



# SUSTAINABLE QUALITY MANAGEMENT: UNFOLDINGS, TRENDS AND PERSPECTIVES FROM THE TRIPLE BOTTOM LINE

Ronald Palandi Cardoso  
José Salvador da Motta Reis  
Nilo Antonio de Souza Sampaio  
José Glenio Medeiros de Barros  
Luís César Ferreira Motta Barbosa  
Gilberto Santos<sup>1</sup>

Received 30.03.2022.  
Accepted 30.06.2022.  
UDC – 005.6:502.131.1

Keywords: *Quality Management; Sustainable Development; Triple Bottom Line; Optimization; quality of life.*

## ABSTRACT

*In this study, the sustainable development and quality management scenario is studied by means of a bibliometry on the Scopus database. During the bibliometry, the models used to practice sustainable quality were catalogued. These models had their functions defined, and their area of action related to the Triple Bottom Line pointed. The 30 most cited articles in the bibliometry had their research opportunities pointed out, in case there is future research, and also their challenges were catalogued to assist in future research in the sustainable development and quality management scenario.*



© 2022 Published by Faculty of Engineering

## 1. INTRODUCTION

Sustainable development is a recurrent and necessary practice for all humanity and its development to create a viable future for the planet. People have a higher quality of life with rapid economic growth compared to other generations, but they must also deal with the burden of this growth, because the high consumption of materials, degrade the environment and increase waste, and moreover can be harmful to health. One tool that has been used to mitigate these consequences is Quality Management, because it integrates sustainability in the area of product development, modifying the spending of materials, and can generate material and capital savings

for companies (Nguyen, Phan, and Matsui, 2018; Siva et al. 2016; Rodrigues et al., 2019; Zgodavova et al., 2019). Quality management brings with it optimizations for processes, evaluating their performance, improving your production line, whether in the area of material use or in the manufacturing time of a product, in the work team, and in several other areas. But, it takes a high level of effort to apply quality management in a company, as it is a drastic change in the production line. There are many tools in quality management, such as the Ishikawa diagram, Histogram, Pareto chart, Control chart, and many other tools available to improve the quality area of a company (Chen, Lee, and Wang, 2020; Elkington, 1998b; Siva et al., 2016; Siva, Gremyr, and Halldórsson, 2018).

<sup>1</sup> Corresponding author: Gilberto Santos  
Email: [gsantos@ipca.pt](mailto:gsantos@ipca.pt)

The quality area of a company is becoming the main point and one of the biggest investments that companies have made. This area leads the future, with its environment-friendly ideas and tools. It also helps the company in its production line. The companies' customers are demanding an attitude that involves care for the environment, and boycotting companies that refuse to follow environmental standards, showing that quality management (Costa et al., 2019; Sá et al., 2019; Barbosa et al., 2021; Sá et al., 2020). The care for the environment is being treated as important by society (Baumgartner, 2014; Goyal, Agrawal, and Saha 2019; Schmitt et al., 2016; Siva et al., 2016; Bravi et al., 2020; Talapatra et al., 2022).

## **2. THEORY BACKGROUND**

In this section the scientific literature is reviewed to introduce the theoretical foundations of the topics sustainability and quality management. The most cited articles in the literature were prioritized.

### **2.1 Management with Triple Bottom Line**

The concern with the environment and with sustainable measures began to be a concern during the 1980s, where the regulations that addressed the environment were updated. In 1987 the Brundtland report was published, which defines sustainability and sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. For this statement to be fulfilled it is necessary that organizations adopt sustainable measures in their production process, for this innovation in products, marketing methods, and manufacturing processes is recurrent and research in the area of sustainability is important (Klewitz & Hansen 2014; Lozano, 2006; Redclift, 2005).

The Brundtland report, published in 1987, is important for the sustainable development of mankind, but it is not something simple to achieve. In it, a series of measures to be taken by countries to promote sustainable development were mentioned, among them, the preservation of the environment, the reduction of energy consumption, the increase in the use of renewable energies, and the control of uncontrolled urbanization. These measures have entered the corporate environment and have become targets for companies, since in the long run the benefit would be better. With this, several methods and tools were developed to make these measures a reality. One of these methods developed was the Triple Bottom Line, which consists in finding the balance between human needs, the integrity of the environment, which is very challenging due to the scarcity of resources, and the companies' profits (Klewitz & Hansen, 2014; Kloepffer, 2008; Redclift, 2005; Wu, 2013).

The Triple Bottom Line is a methodology that has three aspects: profit, people, and planet. This tool is necessary for the sustainable development of an organization, since it is possible to see the scarcity of resources in the future. The first aspect of the Triple Bottom Line is profit, which relates to the finances of the organizations, which relates to the production of profit, together with cost reduction and risk reduction. After the dissemination of sustainable development companies can have a beneficial impact on the world without harming their profits, and the use of the Triple Bottom Line has shown to lead companies to success in their business. Second, we have people, which concerns society as a whole and the impact of companies on society, and the focus of companies is to please their customers. Not only with their products, but with their ideas, and to achieve this goal, many companies get involved with NGOs that focus on caring for the environment, and thus pleasing customers and having a sustainable business development. And the third aspect is the planet, involving the care for the environment, and the management of natural resources, and to meet this aspect, organizations are using materials in an ethical and environmentally friendly way, changing the origin of their energy to use renewable energy, all this to reduce carbon emissions into the atmosphere. And these three aspects used together generate sustainable development, even though companies are the main cause of climate change, they have the tools to improve the environment (Bocken et al. 2014; Elkington 1998a; Kloepffer 2008; Wu 2013; Carvalho, Santos & Gonçalves, 2020).

### **2.2 Quality Management**

Quality Management (QM) is a set of ideas and tools used to impact an organization's environment in multiple ways and can be defined as a philosophy consisting of principles, practices, and tools that include values such as customer focus, constant improvement, and decisions based on proven research. One of the first reasons for the use of Quality Management in the 90's was the improvement of product quality, where it seeks to meet customer expectations by increasing capital input (Nguyen et al., 2018; Siva et al., 2016). QM brings several improvements to the work environment and its production, helping organizations to solve structural problems related to the production chain of their product until it reaches the customer (Nguyen et al., 2018; Sales et al., 2022; Silva et al., 2021; Jimenez et al., 2019; Ribeiro et al., 2019). QM has benefits that address economic profit and objectives beyond capital, such as the effectiveness of the production process, organizational management, efficient use of inputs, and reduction of negative impacts on the environment. These actions are accomplished by reducing material waste, reusing materials, and using energy efficiently. Analyzing most of the benefits that QM brings, it is possible to see that, in its majority, there is an impact on the organization's capital, either by reducing labor,

increasing production, reducing unnecessary expenses (Abbas, 2020; Jermstipparsert, Namdej, and Somjai, 2019; Nguyen et al., 2018).

However, even with the advantages made possible by quality management, organizations do not apply its methods as recommended aiming at their profits. One of the big problems with this is for example, the pollution of nature, which is impacted by large companies cheating environment protection laws and deforestation. Also situations where for the implementation of a quality management method to be successfully implemented, feedback is needed from employees and workers of the organization, and many of them do not cooperate at the time of feedback or are not sincere at the time of the survey. The implementation of a quality method brings several changes to a work environment, as it impacts from the supply of a material. Its production method and processes, and the delivery and care of a customer's preferences, so it takes great financial and manpower effort to successfully apply a quality method (Bowman et al., 2018; Kumar et al., 2020; Schmid, Oлару, and Verjel, 2017; Schmitt et al., 2016).

Organizations live in a competitive environment, searching for higher production. With the advent of quality management many companies are using as a goal to be a sustainable company, encouraging small businesses to follow sustainable standards and apply quality management methods. Most customers today pressure organizations to adhere to sustainable methods in the production of their products making quality management become something important in the production structure of a company (Aryanasl et al., 2016; Goyal et al., 2019; Kumar et al., 2020).

### **2.3 Sustainable Development and Quality Management**

Sustainable development was considered important starting in the 1980s, when laws involving the environment were updated, and progressive companies took sustainable development as a goal to guide their production. The result obtained was the optimization of the production line and consequently higher turnover. To maintain the quality tools were used to beat the sustainable goals of companies not only improving the financial but also contributing to the environment, and creating an ecosystem where customers asked for sustainable attitudes that respect the environment (Bastas & Liyanage 2018; Siva et al., 2016).

The use of quality tools to achieve sustainable development in a company has shown to bring several benefits such as, managing resources by reallocating their use and even recycling helping the environment in the fight against waste of materials, helping to reduce costs and even increase profits by improving logistics

and time spent on the production line. The study of the team in conjunction with the materials allows the improvement the company's management. The analysis of the substitution of materials that can be harmful to the environment by recyclable and environmentally friendly materials helps to improve the companies' performance, and it aims at the environmentally sustainable long term (Bastas and Liyanage, 2018; Jermstipparsert et al., 2019; Nguyen et al., 2018; Siva et al., 2018).

Some examples of quality tools in practice: the Ishikawa Diagram can be used to identify problems directly in the product or in the production line. After its application results, such as process improvement, problem resolution and classification of the causes of the problem can be obtained. Another example would be the use of the control chart that provides the variations of a process analyzing whether the data are within the required limits, having as a benefit the sample of the production status and the long-term stability of the production process. Like these there are several quality tools that facilitate companies in achieving their sustainable ecosystem (Gündüz, Nielsen, and Özdemir, 2013; Siva et al., 2018; Tien Bui et al., 2016; Wang et al., 2017).

## **3. RESEARCH METHOD**

This research is classified as applied and exploratory, with a qualitative approach. The technical procedures adopted, respectively, were bibliometric research and content analysis (Kothari & Garg, 2019). The bibliometric analysis was important, since it explains a relationship between the number of publications and citations, the results presented by the article, and its use for further research (Bornmann et al., 2016; Reis et al., 2020). This analysis also makes it possible to visualize the performance of a research, therefore a bibliometric analysis performs statistical analyses on published documents from several indicators (Aledo et al., 2018; Alvarenga et al., 2021).

## **4. RESULTS AND DISCUSSIONS**

From the analysis of Table 1, which shows the opportunities for research in the area of Sustainable Quality, we can see the grouping into 4 categories, as follows:

- Analyze the impact of quality management tools on sustainable development, with 6 notes;
- Use the quality model in another environment following the sustainable model, with 9 notes;
- Identify advantages of quality methods based on sustainability, with 4 notes;
- Propose changes in the study using sustainable models as a basis, with 11 notes.

**Table 1.** Sustainable Quality Research Opportunities

Opportunities	Authors
Analyze the impact of quality management tools on sustainable development	(Bastas & Liyanage, 2018; Goyal et al., 2019; Gupta, Rajesh K. Singh, & Suri, 2018; Gupta, Rajesh Kumar Singh, & Suri 2018; Leiber 2018; Siva et al. 2018)
Use the quality model in another environment following the sustainable model	(Bowman et al., 2018; Hasanzadeh, Saadatpour, & Afshar 2020; Isaksson, 2019; Kumar et al. 2020; Li, Yan, & Duan 2019; Savov et al., 2017; Siva et al., 2016; Xie et al., 2016; Zeng et al., 2017)
Identify advantages of quality methods based on sustainability	(Aryanasl et al., 2016; Bardfield et al. ,2016; Savino & Mazza 2016; Schmid et al., 2017)
Propose change in the study using sustainable models as a basis	(Abbas, 2020; Barbaritano, Bravi, and Savelli 2019; Bekele et al., 2018; Chen et al., 2020; Dort et al., 2020; Jermsittiparsert et al., 2019; Li et al., 2018; Nguyen et al., 2018; Ozkaya & Erdin 2020; Schmitt et al., 2016; Tariq et al., 2020)

After performing the analysis of table 1, it can be noticed that the 2 gaps of opportunities that stood out are: "Use the quality model in another environment following the sustainable model" with 9 notes and "Propose a change in the study using sustainable models as a basis" with 11 notes. This analysis shows that the main opportunities in the area of Sustainable Quality are related to the variant of an already existing model, and

this variant can refer either to a change in how the model works, or where it is being applied, showing a path for the evolution of the Sustainable Quality area.

Importantly, the gaps show the viability of the models for the evolution of Quality and sustainable development.

**Table 2.** Sustainable Quality Research Challenges

Challenges	Authors
Difficulty in obtaining data volume and quality	(Barbaritano et al., 2019; Bastas & Liyanage 2018; Chen et al., 2020; Dort et al., 2020; Ozkaya & Erdin 2020; Savino & Mazza, 2016; Siva et al., 2016)
Lack of support in obtaining information from participants to generate a reliable survey	(Abbas, 2020; Bardfield et al., 2016; Bowman et al., 2018; Gupta, Rajesh K. Singh, et al., 2018; Gupta, Rajesh Kumar Singh, et al., 2018; Isaksson, 2019; Jermsittiparsert et al., 2019; Leiber, 2018; Siva et al., 2018; Xie et al., 2016)
Problems in the development of the research to generate reliability in the study	(Bekele et al., 2018; Goyal et al., 2019; Li et al., 2018, 2019; Nguyen et al., 2018; Tariq et al., 2020)
Difficulty in applying the quality method in relation to sustainable developments	(Aryanasl et al., 2016; Hasanzadeh et al., 2020; Kumar et al., 2020; Savov et al., 2017; Schmid et al., 2017; Schmitt et al., 2016; Zeng et al., 2017)

Table 2 shows the challenges of research in the area of Sustainable Quality. One can see the grouping into 4 categories, namely:

- Difficulty in obtaining the volume and quality of data" with 7 notes;
- Lack of support in obtaining information from participants to generate a reliable research" with 10 notes;
- Problems in the development of research to generate reliability in the study" with 6 notes;
- Difficulty in applying the quality method in relation to sustainable developments" with 7 notes.

Table 2 presents the challenges separated into gaps faced by the articles studied. It is possible to see that the challenge with the most notes is "Lack of support in obtaining information from the participants to generate

reliable research", which shows a clear difficulty in making progress with Quality and Sustainable Development within an environment due to lack of commitment from the workers involved in the process. Table 3 shows 18 models used in Sustainable Quality management, their main focus within the pillars of Sustainable Quality and their function when applied. It is worth mentioning that all the models mentioned have an impact on the three pillars of Sustainable Quality, being social, environmental, and economic.

By analyzing the table it is possible to notice that the social pillar is one of the least cited. The explanation is that the social one is always developed, since if it affects the environmental one it is directly linked to the sustainable future of humanity, and if it affects the economic one, it is directly related to society and how it is directly linked to the economy.

**Table 3.** Models used in Sustainable Quality

<b>Model</b>	<b>TBL</b>	<b>Função</b>	<b>References</b>
Groundwater Quality Assessment	Environmental	Assessing groundwater quality for domestic and agricultural use	(Li et al., 2018)
Supply Chain Management	Econômico	Dealing with materials and services in an organization aiming at Sustainable Development	(Gupta, Rajesh K. Singh, et al., 2018)
Total Quality Management	Econômico/Environmental	Decrease the amount of energy and financial expenses in order to follow environmentally friendly practices	(Abbas, 2020; Chen et al., 2020)
Multi-Objective Optimization	Econômico	Working with multiple different objectives simultaneously for risk mitigation	(Ehsan & Yang 2018)
Green Supply Chain Management	Environmental	Eliminate or reduce waste material, be it energy or chemical	(Jermstittiparsert et al., 2019)
Managed Aquifer Recharge	Environmental /Social	Treat wastewater discharge and promote the removal of nutrients and pathogens from the water	(Bekele et al., 2018)
Scenario-based Interval-stochastic Fractile optimization with Laplace criterion	Environmental	Managing the allocation of water resources and managing water quality under various uncertainties	(Zeng et al., 2017)
Integração da Quality Management com Sustentabilidade focada em impacto dos defeitos	Economic	Managing the relationship between defects and product performance using lean six sigma	(Goyal et al., 2019)
European Foundation for Quality Management Excellence Model	Social	Managing the leadership system to improve organizational capacity and relationships within an organization	(Aryanasl et al., 2016)
Total Quality Management conjunto com Transformational Leadership e Executive Ability	Social	Dealing with the relationship of the leader and his image before his employees aiming at the organization's long-term goals	(Chen et al., 2020)
Economia Circular	Environmental /Economic	Aims at alternative reuse of materials through recycling and the right choice of materials	(Barbaritano et al., 2019)
Multiple-criteria Decision-making	Economic	Dealing with unstructured problems with multiple conflicting objectives	(Gupta, Rajesh Kumar Singh, et al., 2018)
Sustainable Fire Management	Environmental /Social	Use prescribed fire in conjunction with sustainable practices to reduce fire risk and decrease the risk of excessive smoke to the population	(Bowman et al., 2018)
National Organizational Assessment	Social/Economic	Used to address the issue of Quality and Sustainable Development in low and middle income countries	(Bardfield et al., 2016)
Risk-based Balance Inexact Water Resources Optimization Model	Environmental	Regional water resources management facing the uncertainties of the region, having repulsion to risk incorporated limiting the volatility of the expected profit	(Xie et al., 2016)
Multi-Pollutant Waste Load Allocation Program	Environmental	Reduce the potential for eutrophication in a river reservoir system with discharges from aquaculture industries in the region	(Hasanzadeh et al., 2020)
Time-delay Compensated Gain-scheduled ventilation system	Economic/Social	Solving the delay of the indoor air quality process inside subways based on Smith Predictor, improving the salubrity of the place	(Tariq et al., 2020)
Malcolm Baldrige National Quality Award Model	Economic	Using linear regression as an evaluation method, it is concluded that the use of quality management is determined by the property	(Abbas, 2020)

## 5. CONCLUSION

This study aimed to identify the existing scientific gaps of the papers with the highest number of citations in the theme of Sustainable Quality and Sustainable Development that are indexed in the SCOPUS database, taking into consideration publications entered as of 2016. To complete this objective, an applied research was conducted, of exploratory nature and qualitative approach. The method and technical procedures were adopted, respectively, the bibliographic research and the literature review. As a contribution of this research, it is pointed out the holistic view of opportunities to carry out new investigations on Sustainable Quality and Sustainable Development.

Analyzing tables 1 and 2, it is possible to identify a path for further research, since research opportunities were found and it was clarified some of the possible problems that can be faced during the research, and table 3 shows

18 models found in the articles studied, showing their functions and their work focus, through the pillar of Sustainable Quality.

This work faced the limitation that the research was conducted using only the SCOPUS database, even though it is considered the most structured and comprehensive database today, but can provide a limited view of the studies on the subject. It is suggested that, for future research, other databases such as Web of Science, Science Direct, SciELO, and others be used, to obtain a broader view of the area. It is also possible to use some of the gaps highlighted in the research to develop a research study, which shows that the theme is not exhausted and continues with opportunities in the research area.

**Acknowledgement:** This study was funded by the CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico - (155299/2021-2) for financial support.

## References:

- Abbas, J. (2020). Impact of Total Quality Management on Corporate Sustainability through the Mediating Effect of Knowledge Management. *Journal of Cleaner Production*, 244, 118806. doi: 10.1016/j.jclepro.2019.118806.
- Aledo, J. A., Gámez, J. A., Molina, D., Rosete, A. (2018). Consensus-Based Journal Rankings: A Complementary Tool for Bibliometric Evaluation. *Journal of the Association for Information Science and Technology*, 69(7), 936-48. doi: 10.1002/asi.24040.
- Alvarenga, A. B. C. S., Espuny, M., Reis, J. S. M., Silva, F. O., Sampaio, N. A. S., Nunhes, T. V., Barbosa, L. C. F. M., Santos, G., & Otávio José de Oliveira, O. J. (2021). The Main Perspectives of The Quality of Life of Students In The Secondary Cycle: An Overview of The Opportunities, Challenges and Elements of Greatest Impact. *International Journal for Quality Research*, 15(3), 983-1006. doi: 10.24874/IJQR15.03-19.
- Aryanasl, A., J. Ghodousi, Arjmandi, R., & Mansouri, N. (2016). Can Excellence Management Models Encompass 'Cleaner Production' and 'Sustainable Business' Revolution? (European Foundation for Quality Management as a Case Study). *International Journal of Environmental Science and Technology*, 13(5), 1269-76. doi: 10.1007/s13762-016-0948-9.
- Barbaritano, M., Bravi, L., & Savelli, E. (2019). Sustainability and Quality Management in the Italian Luxury Furniture Sector: A Circular Economy Perspective. *Sustainability (Switzerland)*, 11, 3089. <https://doi.org/10.3390/su11113089>
- Barbosa, L. C. F. M., de Oliveira, O. J., Machado, M. C., Morais, A. C. T., Bozola, P. M., & Santos, G. (2021). Lessons learned from quality management system ISO 9001:2015 certification: practices and barrier identification from Brazilian industrial companies. *Benchmarking: An International Journal*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/BIJ-07-2021-0382>
- Bardfield, J., Palumbo, M., Geis, M., Jasmin, M., Agins, B. D., ... , & Chiware, J. (2016). A National Organizational Assessment (NOA) to Build Sustainable Quality Management Programs in Low- and Middle-Income Countries. *Joint Commission Journal on Quality and Patient Safety*, 42(7), 325-30. doi: 10.1016/S1553-7250(16)42045-3.
- Bastas, A., & Liyanage, K. (2018). Sustainable Supply Chain Quality Management: A Systematic Review. *Journal of Cleaner Production*, 181, 726-44. doi: 10.1016/j.jclepro.2018.01.110.
- Baumgartner, R. J. (2014). Managing Corporate Sustainability and CSR: A Conceptual Framework Combining Values, Strategies and Instruments Contributing to Sustainable Development. *Corporate Social Responsibility and Environmental Management*, 21(5), 258-271. doi: 10.1002/csr.1336.
- Bekele, E., Page, D., Vanderzalm, J., Kaksonen, A., & Dennis Gonzalez, D. (2018). Water Recycling via Aquifers for Sustainable Urban Water Quality Management: Current Status, Challenges and Opportunities. *Water (Switzerland)*, 10(4), 1-25. doi: 10.3390/w10040457.
- Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A Literature and Practice Review to Develop Sustainable Business Model Archetypes. *Journal of Cleaner Production*, 65, 42-56. doi: 10.1016/j.jclepro.2013.11.039.

- Bornmann, L., Thor, A., Marx, W., & Schier, H. (2016). The Application of Bibliometrics to Research Evaluation in the Humanities and Social Sciences: An Exploratory Study Using Normalized Google Scholar Data for the Publications of a Research Institute. *Journal of the Association for Information Science and Technology*, 67(11), 2778-89. doi: 10.1002/asi.23627.
- Bowman, D. M. J. S., Daniels, L. D., Johnston, F. H., Williamson, G. J., Jolly, W. M., ..., & Henderson, S. B. (2018). Can Air Quality Management Drive Sustainable Fuels Management at the Temperate Wildland-Urban Interface?. *Fire* 1(2), 1-15. doi: 10.3390/fire1020027.
- Bravi, L., Santos, G., Pagano, A., & Murmura, F. (2020). Environmental management system according to ISO 14001:2015 as a driver to sustainable development. *Corporate Social Responsibility and Environmental Management*, 27(6), 2599-2614
- Bui, T. Dieu, B. P., Nampak, H., Bui, Q. T., Tran, Q. A., & Nguyen, Q. P. (2016). Hybrid Artificial Intelligence Approach Based on Neural Fuzzy Inference Model and Metaheuristic Optimization for Flood Susceptibility Modeling in a High-Frequency Tropical Cyclone Area Using GIS. *Journal of Hydrology*, 540, 317-330. doi: 10.1016/j.jhydrol.2016.06.027.
- Carvalho, F., Santos, G., & Gonçalves, J. (2020). Critical analysis of information about integrated management systems and environmental policy on the Portuguese firms' website, towards sustainable development. *Corporate Social Responsibility and Environmental Management*, 27(2), 1069-1088
- Chen, R., Lee, Y. D., & Wang, C. H. (2020). Total Quality Management and Sustainable Competitive Advantage: Serial Mediation of Transformational Leadership and Executive Ability. *Total Quality Management and Business Excellence*, 31(5-6), 451-468. doi: 10.1080/14783363.2018.1476132.
- Costa, A. R., Barbosa, C., Santos, G., & Alves, M. R. (2019). Six Sigma: Main Metrics and R Based Software for Training Purposes and Practical Industrial Quality Control. *Quality Innovation Prosperity journal*, 23(2), 83-100
- Dort, J. C., Sauro, K. M., Chandarana, S., Schrag, C., Matthews, J., Nakoneshny, S., ..., Matthews, W. (2020). The Impact of a Quality Management Program for Patients Undergoing Head and Neck Resection with Free-Flap Reconstruction: Longitudinal Study Examining Sustainability. *Journal of Otolaryngology - Head and Neck Surgery*, 49(1), 1-9. doi: 10.1186/s40463-020-00437-2.
- Ehsan, A., Yang, Q. (2018). Optimal Integration and Planning of Renewable Distributed Generation in the Power Distribution Networks: A Review of Analytical Techniques. *Applied Energy*, 210, 44-59. doi: 10.1016/j.apenergy.2017.10.106.
- Elkington, J. (1998a). Accounting for the Triple Bottom Line. *Measuring Business Excellence*, 2(3), 18-22. doi: 10.1108/eb025539.
- Elkington, J. (1998b). Triple Bottom Line. Pdf. *Environmental Quality Management*, 8(1), 37-51.
- Goyal, A., Agrawal, R., & Saha, C. R. (2019). Quality Management for Sustainable Manufacturing: Moving from Number to Impact of Defects. *Journal of Cleaner Production*, 241, 118348. doi: 10.1016/j.jclepro.2019.118348.
- Gündüz, M., Nielsen, Y., & Özdemir, M. (2013). Quantification of Delay Factors Using the Relative Importance Index Method for Construction Projects in Turkey. *Journal of Management in Engineering*, 29(2), 133-139. doi: 10.1061/(asce)me.1943-5479.0000129.
- Gupta, A., Singh, R. K., & Suri, P. K. (2018). Sustainable Service Quality Management by Logistics Service Providers: An Indian Perspective. *Global Business Review*, 19(3\_suppl), S130-150. doi: 10.1177/0972150918758098.
- Gupta, A., Singh, R. K., & Suri, P. K. (2018). Prioritizing Critical Success Factors for Sustainable Service Quality Management by Logistics Service Providers. *Vision*, 22(3), 295-305. doi: 10.1177/0972262918786102.
- Hasanzadeh, S. K., Saadatpour, M., and Afshar, A. (2020). A Fuzzy Equilibrium Strategy for Sustainable Water Quality Management in River-Reservoir System. *Journal of Hydrology* 586, 124892. doi: 10.1016/j.jhydrol.2020.124892.
- Isaksson, R. (2019). A Proposed Preliminary Maturity Grid for Assessing Sustainability Reporting Based on Quality Management Principles. *TQM Journal*, 31(3), 451-466. doi: 10.1108/TQM-12-2017-0167.
- Jermittiparsert, K., Namdej, P., & Somjai, S. (2019). Green Supply Chain Practices and Sustainable Performance: Moderating Role of Total Quality Management Practices in Electronic Industry of Thailand. *International Journal of Supply Chain Management*, 8(3), 33-46.
- Jimenez, G., Santos, G., Sá, J.C., Ricardo, S., Pulido, J., Pizarro, A., & Hernández, H. (2019). Improvement of productivity and quality in the value chain through lean manufacturing - A case study. *Procedia Manufacturing*, 41, 882-889
- Klewitz, J., & Hansen, E.G. (2014). Sustainability-Oriented Innovation of SMEs: A Systematic Review. *Journal of Cleaner Production*, 65, 57-75. doi: 10.1016/j.jclepro.2013.07.017.
- Kloepffer, W. (2008). Life Cycle Sustainability Assessment of Products (with Comments by Helias A. Udo de Haes). *International Journal of Life Cycle Assessment*, 13(2), 89-95. doi: 10.1065/lca2008.02.376.

- Kothari, C. R., & Garg, G. (2019). *Research Methodology Methods and Techniques*. 4<sup>o</sup>. Nova Deli: New Age International.
- Kumar, V., Verma, P., Mangla, S. K., Mishra, A., Chowdhary, D., Hsu, C.H.C., & Lai, K.K. (2020). Barriers to Total Quality Management for Sustainability in Indian Organizations. *International Journal of Quality and Reliability Management* 37(6-7), 1007-31. doi: 10.1108/IJQRM-10-2019-0312.
- Leiber, T. (2018). Impact Evaluation of Quality Management in Higher Education: A Contribution to Sustainable Quality Development in Knowledge Societies. *European Journal of Higher Education*, 8(3), 235-248. doi: 10.1080/21568235.2018.1474775.
- Li, F., Yan, X. F., & Duan, H. F. (2019). Sustainable Design of Urban Stormwater Drainage Systems by Implementing Detention Tank and LID Measures for Flooding Risk Control and Water Quality Management. *Water Resources Management*, 33(9), 3271-3288. doi: 10.1007/s11269-019-02300-0.
- Li, P., He, S., Yang, N., & Xiang, G. (2018). Groundwater Quality Assessment for Domestic and Agricultural Purposes in Yan'an City, Northwest China: Implications to Sustainable Groundwater Quality Management on the Loess Plateau. *Environmental Earth Sciences*, 77(23), 1-16. doi: 10.1007/s12665-018-7968-3.
- Lozano, R. (2006). Incorporation and Institutionalization of SD into Universities: Breaking through Barriers to Change. *Journal of Cleaner Production* 14(9-11), 787-96. doi: 10.1016/j.jclepro.2005.12.010.
- Nguyen, M. H., Phan, A.C., & Matsui, Y. (2018). Contribution of Quality Management Practices to Sustainability Performance of Vietnamese Firms. *Sustainability (Switzerland)*, 10(2), 1-31. doi: 10.3390/su10020375.
- Ozkaya, G., & Erdin, C. (2020). Evaluation of Sustainable Forest and Air Quality Management and the Current Situation in Europe through Operation Research Methods. *Sustainability (Switzerland)*, 12(24), 1-20. doi: 10.3390/su122410588.
- Redclift, M. (2005). Sustainable Development (1987-2005): An Oxymoron Comes of Age. *Sustainable Development* 13(4), 212-227. doi: 10.1002/sd.281.
- Reis, J. S. M., Silva, F.O., Espuny, M., Alexandre, L. G. L., Barbosa, L. C. F. M., Santos, G., ..., Oliveira, O. J. (2020). The Rapid Escalation of Publications on Covid-19: A Snapshot of Trends in the Early Months to Overcome the Pandemic and to Improve Life Quality. *International Journal for Quality Research*, 14(3), 951-968. doi: 10.24874/IJQR14.03-19.
- Ribeiro, P., Sá, J. C., Ferreira, L. P., Silva, F. J. G., Pereira, M. T., & Santos, G. (2019). The impact of the application of lean tools for improvement of process in a plastic company: A case study. *Procedia Manufacturing*, 38, 765-775.
- Rodrigues, J., de Sá, J. C. V., Ferreira, L. P., Silva, F. J. G., & Santos, G. (2019). Lean management "quick-wins": Results of implementation. A case study. *Quality Innovation Prosperity*, 23(3), 3-21.
- Sá, J. C., Barreto, L., Amaral, A., Carvalho, F., & Santos, G. (2019). Perception of the importance to implement ISO 9001 in organizations related to people linked to quality – an empirical study. *International Journal of Quality Research*, 13(4), 1055-1070.
- Sá, J. C., Vaz, S., Carvalho, O., Morgado, L., Lima V., Fonseca, L., Doiro, M., & Santos, G. (2020). A model of integration ISO 9001 with Lean six sigma and main benefits achieved. *Total Quality Management & Business Excellence*, 33(1-2), 218-242.
- Sales, J. P., Reis, J. S. M., Barros, J. G. M., Fonseca, B. B., Junior, A. H. A., Almeida, M. G. D., Barbosa, L. C. F. M., Santos, G., & Sampaio, N. A. S. (2022). Quality Management in The Contours of Continuous Product Improvement. *International Journal for Quality Research*, 16. doi: 10.24874/IJQR16.03-02.
- Savino, M. M., & Mazza, A. (2016). Assessing Product Sustainability Measurement within Quality Management Systems: A Case Study in Automotive Industry. *International Journal of Productivity and Quality Management*, 18(2-3), 258-278. doi: 10.1504/IJPQM.2016.076710.
- Savov, R., Cheben, J., Lancaric, D., & Serencés, R. (2017). Mbnqa Approach in Quality Management Supporting Sustainable Business Performance in Agribusiness. *Amfiteatru Economic*, 19(44), 10-27.
- Schmid, J., Olaru, M., & Verjel, A. M. (2017). The Effect of Sustainable Investments to the Economic Objectives of the Company in Relation to the Total Quality Management. *Amfiteatru Economic*, 19(Specialissue11), 939-950.
- Schmitt, S., Kynast, K., Schirmacher, P., & Herpel, E. (2016). Challenges for Quality Management in Implementation, Maintenance, and Sustainability of Research Tissue Biobanks. *Virchows Archiv*, 468(1), 93-99. doi: 10.1007/s00428-015-1825-5.
- Silva, H. O. G., Costa, M.C.M., Aguilera, M. V. C., Almeida, M. G. D., Fonseca, B. B., Reis, ..., Sampaio, N. A. S. (2021). Improved Vehicle Painting Process Using Statistical Process Control Tools in an Automobile Industry. *International Journal for Quality Research*, 15(4), 1251-1268. doi: 10.24874/IJQR15.04-14.
- Siva, V., Gremyr, I., Bergquist, B., Garvare, R., Zobel, T., & Isaksson, R. (2016). The Support of Quality Management to Sustainable Development: A Literature Review. *Journal of Cleaner Production*, 138, 148-517. doi:

10.1016/j.jclepro.2016.01.020.

- Siva, V., Gremyr, I., & Halldórsson, A. (2018). Organising Sustainability Competencies through Quality Management: Integration or Specialisation. *Sustainability (Switzerland)*, 10(5),1-14. doi: 10.3390/su10051326.
- Talapatra, S., Uddin, K., Doiro, M., & Santos, G. (2022). The linkage between corporate social responsibility and the main benefits obtained from the integration of multiple management systems in Bangladesh. *Social Responsibility Journal*, Vol. ahead-of-print. <https://doi.org/10.1108/SRJ-09-2020-0390>
- Tariq, S., Loy-Benitez, J., Nam, K.J., Heo, S., & Yoo, C. K. (2020). Energy-Efficient Time-Delay Compensated Ventilation Control System for Sustainable Subway Air Quality Management under Various Outdoor Conditions. *Building and Environment*, 174, 106775. doi: 10.1016/j.buildenv.2020.106775.
- Wang, L., Zhang, Z., Long, H., Xu, J., & Liu, R. (2017). Wind Turbine Gearbox Failure Identification with Deep Neural Networks. *IEEE Transactions on Industrial Informatics*, 13(3),1360-1368. doi: 10.1109/TII.2016.2607179.
- Wu, J. (2013). Landscape Sustainability Science: Ecosystem Services and Human Well-Being in Changing Landscapes. *Landscape Ecology*, 28(6), 999-1023. doi: 10.1007/s10980-013-9894-9.
- Xie, Y., Huang, G., Li, W., Li, Y., Jixian Cui, & Xiaowei Sun. (2016). A Risk-Based Balance Inexact Optimization Model for Water Quality Management with Sustainable Wetland System Development—A Case Study of North China. *Wetlands*, 36, 205-222. doi: 10.1007/s13157-014-0604-4.
- Zeng, X. T., Li, Y. P., Huang, G. H., & Liu, J. (2017). Modeling of Water Resources Allocation and Water Quality Management for Supporting Regional Sustainability under Uncertainty in an Arid Region. *Water Resources Management*, 31(12), 3699-3721. doi: 10.1007/s11269-017-1696-4.
- Zgodavova, K., Bober, P., Majstorovic, V., Monkova, K., Santos, G., & Juhaszova, D. (2020). Innovative methods for small mixed batches production system improvement: The case of a bakery machine manufacturer. *Sustainability (Switzerland)* 12(15), Article number 6266.

---

**Ronald Palandi Cardoso**

Universidade do Estado do Rio de Janeiro,  
Resende,  
Brazil  
[ronaldpalandi0805@gmail.com](mailto:ronaldpalandi0805@gmail.com)

**José Salvador da Motta Reis**

Universidade do Estado do Rio de Janeiro,  
Resende,  
Brazil  
[jmottareis@gmail.com](mailto:jmottareis@gmail.com)

**Nilo Antonio de Souza Sampaio**

Universidade do Estado do Rio de Janeiro,  
Resende,  
Brazil  
[nilo.samp@terra.com.br](mailto:nilo.samp@terra.com.br)

**José Glenio Medeiros de Barros**

Universidade do Estado do Rio de Janeiro,  
Resende,  
Brazil  
[glenio.barros@gmail.com](mailto:glenio.barros@gmail.com)

**Luís César Ferreira Motta Barbosa**

Centro Federal de Educação Tecnológica Celso Suckow da Fonseca,  
Rio de Janeiro,  
Brazil  
[luiscesarfb@gmail.com](mailto:luiscesarfb@gmail.com)

**Gilberto Santos**

ESD - Polytechnic Institute of Cavado and Ave,  
Barcelos,  
Portugal  
[gsantos@ipca.pt](mailto:gsantos@ipca.pt)

---

## Appendix A

Table A1. Thirty most cited articles

Autores	Título	Source	Oportunidade	Desafio
Siva et al. (2016)	The support of Quality Management to sustainable development: a literature review	Journal of Cleaner Production	Implement the Integrated Management System to critical business processes to generate capital savings	Collect data using the WoS databases on the selected articles and address the correct topic
P. Li et al. (2018)	Groundwater quality assessment for domestic and agricultural purposes in Yan'an City, northwest China: implications to sustainable groundwater quality management on the Loess Plateau	Environmental Earth Sciences	Encourage research that uses quality tools to improve aquifer management	Data analysis due to variables involving groundwater suitability and sustainability
Bastas and Liyanage (2018)	Sustainable supply chain quality management: A systematic review	Journal of Cleaner Production	Analyze different geographic regions and business sectors to validate sustainable relationships between resources and organizations	Select the articles and may have excluded any article that was significant to the research
Jermisittiparsert et al. (2019)	Green supply chain practices and sustainable performance: Moderating role of total quality management practices in electronic industry of Thailand	International Journal of Supply Chain Management	Propose study on Green Supply Chain involving Thai manufacturing companies investigating its development in their electronics supply chain	Lack of commitment by electronics industries to Green supply chain practice, making performance improvement unfeasible
Nguyen et al. (2018)	Contribution of quality management practices to sustainability performance of Vietnamese firms	Sustainability (Switzerland)	Articulate a questionnaire with objective questions for the involved industry members about quality management to verify changes related to each person's bias	Measuring sustainability performance as it requires long-term performance reporting
Abbas (2020)	Impact of total quality management on corporate sustainability through the mediating effect of knowledge management	Journal of Cleaner Production	Propose a study adding the information about the use of TQM in the corporation provided by the company's operational staff to improve the accuracy of the survey	No commitment by companies to implement TQM practices so that sustainable goals can be achieved
Bekele et al. (2018)	Water recycling via aquifers for sustainable urban water quality management: Current status, challenges and opportunities	Water (Switzerland)	Propose a research for improving groundwater quality using permeable reactive barrier tests	Implementation of Managed Aquifer Recharge as it can mobilize contaminants in aquifers
Li et al. (2019)	Sustainable Design of Urban Stormwater Drainage Systems by Implementing Detention Tank and LID Measures for Flooding Risk Control and Water Quality Management	Water Resources Management	Use Many-Objective Optimization in conjunction with Detention Tank and Low Impact Development to control flood risk	Analyze the data as it presents many variables related to rainfall and flood risk
Zeng et al. (2017)	Modeling of Water Resources Allocation and Water Quality Management for Supporting Regional Sustainability under Uncertainty in an Arid Region	Water Resources Management	Implementing the Market trading Mechanism for efficient allocation of limited resources in arid regions	Apply efficient methods for water allocation due to local authority
Schmitt et al. (2016)	Challenges for quality management in implementation, maintenance, and sustainability of research tissue biobanks	Virchows Archiv	Use a tissue biobank to provide methods involving sustainable techniques that aid in production efficiency and resource savings	Achieve high quality in tissue biobanks due to their need for extreme standardization among the fabrics manufactured
Siva et al. (2018)	Organising sustainability competencies through quality management: Integration or specialisation	Sustainability	Analyze sustainable method of specialization that consists of adding a new competence and analyze the effectiveness of the method in relation to the company's staff	Lack of generalizability of the conclusions and subjective analysis biases of the interviews in a qualitative study of the proposals studied in the research
Leiber (2018)	Impact evaluation of quality management in higher education: a contribution to sustainable quality development in knowledge societies	European Journal of Higher Education	Analyze the impact of Quality Management using the SWOT method on other levels of Education	Lack of student participation in research related to quality management in higher education
Goyal et al. (2019)	Quality management for sustainable manufacturing: Moving from number to impact of defects	Journal of Cleaner Production	Analyze the relationship between top management support and Quality Management performance using weighted defects	Lack of definition of the weight of a defect, depending on the customer's opinion

Aryanasl et al. (2016)	Can excellence management models encompass “cleaner production” and “sustainable business” revolution?	International Journal of Environmental Science and Technology	Identify the advantages of implementing the European Foundation for Quality Management for sustainability	Balancing the European Foundation for Quality Management with sustainable business standards
Chen et al. (2020)	Total quality management and sustainable competitive advantage: serial mediation of transformational leadership and executive ability	Total Quality Management and Business Excellence	Implementing Transformational Leadership to identify its impact on the leadership of organizations generating improvement in the work environment	Data collection since only one data collection method was used
Barbaritano et al. (2019)	Sustainability and quality management in the Italian luxury furniture sector: A circular economy perspective	Sustainability	Propose quantitative research with a larger number of cases about the end-of-life phase of a product to broaden the knowledge about Circular Economy in the furniture sector	Limitation of the Circular Economy study that talks only about stock reduction
Gupta et al. (2018b)	Prioritizing Critical Success Factors for Sustainable Service Quality Management by Logistics Service Providers	Vision	Analyze a larger number of samples using the Multiple-criteria decision-making method to solve unstructured problems with multiple conflicting objectives	Difficulty in obtaining a large amount of decision-making from certain sectors
Gupta et al. (2018a)	Sustainable Service Quality Management by Logistics Service Providers: An Indian Perspective	Global Business Review	Analyze the impact of using Sustainable Service Quality Management in the Logistics Service Provider market on improving the work environment	Communication hurdle with organizations regarding updates according to market requirements without compromising sustainability issues
Bowman et al. (2018)	Can air quality management drive sustainable fuels management at the temperate wildland–urban interface?	Fire	Use fire managers with regulators to enforce sustainable air quality requirements and design smoke management structures that protect public health in an environmentally sustainable way	Lack of support from those who benefit from the fires, to take sustainable measures that benefit public health
Bardfield et al. (2016)	A national organizational assessment (NOA) to build sustainable quality management programs in low- and middle-income countries	Joint Commission Journal on Quality and Patient Safety	Identify the benefits of the National Organizational Assessment in the leadership of a country and its quality management in the social development of the leadership	Communication and support barriers with leaders in relation to NOA
Xie et al. (2016)	A Risk-Based Balance Inexact Optimization Model for Water Quality Management with Sustainable Wetland System Development—A Case Study of North China	Wetlands	Implement the Balance Inexact Optimization model for decision making in water conservation	Difficulty of applying the model successfully due to human interference in the care of water resources
Ozkaya and Erdin (2020)	Evaluation of sustainable forest and air quality management and the current situation in Europe through operation research methods	Sustainability (Switzerland)	Identify sustainable method for protecting forest areas without harming nature and the economy	Absence of a database that allows all countries to be evaluated together
Hasanzadeh et al. (2020)	A fuzzy equilibrium strategy for sustainable water quality management in river-reservoir system	Journal of Hydrology	Implement Fuzzy Membership to make the project modeling more efficient and with lower error rate	Difficulty in making the Stackelberg and Nash Bargaining models reliable and applicable in reality
Tariq et al. (2020)	Energy-efficient time-delay compensated ventilation control system for sustainable subway air quality management under various outdoor conditions	Building and Environment	Propose Replacing fixed set-point control with a real-time set-point update structure to handle time variation	Difficulty in dealing with time variation since the set-point control is fixed
Kumar et al. (2020)	Barriers to Total Quality Management for sustainability in Indian organizations	International Journal of Quality and Reliability Management	Use Bayesian Belief in TQM practices to reduce costs and improve the quality of the production or services provided	Barriers to implementing TQM created by the humans themselves and also by the organization's operating system
Isaksson (2019)	A proposed preliminary maturity grid for assessing sustainability reporting based on quality management principles	TQM Journal	Compose a study using the Maturity Grid method with data from organizations to assess the relationship of sustainability in companies and improve their performance	Lack of support from students where most of them said that the survey would make no difference
Savov et al. (2017)	Mbnqa approach in quality management supporting sustainable business performance in agribusiness	Amfiteatru Economic	Apply the MBNQA method in other areas with different industries to obtain other results and broaden the feasibility of the research	Applying the MBNQA method in companies led by local native people compared to non-local people
Schmid et al. (2017)	The effect of sustainable investments to the economic objectives of the company in relation to the total quality management	Amfiteatru Economic	Analyze advantages of using Sustainable Investments that generate resource and capital savings in conjunction with Total Quality Management techniques in companies	Barriers to implementing sustainability as investors would not be concerned with quality management

Savino and Mazza (2016)	Assessing product sustainability measurement within quality management systems: A case study in automotive industry	International Journal of Productivity and Quality Management	Identify the advantages of using sustainable methods involving sustainable measurement of a product in the automotive industry	Difficulty in obtaining data variety as the data was obtained from only one company
Dort et al.(2020)	The impact of a quality management program for patients undergoing head and neck resection with free-flap reconstruction: Longitudinal study examining sustainability	Journal of Otolaryngology - Head and Neck Surgery	Propose research involving multiple healthcare institutions to indicate the real impact of using quality management in the workplace	Lack of data source variety, obtaining from only one health institution