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Critical Factors of Success for Quality and Food Safety Management: Classification and Prioprization

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Abstract The main proposal of this research is to examine the existing literature on quality management systems and food safety management systems, and group, sort and prioritize the critical success factors that affect these systems in a global context, to help researchers and food industry managers in decision making and prioritization of actions in research and projects related to the topic. We conducted a quali-quantitative research based on a review of published papers about the subject in the last 23 years. The data were treated statistically, grouped and analyzed by the Nihans classification technique. The result led to the selection and prioritization of 14 critical factors of success for quality and food safety management systems.

Keywords Quality Management, Food Safety Management, Critical Success Factors, Food Industry

1. Introduction

The purpose of this research is to examine the existing literature on quality management systems and food safety management systems, and group, sort and prioritize the critical success factors that affect these systems in a global context, to help researchers and food industry managers in decision making and prioritization of actions in research and projects related to this subject.

The quest for continuous improvement of the performance of organizations is one of the biggest challenges for contemporary managers. In the food industry this challenge is directly related to the performance of the quality management system and food safety, as the production and marketing of foods with perceived quality, suited to the needs and aspirations of the final consumer, and doing no harm to the health of people are prerequisites for the company to remain competitive, to grow and develop in the medium and long term.

According to the World Health Organization (WHO), the global food trade is increasing every year, contributing to the risk of the spread of pathogens and contaminants across national boundaries, creating new challenges for the authorities and increasing the need for global sharing information about food safety. And yet, climate change may be a factor in increased rates of some food-borne illnesses due to the faster growth of micro-organisms in foods and water with higher temperatures, resulting in the emergence of toxins in new geographic areas and contributing to increasing the level of pathogens in food [1].

The quality and safety of foods that are eaten daily by every inhabitant of the planet becomes a major factor in maintaining the health of the population. Contaminated food causes many acute and life-long diseases, ranging from diarrheal diseases to various forms of cancer. WHO estimates that the food-borne diseases hydrias and diarrhea, taken together kill about 2.2 million people annually, 1.9 millions of them children [2].

The full extent of the burden and cost of unsafe food, however, is currently unknown. Precise information on the burden of disease is needed to guide food-safety policy, including the development and implementation of food safety standards in the context of the Codex Alimentarius Commission, and provide a baseline for monitoring and impact assessment of food-safety measures [3].

Food-borne diseases and threats to food safety constitute a growing public health problem [1]. Due to the growing number of food scandals, consumer demand, recession and economic crises that occur frequently, it is clear that simply certifying the safety management system and quality does not warrant the high degree of identification, assessment and control of hazards in the food supply, processing and supply chain [4].

It may be noted that requirements for certificates of compliance for food products is the first step towards the continuous improvement of quality and safety of food consumed worldwide. A current example of its importance

is that, recently, the United States began requiring Chinese food imported by them, not only the certification of products and manufacturers, but also the certification of foreign importers, seeking to offer incentives to importers who advocate food safety good practices, and considering disclosing the names of importers with certificates [5].

Currently, the food industry is not only responsible for producing safe food, but also for demonstrating transparently that food safety has been planned and guaranteed. This was achieved through the development of the Hazard Analysis of Critical Control Points (HACCP) systems as part of ensuring the safety of food in food companies [6]. Companies that are committed to producing safe food must be engaged in the effective implementation of quality management systems (QMS) and food safety management (FSMS) which are aligned with existing national and international standards, given that quality is linked to security in consumers' minds, and when they seek a better-quality product it is likely that they also want a safer product [7].

To overcome these challenges is fundamental to understanding and analyzing the critical success factors for implementation of quality and food safety management systems (QFSMS), mainly in small and medium enterprises, as these face greater difficulties related to the implementation of these management systems, due to the fact of not having sufficient expertise, required competence, financial resources and human resources [8]; [9]; [10]; [11]; [12].

Due to the importance of the topic many researchers have devoted themselves to studying and determining the various factors that may have an impact on the effectiveness of a management system and consequently the performance of the organization. Recent research highlights that staff training in tools for troubleshooting, suggestions for incentives, face-to-face and regular visits to the areas of manufacturing, are fundamental to the success of continuous improvement activities [13]. These factors are essential for the effective implementation of quality management systems and food safety, as recorded in the literature review conducted in this research, which is based on a qualitative and quantitative research, based on a literature review of papers published in the scientific literature over the last 23 years. As a result, we obtained a classification of the main critical factors for successful implementation of an integrated QFSMS and made a selection and prioritization of 14 critical success factors for the management of food safety and quality, to support researchers and managers in their projects related to the topic.

2. Materials and Methods

This is a qualitative and quantitative research based on an extensive literature search of articles published in the past 23 years, which had as their subject the systems of quality management and food safety. These studies analyzed the factors influencing the implementation of these two management systems. The articles analyzed were published in scientific magazines and journals between the years 1989 and 2012.

For this study we adopted a strategy of mixed methods research, as a research approach that combines or associates qualitative and quantitative ways, involving the use of both approaches together. Through the mixed method research theory can be used as a structure to be tested and may give more "insights" with the combination and integration of qualitative and quantitative approaches than with each of them separately, because its interaction provides greater understanding of the research problem [14].

The interaction of methods proposed in this research promotes the development of both theory and assessment (or check) theory [15]. Qualitative studies in social sciences are accepted as triangulation or exploratory efforts that complement quantitative studies that provide quality checks for each of these phases, determining the validity and reliability of the result [16]. For [17] conducted a detailed study to examine the ways in which the methods of quantitative and qualitative research were integrated and combined in practice, defining the triangulation as the traditional view that quantitative and qualitative research are combined to triangulate findings in order to be mutually corroborative.

To identify and integrate the existing literature on topic, relevant information for the research was conducted in the electronic database "ProQuest", using keywords like "food safety management", in respect of quality management publications and "factors" and "critical factors" in the titles and abstracts of articles reviewed by specialists. We selected 45 relevant papers and examined them without regard to critical factors for implementation of management systems.

In this study, information was collected from the date described in the articles and were accurately assessed. The words that were found in the literature were translated, compared and contrasted with their meanings in Portuguese. Similar words are combined, so that the factors could be grouped into specific subgroups.

Data were pooled and analyzed using spreadsheets and pivot tables from Microsoft Excel, for further treatment by the *Nihans* technique for elements classification, able to divide a set of numeric elements in different subsets which facilitates decision-making with respect to the priority to be given to each critical factor identified.

3. Literature Review

3.1. Quality Management System (QMS)

Management systems must define how things should be done within a business, the achievement of organizational

goals effectively and efficiently through planning, organization and human resources, directing and controlling the available organizational resources

Therefore, a system of quality management must define how the quality function is structured within a business to obtain better results. [18] Showed that the best results are generated by combining a variety of quality tools, instead of their single use. [19] Stated that "quality is free", emphasized prevention and defined a program of 14 steps for quality improvement through a philosophy of zero defects. [20] Argued that the cause of poor quality is the system and not the employee, and that top management should understand and see the company as a complex system. He emphasized the use of statistical techniques for quality control and proposed 14 principles or points for effective quality management in organizations.

[21] Described the idea of total quality, recognizing that quality was not just a collection of tools and techniques, but supported the integration of statistical techniques and processes within the operation of the companies. In addition, he prescribed 10 benchmarks critical to the successful implementation of total quality control and identified customer satisfaction as its ultimate goal. [22] Advocated a concept that is based on improving quality performance to unprecedented levels. [23] Offered three sets of processes, quality planning, quality improvement and quality control as a general framework for Total Quality Management (TQM) and was one of the first to measure the cost of quality.

TQM has its origins in the Union of Japanese Scientists and Engineers who formed a committee in 1949 to improve Japanese productivity and increase their quality of life after World War II [24]. [25] defined TQM as "an approach to the management of organizations, which emphasizes continuous quality improvement and customer satisfaction, implies the application of tools and systematic approaches to managing organizational processes, with these purposes in mind, and involves the creation of structures, such as quality management teams and boards, to keep the focus on these purposes and approve the procedures for organizational improvement."

The integrated management philosophy and set of practices focusing on continuous improvement and meeting the requirements of customers, reducing rework, long-range thinking, increasing employee involvement and team work to redesign processes, developing a competitive benchmarking, based on problem-solving teams, constantly measuring results and maintaining closer relations with suppliers. Regardless of how it is defined, TQM is what allows companies to reduce costs and achieve a high degree of competitive differentiation [26].

TQM has been to be known as a management philosophy, a way of thinking to transform the status of an organization to a world-class level [27]. It has also been described as a system that helps the organization to achieve excellence), but the performance of the QMS can be affected by adjustments to the internal organizational structure and adjustments related to the external environment [28].

Common themes such as customer focus, continuous improvement and process management, use of scientific tools, a commitment to leadership and human resource management, are the critical factors of TQM [29]. These critical factors are constructed as part of the Malcolm Baldrige Quality Model in the United States, which over the last 20 years has been tested, refined and shown to be correlated with the superior performance of organizations. In Brazil there is also a National Quality Award (NQA) created by the National Quality Foundation founded in 1991. Total Quality Management and the 8 Primary Elements of TQM can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization. The 8 Primary Elements of TQM are:

1. Customer-focused: The customer ultimately determines the level of quality. No matter what an organization does to foster quality improvement—training employees, integrating quality into the design process, upgrading computers or software, or buying new measuring tools—the customer determines whether the efforts were worthwhile.
2. Total employee involvement: All employees participate in working toward common goals. Total employee commitment can only be obtained after fear has been driven from the workplace, when empowerment has occurred, and management has provided the proper environment. High-performance work systems integrate continuous improvement efforts with normal business operations. Self-managed work teams are one form of empowerment.
3. Process-centered: A fundamental part of TQM is a focus on process thinking. A process is a series of steps that take inputs from suppliers (internal or external) and transforms them into outputs that are delivered to customers (again, either internal or external). The steps required to carry out the process are defined, and performance measures are continuously monitored in order to detect unexpected variation.
4. Integrated system: Although an organization may consist of many different functional specialties often organized into vertically structured departments, it is the horizontal processes interconnecting these functions that are the focus of TQM.
5. Strategic and systematic approach: A critical part of the management of quality is the strategic and systematic approach to achieving an organization's vision, mission, and goals. This process, called

strategic planning or strategic management, includes the formulation of a strategic plan that integrates quality as a core component.

6. Continual improvement: A major thrust of TQM is continual process improvement. Continual improvement drives an organization to be both analytical and creative in finding ways to become more competitive and more effective at meeting stakeholder expectations.
7. Fact-based decision making: In order to know how well an organization is performing, data on performance measures are necessary. TQM requires that an organization continually collect and analyze data in order to improve decision making accuracy, achieve consensus, and allow prediction based on past history.
8. Communications: During times of organizational change, as well as part of day-to-day operation, effective communications plays a large part in maintaining morale and in motivating employees at all levels. Communications involve strategies, method, and timeliness.

These criteria are based on 11 grounds: systems thinking, organizational learning, culture of innovation, leadership and constancy of purpose, guidance and processes information, future vision, value generation, valuing people, knowledge about the customer and the market development partnerships, and social responsibility [30].

The system of total quality management can also be assessed and certified by the requirements of international standard ISO 9001:2008, which aims to specify the requirements for a quality management system where an organization wants to demonstrate its ability to provide products that consistently meet customer requirements and applicable laws, as well as plans to increase customer satisfaction. The standard adopts a systems approach and is based on processes and eight management principles: customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial relationships with suppliers (ISO 9001, 2008).

Food industries should incorporate TQM concepts and practices of food-safety management systems, because quality and safety are two important elements in consumer perception of food and decision making associated with the choice of food [31].

3.2. Food Safety Management System (FSMS)

The production of safe, nutritious food with assured quality requires effective management of the entire system especially when this production is large scale. The safety management of food or "Food Safety Management" is a coordinated activity to direct and control an organization with regard to the production of safe food of high quality. This definition does use the word "control" and it is impossible to separate the behavior of food handler from the management system [32]. The safety of the food guarantee for consumers purchasing a quality food with attributes that are of interest, stand out among the attributes related to their health and safety [33].

The Codex Alimentary defines food security as a guarantee that the food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. These health hazards are usually caused by food-safety hazards, which are characterized as biological, chemical or physical, or condition of the food, with the potential to cause an adverse health effect of one or more individuals.

The safety management system of food brings a set of processes and procedures designed to control food-safety hazards [34]. The actions provided for in this type of system are determined through a risk assessment, and initial analysis of the probability of an adverse health effect and the severity of the consequence of a hazard or hazards that can be found in foods [35].

To standardize this analysis of hazards and risks to food safety, the system Hazards Analysis and Critical Control Points (HACCP) was developed, which is a systematic and scientific system to ensure food safety. It was developed by Pillsbury in the 1960s for the U.S. Army and NASA in an effort to achieve "zero defects" and ensure total food safety for the first U.S. manned space program and appeared in the last 20 years as the initial approach to ensure the supply of safe food).

It is a tool for the development, implementation and management of effective procedures to ensure food safety [37]. This system can be applied to control any stage of the food supply chain (supply, processing, and distribution) and is designed to provide food retro action sufficient to direct corrective actions [38].

The HACCP is widely recognized as the best method to ensure product safety, is becoming internationally recognized [39] and has as its main objectives to identify, assess and control the hazards for food safety [40]; [42]; [43]; [44]; [45]; [46] Satin, 200; [47]; [48]; [49]; [50]; [51]; [52] and [53].

The HACCP system has gradually gained popularity and acceptance and is currently considered as a prerequisite for food manufacturers who want to export their products [54] because if the HACCP is applied correctly it will prevent outbreaks of food-borne illness [55] and possible financial and non-financial losses related to these events, which can damage the image of the organization in the market. Systems based on HACCP are considered the most effective way to manage food safety [32] and to ensure that food produced does not cause poisoning or food poisoning toxicity.

All these studies are based on the HACCP approach and its seven principles described in the Codex Alimentation [57] (CAC, 1993). With the introduction of the international standard ISO 22000, [58] this approach was

slightly modified by strengthening the management elements and the proposed improvement security controls. The ISO 22000 relates to food safety as part of a comprehensive management system standard. This approach is similar to that followed by ISO 9001 - quality management systems, ISO 14001 - environmental management, ISO 18801 - safety management and occupational health. In this context, an organization may voluntarily decide to implement ISO 22000 and then seek certification by an authorized certification body, and thus get verification by independent third parties of the effectiveness of its practices related to food safety.

The approach used by ISO 22000 is based on the application of principles of the process management. The central element of management is the concept of processes. In this context, the management system of an organization can be seen as a large file, which can be broken into several sub-processes [55]. Effective management of these processes ensures effective management of the entire organization [56] The ISO 22000 is a standard applicable to all sectors of the chain that influence food safety, as mentioned in the standard ISO 22004 - *Guidelines for the Implementation of Standard Processes Considered in Terms of Food Safety* [54].

In Brazil, the ISO 22000 was published by the Brazilian Association of Technical Standards in July 2006 (ISO 22000, 2006), but as the standard is not a mandatory standard, this represents a limiting requirement for volunteers and tends not to be widely adopted [57].

However, with the increasing importance of issues related to food safety and reports of illness and accidents caused by unintentional ingestion of contaminated food, large companies and stakeholders involved in the food chain are already demanding the application of the concepts and practices focusing on safety in food production, through the implementation of ISO 22000 and other internationally recognized standards of food safety as a way to ensure that the processes of food production have the ability to manufacture safe products, thus preventing diseases caused by food and losses related to accidents caused by unsafe food.

We noted also that the adoption of ISO 22000 makes possible the development of the functions of control and quality assurance, coupled with food safety, establishing continuous quality monitoring procedures and corrective action, also acting as support policies and strategies for the organizations that adopt it, since it requires suppliers and customers to meet the demands of quality and food safety and assures consumers that they are met [58] making it possible for this culture to permeate the entire food supply chain.

In addition to ISO 22000, there are other international quality and food safety standards recognized by the Global Food Safety Initiative (GFSI). Table 1 describes the main existing global standards, as well as the year of publication, country of origin and the entity responsible for the publication and periodic reviews of the same.

These standards are studied and applied by several food chain organizations in the world, because food safety is an important attribute of quality and its suitability requires an effective system and a proper organizational culture focused on food.

Table 1. Main existing global standard

Year of Publication	Country of Origin	Organization	Standard
1997	Germany	Euro-Retailer Produce Working Group (EUREP)	**Euro-Retailer Produce Working Group, Good Agricultural Practices (EUREPGAP)**
1998	England	British Retail Consortium (BRC)	**BRC Food Technical Standard / Global Standard for Food Safety**
2001	USA	SAI Global	**GMA-SAFE – Supplier assessments for food excellence**
2001	USA	Food Products Association (FPA)	**FPA-SAFE – Supplier Audits for Food Excellence**
2003	USA	Safety Quality Food Institute (SQFI)	**Safety Quality Food (SQF)**
2003	Germany	International Featured Standard (IFS)	**IFS Food**
2008	England	British Standards Institution	**Publicly Available Specification (PAS) 220**
2009	Switzerland	ISO/TS 22002-1:2009	**Prerequisite programmers (PRP) on food safety -- Part 1: Food manufacturing**
2009	Netherlands	Foundation for Food Safety Certificate action (FFSC)	**Food Safety System Certification (FSSC) 22000**

Source: Prepared by the author.

4. Analysis and Treatment of Data

4.1. Critical Factors for the Deployment and Performance of the QMS and SGSA

To ensure the effectiveness of the management system, it is necessary to develop a consistent participatory deployment process, based on a cultural realignment of all participants identified five guiding principles for the management culture which includes the formulation of a strategy of general culture, development of cultural leaders, sharing culture with staff, training, motivation and providing performance feedback, providing a measured cultural performance, and continuous commitment to

The critical factors are critical areas that an organization must carefully examine and categorize their impact on the system as well as across the organization in order to manage them successfully and get the application system and affect the organization's mission [59].

Besides the cultural aspects related to the deployment and performance management systems, many authors have studied the main factors that influence this process. Tables 2, 3, 4, 5 and 6 present a chronological bibliography about QMS critical factors

Table 2. Critical factors that influence the quality management system (QMS). Chronological bibliography research - Period from 1989 to 1996.

Year	Authors
1989	[60]
1991	[61]
1995	[62]
1995	[63]
1996	[64]

Table 3. Critical factors that influence the quality management system (QMS). Chronological bibliography research - Period from1996 to 2002.

Year	Authors
1996	[65]
1999	[66]
2002	[67]

Table 4. Critical factors that influence the quality management system (QMS). Chronological bibliography research - Period from 2003 to 2005.

Year	Authors
2003	[68]
2003	[69]
2004	[70]
2005	[71]

Table 5. Critical factors that influence the quality management system (QMS). Chronological bibliography research - Period from 2005 to 2009.

Year	Authors
2005	[70]
2006	[72]
2007	[73]
2007	[74]
2009	[75]
2009	[76]
2009	[77]

Table 6. Critical factors that influence the quality management system (QMS). Chronological bibliography research - Period from 2010 to 2012.

Year	Authors
2010	[78]
2010	[79].
2011	[80]
2012	[81]
2012	[82]

Continuing the research, we carried out a detailed survey of factors related to food safety. Tables 7 present chronological literature surveys on the critical factors for the Food Safety Management System (FSMS).

Table 7. Critical factors that influence the food safety management system (FSMS). Chronological bibliography research - Period from 1999 to 2012.

Year	Authors
1999	[83]
2000	[32]
2001	[10]
2001	[9]
2003	[84]
2004	[85].
2004	[86]
2006	[12]
2007	[11]
2007	[87]
2007	[88]
2008	[89]
2008	[90]
2008	[91]
2009	[4]
2011	[92]
2011	[59]
2012	[93]

In his latest study, the researcher [59] examined the literature on system hazard analysis and critical control points in the food industry registers or the critical factors that affect the implementation of this system in the context of global agric-food sector. According to the results of this study the critical factors listed in descending order of frequency of occurrence in the articles analyzed are as shown in Table 3.

By analyzing the critical factors studied by the authors in the last 23 years it is noted that some factors are repeated or have the same meaning. From this perception data were worked seamlessly into an integrated whole, as in the food industry initiatives for quality management and food safety management should be integrated. Then comes the need to group, sort and prioritize these factors, transforming collected data into useful information for decision making on actions and activities aimed at implementing this management system.

4.2. Nihans Collation and Analysis for the Classification and Prioritization of Critical Factors

Two hundred and twenty-five (225) QMS critical factors and 94 FSMS critical factors were raised, totaling 319 critical factors that were reported in the scientific articles researched, published over the past 23 years.

The factors cited by the authors as being critical to the implementation and maintenance of QMS and FSMS separately were grouped into subgroups by similarities of description, using pivot tables and filters in the program Microsoft Excel. As a result of this grouping 58 critical success factors that impact directly or indirectly on seamlessly implementing a quality and food safety management system (QFSMS) were tabulated.

For prioritization of critical success factors in deploying and maintaining a system of quality management and food safety, we used the technique *Nihans* [94]. The index *Nihans* is used to separate a homogeneous set of quantifiable items, the most important being (class A) those greater than the index and less important (non-class A) those below the index. The application rate of *Nihans* class provides non-A, similarly, identifying those items least important (class C), characterizing class B as the median value.

The index *Nihans* according to [94] is a sorter element able to divide a set of numerical elements into different subsets and is a simple way to divide the population into classes ABC, or any number of other classes. The *Nihans* Index is calculated by the following formula 1:

$$NA = \sum X^2 : \sum X \quad (1)$$

For example, the index *Nihans* the numbers 2, 4, 6, 8 and 9 are calculated as follows:

$$\sum X^2 = 2d+4d+6d\ 8d+\ d = 4+16+36+64+81= 201$$

$$\sum X = 2 + 4 + 6 + 8 + 9 = 29$$

$$NA = \sum X^2 : \sum X = 201/29 = 6.93$$

In this case, all numbers $X > 6.93$ are elements of class A. In example 8 and 9. The value 6.93 is given the name of "cut-off number".

With the *Nihans* technique, used for classification and prioritization, organizations can support managers in more streamlined decision-making processes, where one can better understand the problems and thus enable better systemic decisions, based on concrete facts and data, because according to [94] the decision is one of the core problems of Western rationality and therefore various problems may be experienced in the course of decision making without the use of an appropriate method or poorly structured criteria, where these decisions lead the decision maker to wrong choices. Choices made may well mean the difference between success and failure of a business or organization.

This research article identified a total of 319 scientific factors. These factors were grouped by semantic analysis and as a result we obtained a total of 61 critical success factors that exert some influence on the implementation and maintenance of SGQSA.

After semantic analysis and grouping of the critical factors identified in the literature, we performed the calculations of cut-off numbers for *Nihans* classification, as shown in Table 8.

Table 8. Cut-off numbers for the classification of critical factors

***Nihans* Index**	
Ranking/ Prioritization	**Cut-off numbers**
A	18
B	8
C	3
D	1

Using this technique, we obtained the classification A, B, C, and D as the critical factors of success that influence the seamless deployment and management of a QFSMS, as shown in Tables 9, 10 and 11.

Table 9. Ranking and prioritizing critical factors of success for QFSMS. Classe A.

Critical Factors of Success	**Frequency (X)**	**X^2**	**Ranking/ Prioritization**
Management of the people (knowledge, skills, training and education, etc.).	56	3136	A
Management of the customers / clients	20	400	A
Control, measurement and performance	19	361	A

Table 10. Ranking and prioritizing critical factors of success for QFSMS. Classe B.

Critical Factors of Success	**Frequency (X)**	**X^2**	**Ranking/ Prioritization**
Quality management and continuous improvement	17	289	B
Supplier management	17	289	B
Commitment of top management	15	225	B
Quality assurance, audits, verification, validation and certification	11	121	B
Financial resources	9	81	B
Organizational culture	9	81	B
Organizational strategies	9	81	B
Management by processes	9	81	B
Teamwork	8	64	B
Government and legislation	8	64	B
Employee commitment	8	64	B

Table 11. Ranking and prioritizing critical factors of success for QFSMS. Classe C.

Critical Factors of Success	Frequency (X)	X^2	Ranking/ Prioritization
Time	6	36	C
Behavior	6	36	C
Leadership	6	36	C
Production	5	25	C
Market	5	25	C
Project of products/services	5	25	C
Infrastructure	5	25	C
Communication and integration	4	16	C
Benchmarking	4	16	C
Results	3	9	C
Exports	3	9	C
Information systems	3	9	C
Motivation	3	9	C
Cost and waste	3	9	C
Environmental condit. (internal or external)	3	9	C

The factors that received ranking (C) were less cited by researchers in their scientific articles. They have less importance but must also be included over the long term. Other factors cited by 32 researchers were classified as (D), but with an absolute frequency less than two and were considered in this study as factors of negligible importance for the management system and, therefore were not cited.

The focus of this research is on the 14 critical success factors classified and prioritized as A and B, since they exert a great influence on the systems of quality management and food safety in an integrated manner. They are factors that when well-crafted increase the chances of success and therefore may influence the success of the business and performance of the organization.

To sum up the factors have been classified as A and B, i.e., maximum and median importance, respectively. According to the results obtained in this study, the main critical factor of success for QFSMS is related to the management of people. This result is consistent with the guidelines of [83] which reported that training in food safety is an essential factor in most countries, especially developing ones.

Therefore, the adoption of strategies that prioritize issues related to training, education and development of people who work in the food chain, becomes a factor of the utmost importance and priority in the system of quality management and food safety. The successful deployment of this system is as effective as the skills and knowledge of staff development and implementation, and this is only possible if these people and teams are trained (Manning and Baines, 2004), since the whole process of making decisions and actions are performed by people, and these decisions can lead an organization to success or failure.

According to [93] one of the main obstacles that hinder the adoption of food safety practices in industries that produce olive oil in Turkey, are the difficulties in hiring well-trained staff and lack of training facilities for employees. In this context the human resources of an organization are critical in the implementation of strategies relating to people management. Enterprises that deploy shares of total quality management within the department of human resources to meet the requirements of certification, promote major changes in the organization, upgrading the role of the human resources function, aiming to redesign management practices and human resources management performance, skills development and career planning, rewards and recognition, recruitment and selection, HR planning, and satisfaction and well-being of employees do better than those that do not [95].

5. Conclusions

The main objective of this research was to examine the existing literature on quality management systems and food safety management, grouping and prioritizing critical success factors that affect the implementation of these systems, when implemented in an integrated manner. In the global context, the study concludes by identifying and addressing the 14 critical factors of success that were classified as A and B by analyzing classification Nihans, which was used as an analytical method of data gathered from the scientific literature on the subject. The other factors classified and grouped C and D despite not being priority are subject to review, because the critical factors affecting deployment and performance management systems can vary depending on the type, size, location and sector of the company.

It is recommended that the QMS and FSMS are structured and implemented by organizations in an integrated manner and that the 14 critical factors of success, classified as A and B, are addressed and treated as priority initiatives in the deployment of an effective and integrated QFSMS, for industries that participate in the food chain in the world and can be described respectively as: management of the people; management of the customers/clients; control, measurement and performance; quality management and continuous improvement; vendor management; commitment of top management; quality assurance and certifications; financial resources; organizational culture; organizational strategies; management by processes; teamwork; government and legislation; and commitment of the employees.

Based on these 14 critical factors of success a company can prioritize their activities and focus on the most important foundations of their strategies according to market competition. It is very important that companies understand the importance of the 14 critical factors of success and consider these in their strategies in order to develop, implement and maintain an integrated and effective quality management and food safety. It is hoped

the results of this study will help managers during the decision-making process regarding activities and priority actions for deploying and managing more peaceful, integrated and effective QFSMS in the food chain. This study may also assist researchers in the development of the theme and design of constructs and scientific instruments for field research.

To optimize the implementation of this management system, we suggest the creation of software and computational modules, integrated into existing enterprise information systems in organizations, which are able to support managers in the analysis of impacts of these factors, within the context in which the organizations are embedded. Some information systems have been reported for risk management products in developed countries and regions such as Japan and Europe; however, these information systems are not universally applicable, particularly in developing countries, since the food safety standards, as well as other important factors involved in the manufacture of food products, may vary from country to country [96].

It is hoped that the results of this study will help managers during the decision-making processes in relation to the activities and priority actions for deploying and managing more peaceful, integrated and effective QFSMS in the food industry. This study may also assist researchers in the development of the theme and design of constructs and scientific instruments for field research.

Some limitations regarding the use of the integrated database "Proquest" for the literature review are due to the existence of several articles that did not provide the full text, and also, the way of grouping and analysis of the factors cited by the authors, for possible flaws in translation can occur, changing the meaning of any word or term originally written in another language.

It is recommended that qualitative and quantitative studies in the field, taking into account all the critical factors identified, are carried out to evaluate real situations, so that primary data are collected from member organizations of the food chain. Based on this, future research can have a more specific level of influence and impact on these critical factors in the reality of companies, especially small and micro Brazilian companies operating in this segment. Currently, a pilot research project of small businesses in the Jundiaí and Campo Limpo Paulista region, in São Paulo, Brazil is underway to offer the opportunity to examine in the field the reliability and construct validity obtained in reality.

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