001:2015 certification were significantly different in the Top Management (Leadership) dimension compared to companies without the certification. That is, top management's allocation of resources and promotion of quality management was significantly superior among certified companies. The Top Management (Leadership) dimension relates to the QMS principle of leadership. This principle suggests that leaders must set a sole purpose and direction for the company. Therefore, top management is relevant for the strategic planning and long-term success of the company. The results of this dimension are in line with previous literature related to the implications of QMS on top management and the positive effects for the company (Shaharudin et al., 2018; Aggelogiannopoulos et al., 2007). This result also pointed out the importance of having a QMS during a pandemic.

ISO 9001:2015 certified companies recorded a greater score (4.17) than non-certified companies (3.80) in terms of Quality Planning dimension. Likewise, the results of the Mann-Whitney U test confirmed those distributions across both groups was significantly different. That is, the results supported hypothesis 2 and we concluded that ISO 9001:2015 certified companies were significantly different from the non-certified companies in Quality Planning dimension. Therefore, the results corroborated that companies with ISO 9001 certification are more committed to the success of quality plans when compared to non-certified companies (Popescu & Măndru, 2016; Rusjan & Alič, 2010). The findings also revealed that the QMS allowed companies to stay focused on identifying, understanding, and managing interrelated processes in order to improve their effectiveness and efficiency during the pandemic. This is explained by the fact that ISO 9001:2015 certification requires organization planning of policies and objectives. In addition, the certification increases the participation of all staff members, which also improves the employees' perception of quality.

For Quality Audit and Evaluation dimension, companies with QMS (4.23) significantly outperformed companies without it (3.53). This was the second largest difference noted among all the dimensions of this study. Likewise, the results of the Mann-Whitney U test confirmed that the difference between the two companies was significant. Thus, hypothesis 3 was accepted and we concluded that there were significant differences between certified and non-certified service companies in terms of audits and evaluation during the pandemic. Quality Audit and Evaluation are related to the "decision-based approach" of companies, which establishes quality indicators for evaluation and audit. In order to obtain ISO 9001:2015 certification, companies must perform regular audits, evaluate policies and quality plans, and overcome several audit limitations (Abaza et al., 2020). Following the same line, this research provides evidence of the positive effect of having ISO 9001:2015 on company performance based on the evaluation of policies and plans related to quality (Khatatbeh, 2022). Quality Audit and Evaluation dimension included Benchmarking. In this case, our findings indicated a much higher presence of benchmarking in ISO 9001:2015 certified companies (4.17) than non-certified companies (3.07) during the COVID-19 pandemic.

In terms of Product Design dimension, ISO 9001:2015 certified companies recorded a greater score (4.16) than non-certified companies (3.88). Moreover, results of the Mann-Whitney U test confirmed this difference was significant. Thus, we validated hypothesis 4 and concluded that there were significant differences between certified and non-certified service companies in this dimension. The misbalance was caused by relatively higher investments in the product design and the fact that certified companies heightened their customers' needs. The findings suggested that ISO 9001:2015 certified companies adopted innovative measures to differentiate themselves from non-certified companies in terms of product design, which is in line with previous studies related to the impact of QMS in product design (Fernandes et al., 2015; González-Prida & Crespo, 2012). Furthermore, our findings provide evidence of the importance of this dimension during the COVID-19 pandemic.

7.2. Suppliers block

Suppliers block only included Supplier Quality Management dimension. This dimension captures the relationship between companies and suppliers. In this case, ISO 9001:2015 certified companies (4.06) scored higher than non-certified companies (3.76). In addition, the Mann-Whitney U test allowed us to confirm that distributions of both groups of companies were significantly different. Thus, we validated hypothesis 5 and reported that ISO 9001:2015 certified companies were more concerned about the quality-related policies implemented by suppliers.

This dimension is associated with ISO 9001:2015 principle of relationship management, which highlights the interdependence between interested parties with suppliers and organizations. Therefore, this dimension strengthens the relationship between them. Dellana et al. (2020) reported that ISO 9001:2015 certified companies leverage the integration of risk management into the supply chain to positively affect the supply chain performance. A higher score in this dimension indicated that certified

companies were superior in terms of evaluating and tracking the quality levels of suppliers. The findings suggested that ISO 9001:2015 certified companies had better contact with suppliers than non-certified companies during COVID-19 pandemic.

7.3. Process Management block

The Process Management block included three dimensions: Control and Improvement of the Process, Education and Training, and Quality Circles. Regarding Control and Improvement of the Process, results showed that ISO 9001:2015 certified companies (4.19) obtained a greater score when compared to non-certified companies (3.82). In addition, the Mann-Whitney U test confirmed that distributions of both groups of companies were significantly different. Based on this information, hypothesis 6 was supported. This dimension measures how much operational processes meet the customers' requirements. The implementation of quality control tools and techniques to improve processes was relatively more common across certified companies, which is consistent with previous literature (Cao, 2018; Westgard & Westgard, 2016). Bagodi et al. (2021) identified that the use of statistical quality control approaches helps companies to achieve the desired process performance capability. Moreover, these authors stated that QMS involves cost and time that should be integrated into a system, and it may not necessarily reflect short term benefits. In a highly competitive environment, quality circles represent an adequate source of continuous improvement (Goh, 2000). In other words, the QMS and quality control approaches have long-term effects. Our findings indicated that ISO 9001:2015 certified companies have a competitive advantage over non-certified companies. This is because ISO 9001:2015 certification helps companies to implement actions to enhance the maturity of process management and tools aligned to QMS (Medina-Merodio et al., 2020, pp.102557).

Education and Training dimension the ISO 9001:2015 certified companies (4.14) obtained a greater score when compared to non-certified companies (3.71) in this dimension. This was the third largest difference noted among all the dimensions. The Mann-Whitney U test confirmed that distributions of certified and non-certified companies were significantly different, which led to the acceptance of the hypothesis 7. Education and Training dimension addresses the employee engagement in quality-related activities to education and training, as well as availability of adequate equipment for quality management. Our findings revealed that ISO 9001:2015 certified companies tended to improve their education, training, and use of tools for quality management in comparison to their counterpart during COVID-19 pandemic. Thus, our findings are consistent with previous studies that highlight the positive effect of QMS in education, training, and employee performance (Cabero et al., 2018; Bakotic & Rogosic, 2017). Nurcahyo et al. (2021) found that low commitment among top executives, resistance to change, lack of qualified personnel, and insufficient training are obstacles that need to be overcome for an effective implementation of ISO 9001:2015.

ISO 9001:2015 certified companies (3.99) recorded a considerably higher score than non-certified companies (3.01) in terms of Quality Circles dimension. The Mann-Whitney U test confirmed that the difference between companies was significant. These results supported hypothesis 8. Therefore, it is possible to conclude that ISO 9001:2015 certified companies have a competitive edge when compared to non-certified companies. Quality Circles dimension addresses companies' quality and its relationship with trainees, cost optimization, tools compliance, and employee engagement. In addition, these results are aligned with previous research on the positive effect of Quality circles on company performance (Lagrosen & Lagrosen, 2004). According to Intalar et al. (2018), quality circles promote communication across employees and identification of innovative ideas that lead to successful development of new products. This dimension is also associated with the QMS principle of continuous improvement because it requires management commitment to engage employees in the effort to provide a better service, continuous evaluation and being solution oriented. Furthermore, compared to the other dimensions, the Quality Circles dimension revealed the greatest difference because certified companies obtained the lowest score among all the dimensions. This result suggests that the certified companies may not be constantly or adequately using this technique.

7.4. Customer block

Customer block included the Customer Satisfaction dimension. ISO 9001:2015 certified companies (4.21) scored greater when compared to non-certified companies (3.80). The Mann Whitney U test revealed that the difference between companies was significant. Therefore, hypothesis 9 was confirmed; that is, Peruvian certified service companies were significantly different from those without the certification in the customer satisfaction dimension during the COVID-19 pandemic. The Customer Satisfaction dimension complies with the QMS principle of customer focus. This principle highlights the relevance of meeting customer needs, understanding their requirements and making efforts to exceed their expectations. The Customer Satisfaction dimension is also associated with the QMS principle of continuous improvement since it requires employee engagement to meet customer needs. In that sense, the results provide evidence of the positive effect of having ISO 9001:2015 certification on customer satisfaction. Although previous studies have noted a positive effect (da Fonseca et al., 2019; Psomas et al., 2013), our findings provide more evidence of the advantage that companies with this certification had during the pandemic to increase their customer satisfaction.

8. Conclusions

This article has implemented statistical techniques to demonstrate the differences between ISO 9001 certified and non-certified service companies during the COVID-19 pandemic. The computation of the score of each dimension revealed that the ISO 9001 certified companies performed better in the nine TQM dimensions analyzed in this study.

Overall, ISO 9001:2015 certified companies showed a greater score than its counterpart in each dimension of the four blocks of TQM: Top Management, Supplier, Process Management, and Customer block. In addition, in each dimension the results of the Mann-Whitney U test confirmed that the differences between both groups of companies were significant. Therefore, it is possible to confirm that having QMS represented a competitive advantage for service companies in the nine-dimensional model of TQM during COVID-19.

On the other hand, this research has three relevant practical implications. The dimension with the highest score for service companies was Leadership, which highlights the role of the company's leaders promoting competitiveness and quality to guarantee the company's long-term success and sustainability. Across service companies, practitioners should note that leaders must be responsible for the QMS implementation. In that sense, leaders are key elements to establish adequate policies and goals related to quality, optimize resource allocation, and promote employee participation in the process.

Quality Circles dimension scored the lowest across all dimensions. This suggests that service companies may not be using this technique constantly or adequately. Both ISO 9001:2015 certified and non-certified service companies should focus on training employees in the quality circles methodology. In a highly competitive environment, quality circles represent an adequate source of continuous improvement.

The better performance of certified service companies is explained by the influence of the ISO 9001:2015 QMS principles. Implementing these principles can help service companies to improve in the nine dimensions of the TQM. It also represents a competitive advantage over non-certified service companies. The values equal or greater than 4 in each dimension revealed that managers in certified companies are doing what they are asked to do in companies with the QMS. In the case of non-certified companies, managers tend to perform at different levels according to the model in 8 dimensions. However, managers tend not to implement practices that correspond to Quality Circle Management. This study might encourage Peruvian service companies to allocate the necessary resources to obtain the ISO 9001:2015 certification, due to the positive effect that this certification has on the quality of processes, products and customer satisfaction.

The results also highlight the positive effect of quality certifications on company performance during complex scenarios. Particularly, our findings support the implementation of ISO 9001:2015 certification and provide evidence of its positive impact on service companies during COVID-19 pandemic. Practitioners could also use the results of each dimension as a threshold for the service sector in order to identify weaknesses and competitive advantages.

8.1. Limitations and further research

This study presents limitations that mainly concern the characteristics of the sample used in the analysis. The survey was aimed at the Top Management of companies (i.e., CEOs, presidents, area managers and heads of department). This limited other insights from lower-ranking employees. The sample of this study consisted of Peruvian service companies. In that sense, the results reflected the performance across the tertiary sector. Consequently, the results of this study cannot necessarily be applied to goods companies.

The academic literature on TQM and ISO 9001:2015 QMS during COVID-19 is limited. Further studies could replicate the current research, especially in the case of other developing countries. The preexisting vulnerabilities to which developing countries are constantly exposed have worsened the negative impact of the COVID-19 pandemic. In this context, goods and service companies in developing countries faced more challenging events than developed countries (Rasul, 2020). This allows us to make better comparisons between companies and identify strengths and weaknesses in terms of the performance of TQM dimensions during the COVID-19 pandemic. In this way, new opportunities for improvement can be identified within companies' QMS, and action plans can be implemented to overcome gaps and weaknesses.

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Appendix

Appendix 1. Average response of service companies for each dimension and its variables

Dimension and variables

Top Management

X11 TM is constantly concerned with the QM of the company

X12 TM fully supports employee involvement in the QM of the company

X13 TM regularly meets to discuss QM-related issues

X14 TM allocates the adequate resources to improve the level of quality of the company

X15 TM looks for long-term goals of the company

Quality Planning

X21 The company possess specific objectives regarding quality

X22 The company is aware of the compliance and success of quality policies and plans

X23 The company promotes employee engagement with the design and implementation of quality policies and plans

Quality Audit and Evaluation

X31 The company constantly assesses quality plans and policies

X32 Benchmarking is commonly applied

X33 Decision-making based on data is implemented

Product Design

X41 The company allocates adequate resources in product design

X42 Company's product design main objective is to meet customers' needs

X43 The company implements a methodological process for product design

Supplier Quality Management

X51 The company and its suppliers have long-term collaborative relationships

X52 Suppliers' product quality is adequate

X53 Information about suppliers' performance related to quality management is available

X54 The company constantly evaluates suppliers

Process Control and Improvement

X61 The company's operating process satisfies customers' requirements in regard to the delivery date

X62 The physical layout of the operational team adequately works

X63 All company's operating equipment receives adequate maintenance

X64 The company implements seven tools of quality control (Ishikawa diagram, control charts, flow diagram, checklist, Pareto diagram, histogram)

X65 Quality control is constantly implemented

Education and Training

X71 Proper education and training in topics related to quality is provided to the employees

X72 Most of the employees are able to implement QM tools

X73 The company employees have strong quality awareness

X74 The company promotes employee involvement in quality-related activities

Quality Circles

X81 The company is trained to conduct quality circles

X82 The company quality circles have a positive effect on cost optimization

X83 The company has adequate tools to perform quality circles

X84 Most of the employees engage in quality circles

Customer Satisfaction

X91 The company has access to customer information

X92 The company is aware of the customer complaints information

X93 A customer satisfaction survey is conducted yearly

X94 The company constantly conducts an evaluation of customer requirements

Notes. Values $4 < x \leq 5$ denote that top management is doing what is indicated in the variable; values $3.7 < x \leq 4$ denote that top management tends to do it; values $2 < x \leq 3.7$ denote that top management tends not to do it; and lower values denote that top management is not doing it.

