Relationship Between Quality Management Practices, Performance and Maturity

Quality Management, a Contingency Approach

Por

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Dedication

To my family who through their support, encouragement and example inspired me to move forward with my dreams. Especially Claudia, Alessandra and Luciana who filled my life with meaning and love, as well as to my parents who taught the value of effort and dedication.

Abstract

Quality management is a key element in organizations to improve operational performance, product quality and organizational performance, but despite extensive research, it is still necessary to determine which quality management practices are most important or can generate the greatest benefits in organizations. Likewise, evidence has been found which concludes that not all implementations of quality management systems generate positive effects, so it is necessary to introduce contingent variables in the studies that allow understanding the different situations and thus define which variables are more relevant according to the contingency studied.

Sfreddo, Vieira, Vidor, and Santos (2018) and Sousa and Voss (2002) propose to include the variable of quality maturity level as a contingency variable in order to determine which quality management practices are more relevant according to their maturity level. In this study, a multidimensional study of quality management practices and their relationship to the operational performance of organizations was carried out, taking the quality management maturity level as a contingent variable.

The result of the evaluation of the level of maturity as a contingency variable has demonstrated that the effects of benefits in the operative performance are presented in the levels of high maturity, in changes in the levels below these do not present a significant relation. It was also demonstrated in the study the importance of working in the QM practices infrastructure to allow the development of QM core practices since these are the ones that finally impact on the operational performance.

Keywords

Quality Management, Operation Performance, Quality Management Practices, Maturity Quality Management.

Resumen

La gestión de la calidad es un elemento clave en las organizaciones que permite mejorar el rendimiento operativo, la calidad de los productos y el rendimiento de la organización, pero a pesar de que se han realizado amplias investigaciones, todavía es necesario determinar qué prácticas de gestión de la calidad son más importantes o pueden generar mayores beneficios en las organizaciones. Asimismo, se han encontrado evidencias que concluyen que no todas las implementaciones de sistemas de gestión de calidad generan efectos positivos, por lo que es necesario introducir en los estudios variables contingentes que permitan comprender las diferentes situaciones y de esta manera definir qué variables son más relevantes según la contingencia estudiada.

Sfreddo, Vieira, Vidor y Santos (2018) y Sousa y Voss (2002) proponen incluir la variable del nivel de madurez de la calidad como variable contingente para determinar qué prácticas de gestión de la calidad son más relevantes según su nivel de madurez. En el presente estudio se ha realizado un estudio multidimensional de las prácticas de la gestión de la calidad y su relación con el performance operativo de las organizaciones tomando el nivel de madurez del gestión de la calidad como variable contigente.

El resultado de la evaluación del nivel de madurez como variable de contingencia ha demostrado que los efectos de los beneficios en el desempeño operativo se presentan en los niveles de alta madurez, en cambio los cambios en los niveles inferiores a éstos no presentan una relación significativa. También se demostró en el estudio la importancia de trabajar en la infraestructura de prácticas de gestión de la calidad para permitir el desarrollo de prácticas básicas de gestión de la calidad, ya que son éstas las que finalmente repercuten en el rendimiento operativo.

Palabras Claves

Gestión de la Calidad, Performance Operativo, Prácticas de la Gestión de la Calidad, Madurez de las Gestión de Calidad.

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Introduction

This doctoral thesis is made up of six parts: (a) the Abstract and *Resumen Ejecutivo*; (b) the Table of Contents; (c) the Research Proposal (RP), which was defended earlier; (d) the Results, made up of the accepted or published research paper presenting the doctoral research results; (e) the Conclusions and Recommendations; and (f) the Appendices. The abstract presents the research purpose, the research method, and the main finding in a maximum of 250 words: the new doctoral contribution to management science.

The RP is the final version defended successfully by the student to become a doctoral candidate approximately one to two years earlier. This is why its references seem to be a bit old: they had a cut off in the year when the RP was defended. Besides the front page, Table of Contents, List of Tables, and List of Figures, it contains three chapters: (a) the Introduction, where the research problem is stated, defined, and formulated; (b) the Review of the Literature at the time of its defense. Here the student must show the knowledge gap that he/she found in the academic literature, which he/she addressed during his/her doctoral research; (c) the Methods used to carry out the research, where the student presented details about the population and sample used, the data collection and analyses, the research instrument(s) used, and most importantly, the validity and reliability of the research method, the research design, the research instrument(s), the statistical techniques and procedures used, and of his/her research findings. It also includes the list of References used in the RP and any Appendices attached to the RP at that time.

Then, in Chapter IV the thesis includes a copy of the accepted or published research paper. This paper, as it should be, includes all the details that appear in the journal where it will be published o where it has been published: article title, author(s) name(s), abstract, keywords, paper contents, including the results, where the doctoral contribution to the

management science should be included. It also includes the Conclusions, and the list of References.

The Appendices included in the thesis, among other files, include the following: (a) the letter of acceptance or a copy of the message accepting the research paper, (b) the presentation in PPT used to defend the RP, and (b) the presentation in PPT used in the thesis defense.

In conclusion, this thesis is presented in a *sui generis* manner. The members of the Jury should therefore focus their attention in the Abstract, Chapter IV, where the research paper is presented, and in the Conclusions and Recommendations.

Chapter I to III: Research Proposal

Relationship Between Quality Management Practices, Performance and Maturity Quality Management, a Contingency Approach

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A Research Proposal Presented in Partial Fulfillment of the Requirements for the Degree of Master of Philosophy

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Abstract

Quality Management is a key element in the organization that allows for the improvement of operational performance, product quality and organizational performance, and although extensive research has been carried out, it is still necessary to be able to determine which QM practices are more important or can generate greater benefits in organizations. Due to this, there have been different approaches in how to study practical QM from a one-dimensional approach to a multidimensional approach, being the most recent studies under the last approach the ones which have empirically demonstrated a dependence between QM practices.

Likewise, evidence concluding that not all implementations of quality management system generate positive effects has been found, so it is necessary to introduce contingent variables in the studies that allow an understanding of the different situations that can define which variables are more relevant according to the studied contingency. In this sense, Sousa and Voss (2002) propose to include the variable of quality maturity level as a contingency variable in order to determine which QM practices are more relevant according to the level of maturity of the organizations, an issue that has been the basis for the development of other models of maturity in other fields of management. Thus, this paper aims to analyze the quality management practices level in the manufacturing industry and its relationship with operational performance, using the quality management maturity level as a contingency variable.

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Chapter 1: Introduction

There are many publications and books regarding the features and benefits of proper application of quality management (QM) and several research studies have concluded that QM practices have a positive impact on (a) customer satisfaction (Anderson, Rungtusanatham & Schroeder, 1995; Choi & Eboch, 1998; Rungtusanatham, Forza, Filippini, & Anderson, 1998), (b) product quality (Ahire & O'Shaughnessy, 1998; Choi & Eboch, 1998; Dow, Samson, & Ford, 1999; Forza & Filippini, 1998), and (c) performance (Choi & Eboch, 1998; Curkovic, Melnyk, Calantone, & Handfield, R., 2000; Douglas & Judge; 2001; Dow et al.,1999; Samson & Terziovski, 1999). However, other studies reveal that the impact is weak or statistically non-significant (Sousa & Voss, 2002), this may be because the impact of QM practices is contingent on other factors, such as natural context and culture (Rungtusanatham et al., 1998), firm size (Voss, Blackmon, Cagliano, Hanson & Wilson, 1998) and others (Sousa & Voss, 2008).

Crosby (1976) introduced the concept of quality management maturity as an element that helps managers understand the function of quality, and he stated that long-term activities must be planned, as well as the fact that the involvement of each person—and not just the quality managers—is essential. In this way, quality management has focused on looking for more efficient and effective processes (Juran, Gryna, & Bingham, 2005) and there are many practices that can be implemented and there is little information depicting which are more relevant than others in different contexts, therefore, it is important to be able to find "which practices should be emphasized by organizations at difference stages of QM maturity" (Sousa & Voss, 2002, p. 15).

Background of the Problem

Quality management has become an important element of modern management, to the point that many organizations have implemented quality management practices as part of their routine operations and not only as a temporary application (Sousa & Voss, 2002), this allows organizations to achieve more efficient, more competitive operations, reducing costs and compromising staff (Rusjan & Alic, 2010). However, it is not the only approach since many organizations decide to start with a less complex model, such as ISO 9001 standard's commendation. There are several studies on TQM and quality management system impacts in different sectors, such as manufacturing, services, health care, education, and government (Dean & Bowen, 1994), mainly regarding the positive relationship between the implementation of QM practices and (a) quality performance -internal process and product (Adam, 1994; Adam et al., 1997; Anderson et al., 1995; Choi & Eboch, 1998; Dow et al., 1999), (b) operational performance (Adam, 1994; Choi & Eboch, 1998; Dean & Smell, 1996; Samson & Terziovski, 1999), and (c) business performance (Adam, 1994; Adam et al., 1997; Flynn et al., 1995; Hendricks & Singhal, 1997; Powell, 1995), in this last category is where a weak and less significant relationship has been found. On the other hand, other studies have reported problems generated during the implementation of QM practices (Harari, 1993; MacDonald, 1993), problems of sustaining the improvements achieved (Papa, 1993) and difficulties in implementation (Harari, 1993), which evidences that the key QM practices have not yet been identified to be implemented in many organization (Sousa & Voss, 2002).

Three elements complicate the proper analysis of QM practices implementation (a) the number that currently exist and the lack of a unique definition for each one of them in past research. Ebrahimi and Sadeghi (2013) listed 224 QM practices that

currently exist in the literature and concluded that there are seven main QM practices, (b) it considers QM practices as a single construct or as a multidimensional construct to analyze the relationship between QM and performance. Based on the evidence found by Anderson et al. (1995) and Flynn et al. (1995) about the existence of the interdependence between QM practices, which later was ratified by Kaynak (2003), QM practices were considered as a multidimensional construct, and (c) the adequate use of contingent variables to explain the particular importance of a QM practice in a given context, in this sense Sousa and Voss (2002) suggest the use of a quality management maturity level as a contingency variable.

The challenge for managers is to achieve an effective implementation of the TQM practices and to understand the importance of continuous improvement in modern management (Evans & Lindsay, 2013). However, there are no clear guidelines regarding the sequence for an adequate implementation of QM practices (Ebrahimi & Sadeghi, 2013), for example, maturity models such as CMMI provide a process-improvement approach with practices that are more focused on performance improvement than ISO 9001, which has an assured approach providing goods and services that meet needs (Baldassarre, Caivano, Pino, Piattini & Visaggio, 2012).

The theoretical interest of this research is related to one of the principles mentioned by Crosby (1979, 1996), meaning that quality has a cost, but it is free. This principle relates to the fact that if we properly invest in the quality of the expected benefits, this will outweigh the incurred costs. Flynn, Schroeder and Sakakibara (1995) proposed a framework to study quality practices regarding the performance impact at an operational level. However, there are not enough studies on the relationship between quality management practices and the maturity level of quality management as a contingency variable and this does not allow the monitoring of the implementation progress of QM

practices in order to establish cost-benefit relationships before executing new improvement actions, since one way to evaluate the cost-benefit relationship is to consider the cost of poor quality (Sousa &Voss, 2002). The application of this measure is not widely accepted (Kumar Shah & Fitzroy, 1998), but there are cases where its use has allowed the quantifying of benefits by using the cost of poor quality (Bamford & Land, 2006; Barber, Graves, Hall, Sheath, & Tomkins, 2000; Hwang & Aspinwall, 1999; Ittner, 1996).

Crosby (1976, 1996) included the quality cost in the QMMG as a category to evaluate the maturity, and to extend its vision with other categories such as (a) management understanding and attitude, (b) quality organization, (c) problem handling (d) quality improvement actions, and (e) summation of company quality posture. This allows for a point of reference in regard to the benefit of implementing quality management practices (Sower, Quarles, & Broussard, 2007). Therefore, this represents a knowledge gap in quality management, since there are no studies relating QM practices with maturity levels as a contingency variable.

Statement of the Problem

Since ISO 9001 is considered as a widely recognized quality management model, with more than 1'000.000 certified companies worldwide (ISO, 2016), it can be used as a reference for the implementation of QM practices in different countries. In the last five years, there has been significant growth in developing regions such as Africa (58%) and Middle East (20%), and mixed results in developed countries such as the United States of America (32%), Germany (4.7%) and the United Kingdom (-7-3%). Particularly, in South America, some countries exhibit less progress than others on the implementation of this model, and there are cases, such as the Peruvian case, where the growth level has been 10%, while other Latin American countries' average growth has been 29% between 2010 and 2016 (ISO, 2017).

The problem is that there is no major evidence of the benefits of implementing quality management systems. Mixed results have been reported in relation to the benefits achieved under the scheme of ISO 9001, (a) 23% of the companies studied achieved improvement in earnings before taxes, (b) 38% achieved an improvement in ROA, (c) 51% achieved improvement in sales growth rate, (d) 47.62% improved their operational cost growth rate and (e) 47.29% achieved improvement in their personnel expenses growth rate (Martinez & Martinez, 2007).

This is complemented by the fact that there is no maturity model in quality management that will guide organizations towards the appropriate selection of QM practices to be implemented (Sousa & Voss, 2002) in order to achieve a better cost-benefit by reducing the costs of quality. Therefore, a prior study of the relationship of QM practices and operational performance with quality management maturity, as a contingency variable, will lay the necessary basis for its further development.

Purpose of Study

The purpose of this quantitative study is to analyze the quality management practices level in the manufacturing industry in Peru and its relationship with operational performance and quality management maturity level as a contingency variable. The information regarding the quality management maturity level will be collected through one questionnaire based on the Quality Management Maturity Grid (Crosby, 1979, 1996; Treleven & Benson, 1987) and the TQM practices through validity questionnaires given to quality managers or similar in medium and large-sized manufacturing companies in Peru.

Significance of the Problem

In the past, many authors proposed principles, models and recommendations about how to improve quality (a) Walter Shewhart, (b) Joseph Juran, (c) Edward

Deming, (d) Philip Crosby, (e) Kaoru Ishikawa, (f) Armand Feignbaum and (g) Genichi Taguchi (Hoyer & Hoyer, 2001) and, over time, there has been an interest in how to apply these concepts. QM practices and performance are particular topics that have had many research studies conducted by several authors (Ebrani & Sadeghi, 2013), but there are not enough studies focused on its relationship with maturity level. The maturity level is important because it is a method that evaluates the evolution of organizational capability (Maier, Moultrie & Clarkson, 2012) and gives the manager an idea regarding various elements that the organization needs for an orderly improvement (Crosby, 1979, 1996).

There are several methodologies to achieve improvements. The most important are as follows: (a) six sigma, which focuses on reduced variability, (b) lean, which focuses on optimized flow, and (c) the theory of constraints, which focuses on system constraints (Nave, 2002). All of these methodologies use different QM practices and, depending on the needs, companies normally adopt different methodologies. This study is unique because it aims to inform about the relationship between the use of QM practices and their impact on performance, using the quality management maturity level (QMML) as a contingency variable. This contributes to improve the ability to decide which improvement methodology shall be implemented. In the field of QMML, it is important to understand how the organization improves its capabilities to provide better products and services (Crosby, 1979, 1996). This study shall provide information about the maturity level of manufacturing companies in Peru and, with this information, it is possible to have a first baseline concerning the evolution of quality management in Peru and use the results to implement actions regarding the improved value.

Nature of the Study

This study is quantitative, as it collects data to describe the relationship between the study variables (QM practices, performance and quality management maturity level) through statistical tests (Creswell, 2009). It also applies a deductive and post-positivist focus according to the quality management theory framework (Anderson et al., 1994) and the maturity level concept (Crosby, 1979, 1996). The research design is non-experimental because it does not manipulate the situation or maturity level and, hence, it also is considered a transversal study since the analysis data was collected from a population at a specific point in time. In the quality management field, other authors have used this type of research to analyze the relationship between QM practices and performance (Choi & Eboch, 1998; Curkovic et al., 2000; Pino, 2008; Samson & Terziovski, 1999).

Crosby (1979, 1996) proposed to use a grid with five levels and six components: (a) management understanding and attitude, (b) quality organization, (c) problem handling, (d) cost of quality as percentage of sales, (e) quality improvement actions, and (f) summation of company quality posture, in order to evaluate the quality maturity level. This grid was used by Traleven and Benson (1987) to evaluate the overall quality maturity level in the manufacturing industries in the United States. The use of the maturity grid to evaluate other fields in management has been considered by different authors. Among the most relevant, we can mention the following: (a) knowledge management maturity (Kulkarni, & Louis, 2003), (b) Berkeley PM process maturity model (Kwak & Ibbs, 2000), (c) information security program maturity grid (Stacey, 1996), (d) towards a risk maturity model (Hillson, 1997), and (e) the business process maturity model (Fisher, 2004). This research focuses in the relationship between QM practices and quality, process and business performance, along with quality management

maturities as a contingency variable.

Research Questions

The research questions regarding the relationship between QM practices and operational performance is:

1. What is the relationship between QM practices and operational performance in manufacturing industry in Peru?

Regarding the contingent effect that the maturity of quality management has on the impact of QM practices over the operational performance, the following question is proposed:

2. How the quality management maturity affects the relationship between practical QMs and operational performance?

In regard to quality management practices and taking into consideration which practices are related to each other (Kaynak, 2003), the following research question is presented:

3. What is the relationship between infrastructure quality management practices and core quality management practices in the manufacturing industry in Peru?

Hypotheses

Based on past research and the particular model proposed by Kaynak (2003), which concludes that there are dependency relationships within quality management practices (Ebrani & Sadeghi, 2013), and aiming to find relationships between quality management practices and maturity levels, three groups of hypotheses are proposed (a) relationship within the practices of quality management – infrastructure and core QM practices- (Sousa & Voss, 2002), (b) relationship between quality management practices and process performance, and (c) the existence of a contingency effect for the

quality management maturity level (Sousa & Voss, 2002). The framework for these relationships is shown in Figure 1.

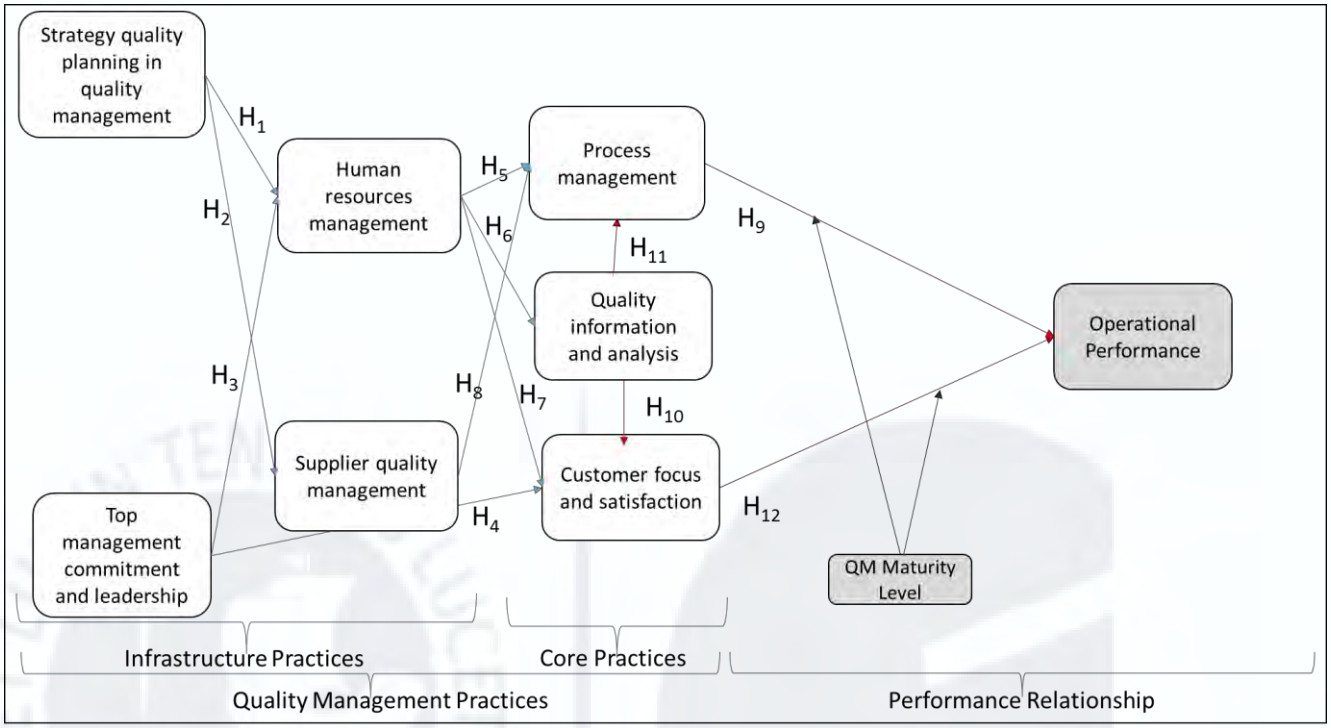

Figure 1. Proposed relationship between the maturity level of key quality management practices and the organization's QMML.

The first hypotheses group shows the possible relationship between key quality management practices. This group is divided into eight hypotheses in order to identify if one or more significant relationship exist:

H1: Strategy quality planning in quality management is positively related to human resources management.

The importance of Strategic Quality Planning as a QM practice has been highlighted by international standards and models such as the ISO 9001:2015 standard and Malcolm Baldrige Award. This QM practices includes the vision and mission statements of the organizations, as well as the formulation of the quality policy (Ebrahimi & Sadeghi, 2013), to determine the critical elements and strategic action

plans, therefore their relationship with the actions taken in the field of human resources management are related to the allocation of resources and achievement of objectives.

H2: Strategy quality planning in quality management is positively related to supplier quality management.

Long-term relationships and the creation of cooperation channels with strategic partners are key elements in the adequate supplier quality management (Kaynak, 2003; Zakaun, Yusof & Shaharoun, 2009), which allow to obtain advantages in both local and international market, when they are involved in the improvement of processes (Yeung, 2008)

H3: Top management commitment and leadership is positively related to human resources management.

This relationship has been studied in various contexts where it was concluded that Top management commitment and leadership influences performance indicators through other QM practices (Ahire & O'Shaughnessy, 1998; Anderson et al., 1994; Flynn et al., 1995; Kaynak, 2003; Sanchez & Martinez, 2004; Wilson & Collier, 2000). In the particular case of its relationship with Human resources management, it was studied by Kaynak (2003) who demonstrated a relationship with training and employee relations as part of the infrastructure practices.

H4: Top management commitment and leadership is positively related to customer focus and satisfaction.

The commitment to customer satisfaction comes from top management, which it is reflected through direct actions to improve the processes and human resources (ISO 9001, 2015). Nair (2006) conducted a meta-analysis where he demonstrated the relationship of these elements, based on the studies conducted by Ahire and

O'Shaughnessy, (1998), Anderson et al., (1994), Choi and Eboch (1998) and Sanchez and Martinez, (2004).

H5: Human resources management is positively related to process management.

Anderson et al. (1994) proposed that an organization that simultaneously encourages cooperation and learning can help in the implementation of process management practices, as well as other studies have incorporated the relations that exist between these two variables (Ahire & O'shaughnessy, 1998; Flynn et al., 1995; Kaynak, 2003).

H6: Human resources management is positively related to quality information and analysis.

The capacity to process and to analyze information is based on the use of statistical skills that must be developed in the people, reason why a suitable approach in the human resource management is essential in the development of this QM practice (Ahire & Dreyfus, 2000; Ho et al., 2001; Wong, Tseng & Tan, 2014). Furthermore, the same relationship was analized by Kaynak (2003), who determined a positive impact between training and employee relations with quality data and reporting.

H7: Human resources management is positively related to customer focus and satisfaction.

The Human resource management is recognized like one of the most important elements for the success of the implementation of QM practices (Fecikova, 2004; Gadenne, 2008). For that reason, this QM practice should be considered a key element in the QM infrastructures practices. In particular, the empowerment of the workforce has demonstrated to have a positive impact on the customer satisfaction (Schneider, Yost, Kropp, Kind & Lam, 2018).

H8: Supplier quality management is positively related to process management.

The Supplier quality management has allowed organizations to ensure an adequate supply of materials, in quality and time, which has improved the reliability of achieving controlled processes and compliant products (Juran, Medina & Ballester, 1990). A source of support for achieving better performance in companies is having suppliers that have managed to implement improvement plans that accompany the growth of their customers (Ebrahimi & Sadeghi, 2013). Finally, a positive relationship has been found when the provider is involved in cooperative programs and long-term relationships (Kaynak, 2003).

The second hypotheses group shows the possible relationship between key quality management practices and performance variable. This group is divided into four hypotheses in order to identify if one or more significant relationships exist:

H9: Process management is positively related to operational performance.

The relationship between process management and operational performance has been addressed in different studies that showed the existing interrelation with customer satisfaction and senior leadership (Zhang, Kang, & Hu, 2018), as well as the relationship that exists between culture organization, process management and company performance (Wong, Tseng & Tan, 2014). Nair (2005) demonstrated, through a Meta-analysis of the studies related to the QM practices, the relationship between Process Management and operational performance based on the studies of Flynn et al. (1995), Choi and Eboch (1998) and Kaynak (2003).

H10: Quality information and analysis is positively related to process management

The development of the capacity for data analysis has allowed the creation of more complex models that allow the empowerment of decision making based on information (Sadikoglu & Zehir, 2010), in this way the so-called big data and business

analytics are considered as elements of the contemporary management, due to its impact on financial and operations results (Stofkova, Stricek & Stofkova, 2016). In past studies, the relationship of this QM practices with the process management was evidenced, ratifying the principles proposed by Deming and Juran (Lee, Rho & Lee, 2003; Kaynak, 2003).

H11: Quality information and analysis is positively related to customer focus.

The levels of compliance with the specifications, rework and costs of quality are important elements for decision making regarding the process management, but equally important or even more is the quality information of the products and their relationship with the focus on the client, especially considering the importance of these measurements being a primary source of opportunities for improvement. In the particular, for example, customer surveys are one of the primary sources of product quality evaluation, so the way the organization obtains this information in opportunity and detail impacts on the customer focus (Birch-Jensen, Gremyr, Hallencreutz & Rönnbäck, 2018).

H12: Customer focus and satisfaction is positively related to operational performance.

The importance of understanding customer requirements and guiding the organization towards compliance and improvement is an important element to achieve the organization's objectives (Jamali, Ebrahimi & Abbaszadeh, 2010). The relationship of this QM practices has been documented in multiple studies in both productive organizations and services (Nair, 2005, Jaca & Psomas, 2015).

The third hypotheses group shows the possible existence of a contingency effect for the quality management maturity level:

H13: There is a contingency effect for the quality management maturity level variable.

Sousa and Voss (2002), evidence the contradictory results about the impact of QM practices on the performance results of organizations and propose to include as a contiguous variable the difference stages of QM.

Theoretical Framework

Anderson et al. (1994) proposed a theory of quality management underlying the Deming Management Method, with a multidimensional approach, where six QM practices (a) visionary leadership - (b) internal and external cooperation (c) learning (d) process management (e) continuous improvement – and (f) employee fulfillment, has a significant direct effect in operational performance (customer satisfaction). Por otro lado Flynn et al. (1995) and Mohrmn et al. (1995) proposed multimensional construct dividing the QM practices into two elements (a) Core QM practices and (b) QM infrastructure practices, obtaining mixed results on the impact of QM practices on performance, Table 1 summarizes the research conducted with a multidimensional approach by these authors.

Multidimensional relationships were reinforced by several studies based on structural equation model and Manovas (Adam et al., 1997; Ahire & O'shaughnessy, 1998; Bakotić, & Rogošić, 2017; Forza & Filippini, 1998; Grandzol & Gershon, 1997; Ho et al, 2001; Kaynak (2003); Powell, 1995; Rungtusanatham et al., 1998; Samson & Terziovski, 1999; Wilson & Collier, 2000; Zu, 2009) concluding that there are dependencies between the different QM practices and their effect on operational performance. Kaynak (2003) validated the direct and indirect relations among QM practices and the effects of these practices on firms performance, in particular the relationships between infrastructure practices and core practices.

Table 1

Summary of studies of multidimensional construct on relationship between QM practices and performance

Study	Multidimensional Construct	Operational Performance	Main Findings
Anderson et Al. (1994)	Visionary leadership; Internal and external cooperation; Learning; Process management; Continuous improvement; Employee fulfillment	Customer Satisfaction	Employee fulfillment has a significant positive effect on customer satisfaction
Flynn et al (1995)	Core QM Practices: Process flow management; Product design Management; Statistical control QM infrastructure practices: Customer relationship; Supplier relationship; Work attitudes; Workforce management; Top management support	Quality market outcomes; Percent passed final inspection with no rework; Competitive advantage	Statistical control and product design process have positive effects on quality markets outcomes; Process flow management and statistical control have effects on Percent passed final inspection with no rework. Quality market outcomes and Percent passed final inspection with no rework effects on Competitive advantage
Mohrman et al. (1995)	Core QM Practices: Quality Improvement teams; Quality councils; Cross-functional planning; Process reengineering; Work simplification; Customer satisfaction monitoring; Direct employee exposure to customer. Production-oriented Practices: Self-inspection; Statistical control methods; Just in time deliveries; Work cells or manufacturing cells	ROE, ROI, ROS, ROA, perceived profitability and competitiveness; Market Share; Cost manufacturing; Inventory turnover; Perceived productivity; Customer satisfaction; Quality and Speed	TQM adoption have a positive relation with efficiency of employee and capital utilization. TQM practices and market share are significantly relation.

At the same time, the Contingency Theory is based on the principle that the effect of one variable on another depends on a third variable, thus the third variable moderates the behavior and receives the name of moderating variable, but not all moderating variables are contingency variables. For the contingency theory of organization, the relationships are among some characteristics of the organization that produce an effect on their effectiveness measured in different aspects (Donaldson, 2001). In the case of this investigation, quality management maturity will be taken as a

contingent variable and, for this purpose, the model proposed by Crosby is used (1979, 1996), from this first Maturity Model, where different measurement levels were identified. These levels allowed organizations to create a guide with the needed steps to improve their processes (Myung, 2009). The levels are used in order to determine which processes are relegated on the road to maturity (Crosby, 1979, 1996), and this has been adopted by many organizations as a way to perform a self-assessment to determine the strategies to be followed (Wiele, Brown Millen, & Whelan, 2000).

Table 2

Quality Management Maturity Levels

Level	Description
Uncertainty	We do not know why we have quality problems.
Awakening	Is it absolutely necessary to have quality problems always?
Enlightenment	We are identifying and resolving our problem through management commitment and quality improvement.
Wisdom	Defect prevention is a routine in our operation.
Certainty	We know why we don't have problems with quality.

Note. Adapted from "Quality Management Maturity Grid" by P. Crosby, 1979, 1996, "Q*uality is Free, The Art of Making Quality Certain,"* (28-40).

Crosby (1979, 1996) identified the characteristics of the state of Quality Management Maturity in five levels (a) uncertainty, (b) awakening, (c) enlightenment, (d) wisdom, and (e) certainty (see Table 2). Moreover, Crosby evaluated the evolution of the processes in the following categories (a) management understanding and attitude, (b) quality organization, (c) problem handling, (d) cost of quality as percentage of sales, (e) quality improvement actions, and (f) summation of company quality posture.

Definitions of terms

Quality is defined by the ISO (2015, p.7) as a "degree to which a set of inherent

characteristics fulfil requirements" and other contemporary authors mentioned different dimensions for the quality definition. One of the main gurus, Juran, defined quality as "fitness for use" (Godfrey, 1999, p.2.2). Deming mentioned the difficulty to define quality and stated that "the difficulty in defining quality is to translate the future needs of the user into measurable characteristics, so that a product can be designed and turned out to give satisfaction at a price that the user will pay", (Deming, 1986). Finally, Crosby (1979, p. 7) pointed out the importance of defining the requirements of products and services, and he defined quality as the "conformance to requirements".

Quality Management aims to establish a management system to avoid failure in the operating cycle (Crosby, 1979). It is defined by the ISO (2015) as the "coordinated activities to direct and control an organization with regard to quality" (p. 9). Juran, Medina and Ballester (1990) indicated that quality management is performed through three processes known as the Juran Trilogy (a) quality planning, which includes the development of activities for products and services required by customers; (b) quality control, which evaluates the actual performance of quality, comparing it with the objectives to work on the gaps; and (c) improvement of quality, seeking to increase current quality levels. Total quality management was based from the quality concept mentioned above, in which quality refers to the achievement of a strategic level, including processes such as human resource management, quality improvement, purchase process through standardizing processes, and focusing on customer satisfaction (Juran, 1995).

The term 'maturity' is defined by the Longman Dictionary (2005) as "the time or state when someone or something is fully grown or developed." Crosby (1979) introduced the concept of maturity grids as tools to evaluate and improve quality management, (Maier et al., 2012). The term 'maturity' in process is defined as "the extent to which a specific process is explicitly, defined, managed, measured, controlled, and effective"

(Paulk, Weber, Curtis, & Chrissis, 1993; pp. 4).

Assumptions

The assumptions for this study are (a) the quality manager or similar has the knowledge to respond the questionnaire; and (b) the company's representative takes the investigation seriously and provides truthful and accurate information.

Limitations

This research is limited by (a) the disposition of the sample subjects to provide truthful information, (b) quality managers' knowledge with respect to QM practices, and (c) lack of companies with high maturity levels (level 4 or 5).

Delimitations

The delimitations for this study are the following: (a) the sample is delimited to industrial manufacturing formal enterprises, considering medium and large companies in Peru; (b) It will consider only those companies that have more than two years of operation, in order to have information about the impact of QM practices on business performance (c) the questionnaire will be sent to a quality manager or similar position within the companies, the questionnaire will be sent to the QM, in cases where there is no quality manager position, it will be sent to the person responsible for managing resources and achieving the objectives related to quality management and (d) the assessment of maturity levels, QM practices and operational performance will focus on the current situation of the organization.

The elements that measure the quality management maturity are delimited as follows (a) management understanding and attitude, (b) quality organization, (c) problem handling (d) cost of quality as percentage of sales, (e) quality improvement actions, and (f) summation of company quality posture (Crosby, 1979, 1996).

Chapter 2: Review of Literature

The quality control concept has evolved from massive inspection to the use of modern management tools. Several authors have contributed to the definition of modern quality management. The most important are (a) Shewart, (b) Deming, (c) Crosby, (d) Feigenbaum, (e) Ishikawa, and (f) Juran (Ebrahimi & Sadeghi, 2013). Each author proposed complementary approaches of how to deal with quality management at organizations, which led to develop standards on quality management systems, such as ISO 9001:2015, the Malcolm Baldrige Excellence Model, and EFQM. These standards and models showed the elements that the organizations should have or develop in order to create effective and efficient quality management systems. Hence, it is necessary to implement quality management practices; furthermore, the practices to be implemented shall be defined and the order and sequences of these practices shall be set.

Several approaches have been developed in regard to the implementation order and sequence of quality management practices and even maturity models have been elaborated to guide organizations. For example, Capability Maturity Models are focused on the improvement of organizational processes. The Software Engineer Institute (SEI) stated that: "… the quality of a system or product is highly influenced by the quality of the process used to develop and maintain it" (Team C.P., 2010). In relation to this, the ISO 9004 (2009) provides the guidelines to achieve a sustained success under a quality management approach. It promotes self-assessment as an important tool to evaluate the maturity level of the organization and to identify strengths, weaknesses, and room for improvement. Nevertheless, it does not describe the main processes that influence the organization's quality management maturity.

The use of the maturity model for self-assessment (e.g. QMMG) is a way to determine the current status of the system and improvement action plans (Maier, 2012).

The problem is, even though the maturity level of quality management can be measured as a metric guide to operational excellence its relationship with the implementation of quality management practices and performance result has not been analyzed. Moreover, the lack of this relationship causes unbalanced decisions with respect to the cost of prevention or cost of improvement, since the potential impacts on the achieved maturity level are not assessed. The action plans shall be oriented to the selection of quality tools in order to use them and improve their implementation. Therefore, the relationship between key quality tools and performance, considering the maturity level as a contingent variable, is the main subject of this research.

The independent variables, which were first reviewed, were the TQM practices (a) human resources management, (b) customer focus and satisfaction, (c) top management commitment and leadership, (d) process management, (e) supplier quality management, (f) quality information and analysis, and (e) strategy quality planning. The dependent variables (performance), and the contingency variable (the levels of quality management maturity) were subsequently reviewed. Germinal studies and recent research were reviewed for both cases. Figure 2 shows the literature review map for this research study.

Documentation

The literature research was conducted through the six Centrum's and Maastricht's documentation centers database reviews (a) Science Direct, (b) Taylor &Francis online, (c) EBSCOhost, (d) ProQuest, (e) Emerald, and (f) JStor. Web sciences of Thomson Reuters was used with the "quality management and practices" keyword, were 631 studies were found, since 1985 to 2018. After reviewing papers with more citations, only 350 were classified as relevant to the investigation's subject. A next filter was used in order to find the most recent documents between the years 2013 and 2018,

where only 101 were classified as relevant to the investigation's subject.

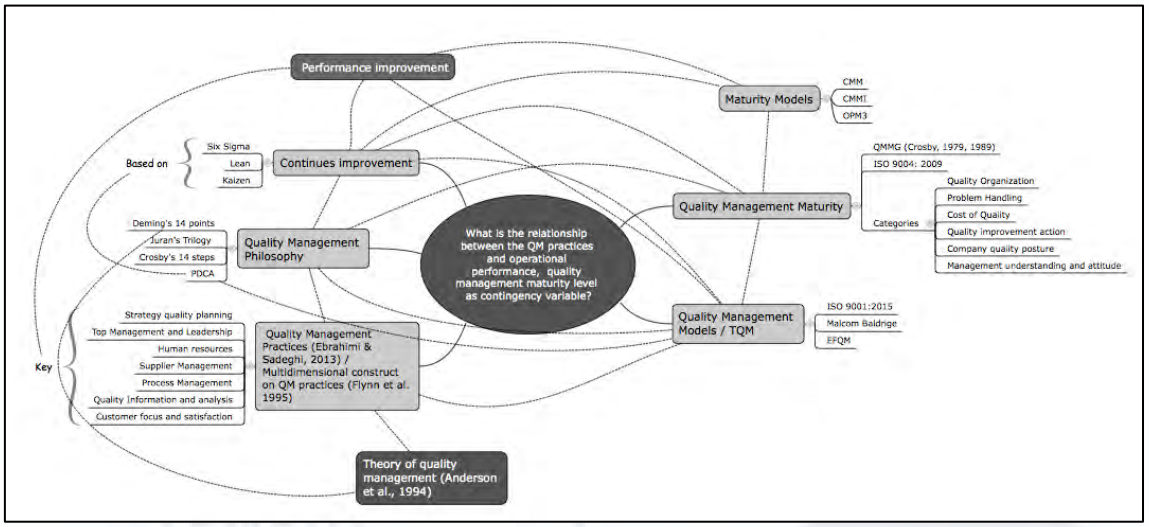

Figure 2. Literature Review Map.

There were only 32 studies that included the "quality management and maturity" keyword between the years 1985 and 2018. Since the investigation is about maturity in managing models, the keywords were changed from "quality management and maturity" to "management and maturity", in order to have a wider range of studies. Using these new keywords, the number of studies including the main core between 1985 and 2018 increased to 408, from which 155 were classified as relevant to the investigation's subject.

Finally, after analyzing the studies between the years 1985 and 2018, only two of them related to quality management practices and maturity. The first study refers to maturity in the supply chain, while the second study focuses on green supply chain practices and environmental management.

Literature Review

Quality management practices

The definition and use of the TQM Practices have been influenced by the thoughts and principles set by the quality gurus (a) Deming (1986), with the 14-point philosophy, (b) Juran, with the quality trilogy (Juran et al., 2005), (c) Feigenbaum

(1961) with the concept of total quality control, (d) Crosby (1979), with the zero defects concept and quality management maturity, among others, what it's generated different approaches and practices over time (Ebrahimi & Sadeghi, 2013). Since the 1980's, the implementation of these practices in companies has had diverse results, which had led many researchers to identify the relationship between quality practices and business performance (Kaynak, 2003), as well as to look for the tools to measure the level of implementation of these practices, of which we can highlight as the seminals the ones developed by (a) Ahire, Golhar, and Walter (1996), (b) Flynn et al. (1994), (c) Grandzol & Gershon (1998) and (d) Saraph, Benson, & Schroeder (1989) and others focused on particular sectors (a) education (Soria-García & Martínez-Lorente, 2014), (b) hospitals (Xiong, He, Ke, & Zhang, 2016), and (c) outsourced production (Gray & Handley, 2011). Most of the research studies concluded that these practices have a positive effect on business performance (Duh, Hsu & Huang, 2012; Ebrahimi & Sadeghi, 2013; Kaynak & Hartley, 2008; Kim, Kumar & Kumar, 2012).

Anderson et al. (1995), Flynn et al. (1995) and Mohran et al. (1995) presented the QM practices as a multidimensional construct, validating the interdependence that exists between QM practices. In particular Flynn et al. (1995) proposed a framework to study quality management practices regarding the performance impact at an operation level, this model has the following categories (a) quality management infrastructure components, which support the effective use of the core quality management practices; (b) core quality management practices, which are directly responsible for improving quality; and (c) performance outcomes, which measure the result of the implemented quality management practices at the level of the perceived quality market outcomes. The relationship result shows the importance of top management support, work force management and work attitudes towards the quality management implementation. This

model shows that there are quality management practices responsible for improving the process results; however, other quality management practices are needed to give a suitable support. Other authors have differentiated these categories as soft and hard QM practices maintaining the same classification principles mentioned above. The first related to aspects of human management and business management and the second associated with techniques and quality tools that directly impact on the performance of companies (Abdullah, Uli & Tari, 2009; Fotopoulus & Psomas, 2009; Ingelsson, Eriksson, & Lilja, 2012; Zhang, Linderman, & Schroeder, 2012).

The review by Sousa and Voss (2002) is based on the categorization carried out by Flynn et al. (1995), which classifies the impact of the practical QM in (a) quality performance, (b) operational performance, and (c) business performance, concluding that the studies carried out up to that year showed the strong and significant effects of QM practices on quality and operational performance, but also the weak effect on business performance. Among the causes stated by the author for this last finding, it is possible that the indicators used to measure it are not influenced by the practical QM used for the study or that there may be other contingent variables that have not been analyzed. This finding leads to the conclusion that it is not always possible to state that quality is free (Sousa & Voss, 2002), in reference to what Crosby (1979) proposed. This conclusion is related to the study carried out by Martinez and Martinez (2007) on the impact of the implementation of ISO 9001 in different companies, which discovered empirical evidence that although the implementation of this model of quality management has had a positive impact on the quality of the product, the benefits achieved by this have not offset the associated costs. Since there is also evidence of positive impacts of QM, it can be concluded that there are specific circumstances that generate a positive framework for the performance impact of some QM practices

(Martinez & Martinez 2007; Sousa & Voss, 2002).

Kaynak (2003) identified the most important studies on quality management practices and their impact on business performance. The definition of the practices to be studied was based on the research conducted by Saraph, et al. (1989) (a) management leadership, (b) training, (c) employee relation, (d) quality data and reporting, (e) supplier quality management, (f) product and service design and (g) process management. After analyzing the research studies conducted from 1995 to 2001, the author concluded that there is not a unique and indisputable effect on business performance. Nevertheless, the majority of quality management practices have a positive impact on some business performance indicators. In addition, the research and measurement studies should consider the multidimensional effect of TQM practices, highlighting the importance of management leadership as a core element of QM infrastructure practices, followed by training and employee relation to achieve a positive impact on QM core practices (quality data and reporting, QM supplier, product and service design and process management). An important conclusion of this study was the confirmation that the quality data and reporting practices do not have a direct impact on performance, but rather an indirect impact on other QM core practices, which suggests the need to carry out a future study that includes the time variable to measure the impact of this QM practices. This multidimensional effect indicates that, in order to have a good prediction of the resulting variable, the most relevant dimensions of the dependent variable shall be considered. The results of this study are part of the model included in Figure 1.

Nair (2005) conducted a more in-depth study through a meta-analysis, aiming to generalize the effects of the practical QMs and respond to the mixed results that were reported until that date. For this reason, the author considered three elements within his research questions (a) Relationship between QM practices and aggregate firm

performance, (b) Relationship between QM practices with individual dimensions of performance and, (c) Moderating factor between QM practices and performance. Regarding the first element, the author concluded that there was no evidence in the meta-analysis that showed an impact of QM practices at plant-level, but it confirmed an impact of QM practices at firm level. Regarding the moderating factor (contingency factor), the author concluded that they existed both at plant level and at firm level, which ratifies the conclusion reached by Sousa and Voss (2002) that it is necessary to carry out new studies contemplating other contingent variables. Empirical researches have a strong situational element, since they relate to contexts, types of organizations, countries or regions (Donaldson, 2001). In the particular case of QM practices, several contingency factors have been evidenced over the years, as shown in Table 3, where it can be seen that there are no studies carried out on the quality management maturity as a contingent variable, to which Sousa and Voss (2002) suggest that it should be carried out in future investigations.

A later study aiming to determine key QM practices was conducted, where Ebrahimi and Sadeghi (2013) found 224 quality management practices reported in different journals in the last 20 years. They first performed a convergence analysis and, based on the positive impact that the practices had on business performance as a dependent variable of the studies, concluded that there are seven key QM practices (a) human resources management, (b) customer focus and satisfaction, (c) top management commitment and leadership, (d) process management, (e) supplier quality management, (f) quality information and analysis, and (e) strategic quality planning, which have influence on different performance outcomes. Regarding the QM used on previous investigations (Flynn et al., 1995; Kaynak, 2003; Nair, 2005), there is a difference in some analyzed QM practices, for example in previous studies, product design and

management were used as key QM practices, while Ebrahimi and Sadeghi (2013) concluded that they should be replaced by strategic quality planning as key QM practices. This research will consider these practices as a variable in the relationship of the maturity level of quality management.

As seen before, the multidimensional studies about QM practices, have generated a series of conclusions over time, which leaves us with the challenge to find which contingent variables can help to conclude which set of QM practices generate a positive impact in the organization's performance. According to this approach, Sousa and Voss (2002) proposed to include the quality management maturity level as a contingent variable, a subject that has not been studied up to date. In order to further examine this hypothesis, particular details will be provided on the literature review concerning (a) key QM practices, (b) quality management system and (c) quality management maturity level, which includes the study's main elements.

Key Quality management practices

The literature review of each of the key QM practices proposed by Ebrahimi and Sadeghi (2013) is presented below.

Human resources management. This QM practice has been recognized by various authors as a vital element in the success of the quality management system (Ebrahimi & Sadeghi, 2013) and has been analyzed in 132 investigations related to QM (Ebrahimi & Sadeghi, 2013). Kaynak (2003) found a strong relationship with other QM practices, which favors the proposal of interdependence between QM practices. Nair (2005) evidences its positive impact on financial performance, operational performance, customer services and product quality by means of a meta-analysis, which is why it is necessary to include it in this study, and Bakotić and Rogošić (2017,) found that the employees have a positive impact on the implementation of process approach, system

approach and continual improvement, validating its importance as part of the infrastructure QM practices.

Human resources management is a variable that has different approaches, according to Ebrahimi and Sadeghi (2013), it includes training, involvement, empowerment and teamwork, and according to ISO 9004 (2009), in its self-assessment tools, included (a) level of recognition, (b) responsibilities, (c) work environment, and (d) networking. Similarly, the Malcom Baldrige framework included (a) assess the workforce's capabilities; (b) action for recruit, hire, place and retain new personal; (c) work accomplishment; and (d) workforce climate. Even though this an extensive point, it is focused on the people's management elements proposed by Deming (1986) that have been included and developed by the main instruments to date (Ahire et al.,1996; Flynn, Schroeder & Sakakibara, 1994; Grandzol & Gershon, 1998; Saraph et al., 1989), which include (a) encouragement to fix a problem, (b) resources to correct the quality problem, (c) cross functional teams, (d) training, and (e) technical knowledge. This study is limited to the elements evaluated in previous studies, taking the literature review map shown in Figure 2 as a reference, since other elements would imply expanding the natural scope of quality management.

Customer focus and satisfaction. This practice has been included in several models and frameworks (a) Baldrige Excellent Framework (NIST, 2017); (b) the International Standard ISO 9004 (2009), in its self-assessment tools, includes how monitoring customer satisfaction and how strategic actions and policies are crucial for the quality management system; and (c) the six sigma methodology establishes the importance of customer feedback as a key drive for project improvement and recommends the use of tools such as quality function deployment, critical to satisfaction matrix, and Kano's customer satisfaction survey (Laureani, & Antony, 2017; McCarty et

al., 2004). The importance of this QM practice is also reflected by its appearance in 78 previous investigations, which places it as the second most studied QM practice (Ebrahimi & Sadeghi, 2013), as well as the empirical evidence on the positive impact of this on the financial performance, operational performance, customer services and quality product (Nair, 2005).

Considering that customer focus and satisfaction refer to how the organization uses feedback, complaints and other sources of information related to the performance of products and services in the market in order to improve quality (Mellat Parast, Adams, & Jones, 2011),other research studies identified this practice as product/service design, since it includes the clients' requirements in order to develop products and services that improve their satisfaction (Ahire & Dreyfus, 2000; Flynn et al., 1995; Kaynak, 2003). This research includes the elements of product/service design within customer focus and satisfaction.

Top management commitment and leadership. This element is focused on implementing the vision and the quality management system in the organization (Hing Yee Tsang & Antony, 2001). Many authors consider this QM as a critical element within the quality management system (Fotopoulos, Psomas & Vouzas, 2010), since (a) it promotes participation and contribution in order to generate a quality culture (Fotopoulos et al., 2010); (b) it affects the operational performance (Samson & Terziovski, 1999), (c) it generates consumer focus and orientation, (Pino, 2008; Miyagawa & Yoshida, 2010), and; (d) it generates a positive impact in product quality (Ahire & O'Shaughnessy, 1998). Likewise, Kaynak (2003) found empirical evidence of a positive relation with (a) training, (b) employee relations, (c) supplier quality management and (d) product design, which ratifies the importance of this QM practice.

Table 3

Contingency Studies

Contingency factor	Studies	Main contextual variable	Research design
National context and culture	Vastag and Whybark (1991)	Country of location	N. I.
	Ebrahinpour and Cullen (1993)	Parent country	I.A.
	Oliver, Delbridge and Lowe (1996)	Country of location	N. I.
	Mesha (1997)	Level of country development	N. I.
	Rungtusanatham et al. (1998)	Country of location	N.I.
	Rungtusanatham et al. (2005)	Country of Location	I.A.
	Flynn and Saladin (2006)	Hofstede's dimension of national culture	I.D.
Firm Size	Voss et al. (1998)	Number of employees	N.I.
Strategic context	Sitkin et al. (1994)	Situational uncertainty environmental	I.D.
	Reed et al. (1996)	Uncertainty and firm orientation	I.D.
	Das et al. (2000)	International competition	I.D.
	Sousa (2003)	Product (variety, new product, production volume, type of process)	I.D.

Note: N.I. = Non-Inferential; I.A.= Inferential Aggregate; I.D.= Inferential Detailed. Adapted from "Contingency research in operations management practices" by R. Sousa, and C. Voss, 2008, Journal of Operations Management, *26*(6), pp. 699-702.

Based on the leadership guidelines developed by Deming (1986), this study will mainly focus on transformational leadership and it will be considered an important element to improve the understanding and attitude of quality management. It is worth to note that the Malcolm Baldrige framework emphasizes leadership, considering the following points as part of the model (a) set vision and values, (b) commitment to legal and ethical behavior, (c) build a successful organization, (d) engage workforce, and (e) create focus on action (NIST, 2017). The impact of these practices on the maturity of the quality management system will be analyzed in this study with a special emphasis on the sustainability of the quality management system.

Process Management. Process Management focuses on how the organization manages the process, including measurement, evaluation and improvement (Anderson et al., 1995). Since Shewhart (1931) introduced the statistical process control, studies and applications have been extensive in the improvement of capabilities, reduction of waste, lead-time and cost (Cronemyr & Danielsson, 2013). The approach of a stable and controlled process over time allows organizations to generate products and services that are consistent with the requirements and controlled quality costs (Juran et al., 2005), but it should be possible to measure whether these processes are capable of meeting the requirements. To this end, the process capability indexes, which allow the organization to make decisions about the need to reduce the variability and problem management, are evaluated (Anderson et al., 1995, Flynn et al., 1995; Kaynak, 2003).

Juran et al. (2005) related the concept of process capability —level variation and quality costs— to planning, quality control and continuous improvement through Juran's trilogy. As part of the planning, the company must determine who the customers are, their requirements, the products and processes that the organization should develop, and then determine the process flows, control points, goals and performance metrics, as well as the evaluation of the products and services. Finally, the company should move on to defining quality improvement infrastructure, equipment and projects that reduce process variation and increase their capacity, achieving a significant reduction in quality costs (Bisgaard, 2007). Kaynak (2003) established the importance of this QM practice as one of the core QM practices that have a direct effect on the quality performance of organizations, which in turn depends on other QM practices, called infrastructure practices (a) quality data and report and (b) supplier quality management and its interrelation with the product or service design.

Supplier quality management. Supplier quality management is the practice oriented to establish a long-term relationship between the company and the supplier (Ebrahimi & Sadeghi, 2013). This practice is considered a strategic element from a quality management point of view (Ellram, 1991) and an element that depends on effective leadership, since it generates organizational changes aimed to prioritize quality instead of price. In addition, other models, such as ISO 9001:2015 (2015), included this practice as a part of the quality management principles and mentioned the benefit of having a stable flow and quality products provided by the suppliers. Lin, Chow, Madu, Kuei and Yu (2005) stated that quality management practices relate to supplier participation —in product design and kaizen projects— and also to supplier selection —quality oriented and cost oriented approaches.

The International Standard ISO 9004 (2009), in its self-assessment tools, includes evaluations of how the company communicates and develops processes and strategies, such as (a) evaluate the supplier to create value for the organization, (b) the potential continuous improvement of their capabilities, and (c) supplier-related risks. According to the processes' perspective, where inputs are transformed into outputs with added value, it is very important to consider that the inputs from approved suppliers or suppliers with an ongoing improvement program provide a better basis for improvement and control (Kaynak, 2003).

In the structural modeling of the relationship between TQM practices and performance measures, proposed by Kaynak (2003), supplier quality management has a relevant role since it depends on the following QM practices (a) management leadership and (b) quality data and reporting. At the same time, it is an exogenous variable for the following QM practices (a) product or service design, (b) process management and (c) inventory management performance, which demonstrates the relevance for its inclusion in this study.

Quality information and analysis. Quality information and analysis refers to how the organization gathers, analyzes and validates the information in order to improve the

decision-making process (Ebrahimi & Sadeghi, 2013), how the information is available for the decision functions (ISO, 2015), and how to monitor, measure and analyze the process performance, its indicators, the customer's satisfaction level, and the employee's feedback (ISO, 2009). It is included in the Malcolm Baldrige framework in the measurement, analysis and knowledge management category with the following elements (a) data and information to monitor operation and performance, (b) use of comparative data and information, (c) use of market data and information, (d) measurement agility to respond to an unexpected change, and (e) review of the organization's performance and capabilities (NIST, 2017). In this case, it is important to mention that these quality management practices did not include knowledge management. However, this research will include it as an additional element, as proposed by Malcolm Baldrige and the EFQM model (Tickle, Mann, & Adebanjo, 2016).

Due to its importance, this QM practice has been studied in 53 previous studies (Ebrahimi & Sadeghi, 2013), and was included in the model proposed by Kaynak (2013) as an infrastructure quality management practice supporting the following QM practices (a) process management and (b) product or service design, which depend on these QM practices (a) training and (b) employee relations. Regarding the dependency mentioned for the present study, both QM practices have been included within the variable human resources management.

Strategy quality planning. Strategic quality planning refers to the strategic decisions regarding quality, such as policies, quality objectives, and improvement methodology selection (Ebrahimi & Sadeghi, 2013). This practice seeks to ensure that the organization's strategic plan is structured considering the needs of stakeholders and customers, as well as a vision of continuous improvement (ISO, 2009, NIST, 2017). In that sense, changing the organizational structure and assigning a specific weight to a high-level function for quality

management (including quality assurance, control and improvement) is a sign of maturity (Crosby, 1979, 1996). With regard to the relationship between strategic planning and quality, several studies concluded that it is relevant to use strategic planning in order to achieve an adequate implementation of total quality management (Oschman, 2017). ISO 9001:2015 (ISO, 2015). This requirement is also included, since it is considered a significant part of the model, in which different scenarios are aligned with the quality decisions made by the organization.

Regarding the impact on the quality management system, there are studies that showed the extent to which the implemented quality management practices affect the quality management system (Fotopoulos, et al., 2010). The concept of quality maturity level provides this result, where the organization makes the decision of implementing a specific quality management practice in order to improve maturity levels. In summary, quality has been studied for over 30 years and it has shown a positive relationship with business performance. In many cases, this relationship has been demonstrated, which means that estimating the implementation in an organization depends on the maturity level of the quality management system and the potential market needs.

Quality management system

The purpose of the quality management system is to coordinate the activities related to quality in the organization (ISO, 2015). This allows the quality level to remain stable and also constitutes the quality improvement basis for products and process (Rusjan & Alic, 2010). Despite the fact that the bases for quality management systems are (a) total quality principles, (b) quality management practices, and (c) techniques related to total quality, (Dean & Bowen, 1994), it is worth to point out that Total Quality is still a field of management and, consequently, it follows the principles and the theory of management focused on understanding organizations, in contrast to quality management that focuses on

how to improve the business performance (Deming, 1986). From this point of view, it is important to find general and specific relationships with the management models within the organization, since these are going to interact with each other in the management theory. For instance, from the quality management perspective, people management is important (Curkovic et al., 2000), but this is also included in human resources management theories that aim to understand the individuals' behavior. In the case of quality management, it focuses on how people management can contribute to improve quality and, thus, business performance.

It is important to recognize that part of the main key practices of quality management is highly correlated with the principles proposed by Deming (1986) regarding people management and organizational culture. However, over time, new elements have been proposed to be considered in the quality management systems models that complement the approach proposed in this research. These are mentioned below in Figure 2.

Maturity of quality management

Since Crosby (1979), introduced the first maturity grid in quality management, others author have been developing grids and models for different disciplines (a) IT management (Becker, Knackstedt, & Pöppelbuß, 2009) (b) process management (Rohloff, 2009; Păunescu, & Acatrinei, 2012), (c) knowledge management (De Bruin, Freeze, Kaulkarni, & Rosemann, 2005; Vanini & Bochert, 2014), (d) project management (Hillson, 1997; Kwak, & Ibbs, 2000; Kerzner, 2002; Grant, & Pennypacker, 2006), (e) business process (Fisher, 2004) and (f) team management (Boughzala & De Vreede, 2015). All these approaches are based on the definition of maturity levels as a model of interpretation of the management development stages in organizations, most of these models focus on a scheme of five levels of maturity focus. Maier et al. (2012) classified the concept of maturity in the following fields (a) process maturity, focus in reduced variabilities, (b) organizational maturity, focus

in measure the organizational maturity as CMM model, (c) process capability, focus in increased process capability and the relationship with the organizational capabilities, (d) project maturity, focus in the maturity project management, and (e) maturity of organizational capabilities, which is based on the relationship between process capabilities and business performance.

Measurement categories of maturity quality management. Crosby (1979) introduced six measurement categories that allowed classifying the organizational status in regard to the management's maturity. The first category is management understanding and attitude. This category measures the level of understanding concerning quality management and leadership attitude as continuous prime movers of improvement. The level of understanding in regard to quality management goes beyond knowing the standards and obtaining certifications for the management systems. It is about understanding the following the importance of prevention as the right way to achieve quality in organizations; quality means conformance to the requirements; quality performance means zero defects; and quality measurement means the price of nonconformance (Crosby, 1996). On the other hand, there are quality management visions proposed by Deming (1986) in regard to the management's attitude towards quality, and Juran (Juran et al., 2005) complements the vision of the relationship between an adequate quality management and the leadership of top management. It should be considered that there are different types of attitudes that motivate and guide behaviors (Eaton & Visser, 2008). Krosnick and Petty (1995), which are classified in four categories (a) aspects of the attitude itself, (b) cognitive structure, i.e. knowledge about attitudes, (c) cognitive process about attitudes, and (d) subjective beliefs about attitudes. The evaluation proposed by Crosby (1979, 1996) in the QMMG is related to this last category and is also called attitude importance (Eaton & Visser, 2008), since the level of importance given to quality within the organization is analyzed.

The second category is quality organization status. It refers to the position towards quality in the organization, from quality leader to quality manager till reaching board of directors (Crosby, 1979, 1996). The functions of the quality management leader have changed over time, these went from inspections tasks to a management and advice role in quality management (Addey, 2004). The maturity level in this category depends on the development of the activities, which in time have changed from a corrective vision to a preventive vision that includes to (a) develop high quality and effective processes through a comprehensive vision of the organization, (b) provide expert advice on quality issues, (c) create an efficient management system that effectively allows controlling the processes, (d) train and persuade the managers and staff to adopt the quality approach, and (e) use soft skills to support and develop an effective culture of quality (Addey 2004). Other authors have highlighted different elements of this function (a) risk analysis, documentation practices and data tracking (Imler, 2006), (b) manage improvement teams, resolve customer complaints, statistical analysis, audits (Palmer, 2006), (c) emotional intelligence (Parthasarathy, 2009); and (d) house competences of quality manager (Inganson, 2017).

If the maturity levels proposed by Crosby with respect to the Quality Manager are analyzed, it shall be noted that these are related to the position's reporting levels and to the prevention vision. However, it does not take into consideration the roles to be played, which can change depending on the region. For instance, in Britain, a survey regarding the perception of the Quality Manager main role stated that "improvement" is the main task. In Australia, the main role of the Quality Manager is related to the monitoring and maintenance of the system (Burcher, Lee, & Waddell, 2008). The Quality Manager's role will be consistent with the responsibility that he/she has in the company, which goes from being support staff to a position that requires making strategic decisions.

The third category relates to problem handling. This approach refers to how the

company resolves problems, from non-effective solutions to effective preventing actions (Crosby, 1979,1996). MacDuffie (1997) proposed three steps for the problem-solving process (a) definition of the problem, (b) analysis of the problem, and (c) generation and selection of the solutions within a comparison framework of three different quality management systems (in the automotive sector). The author concluded that the design of the quality management system and the organizational culture had a direct influence on the effectiveness of the actions taken, from the way the problem is selected to the use of data for the analysis and verification of the effectiveness of the actions taken. In this category, Crosby (1979, 1996) argued that a company reaches the highest maturity level when the problems are frequently prevented. ISO 9001:2015 has replaced this with risk management, which is a mechanism that focuses on preventing situations in order to take mitigation actions and reduce the possibility of occurrence (ISO, 2015).

The fourth category is the cost of poor quality as a percentage of sales. For this category, the classification has a reference value from 20% to 2.5% or less, divided in each of the categories. (Crosby, 1979, 1996). The cost of poor quality measures the relationship between prevention and inspection versus failure cost, internal and external. The traditional quality cost model stated that increasing prevention and appraisal costs were associated with reduced failure cost (Cokins, 2006). In addition, a more recent proposal affirmed that even high-quality levels of prevention and appraisal cost are slightly reduced (Plewa, Kaiser, & Hartmann, 2016). This measurement has not been extensively used. Previous research concluded that 30 to 50% of the analyzed cases have used it (Gupta & Campbell, 1995; Viger & Anandarajan, 1999). This result is in line with Crosby's affirmation (1979), which states that this value is unknown in the first levels of maturity in the companies. Research studies on the relationship between quality cost and quality management maturity concluded that, while the maturity of the quality management system increases, the costs of prevention

increases, and the cost of failure is reduced (Ittner, 1996). However, other research studies have not found a significant relationship between the quality costs and the maturity level, in part due to the fact that many organizations do not formally measure quality costs, (Sower et al., 2007) and this may represent a limiting factor to find a correlation between the first levels of maturity and the quality cost.

The fifth category is quality improvement action. This category is related to how the company organizes and maintains the improvement processes, from sporadic actions to organized and sustained actions over time (Crosby, 1979, 1996). As of the third maturity level, this category introduces the concept of "multi-steps program". However, since the appearance of the QMMG (Crosby, 1979, 1996), different approaches of how to carry out the improvement processes have been developed. The most popular nowadays are the following Six Sigma, Lean and TOC, better known as "improvement methodologies" (Nave, 2002), where the improvement focus is on reducing variability, waste reduction, and constraint management, respectively. Before selecting a methodology, it is important to study the assumptions, approaches and expected effects on the processes after the application (Nave, 2002), so that the effective completion of this activity denotes a maturity level of the quality management system. The Sixth category refers to the total of the organizational quality posture. This category relates to the general perception in regard to the quality in the company. It ranges from "we don't know why we have problems with quality" to "we know why we do not have problems with quality" (Crosby, 1996, p. 32-33).

Quality management maturity levels.

Maier et al. (2012, pp. 9) introduced the following rationale with regard to the maturity level: "whether explicitly stated or implicitly embraced, it is a statement about leverage points envisaged to be used in organizational change initiatives" and introduced four leverage points (a) structure process, (b) organizational structure, (c) people and (d)

learning. There are two recognized quality management maturity models for self-assessment: ISO 9004 and QMMG, both have five levels and the same purpose –identify need for improvement, opportunities and create actions plans for sustained success (ISO, 2009; Crosby, 1979, 1996). The use of a maturity model has the follow benefits (a) a framework for discussion between manager team, (b) generate assessment results for a longitudinal time review, and (c) continuous use of self-assessment tool to increase the maturity level (Bititci, Garengo, Ates & Nudurupati, 2015). The ISO 9004:2009 presents an expanded model and establishes a system of self-evaluation questionnaire (in five maturity levels) (a) key elements, (b) managing for the sustained success of the organization, (c) strategy and policy, (d) resource management, (e) process management, (f) monitoring, measurement analysis and review, and (g) improvement, innovation and learning. Each category has been divided into individual elements, as shown in Table 4.

Crosby (1979, 1996) defined five levels for the QMMG (a) uncertainty, (b) awakening, (c) enlightenment, (d) wisdom and (e) certainty. These levels allow the evolution of the different categories and act as a framework for the long-term planning of quality management. Other models have defined four or five maturity levels, each of them gives a natural evolutionary approach to the management model that they seek to represent (Maier et al., 2012). Uncertainty is the first level of maturity in quality management, which normally does not have a structured improvement scheme. Errors are attributed to people and the real causes of the problem are not analyzed. The quality costs are not measured or controlled (Crosby, 1979, 1996). In the awakening level, the quality function begins to take relevance in the organization, problems are addressed by improvement teams, but not actions aimed at the root cause or fundamental problems are taken. Cost of quality is calculated for the first time, but all the items are not included, which generates estimation errors. Motivation becomes a temporal element at this level, generating the first actions of teamwork and

continuous improvement.

In the Enlightenment level, the quality department is stablished and the focus on problem solving changes from focusing on people to emphasize the system focus. The cost of quality is calculated more accurately and efforts to improve quality are led by an official team, using a systematic analysis of the causes and possible solutions, (Crosby, 1979, 1996). In the Wisdom level, the organization reduces the quality cost and solves their problems effectively, keeping improvements over time. The quality manager improves their position in the organization and the quality management vision is more preventive and people are more committed to customer's satisfaction. Finally, in the certainty level, the quality function reaches the company's directory level, the cost of quality is reduced significantly, the quality team is focused in the prevention of the problems in the products or services, which rarely appear (Crosby, 1979, 1996).

Table 4

Individual Elements for Key Processes and Detailed Elements

Process	Individual Elements
Correlation between key elements and maturity levels	Management focus; leadership approach; strategy and policy; resource; process; monitoring and measurement; improvement, innovation and learning.
Managing for the success of an organization	General; sustained success; the organization's environment; the interested parties' needs and expectations.
Strategy and policy	General; strategy and policy formulation; strategy and policy deployment; strategy and policy communication.
Resource Management	General; financial resources; people in the organization; partners and suppliers; infrastructure; work environment;

	knowledge, information and technology; natural resources.
Process Management	General; process planning and control; process responsibility and authority.
Monitoring, Measurement, Analysis and Review	General; monitoring; general measurement; key performance indicators; internal audit; self-assessment; benchmarking; analysis; review of information collected from the monitoring, measurement and analysis.
Improvement, Innovation and Learning	General; improvement; innovation; learning.

Note. Adapted from Table A.1, A.2, A.3, A.4, A.5, A.6 and A.7 of ISO 9004:2009, "Managing for the sustained success of organization – A quality management approach", (28-37).

Conclusions

The proper development of a quality management system depends on the selection and adoption of principles and the QM practices, therefore several research studies have focused on this and concluded that quality management practices are positively related to the organization's performance in different dimensions, such as (a) productivity, (b) customer satisfaction, (c) quality products and (d) services (Kaynak, 2003), but there are other studies that do not conclude the same, which state that there are contingent variables that must be studied to understand this result (Sousa & Voss, 2002).

Within the contingent variables studied, it has been possible to describe different elements that affect the impact of the QM, (Table 3), but the impact has not been considered in terms of the maturity level reached by the quality management system, which generates the need to study this contingent variable as suggested by Sousa and Voss (2002).

In contrast, it is evidenced that the organizations that implemented maturity models and

had a higher maturity level over time improved their performance in the same period (Gibson et al., 2006). This is correlated to the concept that the organizations which implemented quality management practices also obtained better results. Therefore, it is necessary to establish the quality management maturity level as a contingent variable, a subject that has not been studied to date.

Chapter 3: Method

The purpose for this research is to find the relationship between the key practices in quality management, defined in the previous chapter, and performance and quality maturity level as a contingency variable, as defined by Crosby (1979, 1986). As a result of the literary review, the existence of interdependence between the practical QMs is evidenced, thus in this investigation a multidimensional construct has been selected (Anderson et al., 1995, Flynn et al., 1995, Mohran et al. al., 1995), which is divided into the following categories (a) quality management infrastructure components, and (b) core quality management practices, according to the model presented in Figure 1, which allows deepening the knowledge of the relationships between the selected variables. Likewise, the application of quality management is practiced by different authors, almost always on the discussion of whether or not it would have a positive impact on the company´s performance, but very little has been discusses or researched regarding the sequence to be implemented (Sousa & Voss, 2002), so that the analysis of the level of maturity of the quality management systems in the organizations allows the modeling of the interaction of each variable with the result of the performance obtained.

Research Design

The paradigm proposed in this study is post-positivist because it is focused on identifying and assessing the effect of independent variables and dependent variables, the key practices in quality management into performance level, along with the quality maturity level as a contingency variable. The approach selected is quantitative because it is the most appropriate for understanding the relationship between factors of independent variables and dependent ones (Cresswell, 2014). This approach was used in order to study the relationship between quality management practices and performance (Choi & Eboch, 1998; Samson & Terziovski, 1999; Curkovic et al., 2000; Pino, 2008), and other studies related to maturity

levels or maturity capabilities.

Regarding the relationship to be measured, it implies the knowledge of the maturity stage of the quality management in the organization, and it is important that people taking the surveys have a knowledge of the quality management system of the company and the level of the results obtained in the different categories raised in the maturity levels of quality (Crosby, 1979, 1996). For these reasons, the study will address management positions that have influence, responsibility and decision-making capacity on quality management, such as (a) general manager (applied to companies where this function is performed directly), operation managers (when this function is part of their responsibility in the absence of a quality manager) or quality manager (Projogo, 2005; Hassan & Kerr, 2003; Păunescu, & Acatrinei, 2012).

Appropriateness of Design

According to Cresswell (2014), the quantitative design is related to post-positivist studies and is classified in experimental design or non-experimental design. For this study, a non-experimental design will be used, in particular the structural equation modeling (SEM), because the equation is introduced while the relationship builds QM practices and QM maturity categories –according to previous studies carried out (Kaynak, 2003).

Regarding the instrument for dependent variables –QM practices–, the survey method will be used. This method is used in nonexperimental design, and particularly, in research on quality management practices in order to show the degree or extent of practice for different authors, normally in a Likert scale between five to seven (Ahire et al.,1996; Flynn, Schroeder & Sakakibara, 1994; Grandzol & Gershon, 1998; Saraph et al., 1989).

Regarding the maturity level, it is important to consider that we would like to measure the maturity level using a maturity grid, which allows us to identify if an organization or process has reached a high-performance level. It is important to understand

that maturity grids do not use a Likert scale directly. On the contrary, a description at every level is presented in order to evaluate if the organization has reached or not the desired maturity level, but for the purposes of this study, each category will be transformed into a numerical value from 1 to 5 according to the level of maturity reached, as proposed by Crosby (Crosby, 1979, 1996).

Research Questions

The research questions regarding the relationship between QM practices and operational performance is:

1. What is the relationship between QM practices and operational performance in manufacturing industry in Peru?

Regarding the contingent effect that the maturity of quality management has on the impact of QM practices over the operational performance, the following question is proposed:

2. How the quality management maturity affects the relationship between practical QMs and operational performance?

In regard to quality management practices and taking into consideration which practices are related to each other (Kaynak, 2003), the following research question is presented:

3. What is the relationship between quality management practices in the manufacturing industry in Peru?

Population

Industrial companies in Peru can be divided into different categories (a) formal or informal conditions, (b) level of sales, quantity of employees, (d) classification into micro, small, medium or large companies, (e) property public or private, and (f) geographic location. For the present investigation, informal companies will be excluded from the

population, identify them as those that do not have unified taxpayer´s registry (RUC, by its acronym in Spanish) thus this may limit the possibility of interacting with formal providers, hiring personnel in stable conditions, training investment capacity, among others.

Regarding the sales level and quantity of employers, we will consider the Peruvian classification for medium or large companies, leaving out those companies that are labelled as micro and other micro companies, because normally they do not have quality systems implemented, nor defined quality areas and they do not have measuring processes that will allow us to assess the process of continuum improvements. Consequently, the information provided may distort the objective of this research.

Informed Consent

In order to properly inform participants about the objectives of the research and that the confidentiality of individual data shall be preserved, a consent form was created, and it shall be attached to the beginning of each survey. The corresponding consent form is attached in Appendix A.

Sampling Frame

According to the Industrial Statistical Yearbook ("Anuario Estadistico Industrial"), Mipyme and Internal Commerce (Produce, 2017), in Peru, to the year 2015, there were 152,920 manufacturing companies, out of them 1627 companies were part of the medium and large company category. Within the segmentation by type of taxpayer and entrepreneurial stratum, only 26.4% of micro companies are legal entities, 85,5% in the case of small companies and 96,1% in the case of medium companies. This information validates the decision to use medium and large companies as part of this research due to the fact that most of the questions could not be applied to companies that are registered as individual entities or that have few employees, namely, less than 10 employees. Nowadays, there is not an exact count of all the companies in the manufacturing sector, but we have used the list

published by Peru Top 1000 (Cavanagh, 2018) as a reference. We have determined that all databases of identified companies will be sent directly to the operation manager, quality manager or general manager.

Confidentiality

In order to guarantee data confidentiality, the information shall be gathered in two ways. The first one involves the development of a questionnaire in an auditorium, where the objectives of this study shall be explained. Subjects shall participate voluntarily. Any kind of record regarding the people's ID or the company they represent in the survey shall not be kept. The second one involves an online survey where personal information or the company that completed the survey shall not be kept either.

Geographic Location

The research is going to take place in Peru, mainly in Lima through face-to-face questionnaires and in other regions through online surveys. Peru is a country with 152,920 companies in the manufacturing industry as of 2016 (Produce, 2017). The manufacturing industry is divided into micro and small companies, which have a representation of 98.9% for this category, and medium and large companies with 1.1%. Lima is the capital and economic center of Peru, where about 48% are formal companies.

Instrumentation

The QM practices of this study have been compared with the main instruments used in the past (a) Saraph et al., (1989), (b) Flynn et al. (1994) (c) Ahire, Golhar, and Walter (1996), and (d) Grandzol and Gershon (1998). In Table 5, there is a summary of the connection of each one. As it can be appreciated, most of these instruments show common elements that must be analyzed for the selection of each section of the instruments to be used in this investigation, considering the conclusions given by Motwani (2001), along with the references implementing the same instruments in other contexts or investigations. As for the

selection criteria for each section of the instrument, the desired relationship with the quality management maturity level, the relevance of the questions with the manufacturing industry, and the results obtained by the authors in their respective evaluations have been considered.

Regarding the applicability of the questionnaire, even though all were made focusing on the manufacturing industry, the objective of the questions was not always the same, so it is not possible to apply a single instrument and it is necessary to use sections of each one and develop a new questionnaire (Pino, 2008). Regarding the validation, Singh and Smith (2006) summarized that there are three different approaches used by the authors and concluded that the instruments are validated in order to measure the quality management practices. The different approaches are the following (a) Deming and Juran's ideas by Saraph et al. (1989), (b) world class manufacturing approach by Flynn et al. (1994) and (c) total quality management approach by Ahire et al. (1996) and Grandzol and Gershon (1998). Each approach evaluated the consistency of the classification developed by Ebrahimi and Sadeghi (2013).

Table 5

Instruments for measuring Quality Management Practices

Practices in QM	Saraph, Benson, and Schroeder (1989)	Flynn, Schroeder, and Sakakibara (1994)	Ahire, Golhar, and Walter (1996)	Grandzol and Gershon (1998)
Human resources management	(8) Employee relations	(D V) Workforce Management	(8,9,10) Employee	(3) Employee fulfilment
Customer focus and satisfaction		(D VII) Customer Involvement	(2) Customer Focus	(7) Customer focus
Top management commitment and leadership	(1) Top management and quality policy	(D I) Top Management Support	(1) Top Management Commitment	(1) Leadership
Process Management	(6) Process Management	(D III) Process Management		(5) Process Management
Supplier quality management	(5) Supplier QM	(D VI) Supplier Involvement	(3) Supplier Quality Management	
Quality information and analysis	(7) Quality data & reporting	(D II) Quality Information	(7) Internal Quality Information Usage	
Strategy quality planning in quality management	(1) Top management and quality policy		(6) SPC Usage (5) Benchmarking	

Note. The value in parentheses corresponds to serialization or item classification given by the author in his original instrument.

The methodology for the development of the instrument has followed the nine steps stated by Sarah (1989) (a) literature review, (b) an identified critical factor –key practices of quality management, (c) initial selection of specific quality management items, (d) pretest of the measurement items, (e) refinement of the items, (f) data collection, (e) internal consistency analysis, (g) detailed item analysis, and (h) validity. The literature reviewed was described in Chapter 2 and it was concluded that that the principal QM practices are indicated by Ebrahimi and Sadeghi (2013), so for the initial selection of specific management items, all QM practices have been analyzed separately in the following areas.

Human resources management

The human resources management approach given by Saraph et al. (1989) is focused on training and employee relationship. Specifically, the training approach includes (a) topics, (b) skills, (c) hours, (d) statistical techniques and (e) top management commitment, and employee approach includes (a) quality circle performance, (b) feedback, (c) participation and (d) supervision. Some remarks regarding this approach address the questions about implementation of quality circles because they are not a common practice in Peru. The approach by Ahire et al. (1996) is divided into three topics (a) employee empowerment, (b) employee involvement, and (c) employee training. It takes into account an overview of human resources management and all the questions are written in general terms and focused in the manufacturing sector. The approach by Flynn et al. (1994) is mainly about teamwork and it does not include training, empowerment or other items related to resources management.

According to the analysis, it is concluded that the approach by Ahire et al. (1996) is the best choice for this research, likewise, Crombach's alpha topics for this approach are .79, .81 and .81 respectively, which allow us to have an acceptable level of internal consistency.

Customer focus and satisfaction

The customer focus and satisfaction approach given by Ahire et al. (1996) mainly refers to customer satisfaction and there is also a question in reference to the time the company has been focused on the customer. Grandsol and Gershon's approach (1998) is more focused on the activities undertaken by the company to get customers, both have complementary elements, but the analysis of the proposal made by Samson and Terziovski, (1999) has included items such as (a) current and future requirements of external customers, (b) if customer requirements are disseminated and understood, (c) process for external customer's compliance, (d) if customer compliance is used for improvement actions and (e)

customer satisfaction measure. This approach was used by Pino (2008) in a Peruvian organization with a Crombach's alpha of .69. Compared with other items, the Samson and Terziovski approach is more compatible with Ebrahimi and Sadeghi's (2013) definition and allows us to evaluate a comprehensive vision of customer focus. Therefore, these items have been chosen for this research.

Top management commitment and leadership

These practices of quality management have been analyzed in the past in two different categories. One for top management commitment and other for leadership (a) Saraph et al. (1989) focused on top management and quality policy, (b) Flynn et al. (1994) focused on top management support, (c) Ahire et al. (1996) focused on top management commitment, and Grandzol and Gershon (1998) focused on leadership. According to the approach proposed by Ebrahimi and Sadeghi's (2013), management commitment and leadership involve articulating a vision, providing strategic leadership, and creating and supporting climate to achieve adequate performances and meet customer expectations. For this approach it is necessary to use two different authors, (a) Ahire et al. for management commitment, and (b) Grandzol and Gershon (1998) for leadership.

Process management

Process management refers to "how an organization manages, evaluates and improves its key process" (Ebrahimi and Sadeghi, 2013, p.5637). This practice is included in the principal quality models as ISO 9001, Malcolm Baldrige and EFQM. The approach given by Saraph et al. (1989) does not comply with the above definition because it is focused in statistical process control, inspection, degree of automatization and process instruction. The approach by Flynn et al. (1994) is more focused on classifying and setting in order the workplace and not considering the management element in process. The approach by Grandzol and Gershon (1998) considered a preventive position, process design,

quality measurement process, variation in the process, and total cost view and employee performance in the process. Therefore, this was the chosen approach.

Supplier quality management

This key practice of quality management is focused on a cooperative and long-term relationship with the supplier (Ebrahimi and Sadeghi, 2013). Pino (2008) discusses the approach introduced by Saraph et al. (1989), Powell (1995) and Ahire et al. (1996) and concluded that Saraph approach is the best because it has a wide vision regarding these key practices. This approach included the following items (a) supplier selected, (b) reliance of the supplier, (c) education of the supplier, (d) technical assistant, (e) involvement in product development process, and (f) long term relationship. I agree that the evaluation of this approach is more complete and allows us to evaluate these practices according to the definition of Ebrahimi and Sadeghi, (2013).

Quality information and analysis

These key practices of quality management are centered on how the organization guarantees the availability of reliable, high quality and timely information in order to make decisions that lead to excellence (Ebrahimi and Sadeghi, 2013). According to this approach, the questionnaires that were used by Saraph et al. (1989), Flynn et al. (1994) and Ahire et al. (1996) were analyzed. In the first case, Saraph et al. (1989) included items such as (a) availability of quality costs data, (b) process quality data, (c) data opportunity, and (d) scope and use of information in different levels of the organization. In the case of Flynn et al. (1994), the items used here mainly refer to the use of statistical process control and inspection but with a main point in feedback on the shop floor and employee. Finally, Ahire et al. (1996) introduced similar items to the ones included by Saraph et al. (1989) but with a detailed vision on the level that this information is shown without including elements such as information opportunity. Based on the analysis, we conclude that for the key practice of

quality management, the items mentioned by Saraph et al. (1989) will be used. Likewise, the Crombach's alpha for this approach topics are .88, which allows us to have an acceptable level of internal consistency.

Strategy quality planning

This key practice of quality management includes the development of quality objectives, the evaluation of how the organization develops, implements and improves its strategy and policies to achieve excellence in performance (Ebrahimi and Sadeghi, 2013). According to the aforementioned described by Saraph et al. (1989) in their first Role of divisional top management and quality policy include elements such as (a) responsibility for quality performance (b) support of long-term quality improvement process, (c) extent to quality goals, and (d) comprehensiveness of the quality plan. Survey questions are detailed in Appendix B.

Operational Performance

A traditional view of operational performance variables includes the elements of costs, quality and compliance at the time of delivery (Sousa & Voss, 2008), other authors have included additional elements such as flexibility (Schmenner & Swink, 1998), customer satisfaction, customer claims and quality costs (Samson & Terziovski, 1999), as well as a particular vision of benchmarking the comparison of the organization with respect to the market and competitors (Hasan & Kerr 2003; Jabnoun & Sedrani, 2005). Under these approaches it is concluded that using comparative variables with other companies does not directly measure the level of performance improvement of the organization since having a better level with respect to others does not imply a direct improvement of performance, in turn using direct scales of Quality costs or levels of scrap or defects as proposed by Samson and Terziovski (1999) implies that all processes can have similar values of this type, an issue that cannot be guaranteed unless a group of companies with similar characteristics is studied. Due to

the aforementioned, for the present study we will use the traditional elements of performance measurement mentioned by Sousa and Voss (2008) and those used by Samson and Terziovski (1999) but under the likert scale since this allows us to use an ordinal valuation as interval data (Allen & Seaman, 2007).

Data Collection

To collect data, we will consider companies –identified by a Unified Taxpayer's Registry (RUC)– as analysis units and we will also address operations managers, general managers, quality managers or related positions according to the different type of industry. It is important to mention that the quality manager position is not common in the Peruvian market, but we will complete this information with the person in charge of the quality management system.

In some cases, the survey will be sent online in order to facilitate its collection and completion via Google Forms. Therefore, we will previously verify the e-mail addresses of the people participating in the research. Thus, we will ask for support to institutions that handle company's and employees' databases, such as the Industrial Development Center ("Centro de Desarrollo Industrial", CDI), pertaining to the Industry National Society ("Sociedad Nacional de Industria"). If we do not get the information, we will use the Peru Top 10000 databases, (Cavanagh, 2018) and we will proceed to verify the information directly with the companies.

Data Analysis

The process to follow for the data analysis will be (a) numeric scale assignment for answers in Likert scale, (b) analysis to find extreme values, (c) evaluation of data order, (d) evaluation of reliability and the three components of construct validity, (unidimensionality, convergent validity, and discriminant validity), (e) exploratory factor analysis (EFA), (f) confirmatory factor analysis (CFA), and (g) structural equation model (SEM).

Regarding the Likert scale, we will assign numerical values as follows (a) 1 strongly disagree, (b) 2 Disagree, (c) 3 neither agree nor disagree, (d) 4 agree, and (e) 5 Strongly Agree. Regarding extreme value, if any of them are in the result, it's important to analyze the questionnaire responses and conclude whether or not the data is valid (Ahire et al.,1996). In the case of the measurement of the maturity level of quality management in each of its categories, the following will be assigned (a) 1 for level 1, (b) 2 for level 2, (c) 3 for level 3, (d) 4 for level 4, and (e) 5 for level 5.

Validity and Reliability

Reliability will show the level in which elements of a variable measure the same underlying concept, Saraph et al. (1989) mentioned that 4 methods to assess reliability can be used (a) the retest method, (b) the alternative form method, (c) the splits halves method, and (d) internal consistency method, but they recommend to use the last one because the first three ones need alternative survey formats of the same sample twice. Internal consistency measurement is carried out through Crombach alpha, having as acceptance criteria values higher than a .7 (Saraph et al., 1989).

With regard to Validity, Saraph et al. (1989) considered that there are 3 validation types that are generally used (a) content validity, (b) criterion related validity, and (c) construct validity. However, Ahire et al. (1996) adds the following (a) convergent validity, and (b) discriminant validity. They mentioned the importance of having verified one dimensionality and statistical reliability to carry out any type of construct validity.

Saraph et al. (1989) mentions that content validation is a non-numerical approach determined by the researcher in function of the literary review and experts' evaluation. For this research, key practices of quality management have been obtained through a literary review of prior researches (Ebrahimi and Sadeghi, 2013) and we will try to validate the content by means of qualified experts' judgment.

Regarding convergent validity, the Bentler-Bonett coefficient will be used and equal or higher values to .9 (Ahire et al.,1996) will be considered as acceptance criteria. With regard to discriminant validity, chi-square difference test will be used for each pair of scales in the instrument, considering the chi-square of 10.83 as acceptance criteria, representing a significance level of .001.

For criterion related validity, we will consider how well the quality management practices are related to measure maturity level of quality management, this will be carried out through multiple correlation coefficients (Ahire et al.,1996). The construct validity will be evaluated through the analysis of the factor, considering as an acceptable loading factor the value of 0.35 (Hair, Black, Babin, Anderson, & Tatham, 2006).

References

Abdullah, M. M. B., Uli, J., & Tarí, J. J. (2009). The relationship of performance with soft factors and quality improvement. *Total Quality Management*, *20*(7), 735-748.

Adam, E. E. (1994). Alternative quality improvement practices and organization performance. *Journal of Operations Management*, *12*(1), 27-44.

Adam, E. E., Corbett, L. M., Flores, B. E., Harrison, N. J., Lee, T. S., Rho, B. H., ... & Westbrook, R. (1997). An international study of quality improvement approach and firm performance. *International Journal of Operations & Production Management*, *17*(9), 842-873.

Addey, J. (2004). The modern quality manager. *Total Quality Management & Business Excellence*, *15*(5-6), 879-889.

Ahire, S. L., Golhar, D. Y., & Waller, M. A. (1996). Development and validation of TQM implementation constructs. *Decision sciences*, *27*(1), 23-56.

Ahire, S. L., & O'shaughnessy, K. C. (1998). The role of top management commitment in quality management: an empirical analysis of the auto parts industry. *International Journal of Quality Science*, *3*(1), 5-37.

Ahire, S. L., & Dreyfus, P. (2000). The impact of design management and process management on quality: an empirical investigation. *Journal of operations management*, *18*(5), 549-575.

Allen, I. E., & Seaman, C. A. (2007). Likert scales and data analyses. *Quality progress*, *40*(7), 64.

Anderson, J., Rungtusanatham, M. & Schroeder, R. (1994). A Theory of Quality management underlying the Deming management Method, *Academy of Management Review, 19*(3)*,* 472-509

Anderson, J., Rungtusanatham, M., Schroeder, R., & Devaraj, S. (1995). A path analytic model of a theory of quality management underlying the Deming management method: preliminary empirical findings. *Decision sciences*, *26*(5), 637-658.

Bakotić, D., & Rogošić, A. (2017). Employee involvement as a key determinant of core quality management practices. *Total Quality Management & Business Excellence*, *28*(11-12), 1209-1226

Baldassarre, M. T., Caivano, D., Pino, F. J., Piattini, M., & Visaggio, G. (2012). Harmonization of ISO/IEC 9001: 2000 and CMMI-DEV: from a theoretical comparison to a real case application. *Software Quality Journal*, *20*(2), 309-335.

Bamford, D. R., & Land, N. (2006). The application and use of the PAF quality costing model within a footwear company. *International Journal of Quality & Reliability Management*, *23*(3), 265-278..

Barber, P., Graves, A., Hall, M., Sheath, D., & Tomkins, C. (2000). Quality failure costs in civil engineering projects. *International Journal of Quality & Reliability Management*, *17*(4/5), 479-492.

Becker, J., Knackstedt, R., & Pöppelbuß, D. W. I. J. (2009). Developing maturity models for IT management. *Business & Information Systems Engineering*, *1*(3), 213-222.

Bisgaard, S. (2007). Quality management and Juran's legacy. *Quality and Reliability Engineering International*, *23*(6), 665-677.

Bititci, U. S., Garengo, P., Ates, A., & Nudurupati, S. S. (2015). Value of maturity models in performance measurement. *International journal of production research*, *53*(10), 3062-3085.

Boughzala, I., & De Vreede, G. J. (2015). Evaluating Team Collaboration Quality: The Development and Field Application of a Collaboration Maturity Model. *Journal of Management Information Systems*, *32*(3), 129-157.

Birch-Jensen, A., Gremyr, I., Hallencreutz, J., & Rönnbäck, Å. (2018). Use of customer satisfaction measurements to drive improvements. *Total Quality Management & Business Excellence*, 1-14.

Burcher, P., Lee, G., & Waddell, D. (2008). The challenges for quality managers in Britain and Australia. *the TQM Journal*, *20*(1), 45-58.

Cavanagh, J. (Ed.). (2018). *Peru: the top 10,000 companies*. Peru Top Publications.

Choi, T., & Eboch, K. (1998). The TQM paradox: relations among TQM practices, plant performance, and customer satisfaction. *Journal of Operations Management*, *17*(1), 59-75.

Cokins, G. (2006). Measuring the cost of quality for management. *Quality progress*, *39*(9), 45.

Creswell, J. W., & Creswell, J. D. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Cronemyr, P., & Danielsson, M. (2013). Process Management 1-2-3–a maturity model and diagnostics tool. *Total Quality Management & Business Excellence*,*24*(7-8), 933-944.

Crosby, P. (1979). *Quality is Free, The Art of Making Quality Certain*. New York, NY: Mc Graw-Hill.

Crosby, P. B. (1996). *Quality is still free: making quality certain in uncertain times*. McGraw-Hill Companies.

Curkovic, S., Melnyk, S., Calantone, R., & Handfield, R. (2000). Validating the Malcolm Baldrige National Quality Award framework through structural equation modelling. *International Journal of Production Research*, *38*(4), 765-791.

Dean, J. W., & Bowen, D. E. (1994). Management theory and total quality: improving research and practice through theory development. *Academy of management review*, *19*(3), 392-418.

De Bruin, T., Freeze, R., Kaulkarni, U., & Rosemann, M. (2005). Understanding the main phases of developing a maturity assessment model. Australasian Conference on Information Systems.

Deming, W. E. (1986). Out of the crisis, Massachusetts Institute of Technology. *Center for advanced engineering study, Cambridge, MA*, *510*.

Donaldson, L. (2001). *The contingency theory of organizations*. Sage.

Douglas, T. J., & Judge, W. Q. (2001). Total quality management implementation and competitive advantage: the role of structural control and exploration. *Academy of Management Journal*, *44*(1), 158-169.

Dow, D., Samson, D., & Ford, S. (1999). Exploding the myth: do all quality management practices contribute to superior quality performance?. *Production and operations management*, *8*(1), 1-27.

Duh, R. R., Hsu, A. W. H., & Huang, P. W. (2012). Determinants and performance effect of TQM practices: An integrated model approach. *Total Quality Management & Business Excellence*, *23*(5-6), 689-701.

Ebrahimi, M. & Sadeghi M. (2013). Quality Management and Performance: An Annotated Review. *International Journal of Production Research, 51*(18), 5625 – 5643.

Eaton, A., & Visser, P. (2008). Attitude importance: Understanding the causes and consequences of passionately held views. *Social and Personality Psychology Compass*, *2*(4), 1719-1736.

Ellram, L. M. (1991). A managerial guideline for the development and implementation of purchasing partnerships. *Journal of Supply Chain Management*, *27*(3), 2-8.

Evans, J. R., & Lindsay, W. M. (2013). *Managing for quality and performance excellence*. Cengage Learning.

Feigenbaum, A. V. (1961). *Total quality control: engineering and management, the technical and managerial field for improving product quality, including its reliability, and for reducing operating cost and losses* (No. TS156. Q3 F45).

Fečiková, I. (2004). An index method for measurement of customer satisfaction. *The TQM magazine*, *16*(1), 57-66.

Fisher, D. M. (2004). The business process maturity model. A practical approach for identifying opportunities for optimization. *Business Process Trends*, *9*(4), 11-15.

Flynn, B. B., Schroeder, R. G., & Sakakibara, S. (1994). A framework for quality management research and an associated measurement instrument. Journal of Operations management, 11(4), 339-366.

Flynn, B. B., Schroeder, R. G., & Sakakibara, S. (1995). The impact of quality management practices on performance and competitive advantage. Decision sciences, 26(5), 659-691.

Forza, C., & Filippini, R. (1998). TQM impact on quality conformance and customer satisfaction: a causal model. *International journal of production economics*, *55*(1), 1-20.

Fotopoulos, C. B., & Psomas, E. L. (2009). The impact of "soft" and "hard" TQM elements on quality management results. *International Journal of Quality & Reliability Management*, *26*(2), 150-163.

Fotopoulos, C. V., Psomas, E. L., & Vouzas, F. K. (2010). ISO 9001: 2000 implementation in the Greek food sector. *The TQM Journal*, *22*(2), 129-142.

Gadenne, D., & Sharma, B. (2009). An investigation of the hard and soft quality management factors of Australian SMEs and their association with firm

performance. *International Journal of Quality & Reliability Management*, *26*(9), 865-880.

Gibson, D. L., Goldenson, D. R., & Kost, K. (2006). Performance results of CMMI-based process improvement. *Software Engineering Institute*. (CMU/SEI-2006-TR-004). Pennsylvania, PA: Carnegie Mellon University.

Godfrey, A. B. (1999). Juran's quality handbook. New York, NY: Mc Graw-Hill

Grant, K. P., & Pennypacker, J. S. (2006). Project management maturity: An assessment of project management capabilities among and between selected industries. *Engineering Management, IEEE Transactions on*, *53*(1), 59-68.

Grandzol, J. R., & Gershon, M. (1998). A survey instrument for standardizing TQM modeling research. *International Journal of Quality Science*, *3*(1), 80-105.

Gray, J., & Handley, S. (2011). Managing quality in outsourced production: Construct development and measurement validation. *Quality Management Journal*, *18*(2), 26-45.

Gupta, M., & Campbell, V. S. (1995). The cost of quality. *Production and Inventory Management Journal*, *36*(3), 43.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis 6th Edition. *New Jersey: Pearson Education*.

Harari, O. (1993). Ten reasons why TQM doesn't work. *Management review*, *82*(1), 33.

Hasan, M., & Kerr, R. M. (2003). The relationship between total quality management practices and organizational performance in service organizations. *The TQM Magazine, 15*(4), 286-291.

Hwang, G. H., & Aspinwall, E. M. (1999). The development of a quality cost model in a telecommunications company. *Total Quality Management*, *10*(7), 949-965.

Hendricks, K. B., & Singhal, V. R. (1996). Quality awards and the market value of the firm: An empirical investigation. *Management science*, *42*(3), 415-436.

Hillson, D. A. (1997). Towards a risk maturity model. *International Journal of Project and Business Risk Management*, *1*(1), 35-45.

Hing Yee Tsang, J., & Antony, J. (2001). Total quality management in UK service organisations: some key findings from a survey. *Managing Service Quality: An International Journal*, *11*(2), 132-141.

Hoyer, R., Hoyer, B. (2001). What is quality?. *Quality Progress, 34*(7), 52-62

Ingason, H. Þ., & Jónsdóttir, E. R. (2017). The house of competence of the quality manager. *Cogent Business & Management*, *4*(1).

Ingelsson, P., Eriksson, M., & Lilja, J. (2012). Can selecting the right values help TQM implementation? A case study about organisational homogeneity at the Walt Disney Company. *Total Quality Management & Business Excellence*, *23*(1), 1-11.

Imler, K. (2006). Core roles in a strategic quality system. *Quality Progress*, *39*(6), 57.

Ingason, H. Þ., & Jónsdóttir, E. R. (2017). The house of competence of the quality manager. *Cogent Business & Management*, *4*(1).

International Organization for Standardization (2009). *International ISO 9004 Managing for the sustained success of an organization -- A quality management approach*. Geneva, Switzerland: ISO/TC 176/SC 2.

International Organization for Standardization (2015). *Norma Internacional ISO 9000 - Quality management systems -- Fundamentals and vocabulary*. Geneva, Switzerland: ISO/TC 176/SC 1.

International Organization for Standardization (2017). *The ISO Survey 2016*. Ginebra, Suiza.

Ishikawa, K. (1985). *What is total quality control?: the Japanese way* (Vol. 215). Englewood Cliffs, NJ: Prentice-Hall.

Ittner, C. D. (1996). Exploratory evidence on the behavior of quality costs. *Operations research*, *44*(1), 114-130.

Jabnoun, N., & Sedrani, K. (2005). TQM, culture, and performance in UAE manufacturing. *Quality Management Journal, 12*(4), 8-20.

Jaca, C., & Psomas, E. (2015). Total quality management practices and performance outcomes in Spanish service companies. *Total Quality Management & Business Excellence*, *26*(9-10), 958-970.

Jamali, G., Ebrahimi, M., & Abbaszadeh, M. A. (2010). TQM implementation: an investigation of critical success factors. In *Education and Management Technology (ICEMT), 2010 International Conference on* (pp. 112-116). IEEE.

Juran, J. (Ed) (1995). *A History of Managing for Quality: The Evolution, Trends, and Future Directions of Managing for Quality.* Milwaukee, WI: ASQ Quality Press.

Juran, J., Gryma, F. & Bingham R. (2005). *Manual de Control de la Calidad 3ra Ed*. Barcelona, Spain: Editorial Raverté.

Kaynak, H. (2003). The relationship between total quality management practices and their effects on firm performance. *Journal of operations management*, *21*(4), 405-435.

Kaynak, H., & Hartley, J. L. (2008). A replication and extension of quality management into the supply chain. *Journal of Operations Management*, *26*(4), 468-489.

Kerzner, H. R. (2002). *Strategic planning for project management using a project management maturity model*. John Wiley & Sons.

Kim, D. Y., Kumar, V., & Kumar, U. (2012). Relationship between quality management practices and innovation. *Journal of operations management*, *30*(4), 295-315.

Kulkarni, U., & St Louis, R. (2003). Organizational self-assessment of knowledge management maturity. *AMCIS 2003 Proceedings*, 332.

Kumar, K., Shah, R., & Fitzroy, P. T. (1998). A review of quality cost surveys. *Total Quality Management*, *9*(6), 479-486.

Kwak, Y. H., & Ibbs, C. W. (2000). Assessing project management maturity. *Project Management Journal*, *31*(1), 32-43.

Laureani, A., & Antony, J. (2017). Leadership and Lean Six Sigma: a systematic literature review. *Total Quality Management & Business Excellence*, 1-29.

Lee, S. M., Rho, B. H., & Lee, S. G. (2003). Impact of Malcolm Baldrige National Quality Award criteria on organizational quality performance. *International journal of production research*, *41*(9), 2003-2020.

Longman, P. (2005). *Longman dictionary of contemporary English*. Harlow, England: Pearson Education Limited.

Macdonald, J. (1993). TQM: Does It Always Work?. Technical Communications (Pub.) Limited.

MacDuffie, J. P. (1997). The road to "root cause": Shop-floor problem-solving at three auto assembly plants. *Management Science*, *43*(4), 479-502.

Maier, A., Moultie, J., & Clarkson, P. (2012). Assessing Organizational Capabilities: Reviewing and Guiding the Development of Maturity Grids. *IEEE Transactions on Engineering Management, 59*(1), 138- 159.

McCarty, T., Daniels, L., Bremer, M., Gupta, P., Heisey, J., & Mills, K. (2004). *The Six Sigma black belt handbook*. McGraw-Hill, Inc.

Mellat Parast, M., Adams, S. G., & Jones, E. C. (2011). Improving operational and business performance in the petroleum industry through quality management. *International journal of quality & reliability management, 28(4)*, 426-450.

Miyagawa, M., & Yoshida, K. (2010). TQM practices of Japanese-owned manufacturers in the USA and China. *International Journal of Quality & Reliability Management*, *27*(7), 736-755.

Motwani, J. (2001). Critical factors and performance measures of TQM. *The TQM magazine*, *13*(4), 292-300.

Myung S. (2009). Process Quality Levels of ISO/IEC 15504, CMMI and K-model. *International Journal of Software Engineering and Its Applications, 3*(1), 33-42.

Nave, D. (2002). How to compare six sigma, lean and the theory of constraints. *Quality Progress*, *35*(3), 73-78.

NIST (2017). *2017-2018 Baldrige Excellence Framework, A system approach to approach to improving your organization's performance (Business/Nonprofit)*. Gaithersburg, MD: U.S. Department of Commerce, National Institute of Standards and Technology.

Oschman, J. J. (2017). The Role of Strategic Planning in Implementing a Total Quality Management Framework: An Empirical View. *The Quality Management Journal*, *24*(2), 41.

Palmer, B. (2006). Selling quality ideas to management. *Quality progress*, *39*(5), 27.

Papa, F. A. (1993). Linkage of old and new. *Management Review*, *82*(1), 63-64.

Parthasarathy, R. R. (2009). Emotional Intelligence and the quality manager: Beauty and the beast?. *The Journal for Quality and Participation*, *31*(4), 31.

Paulk M.C., Curtis, B., Chrissis, M. B., & Weber, C. V. (1993). Capability Maturity Model for Software, Version 1.1. *Software Engineering Institute-Carnegie Mellon University. Pittsburgh, Pennsylvania*.

Păunescu, C., & Acatrinei, C. (2012). Managing maturity in process-based improvement organizations: a perspective of the Romanian companies. *Journal of Business Economics and Management*, *13*(2), 223-241.

Pino, R. (2008). TQM and performance in small medium enterprises: The mediating effect of customer orientation and innovation. *International journal of quality & reliability management*, *25*(3), 256-275.

Plewa, M., Kaiser, G., & Hartmann, E. (2016). Is quality still free? Empirical evidence on quality cost in modern manufacturing. *International Journal of Quality & Reliability Management*, *33*(9), 1270-1285.

Powell, T. C. (1995). Total quality management as competitive advantage: a review and empirical study. *Strategic management journal*, *16*(1), 15-37.

Rohloff, M. (2009). Case study and maturity model for business process management implementation. In *Business Process Management* (pp. 128-142). Springer Berlin Heidelberg.

Rungtusanatham, M., Forza, C., Filippini, R., & Anderson, J. C. (1998). A replication study of a theory of quality management underlying the Deming management method: insights from an Italian context. *Journal of Operations Management*, *17*(1), 77-95.

Rusjan, B., & Alic, M. (2010). Capitalising on ISO 9001 benefits for strategic results. *International Journal of Quality & Reliability Management*, *27*(7), 756-778.

Sadikoglu, E., & Zehir, C. (2010). Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. *International journal of production economics*, *127*(1), 13-26.

Samson, D., & Terziovski, M. (1999). The relationship between total quality management practices and operational performance. *Journal of operations management*, *17*(4), 393-409.

Saraph, J. V., Benson, P. G., & Schroeder, R. G. (1989). An instrument for measuring the critical factors of quality management. *Decision sciences*, *20*(4), 810-829.

Schmenner, R. & Swink, M. (1998). On theory in operations management. *Journal of operations management*, *17*(1), 97-113.

Schneider, B., Yost, A. B., Kropp, A., Kind, C., & Lam, H. (2018). Workforce engagement: What it is, what drives it, and why it matters for organizational performance. *Journal of Organizational Behavior*, *39*(4), 462-480.

Singh, P. J., & Smith, A. (2006). An empirically validated quality management measurement instrument. *Benchmarking: An International Journal*, *13*(4), 493-522.

Soria-García, J., & Martínez-Lorente, Á. R. (2014). Development and validation of a measure of the quality management practices in education. *Total Quality Management & Business Excellence*, *25*(1-2), 57-79.

Sousa, R., & Voss, C. A. (2002). Quality management re-visited: a reflective review and agenda for future research. *Journal of operations management*, *20*(1), 91-109.

Sousa, R., & Voss, C. A. (2008). Contingency research in operations management practices. *Journal of Operations Management*, *26*(6), 697-713.

Sower, V. E., Quarles, R., & Broussard, E. (2007). Cost of quality usage and its relationship to quality system maturity. *International Journal of Quality & Reliability Management*, *24*(2), 121-140.

Stacey, T. R. (1996). Information security program maturity grid. *Information Systems Security*, *5*(2), 22-33.

Štofková, J., Stríček, I., & Štofková, K. (2016). Data analysis in quality management of the network enterprise. In *Production Management and Engineering Sciences* (Vol. 273, No. 278, pp. 273-278). ROUTLEDGE in association with GSE Research.

Team, C. P. (2010). CMMI® for Development, Version 1.3, Improving processes for developing better products and services. *no. CMU/SEI-2010-TR-033. Software Engineering Institute*. (CMU/SEI-2010-TR-033). Pennsylvania, PA: Carnegie Mellon University.

Tickle, M., Mann, R., & Adebanjo, D. (2016). Deploying business excellence-success factors for high performance. *International Journal of Quality & Reliability Management*, *33*(2).

Treleven M. & Benson G. (1987). Quality Maturity in U.S. Manufacturing. *1987 ASQC Quality Congress Transactions – Mimmeapolis.*

Vanini, U., & Bochert, S. (2014). An empirical Investigation of Maturity Levels in Knowledge Management. *Electronic Journal of Knowledge Management*, *12*(4), 219-229.

Viger, C., & Anandarajan, A. (1999). Cost Management and Pricing Decisions in the Presence of Quality Cost Information: An Experimental Study with Marketing Managers. *Journal of Cost Management*, *13*, 21-28.

Voss, C., Blackmon, K. L., Cagliano, R., Hanson, P., & Wilson, F. (1998). Made in Europe: small companies. *Business Strategy Review*, *9*(4), 1-19.

Wiele T., Brown A., Millen R. & Whelan D. (2000). Improvement in Organizational Performance and Self-Assessment Practices by Selected American Firms, *Quality Management Journal, Vol* (7)*,* 8-22.

Wong, W. P., Tseng, M. L., & Tan, K. H. (2014). A business process management capabilities perspective on organisation performance. *Total Quality Management & Business Excellence*, *25*(5-6), 602-617.

Xiong, J., He, Z., Ke, B., & Zhang, M. (2016). Development and validation of a measurement instrument for assessing quality management practices in hospitals: an exploratory study. *Total Quality Management & Business Excellence*, *27*(5-6), 465-478.

Yeung, A. C. (2008). Strategic supply management, quality initiatives, and organizational performance. *Journal of Operations Management*, *26*(4), 490-502.

Zakuan, N. M., Yusof, S. M., & Shaharoun, A. M. (2009). The link between total quality management and organizational performance in Malaysian Automotive Industry: The mediating role of ISO/TS16949 efforts. In *Industrial Engineering and Engineering Management, 2009. IEEM 2009. IEEE International Conference on* (pp. 439-443). IEEE.

Zhang, H., Kang, F., & Hu, S. Q. (2018). Senior leadership, customer orientation, and service firm performance: the mediator role of process management. *Total Quality Management & Business Excellence*, 1-16.

Zhang, D., Linderman, K., & Schroeder, R. G. (2012). The moderating role of contextual factors on quality management practices. *Journal of Operations Management*, *30*(1-2), 12-23.

Appendix A: Informed Consent

Surco, September 2018

Dear participant. -

Presented. -

Subject: Questionnaire to measure the relationship of QM practices and operational performance with quality management maturity, as a contingency variable.

Serve this to express my greetings and thanks for your participation answering the enclosed questionnaire, which is designed to be answered by people who currently have a role of decision with respect to quality management in their organizations. This questionnaire is part of the research conducted for the degree of Doctor in Strategic Management from the Pontificia Universidad Catolica del Peru and Doctor in Business Administration from Maastricht School of Management in the Netherlands, with the thesis entitled “Contingency Research in Quality Management Practices and Maturity Quality Management ".

Answering this survey will take about 20 minutes and the results of this study will be made available in April 2019. The names of the companies and the particular results will be maintained in absolute secrecy, only statistical averages and sample data will be published. If you kindly answer the questionnaire, will express their consent to participate in the research study. For any question or query detail please contact me at the following email: lnegron@pucp.edu.pe.

Thank you for your consideration on this matter, without further ado, I remain you.

Best regards. Luis Negron Naldos

Appendix B: Instrument

1. Your company belongs mainly to the sector: (a) public, and (b) private
2. The main activities of the company are: (a) Services, trade, logistics, and (b) Manufacturing, processing of tangible goods
3. Your company has (consider permanent workers, not temporally): (a) less than 50 permanent workers, (b) between 51 and 250 permanent workers, (c) between 251 and 500 permanent workers and (d) more than 500 permanent workers

Question about Human Resource Management:

4. All employee suggestions are evaluated.
5. Resources are available for employee quality training in our plant.
6. There is almost always some kind of employee quality training going on in our plant.
7. Plant managers are often involved in quality training.
8. Most employees in our plant do not view each new quality seminar or training program as "just another fad."

Question about customer focus and satisfaction:

9. We know our external customers' current and future requirements (both in terms of volume and product characteristics).
10. These customer requirements are effectively disseminated and understood throughout the personnel.
11. We have an effective process for resolving external customers' complaints.
12. Customer complaints are used as a method to initiate improvements in our current processes.
13. We systematically and regularly measure external customer satisfaction.

Question about top management commitment and leadership.

14. At this site we proactively pursue continuous improvement rather than reacting to crisis' 'fire-fighting'.

15. Our performance evaluation by the top-level management depends heavily on quality.
16. Top-level managers allocate adequate resources toward efforts to improve quality.
17. We have clear quality goals identified by top-level managers.
18. At company-wide meetings top-level managers often discuss the importance of quality.

Question about process management:

19. Preventing defective products/services from occurring is a strong attitude in this organization.
20. The processes for designing new products/services in this organization ensure quality.
21. Employees involved in different processes know how to use statistical process control methods to evaluate their processes.
22. In this organization, numerical quotas are not the only, nor the most important, measure of an employee's performance.

Question about supplier quality management:

23. Quality is a more important criterion tan Price in selecting suppliers of the major component.
24. Our supplier rating system considers the supplier´s engineering capability.
25. Our supplier rating system considers the supplier´s financial stability.
26. Our supplier rating system considers the supplier´s delivery performance.
27. We provide technical assistance to our suppliers of this component.

Question about quality information and analysis

28. Availability of cost of quality data in the division.
29. Availability of quality data (error rates, defect rates, scrap, defects, etc.)

30. Timeliness of the quality data.
31. Extent to which quality data (cost of quality, defects, errors, scrap, etc.) are used as tools to manage quality.
32. Extent to which quality data are available to managers and supervisors.

Question about Strategy Quality Planning in Quality Management:

33. Extent to which the top division executive (responsible for division profit and loss) assumes responsibility for quality performance.
34. Extent to which the division top management supports long-term quality improvement process.
35. Extent to which the divisional top management has objectives for quality performance.
36. Degree to which the divisional top management considers quality improvement as a way to increase profits.
37. Degree of comprehensiveness of the quality plan within the division.

Question about Maturity level of quality management:

Please indicate (by writing a simple number, ranging from one through five, in the vacant column) your site current performance level for **each** level of the listed attributes

38. Attitude and understanding of the direction: (1) They do not understand quality as a management tool. They tend to blame the quality department for the "quality problems.", (2) They recognize that quality management can be helpful, but are not willing to provide the money or the time to carry it out, (3) Going doing the quality improvement process, you learn more of quality management; It is given help and support, (4) Participation. the absolutes of quality management are understood. Recognize his personal role in giving a continued emphasis, and (5) They consider the quality management system an essential part of the company.

39. Organizational quality situation: (1) The quality function is hidden in the departments of engineering or production. Inspection probably not part of the organization. Emphasis on evaluation and selection, (2) A manager of the energetic quality is named, but the main emphasis is still in the evaluation and make the product. It is still part of the production or some other department, (3) The quality department falls under the senior management; any assessment is incorporated and the manager plays a role in managing the company, (4) The quality manager is an executive of the company; effective reporting of the situation and preventive action. It deals with consumer affairs and special projects, and (5) The quality manager belongs to the steering committee. The main concern is prevention. Quality leads ideas.
40. Handling problems: (1) Problems as they occur are facing; not resolved; inadequate definition; many shouts and accusations, (2) Teams are formed to attack the most important problems. Nobody asks long-term solutions, (3) Communication for corrective action is established. Problems faced openly and resolved in an orderly manner, (4) Problems are identified in its early stages of development. All functions are open to suggestions and improvements, (5) Except in rare cases, problems are prevented.
41. Quality cost as% of sales: (1) Reported: Unknown, real: 20%, (2) Reported: 3%, real: 18%, (3) Reported: 8%, real: 12%, (4) Reported: 6.5%, real: 8%, and (5) Reported: 2.5%, real: 2.5%.
42. Actions to improve quality: (1) There are no organized activities. These activities do not understand, (2) "Motivational" short-term initiatives are attempted, (3) Implementation quality improvement methodology- six sigma, kaizen, lean, etc.-, (4)

Continuous with quality improvement methodology and (5) Improving quality is a normal and continuous activity.

43. Summary of the position of the company regarding the quality: (1) "We do not know why we have problems with quality.", (2) "It is absolutely inevitable to have always problems with quality?", (3) "Through the commitment of management and improving the quality, we are identifying and resolving our problems.", (4) "Preventing defects routinely part of our operation.", and (5) "We know why we don´t have problems with quality."

Question about operational performance:

Please indicate (by writing a simple number, ranging from one through five, in the vacant column) your site current performance level for **each** level of the listed attributes.

44. Customer satisfaction: (1) Sometimes meets expectation, (2) Generally meet expectation, (3) Consistently meet expectation, (4) Always meet expectation, (5) Expect exceeded delighted customers.
45. Employee morale: (1) Very low, (2) Low, (3) Satisfactory, (4) High, (5) Very high.
46. Productivity: (1) Decreasing, (2) Static, (3) Moderate improvement, (4) Consistently improving, (5) Major and significant gains.
47. Delivery in full on time to our customer: (1) Less than 50%, (2) 50 – 80%, (3) 81 - 90%, (4) 91-96%, (5) 97-100%.

Chapter IV. Results

Introduction

As mentioned earlier, this doctoral thesis is made up of six parts: (a) the Abstract and *Resumen Ejecutivo*; (b) the Table of Contents; (c) the Research Proposal (RP), which was defended earlier; (d) the Results, made up of the accepted or published research paper presenting the doctoral research results; (e) the Conclusions and Recommendations; and (f) the Appendices. The abstract presents the research purpose, the research method, and the main finding in a maximum of 250 words: the new doctoral contribution to management science.

Chapter IV the thesis contains an identical copy of the accepted or published research paper. The requirement by CENTRUM PUCP is that the research paper should be accepted or published in a Q1 to Q3 Scopus journal before the doctoral student can defend his/her thesis. The authorship of the paper should show the student´s name as the first author. Then other name(s) can also appear, must notably the name of the thesis advisor, and a co advisor. The paper must be published in English.

As stated earlier, this paper, as it should be, includes all the details that appear in the journal where it will be published o where it has been published: article title, author(s) name(s), abstract, keywords, paper contents, **including the results, where the doctoral contribution to the management science should be included**. It also includes the Conclusions, and the list of References.

Research Paper Accepted

Decision Letter (UQMJ-2019-0088.R1)

From: tom_foster@byu.edu

To: lnegron@pucp.edu.pe, luciananegronmarin@gmail.com

CC:

Subject: Quality Management Journal - Decision on Manuscript ID UQMJ-2019-0088.R1

Body: 18-Jun-2020

Dear Professor Negron:

Ref: Relationship Between Quality Management Practices, Performance and Maturity Quality Management, a Contingency Approach

Our reviewers have now considered your paper and have recommended publication in Quality Management Journal. We are pleased to accept your paper in its current form which will now be forwarded to the publisher for copy editing and typesetting. The reviewer comments are included at the bottom of this letter.

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Relationship Between Quality Management Practices, Performance and Maturity Quality Management, a Contingency Approach

Journal:	*Quality Management Journal*
Manuscript ID	UQMJ-2019-0088.R1
Manuscript Type:	Empirical Article
Keywords:	Quality Management, Operation Performance, Quality Management Practices, Maturity Quality Management
Abstract:	Quality Management is a key element in the organization that allows for the improvement of operational performance, product quality and organizational performance. Likewise, evidence concluding that not all implementations of quality management system generate positive effects has been found, so it is necessary to introduce contingent variables in the studies that allow an understanding of the different situations that can define which variables are more relevant according to the studied contingency. In this sense Sfreddo, Vieira, Vidor, and Santos (2018) and Sousa and Voss (2002) propose to include the variable of quality maturity level as a contingency variable in order to determine which QM practices are more relevant according to the level of maturity of the organizations, an issue that has been the basis for the development of other models of maturity in other fields of management. The result has demonstrated that the effects of benefits in the operative performance are presented in the levels of high maturity, in changes in the levels below these do not present a significant relation. This will allow the development of the basis for the elaboration of a quality management maturity model.

Introduction

There are many publications and books regarding the features and benefits of proper application of quality management (QM) and several research studies have concluded that QM practices have a positive impact on (a) customer satisfaction (Ebrahimi and Sadeghi, 2013; Kaynak, 2003), (b) product quality (Kaynak, 2003), and (c) performance (Sahoo and Yadav, 2018). However, other studies reveal that the impact is weak or statistically non-significant (Sousa and Voss, 2002), this may be because the impact of QM practices is contingent on other factors, such as natural context and culture (Rungtusanatham et al., 1998), firm size (Voss, Blackmon, Cagliano, Hanson and Wilson, 1998) and others

contingency variables as country location, number of employees, and international competition (Sousa and Voss, 2008).

Crosby (1976) introduced the concept of quality management maturity as an element that helps managers understand the function of quality, and he stated that long-term activities must be planned, as well as the fact that the involvement of each person—and not just the quality managers—is essential. In this way, quality management has focused on looking for more efficient and effective processes (Juran, Gryna, and Bingham, 2005) and there are many practices that can be implemented, however, there is little information depicting which are more relevant than others in different contexts, therefore, it is important to be able to find "which practices should be emphasized by organizations at difference stages of QM maturity" (Sousa and Voss, 2002, p. 15) and consolidated a model for evaluation of the management system's maturity level (Sfreddo et al, 2018).

Two elements complicate the proper analysis of QM practices implementation (a) the number that currently exist and the lack of a unique definition for each one of them in past research. Ebrahimi and Sadeghi (2013) listed 224 QM practices that currently exist in the literature and (b) the adequate use of contingent variables to explain the particular importance of a QM practices in a given context, in this sense Sousa and Voss (2002) suggest the use of a quality management maturity level as a contingency variable. Therefore, this study will evaluate the relationship of the Key QM practices proposed by Ebrahimi and Sadeghi (2013) and will assess the impact of the maturity level in a general way, as well as in a particular way in each of its five categories, according to the Quality Management Maturity Grid (QMMG) proposed by Crosby (1979, 1996).

Theorical Background

The theoretical interest of this research is related to one of the principles mentioned by Crosby (1979, 1996), meaning that quality has a cost, but it is free. This principle relates to the fact that if we properly invest in the quality of the expected benefits, this will outweigh the incurred costs. The first reference point is the theory of quality management proposed by Anderson et al. (1994) (underlying the Deming Management Method), which allows us to understand the relational characteristic of QM practices, this was complemented by the approach of a multidimensional construct proposed by Flynn et al., (1995) that divides the QM practices into two elements (a) Core QM practices and (b) QM infrastructure practices. Subsequently, Kaynak (2003) and Bakotić and Rogošić (2017) validated the direct and indirect relationship among QM practices and the effects of these practices on firm's performance, in particular the relationships between infrastructure practices and core practices. Based on these studies it is concluded that the appropriate way to study the relationship of QM practices is to analyze both, infrastructure and core practices together. In order to define the QM practices the result of the research made by Ebrahimi and Sadeghi (2013) was used as a reference, in which seven key QM practices were listed, based on a criterion of frequency in past investigations: (a) top management commitment and leadership, (TMCL); (b) human resources management, (HRM); (c) quality information and analysis, (QIA); (d) process management, (PM); (e) customer focus and satisfaction, (CFS); (f) supplier quality management, (SQM), and (g) strategy quality planning in quality management (SQPQM). However, there are not enough studies on the relationship between quality management practices and the maturity level of quality management as a contingency variable and this does not allow the monitoring of the implementation progress of QM practices in order to establish cost-benefit relationships before executing new improvement actions, since one way to evaluate the cost-benefit relationship is to consider the cost of poor quality (Sousa and Voss, 2002; Sfreddo et al, 2018).

The contingency theory is based on the principle that the effect of one variable on another depends on a third variable, thus the third variable moderates the behavior and receives the name of moderating variable, but not all moderating variables are contingency variables. For the contingency theory of organization, the relationships are among some characteristics of the organization that has an impact on their effectiveness measured in different aspects (Donaldson, 2001) and that the superior performance depends on the ability of its internal features (QM practices) to align themselves with the situational demands of its environment (Roh et al., 2016). For this investigation, quality management maturity summarises a series of organization's characteristics regarding the way in which quality management has been implemented and is therefore considered as a contingency variable (Sousa and Voss, 2008).

The model QMMG, proposed by Corsby (1979, 1996), will be used to measure management maturity, in where different measurement levels and categories were identified. These levels allowed organizations to create a guide with the needed steps to improve their processes (Myung, 2009). The levels are used in order to determine which processes are relegated on the road to maturity (Crosby, 1979, 1996), and this has been adopted by many organizations as a way to perform a self-assessment to determine the strategies to be followed (Wiele, Brown Millen, and Whelan, 2000).

Crosby (1979, 1996) identified the characteristics of the state of Quality Management Maturity in five levels (a) uncertainty, (b) awakening, (c) enlightenment, (d) wisdom, and (e) certainty. Moreover, Crosby evaluated the evolution of the processes in the following categories (a) management understanding and attitude, (b) quality organization, (c) problem handling, (d) cost of quality as percentage of sales, (e) quality improvement actions, and (f) summation of company quality posture. The first category (management understanding and attitude) measures the level of understanding concerning quality management and leadership

attitude as continuous prime movers of improvement. The level of understanding in regard to quality management goes beyond knowing the standards and obtaining certifications for the management systems. It is about understanding the importance of prevention as the right way to achieve quality in organizations; quality means conformance to the requirements; quality performance means zero defects; and quality measurement means the price of nonconformance (Crosby, 1996).

The second category (quality organization status) refers to the position towards quality in the organization, from quality leader to quality manager until reaching board of directors (Crosby, 1979, 1996). The functions of the quality management leader have changed over time, these went from inspections tasks to a management and advice role in quality management (Addey, 2004). The maturity level in this category depends on the development of the activities, which in time have changed from a corrective vision to a preventive vision that includes to (a) develop high quality and effective processes through a comprehensive vision of the organization, (b) provide expert advice on quality issues, (c) create an efficient management system that effectively allows controlling the processes, (d) train and persuade the managers and staff to adopt the quality approach, and (e) use soft skills to support and develop an effective culture of quality (Addey 2004).

The third category, (problem handling), refers to how the company resolves problems, from non-effective solutions to effective preventing actions (Crosby, 1979,1996). The fourth category is the cost of poor quality as a percentage of sales. For this category, the classification has a reference value from 20% to 2.5% or less, divided in each of the categories. (Crosby, 1979, 1996). The cost of poor-quality measures the relationship between prevention and inspection versus failure cost, internal and external. The traditional quality cost model stated that increasing prevention and appraisal costs were associated with reduced failure cost (Cokins, 2006).

The fifth category is quality improvement action. This category is related to how the company organizes and maintains the improvement processes, from sporadic actions to organized and sustained actions over time (Crosby, 1979, 1996). As of the third maturity level, this category introduces the concept of "multi-steps program". However, since the appearance of the QMMG (Crosby, 1979, 1996), different approaches of how to carry out the improvement processes have been developed. The most popular nowadays are the following Six Sigma, Lean and TOC, better known as "improvement methodologies", where the improvement focus is on reducing variability, waste reduction, and constraint management, respectively.

Research Question and Hypothesis

Although there has been an interest in the development of maturity models (Becker, Niehaves, Pöppelbuß, and Simons, 2010), to date there has not been developed one focused on quality management, so it is important to evaluate a structured model of quality practices that have as a moderating variable the level of maturity of quality management. In spite of the existence of multiple investigations of the impact of QM practices on the performance of companies, these have directly analyzed (a) the effect of each practice versus the performance, (b) the relations of the QM practices between them, without considering their grouping as infrastructure or core quality management practices (Kaynak, 2003) and (c) In cases where the relationship between infrastructure practices and core practices has been demonstrated, the relationships between the QM practices that composed them have not been analyzed (Xingxing, 2009), Due to the above, the possibility of building a maturity model is limited by not having clear relationships between the variables in this way (Pöppelbuß and Röglinger, 2011).

In view of the above, it is necessary to make an empirical analysis of the relationships

between the QM practices grouped as infrastructure and core and their final relationship with performance, as presented in Figure 1. At the same time, it is necessary to demonstrate whether the level of maturity influences the relationships described, because both elements are part of the basic principles for the design of a maturity model (Pöppelbuß and Röglinger, 2011). Although both objectives are related, separate question have been proposed for each of them, as shown below.

(1) What is the structural relationship between infrastructure QM practices and core QM practices versus operational performance in manufacturing industry?
(2) Quality management maturity moderates the relationship between key QM practices and operational performance?

In attempting to validate the model of structural relationships presented in Figure 1, a first group of hypotheses has been developed based on each relationship presented. At the same time, in order to evaluate the contingent effect of quality management maturity on these relationships (Sousa and Voss, 2002), a second hypothesis has been praised as follows.

The first hypotheses group shows the possible relationship between key quality management practices. This group is divided into eight hypotheses in order to identify if one or more significant relationship exist:

H1a: Strategy quality planning in quality management is positively related to human resources management. The importance of Strategic Quality Planning as a QM practice has been highlighted by international standards and models such as the ISO 9001:2015 standard and Malcolm Baldrige Award. This QM practices includes the vision and mission statements of the organizations, as well as the formulation of the quality policy (Ebrahimi and Sadeghi, 2013), to determine the critical elements and strategic action plans, therefore their

relationship with the actions taken in the field of human resources management are related to the allocation of resources and achievement of objectives.

H1b: Strategy quality planning in quality management is positively related to supplier quality management. Long-term relationships and the creation of cooperation channels with strategic partners are key elements in the adequate supplier quality management (Kaynak, 2003), which allow to obtain advantages in both local and international market, when they are involved in the improvement of processes (Yeung, 2008)

H1c: Top management commitment and leadership is positively related to human resources management. This relationship has been studied in various contexts where it was concluded that Top management commitment and leadership influences performance indicators through other QM practices (Anderson et al., 1994; Flynn et al., 1995; Kaynak, 2003; Sanchez and Martinez, 2004). In the particular case of its relationship with Human resources management, it was studied by Kaynak (2003) who demonstrated a relationship with training and employee relations as part of the infrastructure practices.

H1d: Top management commitment and leadership is positively related to customer focus and satisfaction. The commitment to customer satisfaction comes from top management, which it is reflected through direct actions to improve the processes and human resources (ISO 9001, 2015). Nair (2006) conducted a meta-analysis where he demonstrated the relationship of these elements.

H1e: **Human resources management is positively related to process management**. Anderson et al. (1994) proposed that an organization that simultaneously encourages cooperation and learning can help in the implementation of process management practices, as well as other studies have incorporated the relations that exist between these two variables (Kaynak, 2003), as well as recent studies have highlighted the influence of unsupportive

organizational culture and resistance to change as factors affecting the implementation of the TQM (Sadikoqlu and Zehir, 2008).

H1f: Human resources management is positively related to quality information and analysis. The capacity to process and to analyze information is based on the use of statistical skills that must be developed in the people, reason why a suitable approach in the human resource management is essential in the development of this QM practice (Ahire and Dreyfus, 2000; Wong, Tseng and Tan, 2014). Furthermore, the same relationship was analyzed by Kaynak (2003), who determined a positive impact between training and employee relations with quality data and reporting.

H1g: **Human resources management is positively related to customer focus and satisfaction**. The Human resource management is recognized like one of the most important elements for the success of the implementation of QM practices (Kekäle, Fecikova, & Kitaigorodskaia, 2004; Gadenne & Sharma, 2009). For that reason, this QM practice should be considered a key element in the QM infrastructures practices. In particular, the empowerment of the workforce has demonstrated to have a positive impact on the customer satisfaction (Schneider, Yost, Kropp, Kind and Lam, 2018).

H1h: **Supplier quality management is positively related to process management**. The Supplier quality management has allowed organizations to ensure an adequate supply of materials, in quality and time, which has improved the reliability of achieving controlled processes and compliant products (Juran, Gryma, and Bingham, 2005). A source of support for achieving better performance in companies is having suppliers that have managed to implement improvement plans that accompany the growth of their customers (Ebrahimi and Sadeghi, 2013). Finally, a positive relationship has been found when the provider is involved in cooperative programs and long-term relationships (Kaynak, 2003).

The second part of the hypotheses shows the possible relationship between key quality

management practices and performance variable. This group is divided into four hypotheses in order to identify if one or more significant relationships exist:

H1i: Process management is positively related to operational performance. The relationship between process management and operational performance has been addressed in different studies that showed the existing interrelation with customer satisfaction and senior leadership (Zhang, Kang, and Hu, 2018), as well as the relationship that exists between culture organization, process management and company performance (Wong, Tseng and Tan, 2014). Nair (2005) demonstrated, through a Meta-analysis of the studies related to the QM practices, the relationship between Process Management and operational performance based on the studies of Flynn et al. (1995) and Kaynak (2003).

H1j: Quality information and analysis is positively related to process management. The development of the capacity for data analysis has allowed the creation of more complex models that allow the empowerment of decision making based on information (Sadikoglu and Zehir, 2010), in this way the so-called big data and business analytics are considered as elements of the contemporary management, due to its impact on financial and operations results (Stofkova, Stricek and Stofkova, 2016). In past studies, the relationship of this QM practices with the process management was evidenced, ratifying the principles proposed by Deming and Juran (Kaynak, 2003).

H1k: Quality information and analysis is positively related to customer focus. The levels of compliance with the specifications, rework and costs of quality are important elements for decision making regarding the process management, but equally important or even more is the quality information of the products and their relationship with the focus on the client, especially considering the importance of these measurements being a primary source of opportunities for improvement. In the particular, for example, customer surveys are one of the primary sources of product quality evaluation, so the way the organization

obtains this information in opportunity and detail impacts on the customer focus (Birch-Jensen, Gremyr, Hallencreutz and Rönnbäck, 2018).

H1l: Customer focus and satisfaction is positively related to operational performance. The importance of understanding customer requirements and guiding the organization towards compliance and improvement is an important element to achieve the organization's objectives (Jamali, Ebrahimi and Abbaszadeh, 2010). The relationship of this QM practices has been documented in multiple studies in both productive organizations and services (Nair, 2005, Jaca and Psomas, 2015).

The second hypothesis shows the possible existence of a contingency effect for the quality management maturity level:

H2: There is a contingency effect for the quality management maturity level variable. Sousa and Voss (2002), evidence the contradictory results about the impact of QM practices on the performance results of organizations and propose to include as a contiguous variable the difference stages of QM practices. The Quality Management Maturity Grid proposed by Crosby (1979, 1996) will be taken as the measurement model, so the overall effect of the maturity level will be evaluated, as well as the effect for each of the five dimensions contained in the mentioned model.

Methods

The paradigm used in this study was post-positivist because it was focused on identifying and assessing the effect of independent variables and dependent variables, the key practices in quality management into operation performance level, along with the quality maturity level as a contingency variable. Regarding the relationship to be measured, it implies the knowledge of the maturity stage of the quality management in the organization, and it is important that people taking the surveys have a knowledge of the quality management

system of the company and the level of the results obtained in the different categories raised in the maturity levels of quality (Crosby, 1979, 1996). For these reasons, the study was address manager positions that have influence, responsibility and decision-making capacity on quality management, such as general manager, operation managers or quality manager (Păunescu, and Acatrinei, 2012).

Population and Sample

Industrial companies in Peru can be divided into different categories, (a) quantity of employees, (b) classification into micro, small, medium or large companies, (the classification in Peru is about annual sales, the medium company has annual sales between US$ 2'1500,000 and 2'900,000 and large company has annual sale more than US$2'900,000) and (c) property public or private. For the present investigation, micro and small companies were excluded from the population, because this may limit the possibility of interacting with providers, hiring personnel in stable conditions, training investment capacity, among others. Under the mentioned conditions the study population was 1610 companies and initially 169 responses were obtained, of which 10 surveys were discarded because they did not belong to the objective positions or functions of the companies. Of the remaining 159 responses, 11 additional samples were discarded for reporting atypical data. Finally, 148 valid responses were registered, generating a response rate of 9.1%, of which 42% had between 51 and 250 employees, 23% between 251 and 500 employees and 35% more than 500 employees. With respect to the size of the companies, the sample was divided into 50 medium company (8.3% of its population) and 98 large company (9.7% of its population).

Instrumentation

For the development of the instrument, that was used in this research, took as reference the instruments used in the past (a) Saraph et al., (1989), (b) Flynn, Schroeder and Sakakibara

(1994) (c) Ahire, Golhar, and Walter (1996), and (d) Grandzol and Gershon (1998) and compared the content of each practice used to determine which practices can be associated with the names described by Ebrahimi and Sadeghi (2013). In Table 1, there is a summary of the connection of each one and as it can be appreciated, most of these instruments show common elements that must be analyzed for the selection of each section of the instruments to be used in this investigation, considering the conclusions given by Motwani (2001), along with the references implementing the same instruments in other contexts or investigations.

Analysis and Results

Validity and Reliability

The Descriptive statistics and correlations for each factor is shown in table 2 and the internal consistency measurement is carried out through Crombach alpha, having as acceptance criteria values higher than a 0.7 (Saraph et al., 1989), in this case all constructs had values above 0.8 which validates the reliability of the test, the results are shown in Table 3. With regard to Validity, Saraph et al. (1989) considered that there are three validation types that are generally used (a) content validity, (b) criterion related validity, and (c) construct validity. However, Ahire et al. (1996) adds the following (a) convergent validity, and (b) discriminant validity. They mentioned the importance of having verified one dimensionality and statistical reliability to carry out any type of construct validity, for it was realized an exploratory factor analysis using principal component extraction with varimax rotation separately performed for infrastructure practices and core practices. For the infrastructure practices, the result validates the four factors (for eigenvalues above 1), with a KMO index value of 0.930 and a Barlett p-Value sphericity test result of 0.000. For the core practices validates the three factors (for eigenvalues above 1), with a KMO index value of 0.936 and a Barlett p-Value sphericity test result of 0.000.

Saraph et al. (1989) mentions that content validation is a non-numerical approach

determined by the researcher in function of the literary review and experts' evaluation. For this research, key practices of quality management have been obtained through a literary review of prior researches (Ebrahimi and Sadeghi, 2013). The construct validity was evaluated through the analysis of the factor, considering as an acceptable loading factor the value of 0.35 (Hair, Black, Babin, Anderson, and Tatham, 2006), as shown in Table 3 all factors loading were above 0.7.

The software Amos® was employed to test the measurement models and the research model. As proposed by Kaynak (2003), the following fit indices were used (a) the ratio of $\chi 2$ to degree of freedom (b) Root Mean Square Error of Approximation (RMSEA), (c) the Akaike's Information Criterion (CAIC), (d) the Parsimony Goodness-of-Fit Index (PGFI), (e) the Parsimony Normed Fit Index (PNFI), and (f) the Comparative Fit Index (CFI). As shown in Table 4, the model's fit indexes are validated. The normality, linearity, and homoscedasticity were tested and confirmed for the variables used in the measurement models. During the estimation of the measurement models proposed the modification indices and standardized residual were revised to obtain a better-fitted model (Byrne, 1998).

Findings

Relation between Key quality management practices and operational performance

The primary purpose for this research was to investigate the relationships between quality management practices and maturity levels under the model presented in Figure 1. Ebrahimi and Sadeghi (2013) determined that seven QM practices are the key practices, therefore in this research study the relationships between these variables, with the objective of determining a baseline of practices that allow the development of a model of maturity in quality management.

The result of the proposed model is shown in Figure 2, where we can see that three

hypotheses do not present a statistically significant relationship, these are (a) H1a: Strategy quality planning in quality management (SQPQM) is positively related to human resources management (HRM), (b) H1g: Human resources management is positively related to customer focus and satisfaction (c) H1h: Supplier quality management is positively related to process management. In the case of hypothesis H1a, although the model does not show a significant relationship between SQPQM and HRM, there is a high significant covariance between SQPQM and TMCL, which demonstrates the importance of this practice of quality in the model of infrastructure practices. In the case of core practices, the hypotheses H1h cannot be concluded that there is a statistically significant relationship because it has a p-Value value greater than 10%, but on the contrary, the H1e shows a significant relationship given that the competencies of the personnel do affect the process management, this is consistent with Kaynak (2003). The model fit assessment is shown in Table 4, where it can be validated that the model meets the requirements set by the authors Bollen (1989), Hair et al (2006), Byrne (2013), Joreskog and Sorbom (1993), Mulaik et al. (1989).

There were no suggestions of additional relationships between the latent variables of the model, therefore the order of causality of the model is correct, as well as the approach about relationship between infrastructure practices and core practices. This approach determines that there are QM practices that are necessary to develop as support elements for other QM practices that have a direct impact on the performance of organizations, even though the practice supplier quality management has had no impact on some of the core QM practices for which this point will be discussed in the conclusion section.

Contingency effect for the quality management maturity level

In order to evaluate the effect of quality management maturity level on the construction of QM practices and the performance operation, the maturity level of the company was calculated as a result of the simple average of the valuations of the five maturity levels of each category

(Crosby, 1979, 1996). For the purpose of generating comparison groups two evaluation levels were determined, values greater than or equal to 3.5 maturity level values were assigned the high category, and values less than 3.5 maturity level values were assigned the low category. With the factor of quality management maturity level as contingency factor a run is realized in the Amos® obtaining the results shown in the Table 5. As can be observed, in the case of the low maturity level, only the hypotheses related to QM practices infrastructure (H1c, H1d, H1e and H1f) have a positive impact on the proposed model; on the contrary, it is evident that all the relationships have a positive and statistically valid effect with respect to the high maturity level. In order to perform a multiple group analysis between the high maturity level versus the low maturity level, it was analyzed whether different sets of path coefficients are invariant (if the coefficients (Wi) of each relationship are the same for both groups), for this purpose, set of multiple restrictions were defined (Wi low level = Wi high level) in the hypothesis coefficients (a) H1c (b) H1d (c) H1e (d) H1f (e) H1k (f) H1j (g) H1i and (h) H1l to obtain a more restricted final model, the analysis will be performed by nested model comparisons (Koufteros and Marcoulides, 2006). The result shows that the difference is significant between the two models as we can see in the Table 6, where the test result gives a p-Value equal to zero. Likewise, the results of the differences between the fit indicators of the model (NFI, IFI, RFI and TLI), which range from 0.016 to 0.024, are shown.

Contingency effect for each maturity category of QMMG.

The result of nested model comparison between low and high maturity level for each of the six categories shows that the difference is significant, showed in the Table 7, where the test result gives a p-Value less than 0.05 in all cases. Likewise, the results of the differences between the fit indicators of the model (NFI, IFI, RFI and TLI), have a range from 0.003 to 0.012, which are lower than those shown when comparing the overall maturity level of the company.

In particular the contingency effect for “cost of poor-quality” and “quality improvement action” category support the concept that investing in quality management generates quantifiable benefits as indicated by Crosby (1979, 1996) and as in the other categories the result of nested model comparison shows that the difference is significant between path coefficients (hypothesis 2).

Discussion

One of the proposed objectives was to demonstrate the multidimensional construct dividing the QM practices into two elements (a) core QM practices and (b) infrastructure QM practices, through the first hypotheses group (from H1b to H1f) these purposes were accomplished, validating past studies conducted by Sousa and Voss, (2002) and Kaynak (2003), as well as in the past by other authors compiled by Sousa and Voss (2008). The particular contribution in this sense is given by the validation of the model of structural relations developed (figure 1) for the QM practices presented by Ebrahimi and Sadeghi (2013), this will allow the development of quality management maturity models for the manufacturing industry that will serve as a guide to optimize the use of resources in the development and improvement of quality management (Pöppelbuß, and Röglinger, 2011). The infrastructure practices proposed in Figure 1 (a) TMCL, (b) SQPQM, (c) HRM and (d) SQM, allow to establish a set of necessary practices to develop and to support the core practices. In particular given the level of correlation found by a) TMCL and (b) SQPQM establish the starting point for the development of a mature model in quality management under the top-down approach. The relationship model of the SQPQM, TMCL and HRM practices show the basic elements of the Infrastructure practices category, so these three practices become the supporting elements of quality management systems as proposed by the ISO 9001:2015 standard (ISO, 2015), the Malcom Baldrige Aware model (NIST, 2017) and the authors as Deming (1986) and Juran (Juran, Gryna, and Bingham, 2005). With the

inclusion of context assessment, business risks and expanded scope in the vision of leadership in quality management systems the ISO standard has deepened its approach to the use of these quality practices as the basis for the development of operational excellence.

The causal relationships between infrastructure practices and core practices allow to conclude that it is not enough to develop core practices to achieve a positive impact on performance, which reinforces the holistic view of relationships in QM practices proposed by Kaynak (2003). With respect to H1g that seeks the relationship between HRM and CFS does not show a significant relationship, this may be due to the approach that the company gives to the quality manufacturing strategy, where for a low or reduced focus on this topic, evidence of little impact has been found in the CFS (Youndt, Snell, Dean, and Lepak, 1996). Strong relationships have usually been found for issues related to the impact of HRM on people's productivity (Youndt, Snell, Dean, and Lepak, 1996). In the case of H1h, on the relationship between SQM and PM as a construct to explain the relationship between QM practices and operational performance, multiple studies and confirmations of the existing relationships have been carried out, but the studies still need to be extended to determine how to strengthen this relationship and if the impact is really significant (Foster, 2008). Given that the SQM practice is based on the way in which organizations collaborate in the supply chain to improve operational performance (Bowersox, Closs, Cooper, 2007), it is evident that the model of collaboration in the Peruvian industrial sector does not yet have a positive impact on process management or operation performance. This result presents an opportunity to deepen the relationship model in the Peruvian industry's supply chain with a view to determining what actions can be implemented to improve this impact.

With regard to core QM practices, the effect of QIA on CFS and PM elements is demonstrated, which is directly related to the evolution of business intelligent and especially

to the capacity of business analytics in the development of improvement models and customer satisfaction in accordance with what is known as Industry 4.0. (Foidl and Felderer, 2015), topics that are still in a germinal stage in most organizations (a) Smart Factory, (b) Cyber-Physical System, (c) Internet of Things (IoT) and (d) Internet of Services (IoS) (Lasi, Fettke, Kemper, Feld, and Hoffmann, 2014).The comparative result of the positive effect of the maturity level as a contingency effect concludes that work on the development of the maturity level of quality management makes it possible to ensure the generation of benefits (Crosby 1996). All categories of Crosby's maturity model (1979, 1996) have an impact on the relationships between QM practices. In particular, the category shows a greater difference is Quality Improvement Action, which allows to conclude that this element is the one that most generates a contingent impact on the relationship between maturity levels and the operational performance of organizations. This category is related to the capacity of companies to adequately implement continuous improvement models such as lean six sigma.

Although there are no global indicators on the levels of maturity in quality management, it can be deduced that average levels of medium-sized companies in the order of 3.04 and 3.69 for large companies mark an important opportunity for development and growth. It also highlights the result of the first category of maturity levels of quality management where large companies have an average value greater than 4.0, this allows the relationship of the main functions of senior management as vision, mission, strategic plan and quality culture (ISO 2015) are more widespread and accepted through the generation of a culture oriented to these principles (Pun and Jaggernath-Furlonge, 2012). In this way, the importance of developing maturity models for this management field is validated, as they exist in other areas such as project management (Grant, and Pennypacker, 2006), software development with the CMMI model (Gibson, Goldenson, and Kost, 2006), business models (Fisher, 2004), among others.

Implications

Considering that the effect of the development of the maturity level in organizations have positive results in the performance of the company implies that a long-term development process must be traced, with defined milestones and sequenced quality management practices. In the same way, it is important to implement a structured improvement model and not just isolated actions. This could imply that certifications such as ISO 9001:2015 do not ensure the achievement of benefits if companies are not at maturity levels above level 3 so the use of maturity measurement models as proposed by ISO 9004:2018 (ISO, 2018) becomes a way to measure and establish a plan of action over time.

Limitations and Future Research

Although the present study has provided theoretical and practical implications, there are some limitations of this research that need to be highlighted. First, in spite of having included the entire population in the sending of the questionnaire, the research participants were volunteers so they might not really represent the study population. Second, the scope of the study was limited to the impact of QM practices on the operational performance, so it is not possible to generalize that the results can be extrapolated to the financial or global performance of the organization. Third, the results of this study are limited by the effect of the digital transformation, in particular by the implementation of changes towards the fourth industrial transformation, called industry 4.0, which could redefine the concepts of continuous improvement and data analysis in the near future (Foidl, and Felderer, 2015).

It is important to develop a conceptual framework for the development of a maturity model in quality management. For this purpose, it is recommended to take as a reference the evaluation model proposed by ISO 9004 (ISO, 2018), related models such as the maturity models in process management (Cronemyr and Danielsson, 2013). A particular case is the

CMMI model, which has had multiple applications and references such as maturity models in the management of processes and good practice developments (Baldassarre, Caivano, Pino, Piattini and Visaggio, 2012) and therefore the principles and bases developed by this maturity measurement and management model should be taken into consideration for the development of the quality management model itself.

It is recommended to carry out future investigations to deepen the practices of quality to be promoted in the development of maturity for medium-sized companies. Similar studies have been developed on the impact of QM practices on the performance of the organization for small and medium companies, but these investigations have not contemplated the development of the maturity level as a contingency variable (Sıtkı and Aslan, 2012).

References

Ahire, S., Golhar, D., and Waller, M. 1996. Development and validation of TQM implementation constructs. *Decision Sciences*, *27*(1), 23-56.

Ahire, S. L., and Dreyfus, P. 2000. The impact of design management and process management on quality: an empirical investigation. *Journal of Operations Management*, *18*(5), 549-575.

Anderson, J., Rungtusanatham, M. and Schroeder, R. 1994. A Theory of quality management underlying the Deming management method, *Academy of Management Review, 19*(3)*,* 472-509

Bakotić, D., and Rogošić, A. 2017. Employee involvement as a key determinant of core quality management practices. *Total Quality Management & Business Excellence*, *28*(11-12), 1209-1226

Baldassarre, M., Caivano, D., Pino, F., Piattini, M., and Visaggio, G. 2012. Harmonization of ISO/IEC 9001: 2000 and CMMI-DEV: from a theoretical comparison to a real case application. *Software Quality Journal*, *20*(2), 309-335.

Becker, J., Niehaves, B., Pöppelbuß, J. and Simons, A. 2010. Maturity models in IS research. *In Proceedings of the European Conference on Information Systems (ECIS), Pretoria.*

Birch-Jensen, A., Gremyr, I., Hallencreutz, J., and Rönnbäck, Å. 2018. Use of customer satisfaction measurements to drive improvements. *Total Quality Management & Business Excellence*, 1-14.

Bollen, K. A. 1989. *Structural equations with latent variables*. John Wiley and Sons.

Bowersox, D., Closs, D. and Cooper, M.B., 2007. *Supply chain logistics management*. McGraw Hill, New York, NY.

Byrne, B. M. 1998. *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: Basic concepts, applications, and programming*. Psychology Press.

Carmines, E. and McIver, J. 1981. Analyzing models with unobserved variables. In: Bohrnstedt, G.W., Borgatta, E.F. (Eds.), *Social Measurement: Current Issues. Sage, Beverly Hills, CA*, pp. 65–115.

Cronemyr, P., and Danielsson, M. 2013. Process management 1-2-3–a maturity model and diagnostics tool. *Total Quality Management & Business Excellence*,*24*(7-8), 933-944.

Crosby, P. 1979. *Quality is free, the art of making quality certain*. New York, NY: Mc Graw-Hill.

Crosby, P. B. 1996. *Quality is still free: making quality certain in uncertain times*. McGraw-Hill Companies.

Deming, W. 1986. Out of the crisis, Massachusetts Institute of Technology. *Center for advanced engineering study, Cambridge, MA*, *510*.

Detert, J. R., Schroeder, R. G., and Mauriel, J. J. 2000. A framework for linking culture and improvement initiatives in organizations. *Academy of management Review, 25*(4), 850-863.

Donaldson, L. 2001. *The contingency theory of organizations*. Sage.

Ebrahimi, M. and Sadeghi M. 2013. Quality management and performance: An annotated review. *International Journal of Production Research, 51*(18), 5625 – 5643.

Evans, J. R., and Lindsay, W. M. 2013. *Managing for quality and performance excellence*. Cengage Learning.

Fisher, D. M. 2004. The business process maturity model. A practical approach for identifying opportunities for optimization. *Business Process Trends*, *9*(4), 11-15.

Flynn, B., Schroeder, R., and Sakakibara, S. 1994. A framework for quality management research and an associated measurement instrument. Journal of Operations management, 11(4), 339-366.

Flynn, B. B., Schroeder, R. G., and Sakakibara, S. 1995. The impact of quality management practices on performance and competitive advantage. Decision sciences, 26(5), 659-691.

Foidl, H., and Felderer, M. 2015. Research challenges of industry 4.0 for quality management. In *International Conference on Enterprise Resource Planning Systems* (pp. 121-137). Springer, Cham.

Foster Jr, S. 2008. Towards an understanding of supply chain quality management. *Journal of operations management*, 26(4), 461-467

Gadenne, D., and Sharma, B. 2009. An investigation of the hard and soft quality management factors of australian SMEs. *International Journal of Quality & Reliability Management*, *26*(9), 865-880.

Gibson, D., Goldenson, D., and Kost, K. 2006. Performance results of CMMI-based process improvement. *Software Engineering Institute*. (CMU/SEI-2006-TR-004). Pennsylvania, PA: Carnegie Mellon University.

Grant, K., and Pennypacker, J. 2006. Project management maturity: An assessment of project management capabilities among and between selected industries. *Engineering Management, IEEE Transactions on*, *53*(1), 59-68.

Grandzol, J. R., and Gershon, M. 1998. A survey instrument for standardizing TQM modeling research. *International Journal of Quality Science*, *3*(1), 80-105.

Hair, J., Black, W., Babin, B., Anderson, R., and Tatham, R. 2006. Multivariate data analysis 6th Edition. *New Jersey: Pearson Education*.

International Organization for Standardization 2018. *International ISO 9004 managing for the sustained success of an organization -- A quality management approach*. Geneva, Switzerland: ISO/TC 176/SC 2.

International Organization for Standardization 2015. *Norma Internacional ISO 9000 - quality management systems -- fundamentals and vocabulary*. Geneva, Switzerland: ISO/TC 176/SC 1.

Jaccard, J. and Wan, C. 1996. *LISREL approaches to interaction effects in multiple regression*. Sage University Paper Series on Quantitative Applications in the Social Sciences, 07–114. Sage, Thousand Oaks, CA.

Jamali, G., Ebrahimi, M., and Abbaszadeh, M. A. 2010. TQM implementation: an investigation of critical success factors. In *Education and Management Technology (ICEMT), 2010 International Conference on* (pp. 112-116). IEEE.

Jöreskog, K. G., and Sörbom, D. 1993. *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Scientific Software International.

Juran, J., Gryma, F. and Bingham R. 2005. *Quality control handbook 3ra Ed*. Barcelona, Spain: Editorial Raverté.

Kaynak, H. 2003. The relationship between total quality management practices and their effects on firm performance. *Journal of Operations Management*, *21*(4), 405-435.

Kekäle, T., Fecikova, I., & Kitaigorodskaia, N. 2004. To make it'total': Quality management over subcultures. *Total Quality Management & Business Excellence*, *15*(8), 1093-1108.

Koufteros, X., & Marcoulides, G. A. 2006. Product development practices and performance: A structural equation modeling-based multi-group analysis. *International Journal of Production Economics*, *103*(1), 286-307

Kulisek, D. G. 2007. Full-time quality manager or part-time quality consultant? Quality Progress, 40(7), 61-63.

Lasi, H., Fettke, P., Kemper, H., Feld, T., and Hoffmann, M. 2014. Industry 4.0. *Business & Information Systems Engineering*, *6*(4), 239-242.

Motwani, J. 2001. Critical factors and performance measures of TQM. *The TQM magazine*, *13*(4), 292-300.

Myung S. 2009. Process Quality Levels of ISO/IEC 15504, CMMI and K-model. *International Journal of Software Engineering and Its Applications, 3*(1), 33-42.

Mulaik, S.A., James, L.R., Van Altine, J., Bennett, N., Lind, S., Stilwell, C.D., 1989. Evaluation of goodness-of-fitness indices for structural equation models. Psychological Bulletin 105, 430– 445.

NIST 2017. *2017-2018 Baldrige excellence framework, A system approach to approach to improving your organization's performance (Business/Nonprofit)*. Gaithersburg, MD: U.S. Department of Commerce, National Institute of Standards and Technology.

Păunescu, C., and Acatrinei, C. 2012. Managing maturity in process-based improvement organizations: a perspective of the Romanian companies. *Journal of Business Economics and Management*, *13*(2), 223-241.

Pöppelbuß, J., and Röglinger, M. 2011. What makes a useful maturity model? a framework of general design principles for maturity models and its demonstration in business process management. In *Ecis* (p. 28).

Pun, K. and Jaggernath-Furlonge, S. 2012. Impacts of company size and culture on quality management practices in manufacturing organizations. *TQM Journal, 24*(1), 83-101

Rungtusanatham, M., Forza, C., Filippini, R., and Anderson, J. C. 1998. A replication study of a theory of quality management underlying the Deming management method: insights from an Italian context. *Journal of Operations Management*, *17*(1), 77-95.

Sadikoglu, E., and Zehir, C. 2010. Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. *International journal of production economics*, *127*(1), 13-26.

Sahoo, S., and Yadav, S. 2018. Total quality management in Indian manufacturing SMEs. *Procedia Manufacturing*, *21*, 541-548.

Sanchez C. & Martinez, A. 2004. Quality management practices in the purchasing function: An empirical study. *International Journal of Operations & Production Management*, *24*(7), 666-687.

Saraph, J. V., Benson, P. G., and Schroeder, R. G. 1989. An instrument for measuring the critical factors of quality management. *Decision sciences*, *20*(4), 810-829.

Schneider, B., Yost, A. B., Kropp, A., Kind, C., and Lam, H. 2018. Workforce engagement: What it is, what drives it, and why it matters for organizational performance. *Journal of Organizational Behavior*, *39*(4), 462-480.

Sfreddo, L. S., Vieira, G. B. B., Vidor, G., & Santos, C. H. S. 2018. ISO 9001 based quality management systems and organisational performance: a systematic literature review. *Total Quality Management & Business Excellence*, 1-21.

Sıtkı İlkay, M., and Aslan, E. 2012. The effect of the ISO 9001 quality management system on the performance of SMEs. International Journal of Quality & Reliability Management, 29(7), 753-778.

Sousa, R., and Voss, C. A. 2002. Quality management re-visited: a reflective review and agenda for future research. *Journal of operations management*, *20*(1), 91-109.

Sousa, R., and Voss, C. A. 2008. Contingency research in operations management practices. *Journal of Operations Management*, *26*(6), 697-713.

Voss, C., Blackmon, K. L., Cagliano, R., Hanson, P., and Wilson, F. 1998. Made in Europe: small companies. *Business Strategy Review*, *9*(4), 1-19.

Wiele T., Brown A., Millen R. and Whelan D. 2000. Improvement in organizational performance and self-assessment practices by selected american firms, *Quality Management Journal, Vol* (7)*,* 8-22.

Wong, W., Tseng, M., and Tan, K. 2014. A business process management capabilities perspective on organization performance. *Total Quality Management & Business Excellence*, *25*(5-6), 602-617.

Yeung, A. C. 2008. Strategic supply management, quality initiatives, and organizational performance. *Journal of Operations Management*, *26*(4), 490-502.

Youndt, M., Snell, S., Dean Jr, J., and Lepak, D. 1996. Human resource management, manufacturing strategy, and firm performance. Academy of management Journal, 39(4), 836-866

Zhang, H., Kang, F., and Hu, S. Q. 2018. Senior leadership, customer orientation, and service firm performance: the mediator role of process management. *Total Quality Management & Business Excellence*, 1-16.

Zu, X. 2009. Infrastructure and core quality management practices: how do they affect quality?. *International Journal of Quality & Reliability Management, 26*(2), 129 -149.

Zu, X., Fredendall, L., and Douglas, T. 2008. The evolving theory of quality management: the role of Six Sigma. *Journal of operations Management*, *26*(5), 630-650.

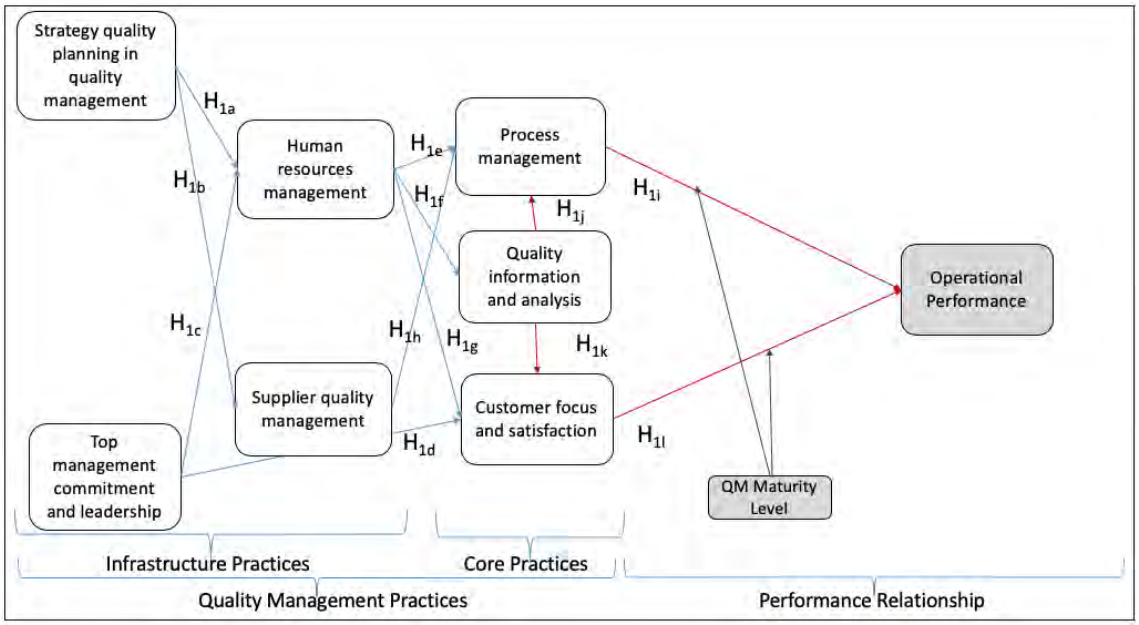


Figure 1. Proposed relationship between quality management practices, performance and maturity quality management, a contingency approach

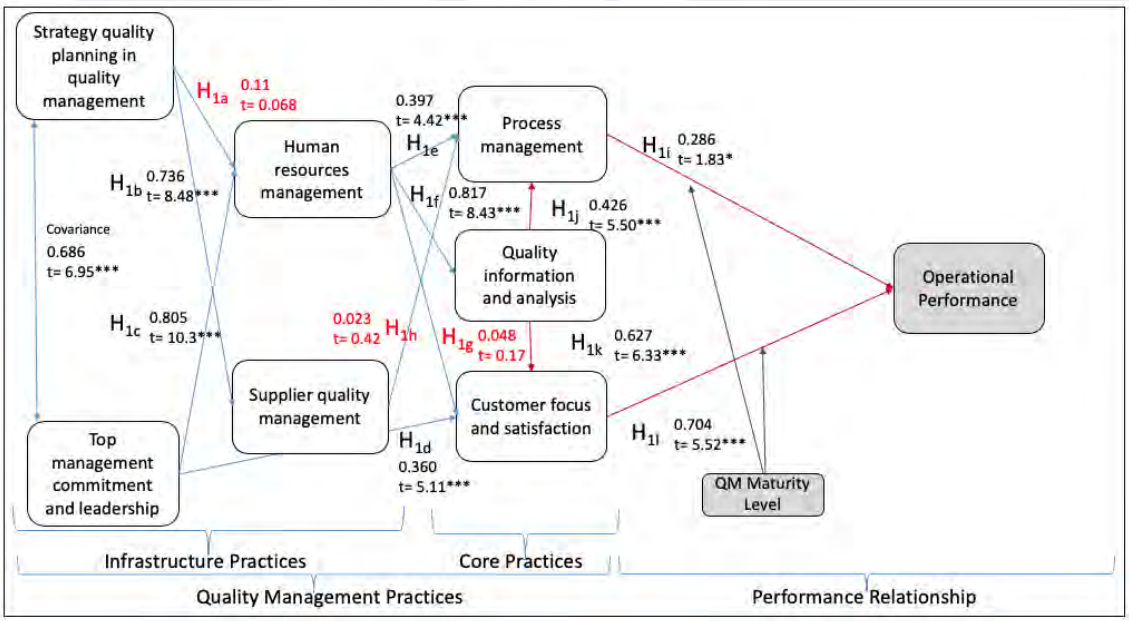


Figure 2. Relationship between the maturity level of key quality management practices. Regression weights. *** P< 0.01, ** P< 0.05, * P< 0.10

Table 1. Instruments for Measuring Quality Management Practices

Practices in QM	Saraph, Benson, and Schroeder (1989)	Flynn, Schroeder, and Sakakibara (1994)	Ahire, Golhar, and Walter (1996)	Grandzol and Gershon (1998)
Human resources management	Employee relations	Workforce Management	Employee	Employee fulfilment
Customer focus and satisfaction		Customer Involvement	Customer Focus	Customer focus
Top management commitment and leadership	Top management and quality policy	Top Management Support	Top Management Commitment	Leadership
Process Management	Process Management	Process Management		Process Management
Supplier quality management	Supplier QM	Supplier Involvement	Supplier Quality Management	
Quality information and analysis	Quality data & reporting	Quality Information	Internal Quality Information Usage	
Strategy quality planning in quality management	Top management and quality policy		SPC Usage Benchmarking	

Table 2. Descriptive statistics and correlations (n=148)

Factor	No. of Var.	Mean	SD	1	2	3	4	5	6	7
1. Top management commitment and leadership	5	3.75	1.04							
2. Human resources management	5	3.71	1.01	0.95*						
3. Quality information and analysis	5	3.40	0.87	0.75*	0.79*					
4. Process management	4	3.27	0.86	0.85*	0.90*	0.90*				
5. Customer focus and satisfaction	5	3.50	0.98	0.83*	0.83*	0.87*	0.86*			
6. Supplier quality management	4	3.68	0.96	0.73*	0.70*	0.55*	0.64*	0.61*		
7. Strategy quality planning	4	3.79	0.99	0.93*	0.89*	0.70*	0.80*	0.77*	0.78*	
8. Operational Performance	4	3.32	0.74	0.81*	0.82*	0.86*	0.86*	0.93*	0.60*	0.76*

* Indicated that correlations is significant at the 0.05 level (two tail)

Table 3. Cronbach's Alpha for the Variables in the Research Model, Average Variance Extracted (AVE) and Standardized Dimension Loading

Variable	Standardized dimen. loading	Cronbach's Alpha	Aver. Var. Extrac. (AVE)
Top management commitment and leadership		0.929	0.724
• We proactively pursue continuous improvement	0.858		
• Performance evaluation by the top-level management depends heavily on quality	0.819		
• Top-level managers allocate adequate resources toward efforts to improve quality	0.885		
• We have clear quality goals identified by top-level managers	0.853		
• At company-wide meetings top-level managers often discuss the importance of quality	0.839		
Human resources management		0.893	0.609
• All employee suggestions are evaluated	0.742		
• Resources are available for employee quality training in our plant	0.756		
• There is almost always some kind of employee quality training going on in our plant.	0.786		
• Plant managers are often involved in quality training	0.790		
• Most employees in our plant do not view each new quality seminar as "just another fad."	0.825		
Quality information and analysis		0.921	0.705
• Availability of cost of quality data in the division	0.828		
• Availability of quality data	0.882		
• Timeliness of the quality data	0.871		
• Extent to which quality data are used as tools to manage quality	0.819		
• Extent to which quality data are available to managers and supervisors	0.794		
Process management		0.881	0.656
• Preventing defective products/services from occurring is a strong attitude in this organization	0.799		
• The processes for designing new products/services in this organization ensure quality	0.808		
• Employees involved in different processes know how to use statistical process control methods	0.813		

• Numerical quotas are not the only, nor the most important, measure of an employee's perform.	0.820		
Customer focus and satisfaction		0.927	0.712
• We know our external customers' current and future requirements	0.832		
• Customer requirements are effectively disseminated and understood throughout the personnel	0.773		
• We have an effective process for resolving external customers' complaints	0.892		
• Customer complaints are used as a method to initiate improvements	0.858		
• We systematically and regularly measure external customer satisfaction.	0.859		
Supplier quality management		0.831	
• Quality is a more important criterion tan Price in selecting suppliers of the major component	0.881		
• Our supplier rating system considers the supplier´s engineering capability			
• Our supplier rating system considers the supplier´s delivery performance			
• We provide technical assistance to our suppliers of this component	0.754		
Strategy quality planning		0.926	0.745
• Extent to which the top division executive assumes responsibility for quality performance	0.826		
• Extent to which the division top management supports long-term quality improvement process	0.908		
• Extent to which the divisional top management has objectives for quality performance			
• Degree to which the divisional top management considers quality improvement as a way to increase profits	0.882 0.835		
Operational Performance		0.806	0.643
• Customer satisfaction	0.858		
• Employee morale	0.751		
• Productivity	0.796		
• Delivery in full on time to our customer	0.800		
Maturity of quality management	From 0.651 to 0.847	0.873	0.569

Table 4. SEM Model Fit

Goodness of fit statistics	Result	Recommended values for satisfactory fit
x^2/df	2.024	< 3.0 (a)
Root Mean Square Error of Approximation (RMSEA)	0.08	≤ 0.08 (b)
Akaike's Information Criterion (CAIC)	1390.3	< Saturated model and independence model (c)
CAIC for Saturated Model	3166.5	
CAIC for Independent Model	5412.3	
Parsimony Goodness-of-fit Index (PGFI)	0.627	> 0.50 (d)
Parsimony Normed Index (PNFI)	0.745	> 0.50 (d)
Comparative Fit Index (CFI)	0.903	> 0.50 (d)

(a) Bollen (1989), Carmines and McIver (1981); (b) Byrne (1998), Jaccard and Wan (1996), Joreskog and Sorbom (1993); (c) Byrne (1998), Joreskog and Sorbom (1993); (d) Byrne (1998), Mulaik et al. (1989)

Table 5. Statistic Comparison – Maturity Level Effect

Hypothesis	Maturity level: Low		Maturity level: High	
	Regression weights	t statistic	Regression weights	t statistic
H1c: Top management commitment and leadership is positively related to human resources management.	0.822	5.90 ***	0.756	6.68 ***
H1d: Top management commitment and leadership is positively related to customer focus and satisfaction.	0.246	3.19 ***	0.577	4.43***
H1e: Human resources management is positively related to process management.	0.303	2.27**	0.571	4.47 ***
H1f: Human resources management is positively related to quality information and analysis.	0.495	5.25***	0.711	3.48***
H1k: Quality information and analysis is positively related to customer focus.	-0,05	-0.39	0.541	5.38 ***
H1j: Quality information and analysis is positively related to process management.	0.144	0.68	0.313	4.38 ***
H1i: Process management is positively related to operational performance.	-0.214	-0.73	0.501	2.63 **
H1l: Customer focus and satisfaction is positively related to operational performance.	0.934	1.87*	0.315	2.85 **

(b) Regression weights. *** P< 0.01, ** P< 0.05, * P< 0.10.

Table 6. AMOS Nested Model Comparisons– Maturity Level Effect

MODEL	DF	CMIN	p-Value	Delta NFI	Delta IFI	Delta RFI	Delta TLI
Equal Loading	8	81,997	0.00	0.019	0.024	0.016	0.021

Table 7. AMOS Nested Model Comparisons– Quality Management Maturity Categories

CATEGORY	DF	CMIN	p-Value	Delta NFI	Delta IFI	Delta RFI	Delta TLI
Management Understanding and Attitude	8	30,283	0.00	0.007	0.008	0.003	0.004
Quality Organization Status Category	8	35,489	0.00	0.007	0.008	0.004	0.004
Problem Handling Category	8	22,153	0.005	0.004	0.005	0.001	0.001
Cost of Poor Quality	8	24,403	0.002	0.004	0.005	0.001	0.001
Quality Improvement Action Category	8	46,857	0.00	0.010	0.012	0.007	0.008
Total of the Organizational Quality Posture	8	29,935	0.007	0.004	0.005	0.001	0.001

Appendix A: Instrument

Question about Human Resource Management:

(a) All employee suggestions are evaluated, (b) Resources are available for employee quality training in our plant. (c) There is almost always some kind of employee quality training going on in our plant. (d) Plant managers are often involved in quality training. (e) Most employees in our plant do not view each new quality seminar or training program as "just another fad."

Question about customer focus and satisfaction:

(a) We know our external customers' current and future requirements (both in terms of volume and product characteristics). (b) These customer requirements are effectively disseminated and understood throughout the personnel. (c) We have an effective process for resolving external customers' complaints. (d) Customer complaints are used as a method to initiate improvements in our current processes. (e) We systematically and regularly measure external customer satisfaction.

Question about top management commitment and leadership:

(a) At this site we proactively pursue continuous improvement rather than reacting to crisis' 'fire-fighting'. (b) Our performance evaluation by the top-level management depends heavily on quality. (c) Top-level managers allocate adequate resources toward efforts to improve quality. (d) We have clear quality goals identified by top-level managers. (e) At company-wide meetings top-level managers often discuss the importance of quality.

Question about process management:

(a) Preventing defective products/services from occurring is a strong attitude in this organization. (b) The processes for designing new products/services in this organization ensure quality. (c) Employees involved in different processes know how to use statistical

process control methods to evaluate their processes. (d) In this organization, numerical quotas are not the only, nor the most important, measure of an employee's performance.

Question about supplier quality management:

(a) Quality is a more important criterion than Price in selecting suppliers of the major component. (b) Our supplier rating system considers the supplier´s engineering capability. (c) Our supplier rating system considers the supplier´s financial stability. (d) Our supplier rating system considers the supplier´s delivery performance. (e) We provide technical assistance to our suppliers of this component.

Question about quality information and analysis:

(a) Availability of cost of quality data in the division. (b) Availability of quality data (error rates, defect rates, scrap, defects, etc.) (c) Timeliness of the quality data. (d) Extent to which quality data (cost of quality, defects, errors, scrap, etc.) are used as tools to manage quality. (e) Extent to which quality data are available to managers and supervisors.

Question about Strategy Quality Planning in Quality Management:

(a) Extent to which the top division executive (responsible for division profit and loss) assumes responsibility for quality performance. (b) Extent to which the division top management supports long-term quality improvement process. (c) Extent to which the divisional top management has objectives for quality performance. (d) Degree to which the divisional top management considers quality improvement as a way to increase profits.

Question about Maturity level of quality management:

Attitude and understanding of the direction: (1) They do not understand quality as a management tool. They tend to blame the quality department for the "quality problems.", (2) They recognize that quality management can be helpful, but are not willing to

provide the money or the time to carry it out, (3) Going doing the quality improvement process, you learn more of quality management; It is given help and support, (4) Participation. the absolutes of quality management are understood. Recognize his personal role in giving a continued emphasis, and (5) They consider the quality management system an essential part of the company.

Organizational quality situation: (1) The quality function is hidden in the departments of engineering or production. Inspection probably not part of the organization. Emphasis on evaluation and selection, (2) A manager of the energetic quality is named, but the main emphasis is still in the evaluation and make the product. It is still part of the production or some other department, (3) The quality department falls under the senior management; any assessment is incorporated and the manager plays a role in managing the company, (4) The quality manager is an executive of the company; effective reporting of the situation and preventive action. It deals with consumer affairs and special projects, and (5) The quality manager belongs to the steering committee. The main concern is prevention. Quality leads ideas.

Handling problems: (1) Problems as they occur are facing; not resolved; inadequate definition; many shouts and accusations, (2) Teams are formed to attack the most important problems. Nobody asks long-term solutions, (3) Communication for corrective action is established. Problems faced openly and resolved in an orderly manner, (4) Problems are identified in its early stages of development. All functions are open to suggestions and improvements, (5) Except in rare cases, problems are prevented.

Quality cost as% of sales: (1) Reported: Unknown, real aprox.: 20%, (2) Reported: 3%, real aprox.: 18%, (3) Reported: 8%, real aprox.: 12%, (4) Reported: 6.5%, real aprox.: 8%, and (5) Reported: 2.5%, real aprox.: 2.5%.

Actions to improve quality: (1) There are no organized/structure activities. These activities do not understand, (2) "Motivational" short-term initiatives are attempted, (3) Implementation quality improvement methodology- six sigma, kaizen, lean, etc-, (4) Continuous with quality improvement methodology and (5) Improving quality is a normal and continuous activity.

Summary of the position of the company regarding the quality: (1) "We do not know why we have problems with quality.", (2) "It is absolutely inevitable to have always problems with quality?", (3) "Through the commitment of management and improving the quality, we are identifying and resolving our problems.", (4) "Preventing defects routinely part of our operation.", and (5) "We know why we don´t have problems with quality."

Question about operational performance:

Customer satisfaction: (1) Sometimes meets expectation, (2) Generally meet expectation, (3) Consistently meet expectation, (4) Always meet expectation, (5) Expect exceeded delighted customers.

Employee morale: (1) Very low, (2) Low, (3) Satisfactory, (4) High, (5) Very high.

Productivity: (1) Decreasing, (2) Static, (3) Moderate improvement, (4) Consistently improving, (5) Major and significant gains.

Delivery in full on time to our customer: (1) Less than 50%, (2) 50 – 80%, (3) 81 -90%, (4) 91-96%, (5) 97-100%.

Chapter V. Conclusions and Recommendations

The primary purpose of this research was to investigate the relationship of the key QM practices proposed by Ebrahimi and Sadeghi (2013) (a) top management commitment and leadership (TMCL), (b) strategic quality planning in quality management (SQPQM), (c) human resources management (HRM), (d) supplier quality management (SQM), (e) customer focus and satisfaction (CFS), (d) process management (PM) and (f) quality information and analysis (QIA), under the model proposed in Figure 1, as well as the contingent effect of the quality management maturity level on the operational performance of the companies, this Chapter develops research findings, implications and recommendations for future research on the subject.

Conclusions

One of the proposed objectives was to demonstrate the multidimensional construct dividing the QM practices into two elements (a) core QM practices and (b) infrastructure QM practices, through the first hypotheses group (from H1b to H1f) these purposes were accomplished, validating past studies conducted by Sousa and Voss, (2002) and Kaynak (2003), as well as in the past by other authors compiled by Sousa and Voss (2008). The particular contribution in this sense is given by the validation of the model of structural relations developed (figure 1) for the QM practices presented by Ebrahimi and Sadeghi (2013), this will allow the development of quality management maturity models for the manufacturing industry that will serve as a guide to optimize the use of resources in the development and improvement of quality management (Pöppelbuß, & Röglinger, 2011). The infrastructure practices proposed in Figure 1 (a) TMCL, (b) SQPQM, (c) HRM and (d) SQM, allow to establish a set of practices necessary to develop to support the core practices. In particular given the level of correlation found by a) TMCL and (b) SQPQM establish the starting point for the development of a mature model in quality management

under the top-down approach. The relationship model of the SQPQM, TMCL and HRM practices show the basic elements of the Infrastructure practices category, so these three practices become the supporting elements of quality management systems as proposed by the ISO 9001:2015 standard (ISO, 2015), and the Malcom Baldrige Aware model (NIST, 2017) and the authors as Deming (1986) and Juran (Godfrey, 1999). With the inclusion of context assessment, business risks and expanded scope in the vision of leadership in quality management systems the ISO standard has deepened its approach to the use of these quality practices as the basis for the development of operational excellence.

The causal relationships between infrastructure practices and core practices allow to conclude that it is not enough to develop core practices to achieve a positive impact on performance, which reinforces the holistic view of relationships in QM practices proposed by Kaynak (2003). With respect to H1g that seeks the relationship between HRM and CFS does not show a significant relationship, this may be due to the approach that the company gives to the quality manufacturing strategy, where for a low or reduced focus on this topic, evidence of little impact has been found in the CFS (Youndt, Snell, Dean, & Lepak, 1996). Strong relationships have usually been found for issues related to the impact of HRM on people's productivity (Youndt, Snell, Dean, & Lepak, 1996). In the case of H1h, on the relationship between SQM and PM as a construct to explain the relationship between QM practices and operational performance, multiple studies and confirmations of the existing relationships have been carried out, but the studies still need to be extended to determine how to strengthen this relationship and that the impact is really significant (Foster, 2008). Given that the SQM practice is based on the way in which organizations collaborate in the supply chain to improve operational performance (Bowersox, Closs, Cooper, 2007), it is evident that the model of collaboration in the Peruvian industrial

sector does not yet have a positive impact on process management or operation performance. This result presents an opportunity to deepen the relationship model in the Peruvian industry's supply chain with a view to determining what actions can be implemented to improve this impact.

With regard to core QM practices, the effect of QIA on CFS and PM elements is demonstrated, which is directly related to the evolution of intelligent business and especially to the capacity of business analytics in the development of improvement models and customer satisfaction in accordance with what is known as Industry 4.0. (Foidl & Felderer, 2015), topics that are still in a germinal stage in most organizations (a) Smart Factory, (b) Cyber-Physical System, (c) Internet of Things (IoT) and (d) Internet of Services (IoS) (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014).The comparative result of the positive effect of the maturity level as a contingency effect concludes that work on the development of the maturity level of quality management makes it possible to ensure the generation of benefits (Crosby 1996). As observed in Chapter 4, all categories of Crosby's maturity model (1979, 1996) have an impact on the relationships between QM practices. In particular, the category shows a greater difference is Quality Improvement Action, which allows to conclude that this element is the one that most generates a contingent impact on the relationship between maturity levels and the operational performance of organizations. This category is related to the capacity of companies to adequately implement continuous improvement models such as lean six sigma.

Although there are no global indicators on the levels of maturity in quality management, it can be deduced that average levels of medium-sized companies in the order of 3.04 and 3.69 for large companies mark an important opportunity for development and growth. It also highlights the result of the first category of maturity levels of quality management where large companies have an average value greater than 4.0, this allows the

relationship of the main functions of senior management as vision, mission, strategic plan and quality culture (ISO 2015) is more widespread and accepted through the generation of a culture oriented to these principles (Pun & Jaggernath-Furlonge, 2012). In this way, the importance of developing maturity models for this management field is validated, as they exist in other areas such as project management (Grant, & Pennypacker, 2006), software development with the CMMI model (Gibson, Goldenson, & Kost, 2006), business models (Fisher, 2004), among others.

Recommendations

As detailed in a previous conclusion, it is important to develop a conceptual framework for the development of a maturity model in quality management. For this purpose, it is recommended to take as a reference the evaluation model proposed by ISO 9004 (ISO, 2018), related models such as the maturity models in process management (Cronemyr & Danielsson, 2013). A particular case is the CMMI model, which has had multiple applications and references such as maturity models in the management of processes and good practice developments (Baldassarre, Caivano, Pino, Piattini & Visaggio, 2012; Sharifloo, Shamsfard, Motazedi & Dehkharghani, 2008) and therefore the principles and bases developed by this maturity measurement and management model should be taken into consideration for the development of the quality management model itself.

It is recommended to carry out future investigations to deepen the practices of quality to be promoted in the development of maturity for medium-sized companies. Similar studies have been developed on the impact of QM practices on the performance of the organization for SME, but these investigations have not contemplated the development of the maturity level as a contingency variable (Kumar & Antony, 2008; Sıtkı & Aslan, 2012).

For future research it is also recommended to address the contingency effect of quality management maturity for service companies given the importance of this sector in different developing countries. In this sense, there are recent studies on (a) the main QM practices that affect the performance of organizations (Jaca & Psomas, 2015; Talib & Qureshi, 2013) and (b) the impact of the six sigma model on service companies (Augusto P., & Monteiro de Carvalho, M., 2014) that could be deepened considering the level of maturity of the quality models evaluated.

Implications

Since this is the first known measurement of quality management maturity level in the Peruvian industry, it will allow to establish a base line for subsequent measurements, as well as a frame of reference on the actions to be taken to improve the six categories proposed. The fact that about 99% of the industries in Peru are small or micro enterprises and that the economic growth experienced by Peru over the last 20 years has been positive is expected that many of these companies will be able to consolidate their growth and become medium-sized companies, so this situation presents an important opportunity to establish (based on the results) lines of action on the development of QM practices in medium-sized companies.

Regarding the contingency effect, although different cases have been demonstrated in previous studies (Table 3), the effect of the development of the maturity level in organizations had not been studied, so seeing its evolution could explain why in all cases there are not significant effects of QM practices on performance (Sousa & Voss, 2002), once this relationship has been demonstrated, the opportunity is opened to study the impact generated by the maturity level in quality management. The fact that the level of maturity is a contingent variable at the time of obtaining positive results in the performance of the company implies that organizations probably do not have these in the short term, so

quality management should be seen with a long-term results approach, as well as an obligation to seek to implement continuous improvement models to achieve improved system maturity. This also implies that certifications such as ISO 9001:2015 do not ensure the achievement of benefits if companies are not at maturity levels above level 3 so the use of maturity measurement models as proposed by ISO 9004:2018 (ISO, 2018) becomes a way to measure and establish a plan of action over time.

Appendix A: Informed Consent

Surco, September 2018

Dear participant. -

Presented. -

Subject: Questionnaire to measure the relationship of QM practices and operational performance with quality management maturity, as a contingency variable.

Serve this to express my greetings and thanks for your participation answering the enclosed questionnaire, which is designed to be answered by people who currently have a role of decision with respect to quality management in their organizations. This questionnaire is part of the research conducted for the degree of Doctor in Strategic Management from the Pontificia Universidad Catolica del Peru and Doctor in Business Administration from Maastricht School of Management in the Netherlands, with the thesis entitled “Contingency Research in Quality Management Practices and Maturity Quality Management ".

Answering this survey will take about 20 minutes and the results of this study will be made available in April 2019. The names of the companies and the particular results will be maintained in absolute secrecy, only statistical averages and sample data will be published.

If you kindly answer the questionnaire, will express their consent to participate in the research study. For any question or query detail please contact me at the following email: lnegron@pucp.edu.pe.

Thank you for your consideration on this matter, without further ado, I remain you.

Best regards. Luis Negron Naldos

Appendix B: Instrument

1. Your company belongs mainly to the sector: (a) public, and (b) private
2. The main activities of the company are: (a) Services, trade, logistics, and (b) Manufacturing, processing of tangible goods
3. Your company has (consider permanent workers, not temporally): (a) less than 50 permanent workers, (b) between 51 and 250 permanent workers, (c) between 251 and 500 permanent workers and (d) more than 500 permanent workers

Question about Human Resource Management:

4. All employee suggestions are evaluated.
5. Resources are available for employee quality training in our plant.
6. There is almost always some kind of employee quality training going on in our plant.
7. Plant managers are often involved in quality training.
8. Most employees in our plant do not view each new quality seminar or training program as "just another fad."

Question about customer focus and satisfaction:

9. We know our external customers' current and future requirements (both in terms of volume and product characteristics).
10. These customer requirements are effectively disseminated and understood throughout the personnel.
11. We have an effective process for resolving external customers' complaints.
12. Customer complaints are used as a method to initiate improvements in our current processes.
13. We systematically and regularly measure external customer satisfaction.

Question about top management commitment and leadership.

14. At this site we proactively pursue continuous improvement rather than reacting to crisis' 'fire-fighting'.
15. Our performance evaluation by the top-level management depends heavily on quality.
16. Top-level managers allocate adequate resources toward efforts to improve quality.
17. We have clear quality goals identified by top-level managers.
18. At company-wide meetings top-level managers often discuss the importance of quality.

Question about process management:

19. Preventing defective products/services from occurring is a strong attitude in this organization.
20. The processes for designing new products/services in this organization ensure quality.
21. Employees involved in different processes know how to use statistical process control methods to evaluate their processes.
22. In this organization, numerical quotas are not the only, nor the most important, measure of an employee's performance.

Question about supplier quality management:

23. Quality is a more important criterion tan Price in selecting suppliers of the major component.
24. Our supplier rating system considers the supplier´s engineering capability.
25. Our supplier rating system considers the supplier´s financial stability.
26. Our supplier rating system considers the supplier´s delivery performance.
27. We provide technical assistance to our suppliers of this component.

Question about quality information and analysis

28. Availability of cost of quality data in the division.
29. Availability of quality data (error rates, defect rates, scrap, defects, etc.)
30. Timeliness of the quality data.
31. Extent to which quality data (cost of quality, defects, errors, scrap, etc.) are used as tools to manage quality.
32. Extent to which quality data are available to managers and supervisors.

Question about Strategy Quality Planning in Quality Management:

33. Extent to which the top division executive (responsible for division profit and loss) assumes responsibility for quality performance.
34. Extent to which the division top management supports long-term quality improvement process.
35. Extent to which the divisional top management has objectives for quality performance.
36. Degree to which the divisional top management considers quality improvement as a way to increase profits.
37. Degree of comprehensiveness of the quality plan within the division.

Question about Maturity level of quality management:

Please indicate (by writing a simple number, ranging from one through five, in the vacant column) your site current performance level for **each** level of the listed attributes

38. Attitude and understanding of the direction: (1) They do not understand quality as a management tool. They tend to blame the quality department for the "quality problems.", (2) They recognize that quality management can be helpful, but are not willing to provide the money or the time to carry it out, (3) Going doing the

quality improvement process, you learn more of quality management; It is given help and support, (4) Participation. the absolutes of quality management are understood. Recognize his personal role in giving a continued emphasis, and (5) They consider the quality management system an essential part of the company.

39. Organizational quality situation: (1) The quality function is hidden in the departments of engineering or production. Inspection probably not part of the organization. Emphasis on evaluation and selection, (2) A manager of the energetic quality is named, but the main emphasis is still in the evaluation and make the product. It is still part of the production or some other department, (3) The quality department falls under the senior management; any assessment is incorporated and the manager plays a role in managing the company, (4) The quality manager is an executive of the company; effective reporting of the situation and preventive action. It deals with consumer affairs and special projects, and (5) The quality manager belongs to the steering committee. The main concern is prevention. Quality leads ideas.
40. Handling problems: (1) Problems as they occur are facing; not resolved; inadequate definition; many shouts and accusations, (2) Teams are formed to attack the most important problems. Nobody asks long-term solutions, (3) Communication for corrective action is established. Problems faced openly and resolved in an orderly manner, (4) Problems are identified in its early stages of development. All functions are open to suggestions and improvements, (5) Except in rare cases, problems are prevented.
41. Quality cost as% of sales: (1) Reported: Unknown, real: 20%, (2) Reported: 3%, real: 18%, (3) Reported: 8%, real: 12%, (4) Reported: 6.5%, real: 8%, and (5) Reported: 2.5%, real: 2.5%.

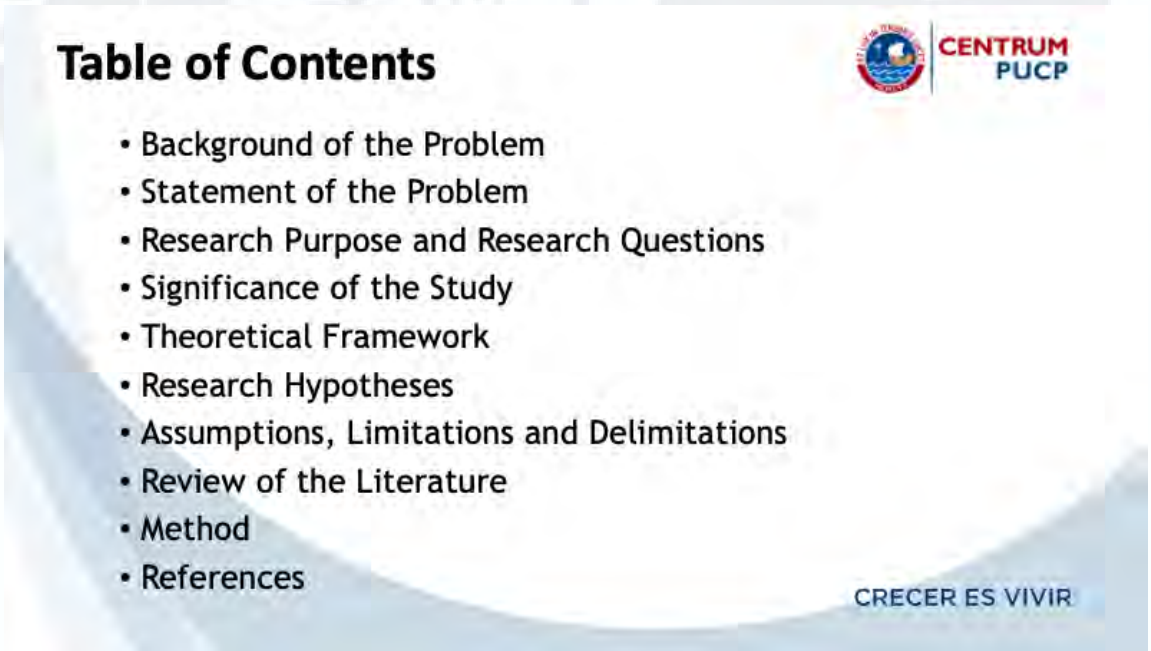
42. Actions to improve quality: (1) There are no organized activities. These activities do not understand, (2) "Motivational" short-term initiatives are attempted, (3) Implementation quality improvement methodology- six sigma, kaizen, lean, etc.-, (4) Continuous with quality improvement methodology and (5) Improving quality is a normal and continuous activity.
43. Summary of the position of the company regarding the quality: (1) "We do not know why we have problems with quality.", (2) "It is absolutely inevitable to have always problems with quality?", (3) "Through the commitment of management and improving the quality, we are identifying and resolving our problems.", (4) "Preventing defects routinely part of our operation.", and (5) "We know why we don´t have problems with quality."

Question about operational performance:

Please indicate (by writing a simple number, ranging from one through five, in the vacant column) your site current performance level for **each** level of the listed attributes.

44. Customer satisfaction: (1) Sometimes meets expectation, (2) Generally meet expectation, (3) Consistently meet expectation, (4) Always meet expectation, (5) Expect exceeded delighted customers.
45. Employee morale: (1) Very low, (2) Low, (3) Satisfactory, (4) High, (5) Very high.
46. Productivity: (1) Decreasing, (2) Static, (3) Moderate improvement, (4) Consistently improving, (5) Major and significant gains.
47. Delivery in full on time to our customer: (1) Less than 50%, (2) 50 – 80%, (3) 81 -90%, (4) 91-96%, (5) 97-100%.

Appendix C: Research Proposal Presentation in Power Point (PPT)



Background of the Problem

CENTRUM PUCP

- Three elements complicate the proper analysis of QM practices implementation (Sousa & Voss, 2002)
  - The number that currently exists (QM practices) and the lack of a unique definition for each one of them in past research.
  - It considers QM practices as a single construct or as a multidimensional construct (infraestructure and core practices) to analyze the relationship between QM practices and performance.
  - The adequate use of contingent variables to explain the particular importance of a QM practice in a given context, in this sense Sousa and Voss (2002) suggest the use of a quality management maturity level as a contingency variable

CRECER ES VIVIR

Background of the Problem

Prior Results

There are several studies on TQM and quality management system have a positive impact in different sectors, such as manufacturing, services, health care, education, and government.

Background of the Problem

Problem on Implementation

Studies have reported problems generated during the implementation of QM practices: Problems of sustaining the improvements achieved and difficulties in implementation, which evidences that the key QM practices have not yet been identified to be implemented in many organizations (Sousa & Voss, 2002)

Background of the Problem

Mixed results have been reported in relation to the benefits achieved under the scheme of ISO 9001, (a) 23% of the companies studied achieved improvement in earnings before taxes, (b) 38% achieved an improvement in ROA, (c) 51% achieved improvement in sales growth rate, (d) 47.62% increased their operational cost, (e) 47.29% decreased their personnel expenses (Martinez & Martinez, 2007).

Background of the Problem

Challenge

The challenge for managers is to achieve an effective implementation of the QM practices and to understand the importance of continuous improvement in modern management (Evans & Lindsay, 2013). However, there are no clear guidelines regarding the sequence for an adequate implementation of QM practices (Ebrahimi & Sadeghi, 2013)

Statement of the Problem

The problem is that there is no comprehensive evidence of the benefits of implementing quality management systems.

Research Purpose

The purpose of this quantitative study is to analyze the quality management practices level in the manufacturing industry in Peru and its relationship with operational performance and quality management maturity level as a contingency variable.

Research Questions

CENTRUM PUCP

- Research Questions e relationship between QM practices and operational performance:
  - What is the relationship between QM practices and operational performance in the manufacturing industry in Peru?

CRECER ES VIVIR

Research Questions

CENTRUM PUCP

- Regarding the contingent effect that the maturity of quality management has on the impact of QM practices over the operational performance:
  - How does the quality management maturity affect the relationship between QM practices and operational performance?

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Research Questions

CENTRUM PUCP

- In regard to QM practices and how they are related to each other:
  - What is the relationship between infrastructure quality management practices and core quality management practices in the manufacturing industry in Peru?

CRECER ES VIVIR

Significance of the Study

CENTRUM PUCP

- This study contributes to improve the ability to decide which QM practices shall be implemented to achieve better operational performance in industrial companies in Peru.
- The present study improves the results of the implementation of QM's practices according to the level of quality management maturity.

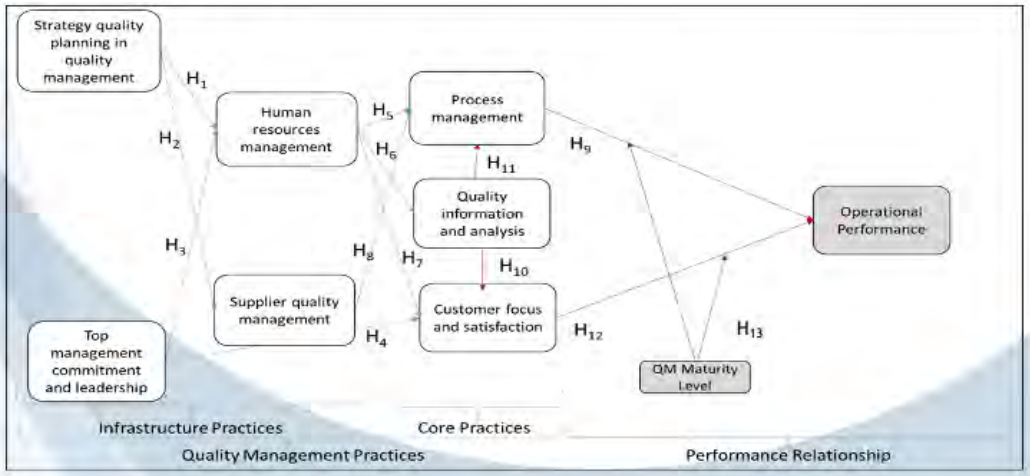
CRECER ES VIVIR

Theoretical Framework

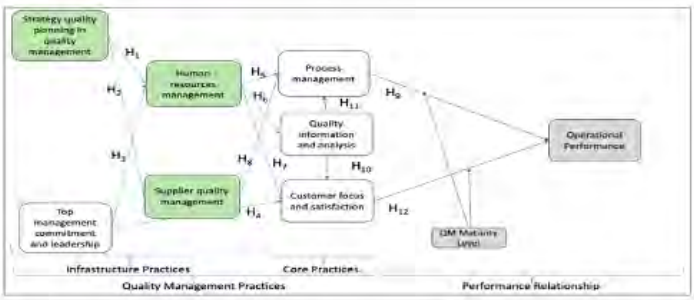
Theory of Quality Management –
Anderson, J., Rungtusanatham, M. & Schroeder, R. (1994)

- Proposition 1: Visionary leadership enables the simultaneous creation of a cooperative and learning organization.
- Proposition 2: An organization that simultaneously fosters cooperation and learning facilitates the implementation of process management practices.
- Proposition 3: Process management practices simultaneously result in continuous improvement of quality and employee fulfillment.
- Proposition 4: An organization's simultaneous efforts continuously to improve its quality and to fulfill its employees lead to higher customer satisfaction.

Theoretical Framework (Sousa & Voss, 2002; Ebrahimi & Sadeghi, 2013)



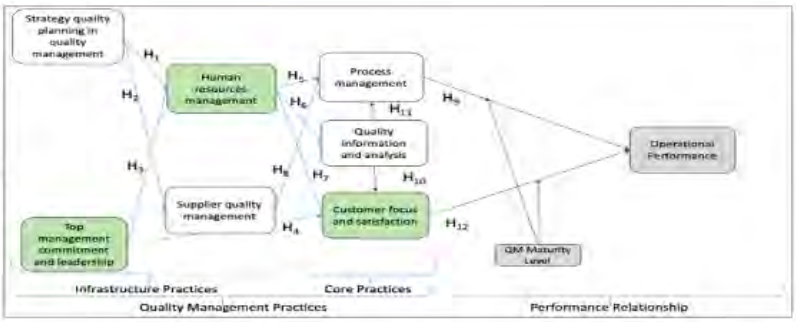
Research Hypotheses



- **H1:** Strategy quality planning in QM is positively related to human resources management. (Ebrahimi & Sadeghi, 2013).

- **H2:** Strategy quality planning in QM is positively related to supplier quality management. (Kaynak, 2003; Yeung, 2008; Zakaun, Yusof & Shaharoun, 2009).

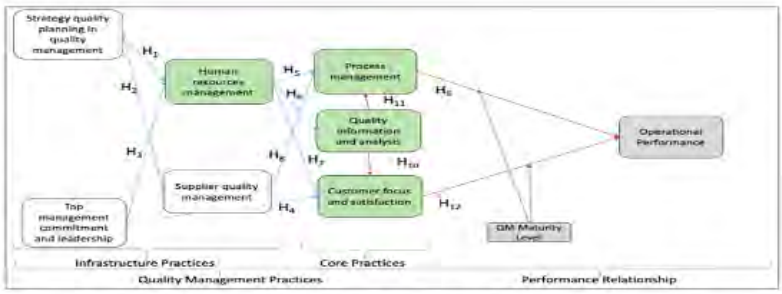
Research Hypotheses



- **H3:** Top management commitment and leadership is positively related to human resources management (Ahire & O'Shaughnessy, 1998; Anderson et al., 1994; Flynn et al., 1995; Kaynak, 2003; Sanchez & Martinez, 2004; Wilson & Collier, 2000).

- **H4:** Top management commitment and leadership is positively related to customer focus and satisfaction (Ahire & O'Shaughnessy, 1998; Anderson et al., 1994; Choi and Eboch, 1998; Nair, 2006; Sanchez and Martinez, 2004).

Research Hypotheses

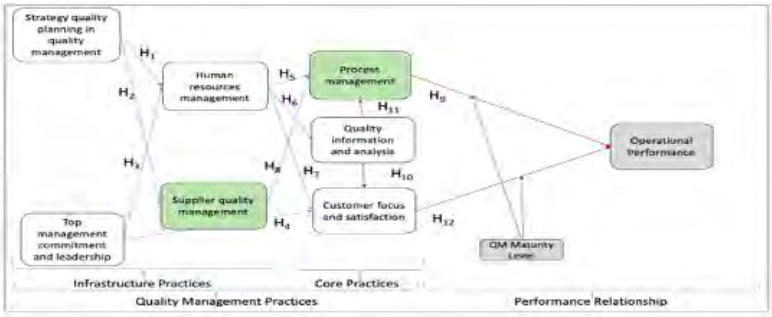


- **H5**: Human resources management is positively related to process management. (Ahire & O'shaughnessy, 1998; Flynn et al., 1995; Kaynak, 2003).

- **H6:** Human resources management is positively related to quality information and analysis. (Ahire & Dreyfus, 2000; Ho et al., 2001; Kaynak, 2003; Wong, Tseng & Tan, 2014).

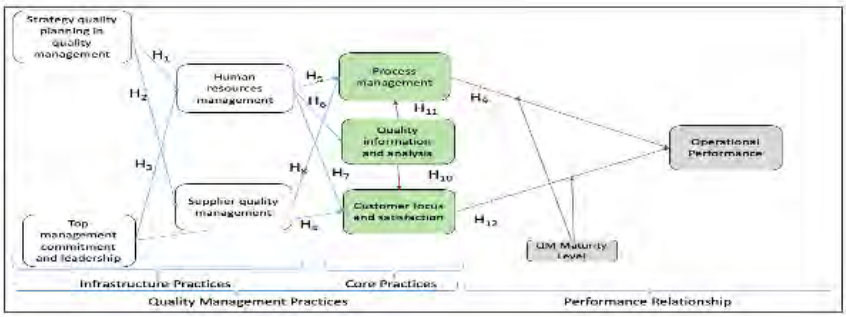
- **H7**: Human resources management is positively related to customer focus and satisfaction (Fecikova, 2004; Gadenne, 2008; Schneider, Yost, Kropp, Kind & Lam, 2018).

Research Hypotheses



- **H8**: Supplier quality management is positively related to process management.(Ebrahimi & Sadeghi, 2013; Juran, Medina & Ballester, 1990; Kaynak, 2003).

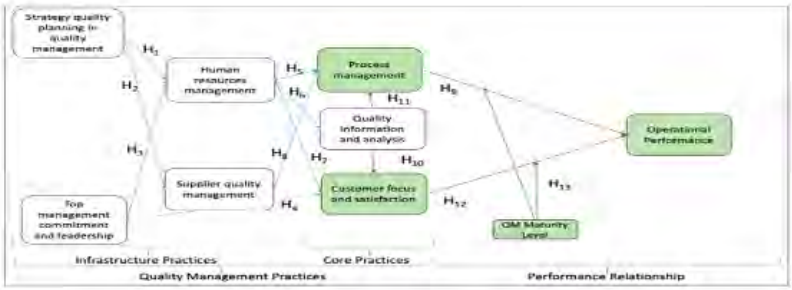
Research Hypotheses



- **H10**: Quality information and analysis is positively related to process management (Kaynak, 2003; Lee, Rho & Lee, 2003; Stofkova, Sadikoglu & Zehir, 2010; Stricek & Stofkova, 2016)

- **H11**: Quality information and analysis is positively related to customer focus (Birch-Jensen, Gremyr, Hallencreutz & Rönnbäck, 2018).

Research Hypotheses



- **H9:** Process management is positively related to operational performance. (Kaynak,2003; Nair, 2005; Wong, Tseng & Tan, 2014; Zhang, Kang, & Hu, 2018).
- **H12:** Customer focus and satisfaction is positively related to operational performance (Jamali, Ebrahimi & Abbaszadeh, 2010; Nair, 2005, Jaca & Psomas, 2015)
- **H13:** There is a contingency effect for the quality management maturity level variable (Sousa and Voss, 2002)

Assumptions

- The quality manager or equivalent has the knowledge and experience to respond the questionnaire.
- The company's representative takes the investigation seriously and provides truthful and accurate information.

Limitations

- The sample is referred to medium and large industrial companies therefore the results may not be extrapolated to all types of industrial companies in Peru.
- The representativeness of all industrial sectors in Peru will be limited by the number of industrial companies in each sector that participates in the research.
- The result of the study will be limited by the applied level of the QM practices in the industries that form part of the sample, and may not find a high level of application in all the QM practices.
- Lack of companies with high quality management maturity levels (level 4 or 5).

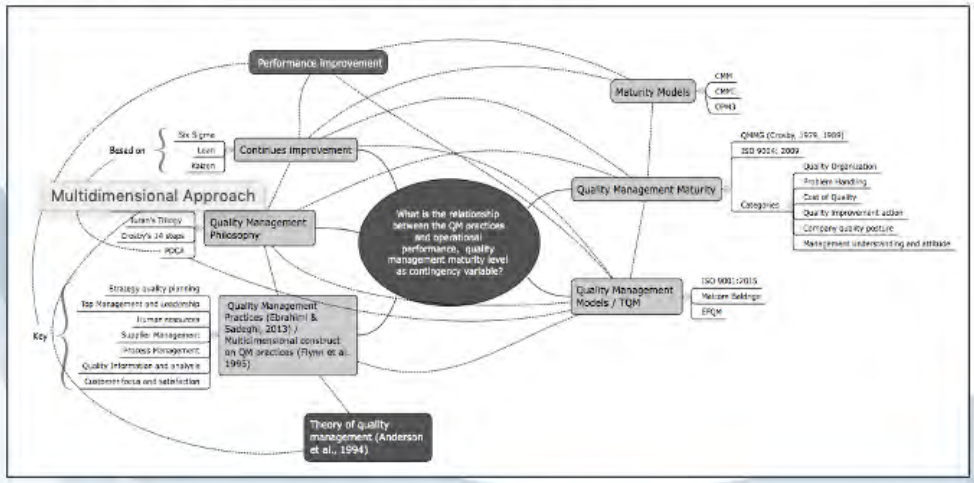
The Delimitations

- The sample is delimited to formal industrial manufacturing enterprises, considering medium and large companies in Peru.
- It will consider only those companies that have more than two years of operation, in order to have information about the impact of QM practices on business performance
- The questionnaire will be sent to a quality manager or similar position within the companies. In cases where there is no quality manager position, it will be sent to the person responsible for managing resources and achieving the objectives related to quality management.

The Delimitations

- The assessment of maturity levels, QM practices and operational performance will focus on the current situation of the organization.
- The elements that measure the quality management maturity are delimited as follows (a) management understanding and attitude, (b) quality organization, (c) problem handling (d) cost of quality as percentage of sales, (e) quality improvement actions, and (f) summation of company quality posture (Crosby, 1979, 1996).

Review of the Literature



Summary of studies of multidimensional construct on relationship between QM practices and performance

Study	Multidimensional Construct	Operational Performance	Main Findings
Anderson et Al. (1994)	Visionary leadership; Internal and external cooperation; Learning; Process management; Continuous improvement; Employee fulfillment	Customer Satisfaction	Employee fulfillment has a significant positive effect on customer satisfaction
Flynn et al (1995)	Core QM Practices: Process flow management; Product design Management; Statistical control QM infrastructure practices: Customer relationship; Supplier relationship; Work attitudes; Workforce management; Top management support	Quality market outcomes; Percent passed final inspection with no rework; Competitive advantage	Statistical control and product design process have positive effects on quality markets outcomes; Process flow management and statistical control have effects on Percent passed final inspection with no rework. Quality market outcomes and Percent passed final inspection with no rework effects on Competitive advantage
Mohrman et al. (1995)	Core QM Practices: Quality Improvement teams; Quality councils; Cross-functional planning; Process reengineering; Work simplification; Customer satisfaction monitoring; Direct employee exposure to customer. Production-oriented Practices: Self-inspection; Statistical control methods; Just in time deliveries; Work cells or manufacturing cells	ROE, ROI, ROS, ROA, perceived profitability and competitiveness; Market Share; Cost manufacturing; Inventory turnover; Perceived productivity; Customer satisfaction; Quality and Speed	TQM adoption have a positive relation with efficiency of employee and capital utilization. TQM practices and market share are significantly relation.

Multidimensional Approach

Studies Found

- Adam et al., 1997;
- Ahire & O'shaughnessy, 1998;
- Bakotić, & Rogošić, 2017;
- Forza & Filippini, 1998;
- Grandzol & Gershon, 1997;
- Ho et al, 2001;
- Kaynak ,2003;
- Powell, 1995;
- Rungtusanatham et al., 1998;
- Samson & Terziovski, 1999;
- Wilson & Collier, 2000;
- Zu, 2009

Contingency Studies

Contingency factor	Studies	Main contextual variable	Research design
National context and culture	Vastag and Whybark (1991)	Country of location	N. I.
	Ebrahinpour and Cullen (1993)	Parent country	I.A.
	Oliver, Delbridge and Lowe (1996)	Country of location	N. I.
	Mesha (1997)	Level of country development	N. I.
	Rungtusanatham et al. (1998)	Country of location	N.I.
		Country of Location	I.A.
	Rungtusanatham et al. (2005) Flynn and Saladin (2006)	Hofstede's dimension of national culture	I.D.
Firm Size	Voss et al. (1998)	Number of employees	N.I.
Strategic context	Sitkin et al. (1994)	Situational uncertainty environmental	I.D.
	Reed et al. (1996)	Uncertainty and firm orientation	I.D.
	Das et al. (2000)	International competition	I.D.
	Sousa (2003)	Product (variety, new product, production volume, type of process)	I.D.

Note: N.I. = Non-Inferential; I.A.= Inferential Aggregate; I.D.= Inferential Detailed.

Adapted from "Contingency research in operations management practices" by R. Sousa, and C. Voss, 2008, Journal of Operations Management, *26*(6), pp. 699-702.

QM's practices and Contingency Factors

Quality Management Maturity Level

Level	Description
Uncertainty	We do not know why we have quality problems.
Awakening	Is it absolutely necessary to have quality problems always?
Enlightenment	We are identifying and resolving our problem through management commitment and quality improvement.
Wisdom	Defect prevention is a routine in our operation.
Certainty	We know why we don't have problems with quality.

Note. Adapted from "Quality Management Maturity Grid" by P. Crosby, 1979, 1996, "*Quality is Free, The Art of Making Quality Certain,*" (28-40).

Categories of Maturity Level

(a) Management understanding and attitude,
(b) Quality organization,
(c) Problem handling,
(d) Cost of quality as percentage of sales
(e) Quality improvement actions, and
(f) Summation of company quality posture.

Conclusions

- The proper development of a quality management system depends on the selection and adoption of the QM practices, therefore several research studies have focused on this and concluded that quality management practices are positively related to the organization's performance in different dimensions, such as (a) productivity, (b) customer satisfaction, (c) quality products and (d) services (Kaynak, 2003), but there are other studies that do not conclude the same, which state that there are contingent variables that must be studied to understand this result (Sousa & Voss, 2002).

Population and Sample

Research Design

- The paradigm proposed in this study is post-positivist because it is focused on identifying and assessing the effect of **independent variables** (the key practices in quality management) and **dependent variables** (operational performance), along with the quality maturity level as a contingency variable.
- The approach selected is quantitative because it is the most appropriate for understanding the relationship between factors of independent variables and dependent ones (Cresswell, 2014).

Appropriateness of Design

- For this study, a non-experimental design will be used, in particular the structural equation modeling (SEM), because it's necessary to analyze structural relationships between QM practices and performance.
- For the reliability of each scale of QM's pratices and performance constructs will be estimated by calculating Cronbach's α (Cronbach, 1951)
- For the unidimensionality of factors, an exploratory factor analysis using principal component extraction with a varimax rotation will be used. (separately performed for QM's practices and perceived performance constructs).

Population and Sample

- The Population for the current research are formal industrial companies in Peru (medium or large companies).

References

- The moderating variables are: (a) level of sales, (b) quantity of employees, (c) public or private property, and (d) geographic location.

- According to the Industrial Statistical Yearbook (Produce, 2017), there were 152,920 manufacturing companies, out of which **1627 companies** were part of the medium and large company category.

Population and Sample

- SEM models containing seven or eight constructs, each with more than three items (observed variables), and with high Item communalities (0.6 or higher), can be adequately estimated with samples as small as 300 (Hair, Black, Babin, Anderson, & Tatham, 2006).

Instruments for measuring Quality Management Practices

References	Saraph, Benson, and Schroeder (1989)	Flynn, Schroeder, and Sakakibara (1994)	Ahire, Golhar, and Waller (1996)	Grandzol and Gershon (1998)
Human resources management	(8) Employee relations	(D V) Workforce Management	(8,9,10) Employee	(3) Employee fulfillment
Customer focus and satisfaction		(D VII) Customer Involvement	(2) Customer Focus	(7) Customer focus
Top management commitment and leadership	(1) Top management and quality policy	(D I) Top Management Support	(1) Top Management Commitment	(1) Leadership
Process Management	(6) Process Management	(D III) Process Management		(5) Process Management
Supplier quality management	(5) Supplier QM	(D VI) Supplier Involvement	(3) Supplier Quality Management	
Quality information and analysis	(7) Quality data & reporting	(D II) Quality Information	(7) Internal Quality Information Usage	
Strategy quality planning in quality management	(1) Top management and quality policy		(6) SPC Usage (5) Benchmarking	

Note. The value in parentheses corresponds to serialization or item classification given by the author in his original instrument.

Instruments for Measuring QM's Practices

References

- Ahire, S. L., Golhar, D. Y., & Waller, M. A. (1996). Development and validation of TQM implementation constructs. *Decision sciences*, *27*(1), 23-56.
- Ahire, S. L., & O'shaughnessy, K. C. (1998). The role of top management commitment in quality management: an empirical analysis of the auto parts industry. *International Journal of Quality Science*, *3*(1), 5-37.
- Anderson, J., Rungtusanatham, M. & Schroeder, R. (1994). A Theory of Quality management underlying the Deming management Method, *Academy of Management Review, 19*(3), 472-509
- Bititci, U. S., Garengo, P., Ates, A., & Nudurupati, S. S. (2015). Value of maturity models in performance measurement. *International journal of production research*, *53*(10), 3062-3085.
- Birch-Jensen, A., Gremyr, I., Hallencreutz, J., & Rönnbäck, Å. (2018). Use of customer satisfaction measurements to drive improvements. *Total Quality Management & Business Excellence*, 1-14.
- Cavanagh, J. (Ed.). (2018). *Peru: the top 10,000 companies*. Peru Top Publications.

References

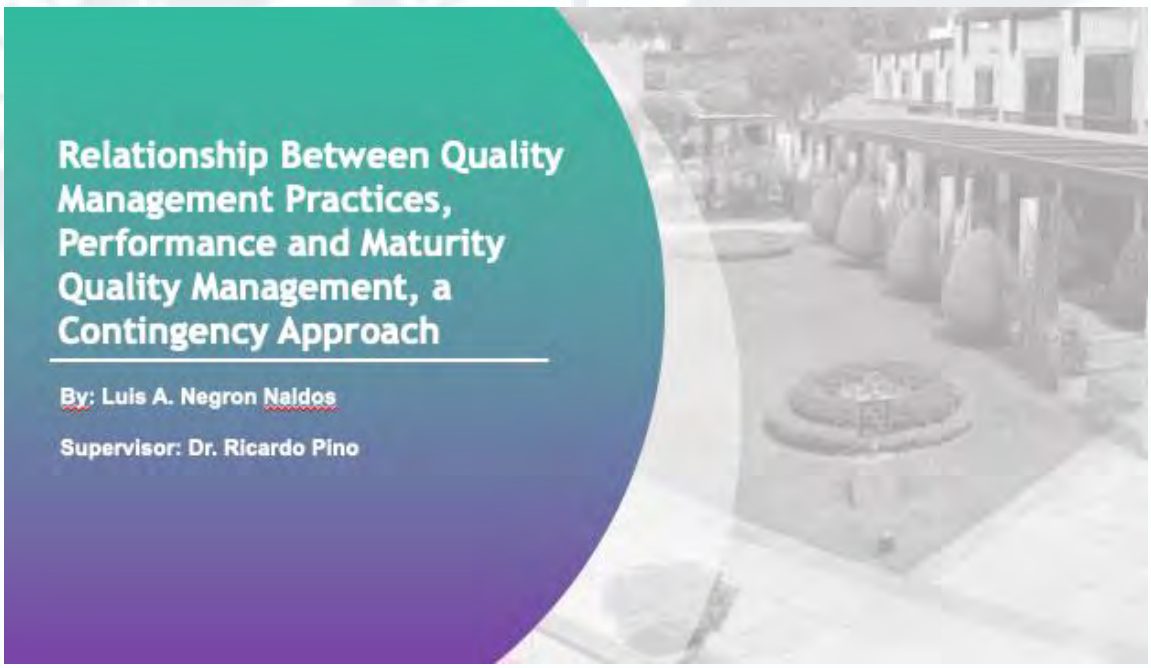
- Cronemyr, P., & Danielsson, M. (2013). Process Management 1-2-3–a maturity model and diagnostics tool. *Total Quality Management & Business Excellence*,*24*(7-8), 933-944.
- Crosby, P. (1979). *Quality is Free, The Art of Making Quality Certain.* New York, NY: Mc Graw-Hill.
- Crosby, P. B. (1996). *Quality is still free: making quality certain in uncertain times.* McGraw-Hill Companies.
- Ebrahimi, M. & Sadeghi M. (2013). Quality Management and Performance: An Annotated Review. *International Journal of Production Research*, *51*(18), 5625 - 5643.
- Fotopoulos, C. B., & Psomas, E. L. (2009). The impact of "soft" and "hard" TQM elements on quality management results. *International Journal of Quality & Reliability Management*, *26*(2), 150-163
- International Organization for Standardization (2015). *Norma Internacional ISO 9000 - Quality management systems -- Fundamentals and vocabulary.* Geneva, Switzerland: ISO/TC 176/SC 1.

References

References

- Kaynak, H. (2003). The relationship between total quality management practices and their effects on firm performance. *Journal of operations management*, *21*(4), 405-435.
- Kaynak, H., & Hartley, J. L. (2008). A replication and extension of quality management into the supply chain. *Journal of Operations Management*, *26*(4), 468-489.
- Pino, R. (2008). TQM and performance in small medium enterprises: The mediating effect of customer orientation and innovation. *International journal of quality & reliability management*, *25*(3), 256-275.
- Rungtusanatham, M., Forza, C., Filippini, R., & Anderson, J. C. (1998). A replication study of a theory of quality management underlying the Deming management method: insights from an Italian context. *Journal of Operations Management*, *17*(1), 77-95.
- Saraph, J. V., Benson, P. G., & Schroeder, R. G. (1989). An instrument for measuring the critical factors of quality management. *Decision sciences*, *20*(4), 810-829.

Appendix D: Thesis Presentation in Power Point (PPT)



Background of the Problem

Mixed results have been reported in relation to the benefits achieved under the scheme of ISO 9001, (a) 23% of the companies studied achieved improvement in earnings before taxes, (b) 38% achieved an improvement in ROA, (c) 51% achieved improvement in sales growth rate, (d) 47.62% increased their operational cost, (e) 47.29% decreased their personnel expenses (Martinez & Martinez, 2007).

Background of the Problem

Challenge

The challenge for managers is to achieve an effective implementation of the QM practices and to understand the importance of continuous improvement in modern management (Evans & Lindsay, 2013). However, there are no clear guidelines regarding the sequence for an adequate implementation of QM practices (Ebrahimi & Sadeghi, 2013)

Statement of the Problem

Evidence has been found which concludes that not all implementations of quality management systems generate positive effects.

Hypotheses

- Two elements complicate the proper analysis of QM practices implementation (a) the number that currently exist and the lack of a unique definition for each one of them in past research. Ebrahimi and Sadeghi (2013) listed 224 QM practices that currently exist in the literature and (b) the adequate use of contingent variables to explain the particular importance of a QM practices in a given context, in this sense Sousa and Voss (2002) suggest the use of a quality management maturity level as a contingency variable.
- Therefore, in this study has been evaluated the relationship of the Key QM practices proposed by Ebrahimi and Sadeghi (2013) and the impact of the maturity level in a general way, as well as in a particular way in each of its five categories, according to the Quality Management Maturity Grid (QMMG) proposed by Crosby (1979, 1996).

Hypotheses

- The first hypotheses group shows the possible relationship between key quality management practices. This group is divided into eight hypotheses in order to identify if one or more significant relationship exist, as shown in the following figure

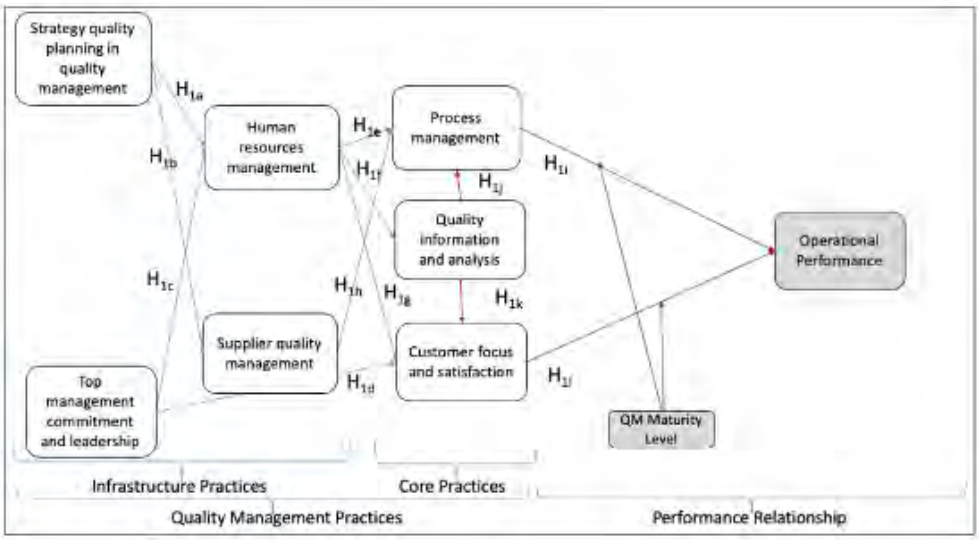


Figure 1. Proposed relationship between quality management practices, performance and maturity quality management, a contingency approach

Hypotheses

- It is necessary to make an empirical analysis of the relationships between the QM practices grouped as infrastructure and core and their final relationship with performance, as presented in Figure 1. At the same time, it is necessary to demonstrate whether the level of maturity influences the relationships described, because both elements are part of the basic principles for the design of a maturity model (Pöppelbuß and Röglinger, 2011).

Hypotheses

- The second hypothesis shows the possible existence of a contingency effect for the quality management maturity level:

H2: There is a contingency effect for the quality management maturity level variable

Theoretical Framework

Theory of Quality Management -
Anderson, J., Rungtusanatham, M. & Schroeder, R. (1994)

- Proposition 1: Visionary leadership enables the simultaneous creation of a cooperative and learning organization.
- Proposition 2: An organization that simultaneously fosters cooperation and learning facilitates the implementation of process management practices.
- Proposition 3: Process management practices simultaneously result in continuous improvement of quality and employee fulfillment.
- Proposition 4: An organization's simultaneous efforts continuously to improve its quality and to fulfill its employees lead to higher customer satisfaction.

Methodology

- A non-experimental design has been used, in particular structural equation modeling (SEM), according to previous studies carried out (Kaynak, 2003).
- Regarding the instrument, survey method was used. This method is used in nonexperimental design, and particularly, in research on quality management practices in order to show the degree or extent of practice for different authors, normally in a Likert scale.

Sampling

- In Peru, to the year 2015, there were 152,920 manufacturing companies, out of them 1,627 companies were part of the medium and large company category.
- Initially, 169 responses were obtained, of which 10 surveys were discarded because they did not belong to the objective positions or functions of the companies. Of the remaining 159 responses, 11 additional samples were discarded for not reporting atypical data.
- Finally, 148 valid responses were registered, of which 42% had between 51 and 250 employees, 23% between 251 and 500 employees and 35% more than 500 employees. With respect to the size of the companies, the sample was divided into 34% medium company and 66% large company.

Validity and Reliability

Table 3. Cronbach's Alpha for the Variables in the Research Model, Average Variance Extracted (AVE) and Standardized dimension loading

Variable	Standardized dimen. loading	Cronbach's Alpha	Aver. Var. Extrac. (AVE)
Top management commitment and leadership		0.929	0.724
• We proactively pursue continuous improvement	0.858		
• Performance evaluation by the top-level management depends heavily on quality	0.819		
• Top-level managers allocate adequate resources toward efforts to improve quality	0.885		
• We have clear quality goals identified by top-level managers	0.853		
• At company-wide meetings top-level managers often discuss the importance of quality	0.839		
Human resources management		0.893	0.609
• All employee suggestions are evaluated	0.742		
• Resources are available for employee quality training in our plant	0.756		
• There is almost always some kind of employee quality training going on in our plant.	0.786		
• Plant managers are often involved in quality training	0.790		
• Most employees in our plant do not view each new quality seminar as "just another fad."	0.825		
Quality information and analysis		0.921	0.705
• Availability of cost of quality data in the division	0.828		
• Availability of quality data	0.882		
• Timeliness of the quality data	0.871		
• Extent to which quality data are used as tools to manage quality	0.819		
• Extent to which quality data are available to managers and supervisors	0.794		
Process management		0.881	0.656
• Preventing defective products/services from occurring is a strong attitude in this organization	0.799		
• The processes for designing new products/services in this organization ensure quality	0.808		
• Employees involved in different processes know how to use statistical process control methods	0.813		

Validity and Reliability

• Numerical quotas are not the only, nor the most important, measure of an employee's perform.	0.820		
Customer focus and satisfaction		0.927	0.712
• We know our external customers' current and future requirements	0.832		
• Customer requirements are effectively disseminated and understood throughout the personnel	0.773		
• We have an effective process for resolving external customers' complaints	0.892		
• Customer complaints are used as a method to initiate improvements	0.858		
• We systematically and regularly measure external customer satisfaction.	0.859		
Supplier quality management		0.831	
• Quality is a more important criterion tan Price in selecting suppliers of the major component	0.881		
• Our supplier rating system considers the supplier's engineering capability			
• Our supplier rating system considers the supplier's delivery performance			
• We provide technical assistance to our suppliers of this component	0.754		
Strategy quality planning		0.926	0.745
• Extent to which the top division executive assumes responsibility for quality performance	0.826		
• Extent to which the division top management supports long-term quality improvement process	0.908		
• Extent to which the divisional top management has objectives for quality performance			
• Degree to which the divisional top management considers quality improvement as a way to increase profits	0.882 0.835		
Operational Performance		0.806	0.643
• Customer satisfaction	0.858		
• Employee morale	0.751		
• Productivity	0.796		
• Delivery in full on time to our customer	0.800		
Maturity of quality management	From 0.651 to 0.847	0.873	0.569

Findings – Regression Weights

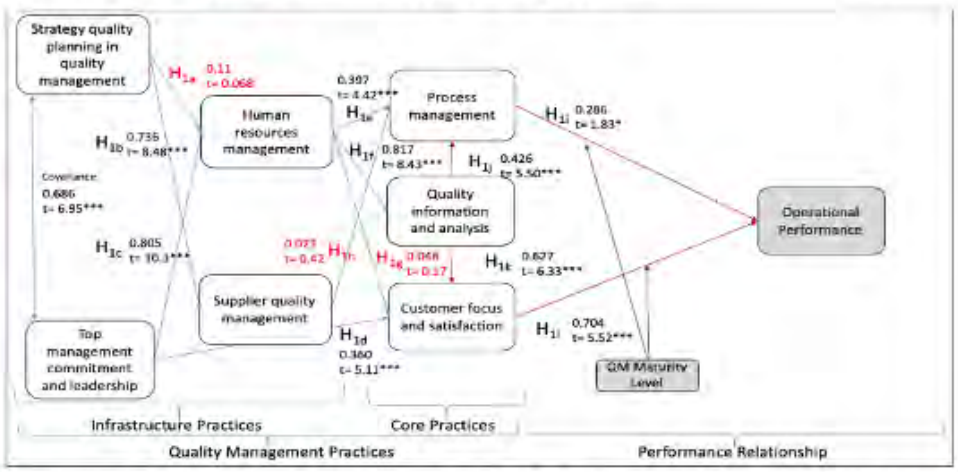


Figure 2. Relationship between the maturity level of key quality management practices. Regression weights. *** P< 0.01, ** P< 0.05, * P< 0.10

Findings – SEM Model Fit

Goodness of fit statistics	Result	Recommended values for satisfactory fit
x^2/df	2.024	< 3.0 (a)
Root Mean Square Error of Approximation (RMSEA)	0.08	≤ 0.08 (b)
Akaike's Information Criterion (CAIC)	1390.3	< Saturated model and independence model (c)
CAIC for Saturated Model	3166.5	
CAIC for Independent Model	5412.3	
Parsimony Goodness-of-fit Index (PGFI)	0.627	> 0.50 (d)
Parsimony Normed Index (PNFI)	0.745	> 0.50 (d)
Comparative Fit Index (CFI)	0.903	> 0.50 (d)

(a) Bollen (1989), Carmines and McIver (1981); (b) Byrne (1998), Jaccard and Wan (1996), Joreskog and Sorbom (1993); (c) Byrne (1998), Joreskog and Sorbom (1993); (d) Byrne (1998), Mulaik et al. (1989)

- **Statistic Comparations – Maturity Level Effect**

Hypothesis	Maturity level: Low		Maturity level: High	
	Regression weights	t statistic	Regression weights	t statistic
H1c: Top management commitment and leadership is positively related to human resources management.	0.822	5.90 ***	0.756	6.68 ***
H1d: Top management commitment and leadership is positively related to customer focus and satisfaction.	0.246	3.19 ***	0.577	4.43***
H1e: Human resources management is positively related to process management.	0.303	2.27**	0.571	4.47 ***
H1f: Human resources management is positively related to quality information and analysis.	0.495	5.25***	0.711	3.48***
H1k: Quality information and analysis is positively related to customer focus.	-0.05	-0.39	0.541	5.38 ***
H1j: Quality information and analysis is positively related to process management.	0.144	0.68	0.313	4.38 ***
H1i: Process management is positively related to operational performance.	-0.214	-0.73	0.501	2.63 **
H1l: Customer focus and satisfaction is positively related to operational performance.	0.934	1.87*	0.315	2.85 **

*Regression weights: *** P< 0.01, ** P< 0.05, * P< 0.10*

AMOS Nested Model Comparisons– Maturity Level Effect

MODEL	DF	CMIN	p-Value	Delta NFI	Delta IFI	Delta RFI	Delta TLI
Equal Loading	8	81,997	0.00	0.019	0.024	0.016	0.021

In order to perform a multiple group analysis between the high maturity level versus the low maturity level, it was analyzed whether different sets of path coefficients are invariant (if the coefficients (Wi) of each relationship are the same for both groups), for this purpose, set of multiple restrictions were defined (Wi low level = Wi high level) in the hypothesis coefficients (a) H1c (b) H1d (c) H1e (d) H1f (e) H1k (f) H1j (g) H1i and (h) H1l to obtain a more restricted final model, the analysis will be performed by nested model comparisons (Koufteros and Marcoulides, 2006).

CONCLUSIONS

- One of the proposed objectives was to demonstrate the multidimensional construct dividing the QM practices into two elements (a) core QM practices and (b) infrastructure QM practices, through the first hypotheses group (from H1b to H1f) these purposes were accomplished, validating past studies conducted by Sousa and Voss, (2002) and Kaynak (2003), as well as in the past by other authors compiled by Sousa and Voss (2008).
- The particular contribution in this sense is given by the validation of the model of structural relations developed (figure 1) for the QM practices presented by Ebrahimi and Sadeghi (2013),

CONCLUSIONS

- The relationship model of the SQPQM, TMCL and HRM practices show the basic elements of the Infrastructure practices category, so these three practices become the supporting elements of quality management systems.
- The causal relationships between infrastructure practices and core practices allow to conclude that it is not enough to develop core practices to achieve a positive impact on performance, which reinforces the holistic view of relationships in QM practices proposed by Kaynak (2003).

CONCLUSIONS

- With regard to core QM practices, the effect of QIA on CFS and PM elements is demonstrated, which is directly related to the evolution of business intelligent and especially to the capacity of business analytics in the development of improvementmodels and customer satisfaction in accordance with what is known as Industry 4.0 (Foidl and Felderer, 2015)

CONCLUSIONS

- The comparative result of the positive effect of the maturity level as a contingency effect concludes that work on the development of the maturity level of quality management makes it possible to ensure the generation of benefits (Crosby 1996).
- All categories of Crosby's maturity model (1979, 1996) have an impact on the relationships between QM practices.
- In particular, the category shows a greater difference is Quality Improvement Action, which allows to conclude that this element is the one that most generates a contingent impact on the relationship between maturity levels and the operational performance of organizations.

Recommendations

- As detailed in a previous conclusion, it is important to develop a conceptual framework for the development of a maturity model in quality management. For this purpose, it is recommended to take as a reference the evaluation model proposed by ISO 9004 (ISO, 2018), related models such as the maturity models in process management (Cronemyr & Danielsson, 2013).
- A particular case is the CMMI model, which has had multiple applications and references such as maturity models in the management of processes and good practice developments (Baldassarre, Caivano, Pino, Piattini & Visaggio, 2012; Sharifloo, Shamsfard, Motazedi & Dehkharghani, 2008) and therefore the principles and bases developed by this maturity measurement and management model should be taken into consideration for the development of the quality management model itself.

Implications

[Sin título]

- Regarding the contingency effect, although different cases have been demonstrated in previous studies, the effect of the development of the maturity level in organizations had not been studied, so seeing its evolution could explain why in all cases there are not significant effects of QM practices on performance (Sousa & Voss, 2002), once this relationship has been demonstrated, the opportunity is opened to study the impact generated by the maturity level in quality management

Implications

- The fact that the level of maturity is a contingent variable at the time of obtaining positive results in the performance of the company implies that organizations probably do not have these in the short term, so quality management should be seen with a long-term results approach, as well as an obligation to seek to implement continuous improvement models to achieve improved system maturity.

Implications

- This also implies that certifications such as ISO 9001:2015 do not ensure the achievement of benefits if companies are not at maturity levels above level 3 so the use of maturity measurement models as proposed by ISO 9004:2018 (ISO, 2018) becomes a way to measure and establish a plan of action over time.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