Competencies for Quality Management:
A Systematic Literature Review and Perspectives
for the Future

Artur Henrique de Morais Brito and Fernando Tobal Berssaneti
Department of Production Engineering
Universidade de São Paulo
Av. Prof. Almeida Prado, 128, Travessa 2, Cidade Universitária,
São Paulo, SP, Brazil
artur.brito@usp.br, fernando.berssaneti@usp.br

Abstract

Quality management is crucial to the companies so that they can maintain and enhance their competitive advantage towards the market. In this context, the quality managers play a fundamental role and is important that they have the necessary competences to do their job. However, the competences for the quality management are not a subject broadly discussed in the academy, despite its presence in the professional literature. In order to address this issue, the present study aims to perform a mapping of the academic literature regarding the competences for quality management through a bibliometric analysis complemented by a content analysis. As results, the main authors, journals, and themes related to this area were identified, as well as the main dimensions of competence and the main research gaps to guide future studies.

Keywords
quality management; competence; literature review, bibliometrics

1. Introduction
Quality management increasingly adopts a leading role in leveraging the competitive advantage of the companies, especially in the digitalization era (Jason et al. 2023). In general, it contributes to maintaining the competitive advantage by promoting the development of specific skills and producing complex social relationships that are directly related to the history and culture of the company (Escrig-Tena and Bou-Llusar 2005; Perez-Arostegui et al. 2012).

Recognition of the importance of quality management competencies is not new. Since Jonker (1999), it is perceived the need for companies, institutions and organizations to deal with the quality of their products and services, being such competencies fundamental to this process. However, its role becomes increasingly critical in maintaining competitive advantage and increasing the performance of organizations (Bolatan et al. 2022), since failures in quality improvement programs are not usually associated with basic failures in quality principles, but rather with a lack of skills and inefficient deployment systems (Huq 2006).

To avoid these shortcomings, quality management competencies have become a focal point of development in companies (Khanna and Gupta 2014), being directly related to quality managers. These professionals may assume different roles from one organization to another, but in general their function is to ensure that products and services are adherent to the objectives and requirements of internal and external stakeholders (Ingason and Jónsdóttir 2017).

There is a gradual change in the vision of a quality manager with a merely inspector role for someone who is integrated into the managerial role (Elg et al. 2011), which requires a constant update in their competencies (Jason et al., 2023). Despite the vast existing literature on competencies (Ellström 1997; Hecklau et al. 2016; Katz 1955; Le Deist and Winterton 2005), the topic of quality management competencies is virtually non-existent (Martin et al. 2021).

Which skills are required to be a quality management professional is a question rarely asked and not yet answered in the research on quality management (Martin et al. 2021, 2019). Therefore, it is of fundamental importance that the knowledge generated so far is consolidated and mapped in order to guide future work and consequently help the development of the research field.

1.1 Objectives
Thus, the objective of this article is to map the area of competencies for quality management through a bibliometric analysis combined with a content analysis. The proposed objective can be materialized through the following research questions:

RQ1: What are the main journals, authors and themes related to quality management competencies?
RQ2: What are the main dimensions of competencies for quality management treated in the academic literature?
RQ3: What are the main research gaps in the area of quality management skills?

This article is structured in five sections. Section 2 presents a brief literature review on the subject, while section 3 discusses the methods of sampling and analysis of the data used. In section 4 are presented the results and analyses obtained from the application of the bibliometric and content analysis methods. Finally, section 5 brings the conclusions of the study.

2. Literature Review
The theme related to competencies for quality management began in an incipient way in Jonker (1999), in which the author demonstrates the importance of a change of focus from organizational competencies to individual competencies due to the change in the environment in which organizations are inserted. The field of research presents an advance when in Tillema (2003), the issue of quality in audits is addressed, which should be evaluated in four levels: evaluation infrastructure, competencies, instruments and advisors. Since 2005, the field has evolved more consistently, turning more intensively to competencies focused on quality management. Escrig-Tena and Bou-Llusar (2005) propose a procedure to evaluate competencies for Quality Management considering that the competency-based perspective was quite relevant for strategic thinking, but requires a definition at the operational level, which limits its empirical application. The authors identified objective measurement criteria, as well as defined a measurement scale that culminated in the creation of a measurement system for the nine competencies for quality management identified in the article.

Huq (2006) opens a new strand of analysis by presenting a model for the implementation of the Six-Sigma through the competency-based approach (CBP). The analysis is carried out through a case study in a teaching hospital, in which it identifies the importance of certain competencies such as strategic leadership, participatory management and focus on internal and external customers, fundamental for the implementation of the methodology. Still regarding the implementation of Six Sigma, Hilton and Sohal (2012) examines the relationship between a successful implementation of Lean Six-Sigma and various KPIs composed of competencies. In addition to Six Sigma, the effects of competency-based training for the implementation of the principles of 5"S" and Total Quality Management (TQM) were studied (Khanna and Gupta, 2014). The authors identified that there are several definitions of competence, however, the only point in common is that they always describe individual and organizational competencies. Thus, they identify a series of important competencies for the implementation of methodologies and put them into practice through the preparation of a training module applied in industries.

Since quality management systems are based on international standards and commonly added, the study of the impacts of ISO 9001 combined with competencies began to be developed with the increase in the maturity of the field. In Wang (2014), the author examines how the quality management system based on ISO 9001 moderates the company's innovation and performance efforts, identifying that an increase in investment in R&D improves quality management to a certain limit, when it starts to reduce quality, thus having a curve in the inverted U-shape. Not only innovation is addressed in relation to ISO 9001, but also what are the competencies necessary for quality managers to master and apply the quality management system based on this standard (Fonseca et al. 2017). More recently, Závadský et al. (2019) identified 15 KPIs to control quality management in manufacturing companies and developed a model with 10 competencies for each of the KPIs, grouping them, when necessary, related to ISO 9001.

In recent years, there has been a branching of the research field tangentially to other areas of knowledge such as information technology (Perez-Arostegui et al. 2012) when analyzing the impact of IT competencies on quality performance, which are related to 4 elements: IT infrastructure, IT technical knowledge, IT management knowledge

and IT integration with the company's strategy. In Pérez-Aróstegui et al. (2015) the authors return to the theme and develop a deeper knowledge of the complementarities of IT competence with other resources or organizational practices that have a strong presence in companies, such as quality management practices, resulting in a direct and positive correlation between IT competencies and the implementation of quality management.

Another area developed in recent years is quality management skills in Industry 4.0. In Babatunde (2020), the author maps the implications and competencies of Industry 4.0 in the hard and soft aspects of total quality management (TQM). Moreover, in Kannan and Garad (2021), the authors investigate the current competencies of quality professionals and the new competencies that would be needed to adapt to Industry 4.0. Using a mixed methodology, the authors conducted a case study at an electronics manufacturer obtaining primary data through survey and qualitative data through semi-structured journals and content analysis. Thus, they identified the main gaps in the competence of quality professionals required in Industry 4.0, in addition to making recommendations on how to prepare these professionals for the manufacturing, business, product and customer changes, characteristics of this new industry.

With all these advances, it is necessary, at some point, to consolidate knowledge into clear and concise frameworks for both academics and professionals. The first attempt in this direction was made by Ingason and Jónsdóttir (2017), whose main objective was to define what are the elements that characterize a competent quality manager through the creation of a model presenting the different attributes necessary for a quality management professional. These attributes were classified into knowledge, skills, and competencies and, through a literature review, content analysis and survey, the authors created the "House of Competencies of a Quality Manager". In this framework, skills and knowledge are the pillars, which must be robust and well balanced to support the competencies that form the roof of the house. Despite bringing a great advance in the consolidation of the field, this study presents a very practical bias, not presenting a great upholstery of academic literature.

Aiming to overcome this problem, Martin et al. (2021) sought to introduce a competency-based terminology to describe the general competencies of quality management work in organizations and create a competency framework to understand what it takes to be a quality management professional. Based on the definitions of competence of Ellström (1997 1992), the authors developed a framework of competencies for quality management based on four dimensions: Human, Methods, and Processes, Conceptual and Contextual. In addition, they identified a generic responsibility structure for quality management, based on two axes: Functional Scope (strategic and operational) and Situational Range (centralized and local), also classifying competencies into exploitative and explorative.

3. Methodology

Due to the number of articles in the field of Competencies in Quality Management, a bibliometric analysis combined with a content analysis was adopted as a methodological framework to answer the proposed research questions. Bibliometric studies are important to synthesize past knowledge, thus being able to advance in a certain line of research (Zupic and Čater 2015), being increasingly accepted in academia due to the large number of articles published (NeelyM 2005). In relation to content analysis, this methodology allows a deeper understanding of the constructs and their relationships (Duriau et al. 2007).

Bibliometric studies will be carried out through five stages: (1) research design, (2) compilation of bibliometric data, (3) data analysis, (4) data visualization, and (5) interpretation (Zupic and Čater 2015). For content analysis, all articles in the sample were read. Figure 1 shows an explanatory flowchart of the research process adopted.

3.1 Data Collection (Sampling)

The articles in the sample were obtained through the scientific bases Scopus and Web of Science in April 2023. Both sources were chosen since they have a large quality and quantity of articles, as well as similar coverage (Calof et al., 2022). In addition, they present metadata compatible with bibliometric software, being able to load abstracts, references, citation indexes, authors, institutions, countries, and other information (Carvalho et al. 2013).

The research of the documents was made through the title, abstract and keywords, aiming to find as many articles as possible to ensure that important publications were not removed from the sample. The research strings used in both databases are presented below:

Scopus: (TITLE-ABS-KEY("quality manag*") AND TITLE-ABS-KEY("competenc*")) AND (LIMIT-TO (SUBJAREA,"BUSI") AND (LIMIT-TO (DOCTYPE,"ar"))

Web of Science: "quality manag*" AND "competenc*" (Topic) and Articles (Document Types) and Management or Business (Web of Science Categories)

Two filter layers were adopted. The first one aimed to limit the scope of the study to the area of Business, Management and Accounting, since about 65% of the sample was related to the area of medicine. The second layer of filtering was by document type, limiting only to articles to ensure the accuracy of the sample. No temporal filters were used.
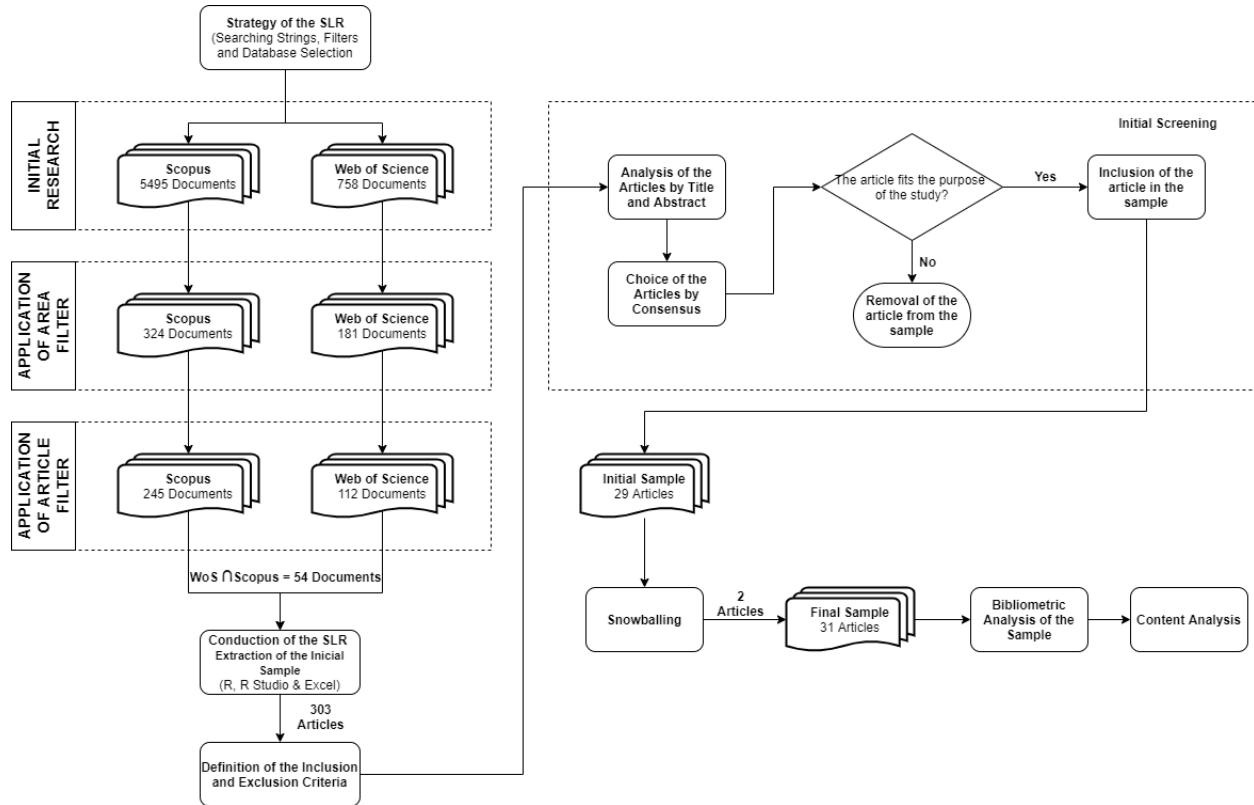

Figure 1. Literature review workflow.
Source: Authors

After applying the filters, the search strings identified 245 documents in Scopus and 112 in Web of Science. The bibliometric data was inserted into a routine in the R Studio software (Racine, 2012) to compile the results obtained in both platforms removing the duplicated results. With this process, an intersection of 54 articles was identified, which were removed from the sample, leaving 303 documents for analysis (245 Scopus + 112 WoS – 54 Scopus Ω WoS).

The sample obtained passed through a screening process to define the inclusion and exclusion of the articles in the initial sample. When the title and abstract were not enlightening, the full article was screened. The inclusion and exclusion criteria were defined based on adherence to the theme of competencies in quality management, being the two: (1) articles that did not relate Quality Management as the main construct, and (2) articles of other technical nature as Medicine, totaling 29 articles. The final sample was obtained through the snowballing technique (Wohlin, 2014), through which 2 (two) more articles were added to the sample, totaling 31 documents.
Next, the keywords were groomed to ensure that quality and standardization of the data was maintained, removing different versions of names or equivalent terms. An example of this stage was the replacement of the word *competences* by *competence* and *quality management (qm)* by *quality management*.

3.2 Data Analysis
The document management was performed through the Mendeley software (Butros and Taylor 2011) and the data analysis took place in two stages First, the bibliometric analysis was performed aiming to answer the research question RQ1. To this end, data analysis was done through Biblioshiny (Aria and Cuccurullo 2017) and complemented by an

analysis of co-occurrence networks (analysis of the main keywords) through the VOSviewer software (van Eck and Waltman 2010). For the analysis of the themes regarding the competencies in quality management, a classification in four quadrants was used (López-Robles et al. 2019):

1. **Motor themes** (1st Quadrant): consists of themes of strong centrality and density that are relevant to the development and structuring of the research field.
2. **Very developed or isolated themes** (2nd Quadrant): strongly related and highly specialized themes, but do not have an adequate basis or importance for the field.
3. **Emerging or declining themes** (3rd Quadrant): themes that are relatively weak in relation to centrality and density, representing the beginning or end of a research topic's life.
4. **Basic and transversal themes** (4th Quadrant): themes that are important for the field of research but need further development.

The second stage of data analysis aimed to answer research questions QP2 and QP3 and was performed through a content analysis. To this end, a detailed reading of all the articles in the sample was made (Mayring, 2014; Seuring and Müller, 2008), seeking to understand the main dimensions of competencies treated in the literature, as well as future research opportunities.

4. Results and Discussion

In this section, the results of the Bibliometric analysis and the content analysis are presented and discussed. Section 4.1 presents a descriptive analysis of the sample, while section 4.2 presents the main themes uncovered in the analysis, answering the RQ1. Section 4.3 answers the RQ2, presenting the competency dimensions obtained in the content analysis. Finally, section 4.4 points out the main research questions, thus answering RQ3.

4.1 Descriptive Analysis of the Sample

The sample analyzed covers the years 1999 to 2023, totaling more than 21 years of research, indicating that the subject has been studied for a long time. In general, it was not possible to notice a trend of growth in publications, however, in the last five years (2019-2023) about 32% of the sample was published, which reveals an increase in interest in the subject, as well as a constancy of the subject in the academic environment, which continues to generate articles annually.

The most cited paper in the sample is Hilton and Sohal (2012), in which the authors examine the relationship between a successful Lean Six Sigma deployment and some key explanatory variables that comprise the competency of the organization, the competency of the deployment facilitator, and the competency of the project leaders. In this study, the authors identified the key technical and interpersonal competencies needed by Black Belts and Master Black Belts for the proper development of Six Sigma. Table 1 presents the 10 most cited articles in the sample, with a total of 632 citations.

Despite not being one of the most cited papers in the sample, Jonker (1999) is the oldest. In this study, the author seeks to understand what the nature of quality management will be in developing companies, pointing out that organizations are going through a fundamental process of change and that competencies are losing focus on the company and changing to employees through the concept of Personal Quality Management (PQM), whose proof can be carried out through quality certifications.

Table 1. Most cited articles in the sample
Source: Authors

Article Name	Reference	Total Citations	CT per Year
A Conceptual Model for the Successful Deployment of Lean Six Sigma	Hilton and Sohal, (2012)	169	14,091
Implementing Supply Chain Quality Management	Kuei et al. (2008)	92	5,667
The Role of Leadership Competencies for Implementing TQM: an Empirical Study in Thai Manufacturing Industry	Das et al. (2011)	83	6,750

A Model for Evaluating Organizational Competencies: An Application in The Context of a Quality Management Initiative	Escrig-Tena and Bou-Llusar (2005)	61	3,333
Exploring the Relationship Between Information Technology Competence and Quality Management	Pérez-Aróstegui et al. (2015)	48	5,750
Information Technology-enabled Quality Performance: An Exploratory Study	Perez-Arostegui et al. (2012)	43	3,818
A Longitudinal Study if Innovation Competence and Quality Management on Firm Performance	Wang (2014)	40	4,222
The Role of Quality Managers in Contemporary Organizations	Elg et al. (2011)	35	2,917
Comparative Study of the Impact of Competency-based Training on 5 S and TQM: a Case Study	Khanna and Gupta (2014)	31	3,333
Competencies of Quality Professionals in the Era of Industry 4.0: A Case Study of Electronics Manufacturer from Malaysia	Kannan and Garad (2021)	30	8,500

*TC per Year - Total Citations per Year

Regarding the journals, the publications are relatively dispersed in the literature. The *International Journal of Quality and Reliability Management (IJQRM)* stands out, containing 4 (four) articles in the sample that deal mostly with the competencies for implementing quality improvement programs, such as 5"S" and TQM (Khanna and Gupta, 2014), Six Sigma (Hilton and Sohal 2012) and TQM (Das et al. 2011). In addition, this journal also brings advances in the subject, such as the competencies for quality management needed in industry 4.0 (Kannan and Garad, 2021). In the second position are *Quality – Access to Success* and *Total Quality Management and Business Excellence*, each with two papers present in the sample. Both journals do not present a defined line as the IJQRM, dealing with several topics, such as KPIs for quality management (Závadský et al. 2019) and quality management in supply chain (Kuei et al. 2008), respectively.

Regarding the most relevant authors, the main ones are ELG M, GREMYR I and MARTIN J, the first two with 3 articles in the sample and the last with 2 (two). It is interesting to notice that the three authors work a lot together. The oldest paper among them is (Elg et al. 2011), in which the first two authors seek to understand how quality management should be planned and practiced in relation to business operation. The partnership between the three authors can be seen in (Martin et al. 2021) and in (Martin et al. 2019), in which a competency framework for the quality management professional is sought and the adequacy between the competencies of the quality management professional and the competencies required in organizations is examined, respectively.

Finally, regarding the keywords, Figure 2 shows the co-occurrence network obtained through VOSviewer.
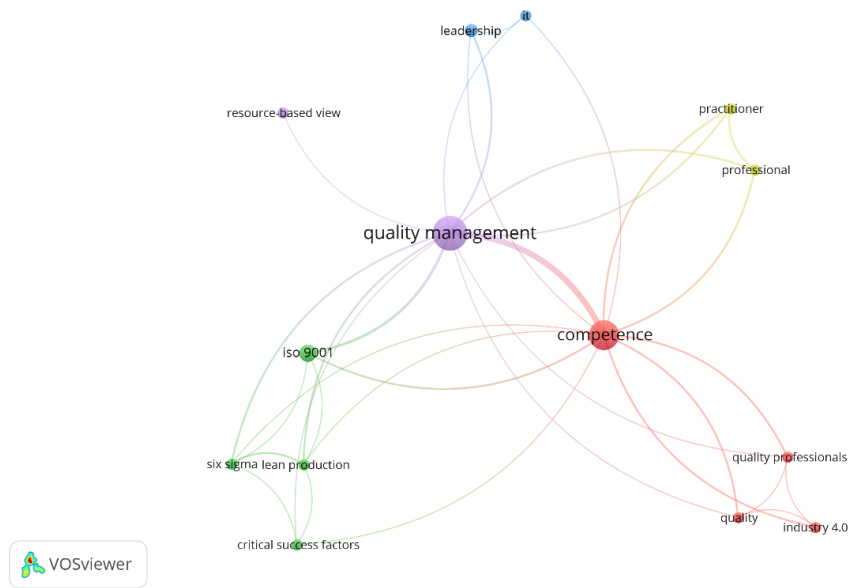
Figure 2. Co-occurrence network
Source: Authors

It is possible to notice that the keywords *quality management* and *competence* are the most recurrent in the sample, since they were used in the search strings in the scientific bases, having a strong relationship with each other. However, the emergence of five clusters in the network stands out. The purple cluster features *quality management* and *resource-based view*. Thus, it is composed of articles that use the resource-based view to address competencies in different contexts (Wang 2014). The green cluster brings keywords linked to quality improvement models treated by different authors (Das et al., 2011; Hilton and Sohal 2012; Khanna and Gupta, 2014), certification, especially ISO 9001 (Fonseca et al. 2017; Wang, 2014; Závadský et al. 2019) and critical success factors, usually related to the implementation of a quality management system (Kuei et al. 2008). The red cluster, in which the keyword *competence* is included, has as its main exponent the reference to industry 4.0, a relatively recent theme in the literature of competencies for quality management (Babatunde 2020; Jason et al. 2023; Kannan and Garad, 2021). The yellow cluster presents themes related to practice (Ingason and Jónsdóttir 2017; Martin et al., 2021, 2019), while the blue cluster presents themes related to leadership and information technology, which are important themes within the literature of competencies for quality management due to their recurrence of articles (Bolatan et al. 2022; Das et al. 2011; Perez-Arostegui et al. 2012; Pérez-Aróstegui et al. 2015; Power, 2014; Wang 2014)

4.2 Main Themes
According to Small and Koenig (1977), the classification of articles into fields or specialties is a problem with practical importance in science. Thus, after mapping the authors, their main articles and journals, a thematic coupling analysis by clusters was also performed.

Figure 3. Thematic map
Source: Authors

The motor themes identified are related to *quality management, competencies* and *practitioners*, being the most relevant theme to the entire field (Fonseca et al. 2017; Martin et al. 2021, 2019; Závadský et al. 2019). Regarding the Niche Themes, we can see those related to quality improvement systems, once they are normally related to specific knowledge areas (Das et al. 2011; Hilton and Sohal 2012; Khanna and Gupta, 2014). When it comes to the Emerging and Declining Themes, there are those related to *leadership*, *IT* and *resource-based view* with the same density and centrality. However, it is interesting to notice that, while *resource-based view* could be considered a declining theme due to its lack of appeal and publications inside the field (Wang, 2014), *leadership* and *information technology* may be considered as emerging, due to the recent articles that have been published (Bolatan et al. 2022; Duffield and Whitty 2015; Jason et al. 2023; Perez-Arostegui et al., 2012; Pérez-Aróstegui et al. 2015). Finally, regarding the basic themes, they are very relevant to the field, but there is still a necessary development. They concern ISO 9001 (Elg et al., 2011; Fonseca et al. 2017; Ingason and Jónsdóttir, 2017; Rogala 2016) which is intimately related to the necessary competencies for quality management and *industry 4.0*, which is the most recent theme, but a very prominent one, already (Babatunde, 2020; Kannan and Garad 2021).

4.3 Competency Dimensions
Aiming to respond to RQ2, the first product of content analysis was the identification of the main dimensions of competence addressed by the authors in their articles. Table 2 summarizes the main findings of the authors.

Table 2. Main dimensions of competencies
Source: Authors

Reference	Competency Dimensions	Reference	Competency Dimensions
Martin et al. (2021)	Human Competence, Methods and Processes Competence, Conceptual Competence and Contextual Competence	Pérez-Aróstegui et al. (2015)	Information Technology Competence

Reference	Competency Dimensions	Reference	Competency Dimensions
Kannan and Garad (2021)	Technical Competence, Methodological Competence, Social Competence and Personal Competence	Wang (2014)	Innovation Competence
Závadský et al. (2019)	Academic Competencies, Workplace Competencies and Personal Competencies	Perez-Arostegui et al. (2012)	Information Technology Competence
Cha (2019)	Relational Competence and Technological Competence	Hilton and Sohal (2012)	Technical Competence, Interpersonal Competence and Organizational Competence
Ingason and Jónsdóttir (2017)	Technical Competence, Behavioral Competence and Contextual Competence	Das et al. (2011)	Leadership Competence
Fonseca et al. (2017)	Technical Competence, Interpersonal Competence and Organizational Competence	Escrig-Tena and Bou-Llusar (2005)	Managerial Competence, Entry Based Competence, Transformation Based Competence and Exit Based Competence

Overall, 11 types of competency dimensions were identified in the sample. The most cited in the literature is Human Competence, representing 23% of the occurrences and being present in 26% of the articles in the sample. It is named in different ways, such as human competence (Martin et al. 2021), personal (Kannan and Garad 2021; Závadský et al., 2019), interpersonal (Fonseca et al. 2017; Hilton and Sohal 2012) and relational (Cha, 2019). The second most cited competency is Technique, representing 17% of the occurrences and being present in 11% of the articles in the sample (Cha 2019; Fonseca et al., 2017; Hilton and Sohal 2012; Ingason and Jónsdóttir, 2017; Kannan and Garad, 2021). Finally, the third most cited are the Contextual, with 10% of the occurrences and present in 11% of the articles (Ingason and Jónsdóttir 2017; Martin et al. 2021; Závadský et al. 2019).

The three types presented above are quite classic in the competency literature (Ellström, 1997, 1992; Hecklau et al., 2016; Katz 1955; Le Deist and Winterton, 2005), however, are sometimes evaluated by different epistemological cuts, which makes it difficult to develop a framework with unique definitions for each of the types of competence. This reveals a lack of maturity of the field, which does not yet have a consolidated theoretical basis.

4.4 Research Gaps
A second product of the content analysis aimed to respond RQ3 and identify what are the main research gaps within the context of competencies in quality management. Some of them are related to the authors' research, while others deal with the topic more broadly. Table 3 summarizes the information collected.

Table 3. Research gaps
Source: Authors

Reference	Purpose of the Article	Research Gap
Jason et al. (2023)	Understand how digitalization influences the role of QM professionals, by assessing its influence on the professionals' improvement practices	Study the impact of digitalization on daily improvement work is different for each characteristic of QM professionals, such as education, experience, etc.

Reference	Purpose of the Article	Research Gap
Bolatan et al. (2022)	Investigate the relationships between firms' strategic planning (SP), leadership and technology transfer competence (TTC) by incorporating the mediating role of strategic quality management (SQM).	Study the role of strategic quality management (SQM) in the development of competencies and how it enhances other organizational functions, such as exporting, knowledge management, and development of new products
Martin et al. (2021)	Introduce competency-based terminology to describe the general competencies of quality management work in organizations and create a framework of competencies to understand what it takes to be a quality management professional.	1. Test the causal relationships of the model proposed by the authors and the practical performance of quality management. 2. Study the relationship between competencies and the performance of professionals.
Kannan and Garad (2021)	Investigate the current competencies of quality professionals and the new skills that would be needed to adapt to Industry 4.0, using an electronics industry as a case study.	1. Study the competency gaps in relation to those required in Industry 4.0 in other types of industry. 2. Understand how Quality professionals can play a role in ensuring information integrity and setting future audit standards.
Ingason and Jónsdóttir (2017)	Define what are the elements that characterize a competent quality manager through the creation of a model presenting the different attributes necessary for a quality management professional, classifying them into knowledge, skills, and competencies.	1. Deepen the analysis of the interconnections between knowledge, skills, and competencies, connecting them with behavioral science. 2. Conduct *survey* field research with a larger sample, including the professionals who recruit quality managers and the executives who oversee their work
Pérez-Aróstegui et al. (2015)	Develop a deeper knowledge of the complementarities of IT competence with other organizational resources or practices that have a strong presence in companies, such as quality management practices.	1. Empirically study the moderating effect of IT competence on the impact of implementing quality management practices on organizational outcomes. 2. Analyze the mediating role of quality management practices in the relationship between IT competence and performance.

5. Conclusions

The objective of this article was to map the area of competencies for quality management through a bibliometric analysis combined with a content analysis. Our findings suggests that, in general, the literature on competencies for quality management has been developing over the years, although there are still many gaps that need to be filled. The field presents a very pulverized structure, without a solid theoretical basis that permeates the studies that integrate it. Despite this, the field is presenting developments when interacting with other areas of knowledge such as Industry 4.0 and information technology.

In a theoretical way, the study contributes with the indication of the main authors, journals, and themes for the field, in addition to pointing out the main dimensions of competencies treated and research gaps, in order to guide future researchers who wish to contribute to the theme. From a practical point of view, this article helps to structure the existing knowledge about the competencies for quality management, in addition to guiding professionals in the area on the main dimensions of competencies, necessary for a quality manager.

Despite the authors' efforts to obtain the most complete sample possible, this study has limitations directly related to the databases and methodological choices regarding the search strings, filters and databases used. In addition, the sample selection process had the analysis of only two researchers, which may instill a bias to the data due to the non-existence of several evaluators and eventual choices by consensus.

As opportunities for future research, in addition to those mentioned in section 4, there is a need to identify the main competencies addressed in each of the dimensions presented by the researchers to seek and understand eventual correlations between the dimensions of competence presented. In addition, it is necessary a theoretical study about the definitions of competence used by the various researchers, to obtain a more general definition for each of them, aiming to direct the field of study to a common theoretical basis.

References

Aria, M. and Cuccurullo, C., Bibliometrix: An R-Tool for Comprehensive Science Mapping Analysis, *Journal of Informetrics,* vol. 11, no. 4, pp. 959–75, 2017.

Babatunde, O.K., Mapping the Implications and Competencies for Industry 4.0 to Hard and Soft Total Quality Management, *TQM Journal*, vol. 33, no. 4, pp. 896–914, 2020.

Bolatan, G.I.S., Golgeci, I., Arslan, A., Tatoglu, E., Zaim, S. and Gozlu, S., Unlocking the Relationships between Strategic Planning, Leadership and Technology Transfer Competence: The Mediating Role of Strategic Quality Management, *Journal of Knowledge Management*, vol. 26, no. 11, pp. 89–113, 2022.

Butros, A. and Taylor, S., Managing Information: Evaluating and Selecting Citation Management Software, a Look at EndNote, RefWorks, Mendeley and Zotero, *Proceedings of the 36th IAMSLIC Conference: Mar del Plata, Argentina*, vol. 17-21 October, 2010, pp. 53–66, 2011.

Calof, J., Søilen, K.S., Klavans, R., Abdulkader, B. and Moudni, I. El., Understanding the Structure, Characteristics, and Future of Collective Intelligence Using Local and Global Bibliometric Analyses, *Technological Forecasting and Social Change*, vol. 178(March 2021), 2022.

Carvalho, M.M., Fleury, A. and Lopes, A.P., An Overview of the Literature on Technology Roadmapping (TRM): Contributions and Trends, *Technological Forecasting and Social Change*, vol. 80, no. 7, pp. 1418–1437, 2013.

Cha, W., Comeback Workout: QM Practices and the Health and Fitness Industry, *International Journal of Quality and Service Sciences*, vol. 11, no. 2, pp. 283–301, 2019.

Das, A., Kumar, V. and Kumar, U., The Role of Leadership Competencies for Implementing TQM: An Empirical Study in Thai Manufacturing Industry, *International Journal of Quality and Reliability Management*, vol 28, no. 2, pp. 195–219, 2011.

Duffield, S. and Whitty, S.J., Developing a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects, *International Journal of Project Management*, vol. 33, no. 2, pp. 311–24, 2015.

Duriau, V.J., Reger, R.K. and Pfarrer, M.D., And Methodological Refinements, *Organizational Research Methods* vol. (February 2005), pp. 5–34, 2007.

Elg, M., Gremyr, I., Hellström, A. and Witell, L., The Role of Quality Managers in Contemporary Organisations, *Total Quality Management and Business Excellence*, vol. 22, no. 8, pp. 795–806, 2011.

Ellström, P.E., Kompetens, Utbildning Och Lärande i Arbetslivet, *Stockholm: Nordstedts Juridik*, 1992.

Ellström, P.E., The Many Meanings of Occupational Competence and Qualification, *Journal of European Industrial Training*, vol. 21, pp. 266–73, 1997.

Escrig-Tena, A.B. and Bou-Llusar, J.C., A Model for Evaluating Organizational Competencies: An Application in the Context of a Quality Management Initiative, *Decision Sciences*, vol. 36, no. 2, pp. 221–57, 2005.

Fonseca, L.M., Domingues, J.P. and dos Guimarães Sá, J., Leading Quality in the 21st Century: Profiles of Quality and Organizational Excellence Managers, *Quality - Access to Success*, vol. 18, no. 161, pp. 34–38, 2017.

Hecklau, F., Galeitzke, M., Flachs, S. and Kohl, H., Holistic Approach for Human Resource Management in Industry 4.0, *Procedia CIRP*, vol. 54, pp. 1–6, 2016.

Hilton, R.J. and Sohal, A., A Conceptual Model for the Successful Deployment of Lean Six Sigma, *International Journal of Quality and Reliability Management*, vol. 29, no. 1, pp. 54–70, 2012.

Huq, Z., Six-Sigma Implementation through Competency Based Perspective (CBP), *Journal of Change Management*, vol. 6, no. 3, pp. 277–89, 2006.

Ingason, H.Þ. and Jónsdóttir, E.R, The House of Competence of the Quality Manager, *Cogent Business and Management*, vol. 4, no. 1, 2017.

Jason, M., Hung, D.Q. and Ida, G., The Influence of Digitalisation on the Role of Quality Professionals and Their Practices, *Cogent Business and Management*, vol. 10, no. 1, 2023.

Jonker, J., Some Reflections on the Emerging Notion of Personal Quality Management, *Journal of Workplace Learning*, vol. 11, no. 4, pp. 123–30, 1999.

Kannan, K.S.P.N. and Garad, A., Competencies of Quality Professionals in the Era of Industry 4.0: A Case Study of Electronics Manufacturer from Malaysia, *International Journal of Quality and Reliability Management*, vol. 38, no. 3, pp. 839–71, 2021.

Katz, L., Skills of an Effective Administrator, *Harvard Business Review* vol. 33, pp. 33–42, 1955.

Khanna, V.K. and Gupta, R., Comparative Study of the Impact of Competency-Based Training on 5 'S' and TQM: A Case Study, *International Journal of Quality and Reliability Management*, vol. 31, no. 3, pp. 238–60, 2014.

Kuei, C.H., Madu, C.N. and Lin, C., Implementing Supply Chain Quality Management, *Total Quality Management and Business Excellence*, vol. 19, no. 11, pp. 1127–41, 2008.

Le Deist, F.D. and Winterton, J, What Is Competence?, *Human Resource Development International*, vol. 8, no. 1, pp. 27–46, 2005.

López-Robles, J.R., Otegi-Olaso, J.R., Porto Gómez, I. and Cobo, M.J., 30 Years of Intelligence Models in Management and Business: A Bibliometric Review, *International Journal of Information Management*, vol. 48(April 2017), pp. 22–38, 2019.

Martin, J., Elg, M. and Gremyr, I., Fit for Purpose? Exploring Competence in Quality Management, *International Journal of Quality and Service Sciences*, vol. 11, no. 3, pp. 317–33, 2019.

Martin, J., Elg, M., Gremyr, I. and Wallo, A., Towards a Quality Management Competence Framework: Exploring Needed Competencies in Quality Management, *Total Quality Management and Business Excellence*, vol. 32, no. 3–4, pp. 359–78, 2021.

Mayring, P. Qualitative Content Analysis, *The SAGE Handbook of Qualitative Data Analysis*, pp. 170–83, 2014.

Neely, A. The Evolution of Performance Measurement Research: Developments in the Last Decade and a Research Agenda for the Next, *International Journal of Operations and Production Management*, vol. 25, no. 12, pp. 1264–77, 2005.

Perez-Arostegui, M.N., Benitez-Amado, J. and Tamayo-Torres, J., Information Technology-Enabled Quality Performance: An Exploratory Study, *Industrial Management and Data Systems*, vol. 112, no. 3, pp. 502–18, 2012.

Pérez-Aróstegui, M.N., Bustinza-Sánchez, F. and Barrales-Molina, V., Exploring the Relationship between Information Technology Competence and Quality Management, *BRQ Business Research Quarterly*, vol. 18, no. 1, pp. 4–17, 2015.

Power, D. J., Competence and Capability in Quality in the High-Tech Sector: An International Comparison, *International Journal of Operations and Production Management*, vol. 34, no. 9, pp. 1184–1209, 2014.

Racine, J. S., RSTUDIO: A Platform-Independent IDE for R and Sweave, *Journal of Applied Econometrics*, vol. 27, no. 1, pp. 167–72, 2012.

Rogala, P., Identification of Barriers to Improving Quality Management Systems, *TQM Journal*, vol. 28, no. 1, pp. 79–88, 2016.

Seuring, S. and Müller, M., From a Literature Review to a Conceptual Framework for Sustainable Supply Chain Management, *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1699–1710, 2008.

Tillema, H., Auditing Assessment Practices in Organisations: Establishing Quality Criteria for Appraising Competencies, *International Journal of Human Resources Development and Management*, vol. 3, no. 4, pp. 359–70, 2003.

van Eck, N.J. and Waltman, L., Software Survey: VOSviewer, a Computer Program for Bibliometric Mapping, *Scientometrics*, vol. 84, no. 2, pp. 523–38, 2010.

Wang, C.H., A Longitudinal Study of Innovation Competence and Quality Management on Firm Performance, *Innovation: Management, Policy and Practice*, vol. 16, no. 3, pp. 392–403, 2014.

Wohlin, C., Guidelines for Snowballing in Systematic Literature Studies and a Replication in Software Engineering, *ACM International Conference Proceeding Series*, 2014.

Závadský, J., Korenková, V., Závadská, Z., Kadárová, J. and Tuček, D., Competences in the Quality Management System Evaluation Based on the Most Worldwide Used Key Performance Indicators, *Quality - Access to Success*, vol. 20, no. 169, pp. 29–41, 2019.

Zupic, I. and Čater, T., Bibliometric Methods in Management and Organization, *Organizational Research Methods*, vol. 18, no. 3, pp. 429–72, 2015.

Biographies

Artur Henrique de Morais Brito is currently a Master Student in Operations Management at the University of São Paulo. He is graduated in Civil Engineering at the Federal University of Pernambuco with a double degree in Infrastructure Engineering at ESTP Paris. He works as a Development Manager at an engineering consulting company. His main research interests are quality management and ESG.

Fernando Tobal Berssaneti is currently a Professor of Industrial Operations and Industrial Management at the University of Sao Paulo and member of the Board of Trustees of the Carlos Alberto Vanzolini Foundation. He received a PhD in Production Engineering at the Polytechnic School of São Paulo (2011). He works as a business consultant and teaches courses in Specialization courses at Polytechnic School of São Paulo since 2004. Among his research interests there are Project and Product Management and Quality and Productivity Management.