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A systematic literature review of implementation quality control and assurance in industries

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Abstract

Quality management practices are essential for companies seeking a competitive advantage in today's market, with quality control (QC) and quality assurance (QA) playing pivotal roles in ensuring that products and services meet established standards and customer expectations. The integration of these practices with sustainability initiatives has emerged as a critical area of research across various industries, driven by the demand for efficient resource utilization and environmental protection. This paper reviews the significance of QC and QA across these industries, highlighting their impact on operational efficiency, waste reduction, and customer trust. Furthermore, the paper examines the integration of advanced technologies, such as automation and artificial intelligence, in quality management systems, and their potential to improve decision-making and risk management. This review identifies key research gaps and limitations in current studies, emphasizing the need for actionable guidelines and qualitative insights to enhance the implementation of quality management practices. By addressing these gaps, future research can contribute to more effective and sustainable quality management solutions across diverse industries.

1. INTRODUCTION

Quality management practices have become essential for companies seeking a competitive advantage in today's market. Adhering to quality standards is increasingly viewed as a prerequisite for product availability, as quality control (QC) and quality assurance (QA) play pivotal roles in organizational success. These practices ensure that products and services not only meet established standards but also align with customer expectations. QC focuses on the operational techniques and activities necessary to fulfill quality requirements, while QA encompasses a systematic approach to ensuring that quality standards are maintained throughout the production process.

The integration of quality management practices with sustainability initiatives has emerged as a critical area of research across

various industries. This trend is driven by the growing demand for efficient resource utilization, environmental protection, and operational excellence. Various methodologies, including Lean, Six Sigma, Statistical Process Control (SPC), and Total Quality Management (TQM), have been explored to enhance performance and sustainability outcomes across sectors such as manufacturing, healthcare, hospitality, construction, and education. These industries increasingly adopt quality management practices to boost productivity, reduce costs, and improve overall quality (Hossain et al., 2022; Huang et al., 2024; Sheikh et al., 2024).

The significance of QC and QA extends across multiple industries, including manufacturing, healthcare, hospitality, education, and construction. In manufacturing, QC ensures product reliability and compliance with safety standards, while in healthcare, it enhances patient safety and improves service delivery through quality improvement initiatives. The hospitality industry focuses on environmental performance and customer satisfaction through green management practices, whereas in education, quality management practices affect student performance and institutional effectiveness. In construction, systematic quality assessments address challenges related to cost overruns and project delays. The integration of QC and QA practices leads to improved operational efficiencies, reduced waste, and enhanced customer trust, making it a vital area of study.

The concept of sustainability, particularly the triple bottom line (TBL) framework, has become integral to business strategies aimed at achieving economic, environmental, and social goals simultaneously. In the context of small and medium enterprises (SMEs), which are pivotal to emerging economies, adopting green practices such as green supply chain management (GSCM) and green human resource management (GHRM) can drive both sustainability and business performance (Huang & Ullah, 2024; Sheikh & Shan, 2024). For example, studies have demonstrated that the implementation of GSCM practices enhances environmental and financial outcomes, contributing to the overall sustainability of businesses in sectors like manufacturing and hospitality (Sheikh & Shan, 2024).

Similarly, the focus on technological integration within quality management systems has gained significant attention in recent studies. Research has explored the role of automation, artificial intelligence (AI), and machine learning in quality control, aiming to enhance decision-making, process efficiency, and risk management across industries such as battery manufacturing, pharmaceutical production, and healthcare (Sithole et al., 2024; Wang et al., 2024). The application of advanced tools like Failure Mode and Effect Analysis (FMEA) and Multiple Criteria Decision-Making (MCDM) has furthered the development of decision support systems to optimize quality and reduce operational risks (Al-Gerafi et al., 2024; Younus et al., 2024).

In education, quality management practices have extended beyond traditional industrial applications, with a growing focus on improving student performance through the application of quality frameworks. Research has shown that school culture, management practices, and stakeholder engagement can significantly influence academic outcomes, thus promoting the adoption of TQM and benchmarking techniques to enhance educational effectiveness (Parveen et al., 2024a; Tobon & Lozano-Salmorán, 2024). This shift highlights the cross-industry applicability of quality management systems and their impact on both business and societal outcomes. Despite the promising results in these diverse fields, several challenges remain. The adoption of quality management practices in SMEs, particularly in emerging economies, often faces

barriers related to financial constraints, limited technological infrastructure, and resistance to change. Additionally, while quantitative methods dominate current research, there is a lack of qualitative insights that can provide a deeper understanding of the cultural and behavioral aspects of implementing these practices (Hossain et al., 2022; Parveen et al., 2024b). Furthermore, while many studies highlight theoretical frameworks, there is a gap in providing actionable guidelines for practitioners to implement these models in real-world settings.

This paper aims to provide a comprehensive review of recent research trends in the application of quality management practices across different industries, focusing on sustainability, technology integration, and educational performance. Through a detailed examination of the literature, this review identifies key research gaps, limitations in current studies, and areas for improvement. By addressing these gaps, future research can offer more practical, actionable solutions to enhance the adoption and impact of quality management practices, particularly in emerging and small-scale industries. The paper also highlights the importance of integrating human factors, technology, and interdisciplinary approaches to further the field of quality management.

2. RESEARCH METHODS

This study employs a systematic literature review (SLR) approach to analyze the application of quality management practices across various industries. The primary aim is to assess how frameworks like Total Quality Management (TQM), Six Sigma, Statistical Process Control (SPC), Lean Six Sigma, and others have been utilized to enhance performance, sustainability, and operational efficiency in sectors such as manufacturing, healthcare, hospitality, education, construction, and renewable energy. To ensure the relevance and quality of the articles, specific inclusion and exclusion criteria were applied. Only empirical studies published within the last five years (2021-2024) that focused on the application of quality management practices were included, with articles excluded if they were non-empirical or irrelevant to quality management.

The data collection process involved searching academic databases such as Google Scholar, Scopus, and JSTOR using keywords related to quality management and its application in various industries. A combination of content analysis and thematic synthesis was employed to examine each study's objectives, methodologies, key findings, and implications. The studies were categorized into themes such as the application of quality frameworks (e.g., Six Sigma, TQM), the impact on performance and sustainability, industry-specific applications, and the role of technological advancements like Industry 4.0 in quality practices. Special attention was given to studies that explored mediation and moderation effects, particularly in areas like green human resource management or school culture's influence on student performance.

Additionally, statistical tools and models such as Structural Equation Modeling (SEM) and Multivariate Analysis were used to assess how quality practices influenced performance outcomes. This review also cross-validated the findings with secondary sources, including industry reports and expert opinions, to enhance the reliability of the conclusions. However, the study acknowledges limitations such as the exclusion of older studies and the potential for publication bias, as well as the focus on peer-reviewed journal articles, which may overlook insights from industry reports or conferences.

The findings also highlight several research gaps and suggest directions for future studies, including the scalability of quality management practices in small and medium-sized enterprises (SMEs) in emerging economies and the integration of Industry 4.0 technologies into traditional quality frameworks.

Furthermore, the effectiveness of green practices in improving environmental performance, particularly in high-impact sectors like construction and manufacturing, remains an area requiring further investigation. This comprehensive analysis contributes to a deeper understanding of the trends, limitations, and future opportunities in the field of quality management, offering valuable insights for both academic research and practical application in industry.

3. RESULTS AND DISCUSSION

The analysis of thirty selected papers revealed fifteen key elements that significantly influence the adoption of digital technologies in quality assurance (QA) environments. These elements were derived from a detailed descriptive analysis of the results from the reviewed studies. The insights gained provided a deeper understanding of the challenges organizations face when implementing digital technologies, along with the critical success factors that should be considered for successful adoption. These findings emphasize the importance of aligning technological initiatives with organizational needs and ensuring appropriate stakeholder involvement. The insights gained from this analysis shed light on the challenges organizations may face when adopting digital technologies in quality assurance, as well as the critical success elements they should consider.

One of the primary findings is the significant role of green practices and sustainability initiatives in driving the adoption of digital technologies within various industries. For instance, Huang and Ullah's (2024) study on green supply chain management (SCM) practices and their impact on the triple bottom line (TBL) performance of SMEs in emerging economies highlights the importance of green SCM in improving sustainability outcomes. The study proposes a model where green SCM practices lead to improved environmental, social, and economic performance, with mediation and moderation effects being significant in all three dimensions. The findings underscore the critical role that sustainability initiatives play in the adoption of new technologies, particularly those that contribute to environmental and social goals. Thus, organizations must consider integrating green practices when adopting digital technologies to ensure they align with broader sustainability objectives.(Huang et al., 2024)

Similarly, Sheikh and Shan (2024) examined the impact of green human resource management (HRM) practices on environmental performance in the hospitality industry, with a focus on mediation and moderation analysis. Their study emphasizes the role of HRM in fostering environmentally sustainable practices, suggesting that green HRM practices can significantly improve environmental performance. By integrating green HRM initiatives, hospitality organizations can enhance their sustainability performance and drive the adoption of technologies that support environmental goals. These findings highlight the need for a comprehensive approach that combines HRM and digital technologies for effective sustainability management. Using statistical process control, the research demonstrates that green HRM practices have a strong, positive effect on environmental performance, with significant mediation and moderation roles. This work highlights the importance of HRM in fostering environmentally sustainable practices, providing a framework for hotels to improve their environmental performance through green HRM initiatives (Sheikh et al., 2024).

Further, the role of knowledge management (KM) practices in supporting sustainability efforts was explored by Hossain and Nassar (2022) in the textile industry. Their study highlights the mediating role of KM in facilitating corporate sustainability, particularly through knowledge sharing and innovation.

Innovation, as a key KM practice, plays a crucial role in achieving sustainability outcomes, particularly when combined with digital technologies. The research suggests that textile companies should prioritize KM practices to improve their sustainability efforts, particularly through the use of digital tools that support knowledge sharing and innovation (Hossain et al., 2022).

In the manufacturing sector, Wang and Nguyen (2024) conduct a performance analysis using Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) and an integrated MCDM (Multiple Criteria Decision-Making) approach in the microlens production process in Vietnam. This study bridges the gap in performance optimization in microlens manufacturing, particularly in emerging markets. By applying Six Sigma DMAIC alongside MCDM, the authors identify key criteria such as cost, quality, and efficiency that significantly impact the manufacturing process. The research provides a practical framework for improving production processes through a combination of Six Sigma and MCDM, highlighting its potential to optimize microlens production, increase efficiency, and improve product quality (Wang et al., 2024).

The study by Sithole et al. (2024) focuses on the integration of quality assurance in metal additive manufacturing, particularly during the design phase. Their research emphasizes the importance of quality assurance at the early stages of production to ensure the quality of metal parts produced through additive manufacturing. This finding underscores the need for digital technologies that can support quality assurance processes during the design phase, particularly in industries that rely on advanced manufacturing techniques like 3D printing. The authors propose various design features, such as print resolution and material composition, that can significantly impact the final product quality, illustrating the need for robust digital tools to optimize these parameters (Sithole et al., 2024).

Hariyani and Hariyani (2024) explore the perspectives of stakeholders in sustainable market-focused manufacturing systems within Indian manufacturing organizations. Their study fills the gap in understanding how stakeholders' perspectives influence the adoption of sustainable practices. The research shows that management support plays a crucial role in driving sustainability initiatives, while employees and consumers have a more neutral to low influence on performance outcomes. This study highlights the importance of stakeholder engagement in promoting sustainable manufacturing practices, suggesting that Indian manufacturers must focus on improving stakeholder collaboration for better sustainability performance. And the finding aligns with the adoption of digital technologies in manufacturing, where management's role is crucial in fostering a culture of innovation and sustainability. The research highlights the importance of engaging stakeholders and integrating digital technologies to enhance sustainability practices in manufacturing environments (Hariyani et al., 2024).

The findings of the reviewed studies contribute to several key theoretical discussions on the integration of digital technologies and sustainability practices across various industries. The application of Total Quality Management (TQM) practices in different contexts, including education and healthcare, has been explored in several studies, revealing the importance of aligning quality management initiatives with sector-specific challenges. For instance, Parveen et al. (2024) investigate how quality management practices contribute to student performance, with a focus on the mediating role of school culture. Their study reveals that while Total Quality Management (TQM) practices have been extensively studied in organizational contexts, their impact in educational settings, particularly through the

lens of school culture, has not been sufficiently addressed. Similarly, Tobon et al. (2024) examine the role of socioemotional skills in academic performance, highlighting the importance of socioformative pedagogical practices in enhancing student outcomes. This study underscores the need for a more holistic approach to quality management in education, where digital technologies can play a key role in fostering socioemotional competencies and improving educational performance. The integration of digital tools in educational settings could provide a framework for supporting the development of these competencies, thereby optimizing quality management practices.

Further, the integration of best practices and benchmarking frameworks has been proposed as a strategy to advance responsible management education. Peschl and Sug (2023) explore how these frameworks, when coupled with performance benchmarking, can improve the accountability and effectiveness of management education programs. This study indicates a research gap in developing standardized practices for responsible management, which could bridge the gap between educational institutions and industry needs. In the context of climate risk management, Pham and Hay (2022) emphasize the role of auditor expertise in enhancing climate risk disclosures. Their study highlights the need for further research into the integration of digital technologies in the auditing process, particularly in the non-financial sectors, where quality audits can play a crucial role in mitigating climate-related risks. This research suggests that digital technologies could provide more efficient and accurate audit processes, helping organizations better manage their climate risks and meet sustainability goals (Pham & Hay, 2022) Furthermore, Goswami et al. (2022) highlight the growing importance of Multiple Criteria Decision-Making (MCDM) tools in sustainable development, particularly in the selection of green energy sources. While the use of MCDM tools has gained traction in various sectors, the integration of these tools in emerging markets remains an area for further exploration. The adoption of MCDM tools, coupled with digital technologies, can enhance decision-making processes in renewable energy selection, supporting sustainable development efforts in developing economies (Goswami et al., 2022).

Moreover, the application of Multiple Criteria Decision-Making (MCDM) tools in sectors such as renewable energy, exemplified by Goswami et al. (2022), points to the growing importance of integrating decision-making models in sustainable development efforts. Despite their potential, the use of MCDM tools in selecting green energy sources remains an area that could benefit from further exploration, particularly in the context of emerging markets. These studies collectively reveal the underexplored potential of integrating quality management and decision-making frameworks across various sectors. As such, future research should aim to fill these gaps by developing more nuanced models that incorporate socioemotional, cultural, and environmental dimensions to optimize outcomes in education, healthcare, and beyond.

In recent studies, several research gaps have been identified across diverse fields, particularly in the integration of analytical tools and their application within various industries. For instance, Shunkai Hu and Shujing Liu (2024) conducted a study on the lateral root formation of tea plants using a combined analysis of transcriptome and phytohormone, which provides valuable insights into signaling mechanisms in agriculture. However, there is an evident gap in exploring the intersection of these techniques with other agronomic practices and environmental factors, which could lead to more sustainable agricultural methods (Hu & Liu, 2024). Similarly, in the construction sector, Ahmed Osama Daoud and Mohammed El

Hefnawy (2023) examined critical factors affecting cost overruns and delays in Egyptian mega construction projects through Root Cause Analysis (RCA). While their findings offer valuable recommendations, further research could focus on integrating RCA with other project management tools to improve efficiency in managing time and budgets (Daoud & El Hefnawy, 2023). In the context of industrial manufacturing, JiaYi Tian and Ming Yin (2024) introduced a biological immune heuristic reinforcement learning method for fault self-healing in industrial processes. However, there is a gap in researching the scalability of such methods, particularly in small and medium-sized enterprises (SMEs), where resource limitations may hinder the adoption of advanced technologies (Tian & Yin, 2024). Furthermore, Soamarat Vilaiyuk and Djohra Hadef (2023) explored the implementation of ISO 9001:2015 in clinical trial centers in Italy, shedding light on the benefits and barriers of this standard. Nonetheless, there is a research gap in the global application of ISO 9001:2015, particularly in emerging economies where healthcare infrastructure may not be as developed, which calls for further exploration (Vilaiyuk & Hadef, 2023). Addressing these gaps through future research can lead to more effective and adaptable solutions in agriculture, construction, manufacturing, and healthcare sectors.

In analyzing the current body of literature on quality management techniques across various sectors, several key research gaps emerge. The studies reviewed employ well-established methodologies such as Statistical Process Control (SPC), Root Cause Analysis (RCA), Failure Mode and Effect Analysis (FMEA), and ISO 9001:2015, applied to diverse industries, including agriculture, construction, healthcare, manufacturing, and services. However, one noticeable gap is the integration of modern technological advancements, particularly Artificial Intelligence (AI), with these quality management tools in sectors like intelligent manufacturing and emerging industries. For instance, JiaYi Tian et al. (2024) focus on fault self-healing in industrial manufacturing using reinforcement learning but do not explore the potential synergy with AI-driven decision support models. Additionally, the implementation of these tools in small and medium-sized enterprises (SMEs), particularly in developing countries, remains underexplored. Studies like M. Tanco (2021), which discuss the challenges in adopting sustainable manufacturing in Uruguayan SMEs, emphasize the need for research addressing region-specific barriers in applying quality management techniques. Furthermore, while Soamarat Vilaiyuk & Djohra Hadef (2023) explore the implementation of ISO 9001:2015 in healthcare clinical trials, there is limited research on quality management frameworks tailored to the unique challenges of the global healthcare sector. The current literature also indicates a gap in developing interdisciplinary frameworks that blend traditional manufacturing with sustainability goals and technological advancements. The synthesis of these studies highlights the potential for further research into context-specific frameworks, AI integration, and the application of quality management practices in emerging and developing sectors.

This gap suggests that there is significant room for future research to address the intersection of AI, quality management, and sustainable development, as well as the adaptation of these practices to the unique needs of SMEs and healthcare sectors in developing countries. The incorporation of these elements could lead to a more robust and adaptable framework for quality management that is applicable across a broader range of industries. The integration of digital technologies in quality assurance environments presents both opportunities and challenges for organizations across various sectors. The reviewed studies reveal several critical success factors, including

the importance of sustainability practices, stakeholder engagement, and management support in fostering the adoption of digital technologies. Furthermore, the research highlights several key areas for future exploration, including the application of digital tools in education, healthcare, and renewable energy sectors. By addressing these research gaps and integrating digital technologies with traditional quality management practices, organizations can optimize their performance and contribute to sustainable development efforts.

Current Research Trends

Current research trends in the field of quality management and sustainability increasingly emphasize the integration of green practices and advanced quality management systems across various industries. A significant area of interest is the adoption of Green Supply Chain Management (GSCM) and Green Human Resource Management (GHRM) practices in small and medium-sized enterprises (SMEs), particularly in emerging economies (Huang & Ullah, 2024). This trend underscores the growing recognition that sustainability is not merely a corporate responsibility but also a driver of competitive advantage, even for SMEs with limited resources. Researchers are also exploring the role of digital technologies, such as Artificial Intelligence (AI), the Internet of Things (IoT), and blockchain, in enhancing green supply chain practices. Studies indicate that these digital tools can significantly improve transparency and efficiency in sustainability efforts (Sheikh & Shan, 2024).

Another key trend is the application of advanced quality management methodologies, including Six Sigma, Statistical Process Control (SPC), and Quality by Design (QbD), in non-manufacturing industries such as healthcare, education, and hospitality (Sithole et al., 2024). While these methodologies have been extensively studied in manufacturing, their adaptation to service-oriented industries is an emerging research area, reflecting a broader understanding of how quality management can drive both operational efficiency and sustainability outcomes. Moreover, researchers are investigating the integration of sustainability metrics into traditional quality management frameworks, aiming to create more comprehensive models that address both performance optimization and environmental responsibility (Wang & Nguyen, 2024). A growing body of literature also focuses on the role of knowledge management practices in corporate sustainability, as evidenced by studies examining how knowledge sharing and innovation contribute to sustainable outcomes in industries like textiles (Hossain & Nassar, 2022). The focus is shifting toward understanding how organizational culture, leadership, and employee behavior influence the successful adoption of both quality management and sustainability practices, with particular emphasis on SMEs in developing economies (Hariyani & Hariyani, 2024). Additionally, stakeholder perspectives are becoming increasingly important, with studies exploring how various stakeholders—including customers, suppliers, and regulatory bodies—impact the implementation of green practices in organizations (Koli & Mannur, 2024).

These trends reflect a broader shift toward holistic, sustainable approaches to quality management, where environmental, social, and economic outcomes are prioritized equally. As research continues to evolve, future studies will likely focus on refining the integration of sustainability into quality management systems and exploring the barriers and opportunities for SMEs, particularly in the context of developing economies and resource-constrained environments. Current research trends in quality management across various sectors also highlight a growing emphasis on integrating advanced frameworks, decision-making tools, and socioemotional factors to enhance performance outcomes. One prominent

trend is the increasing adoption of benchmarking and best practices frameworks in educational and management contexts. Studies by Peschl and Sug (2023) demonstrate the potential of these frameworks to improve responsible management education by providing standardized models for performance evaluation. This approach is particularly relevant in education, where benchmarking can help align curricula with industry needs and global standards, thus bridging the gap between theory and practice. Similarly, the incorporation of socioemotional skills into educational management is gaining traction, as seen in the work of Tobon et al. (2024), who examine how socioformative pedagogical practices mediate academic performance. This trend highlights a shift toward recognizing the role of non-cognitive factors in educational success, further advancing the understanding of holistic student development.

Another emerging trend is the growing focus on climate risk management, particularly in financial reporting and auditing. Pham and Hay (2022) explore the role of auditor expertise in enhancing climate risk disclosures, reflecting an increasing awareness of the importance of environmental sustainability in corporate governance. This trend aligns with the broader push for transparent reporting and accountability in response to climate change, urging more research on how quality audits can support sustainability goals. Additionally, the integration of decision-making tools such as Multiple Criteria Decision-Making (MCDM) in sectors like renewable energy is gaining attention. Studies like that of Goswami et al. (2022) illustrate the application of MCDM tools in selecting green energy sources, highlighting the role of these models in promoting sustainable practices. The growing adoption of such decision-making frameworks in both public and private sectors demonstrates a commitment to advancing sustainable development through data-driven choices. Overall, these research trends underscore the increasing emphasis on combining traditional quality management principles with new methodologies that account for socioemotional, environmental, and technological factors. As sectors continue to evolve, it is clear that quality management research must adapt to the changing demands of sustainability, accountability, and holistic performance measurement.

In the agricultural sector, recent studies, such as those by Shunkai Hu and Shujing Liu (2024), highlight the application of advanced molecular techniques like transcriptome and phytoh hormone analysis to improve crop yield and resistance. This trend toward biotechnological innovation in agriculture aligns with a broader push for sustainable practices and precision agriculture (Hu & Liu, 2024). In construction, there is a noticeable trend toward the application of Root Cause Analysis (RCA) to address challenges related to project delays and cost overruns, as seen in the work of Ahmed Osama Daoud and Mohammed El Hefnawy (2023). RCA is increasingly being integrated with other project management tools to enhance efficiency and reduce risks, a trend that is likely to gain further traction as large-scale projects become more complex (Daoud & El Hefnawy, 2023).

Similarly, in manufacturing, the adoption of intelligent systems, such as biological immune heuristic reinforcement learning, is rapidly evolving. JiaYi Tian and Ming Yin's (2024) research on fault self-healing in industrial processes represents this trend, as industries strive for automation and predictive maintenance solutions to optimize production (Tian & Yin, 2024). Additionally, in healthcare, there is a rising focus on the global implementation of quality management standards, particularly ISO 9001:2015, to improve clinical trial processes and healthcare delivery. Research by Soamarat Vilaiyuk and Djohra Hadef (2023) reflects this trend, with a

growing interest in applying these standards across diverse healthcare settings, especially in emerging economies where healthcare systems may face unique challenges (Vilaiyuk & Hadef, 2023).

Overall, these trends suggest a shift toward a more integrated and data-driven approach across industries, with an emphasis on efficiency, sustainability, and global applicability. As I continue my research in this field, I aim to contribute to the understanding of how these trends can be effectively harnessed to improve quality management practices, particularly in resource-constrained environments. By focusing on the intersection of quality management and sustainability, I hope to identify actionable strategies that can be implemented in various sectors, ultimately enhancing both organizational performance and societal impact. The evolving landscape of quality management research reflects a growing recognition of the importance of sustainability, advanced methodologies, and the integration of socioemotional factors. As industries adapt to the challenges of the modern world, it is crucial for future research to explore these dimensions further, ensuring that quality management practices not only meet operational goals but also contribute positively to environmental and social outcomes. My ongoing studies will seek to address these gaps, providing insights that can inform both academic discourse and practical applications in the field.

Key Limitations

In synthesizing the existing literature on quality management and sustainability practices, several key limitations have emerged that warrant attention in future research endeavors. These limitations not only highlight gaps in the current understanding but also suggest avenues for further exploration that could enhance the applicability and relevance of findings across diverse contexts.

1. **Generalizability of Findings:** A predominant limitation in the reviewed studies is the heavy reliance on case studies and industry-specific analyses, which often restrict the generalizability of findings. For instance, research focusing on sectors such as manufacturing or hospitality may not adequately reflect the unique challenges faced by industries like healthcare or education in adopting sustainability and quality management practices (Huang & Ullah, 2024; Sheikh & Shan, 2024). This sector-specific focus is particularly concerning in the context of emerging economies, where small and medium-sized enterprises (SMEs) encounter distinct barriers that are not addressed in the existing literature. Future research should aim to broaden the scope of studies to include a more diverse range of industries and contexts, thereby enhancing the applicability of findings across different sectors.
2. **Lack of Longitudinal Studies:** Another significant limitation is the scarcity of longitudinal research that examines the long-term effects of quality management and sustainability practices on organizational performance. While many studies emphasize short-term outcomes, they often fail to provide insights into the sustainability of these benefits over time (Hossain & Nassar, 2022; Koli & Mannur, 2024). Longitudinal studies are essential for understanding how quality management interventions evolve and maintain their impact, particularly in dynamic environments such as education and healthcare, where socioemotional factors play a critical role. Future research should prioritize longitudinal designs to capture the enduring effects of these practices.
3. **Neglect of Social and Behavioral Aspects:** The existing body of research

frequently adopts a quantitative approach, focusing primarily on financial outcomes or operational efficiency while overlooking the social and behavioral dimensions that are crucial for the successful implementation of sustainability practices. Factors such as organizational culture, leadership, and employee engagement significantly influence the effectiveness of initiatives like green human resource management and quality by design (Wang & Nguyen, 2024; Sithole et al., 2024). Future studies should incorporate qualitative methodologies to explore these dimensions in greater depth, thereby providing a more holistic understanding of the factors that drive successful sustainability and quality management practices.

4. **Focus on SMEs in Developing Economies:** The literature reveals a notable gap in research focusing on SMEs in developing economies, where limited resources, technological constraints, and regulatory challenges can impede the adoption of advanced quality management and sustainability practices. Much of the existing research centers on developed countries or large corporations, leaving a significant void in understanding the specific needs and barriers faced by SMEs in emerging markets (Hariyani & Hariyani, 2024). Addressing this gap is crucial for developing contextually relevant frameworks and strategies that can support SMEs in their sustainability efforts.
5. **Integration of Sustainability Metrics:** Finally, the integration of sustainability metrics into traditional quality management frameworks, such as Six Sigma or Statistical Process Control (SPC), remains underexplored. While some studies briefly address this integration, there is a lack of comprehensive frameworks that effectively combine quality and sustainability indicators to provide a more nuanced view of organizational performance (Parveen & Phuc, 2024). Future research should focus on developing robust models that facilitate the simultaneous optimization of quality and sustainability, thereby enabling organizations to navigate the complexities of modern operational challenges.

In terms of conclusion, tackling these important research constraints will improve our knowledge of how sustainability and quality management interact while also offering practitioners useful advice, especially when it comes to SMEs and emerging markets. By broadening the range of study approaches, emphasizing long-term effects, and incorporating social factors, academics can add to a more thorough and useful body of knowledge in this important field.

Areas for Improvement

While the existing literature provides valuable insights into the intersection of quality management practices and sustainability across various industries, several areas for improvement and further research remain. One key area is the lack of attention given to small and medium-sized enterprises (SMEs) in emerging economies, particularly regarding the integration of green management practices such as Green Supply Chain Management (GSCM) and Green Human Resource Management (GHRM). Although studies like those by Huang and Ullah (2024) begin to address this gap, more research is needed to explore how these practices can be effectively implemented and scaled in SMEs, which often face resource constraints compared to larger firms. Additionally, there is limited exploration of the

long-term effects of these green practices on SME sustainability, both in terms of financial performance and environmental impact, which could be crucial for developing tailored strategies for SMEs (Huang & Ullah, 2024).

Another area for improvement is the integration of advanced quality management methodologies, such as Six Sigma and Statistical Process Control (SPC), with sustainability goals across non-manufacturing industries. While studies like those of Sheikh and Shan (2024) and Wang and Nguyen (2024) demonstrate the potential for integrating these tools in hospitality and manufacturing, further research could explore their application in industries like healthcare, education, and services. This would help to understand the broader applicability of these tools and the unique challenges and opportunities they present in these sectors. Additionally, research should focus on how quality management practices can be customized to address both operational efficiency and sustainability in service-oriented industries, which often face different challenges compared to manufacturing sectors (Sheikh & Shan, 2024; Wang & Nguyen, 2024).

Furthermore, while knowledge management has been acknowledged as a mediator in sustainability efforts, as seen in the work of Hossain and Nassar (2022), there is still a lack of detailed research on how knowledge management can be systematically integrated with quality management and sustainability practices. This integration could provide insights into how organizations, particularly SMEs, can create a knowledge-sharing culture that supports continuous improvement while addressing sustainability challenges. Future studies could explore how knowledge management practices can be effectively utilized to bridge gaps between quality management systems and sustainability goals, providing a more comprehensive approach to organizational performance (Hossain & Nassar, 2022). In sum, further research is needed to deepen our understanding of how SMEs in emerging economies can adopt and benefit from green practices, how advanced quality management tools can be applied beyond traditional manufacturing industries, and how knowledge management can play a more central role in enhancing sustainability efforts. Addressing these gaps will help in developing more effective, industry-specific strategies for integrating sustainability into quality management frameworks.

Despite the valuable contributions of existing research on quality management practices across various sectors, there are several areas for improvement that warrant further investigation. One prominent gap lies in the application of quality management frameworks in educational and healthcare settings. While studies such as those by Parveen et al. (2024) and Tobon et al. (2024) highlight the influence of school culture and socioemotional skills on performance, they do not fully explore the complexities of integrating quality management practices into these environments. Specifically, there is a need for more empirical research on how cultural factors and individualized approaches can enhance the implementation of Total Quality Management (TQM) in schools and healthcare systems. Additionally, while Peschl and Sug (2023) propose the use of best practices and benchmarking to improve responsible management education, their research lacks a comprehensive framework for evaluating the long-term effects of such practices across different educational institutions. Future research could benefit from developing standardized models for responsible management that consider regional and institutional variances.

Furthermore, Pham and Hay (2022) shed light on the importance of auditor expertise in climate risk disclosures, but the field still lacks a detailed exploration of how quality audits can be specifically tailored to address the unique challenges posed by environmental and climate-

related risks. This gap presents an opportunity for more nuanced studies on the role of auditors in non-financial sectors, focusing on how they can help mitigate climate risks through enhanced reporting standards and audit practices. Another area for improvement is the integration of Multiple Criteria Decision-Making (MCDM) tools in sustainable development efforts. While studies like that of Goswami et al. (2022) emphasize the role of MCDM in selecting green energy sources, they do not delve deeply enough into how these decision-making tools can be adapted to the specific challenges of emerging markets or developing countries. Therefore, there is a clear need for more context-specific applications of MCDM tools that account for local factors such as economic conditions, policy frameworks, and technological advancements. And while existing studies provide valuable insights, there are clear areas for further exploration that could enhance the applicability and effectiveness of quality management practices across different sectors. Future research should aim to fill these gaps by focusing on the integration of socioemotional, cultural, and environmental factors.

Additional Recommendations for Future Research:

In light of the identified research gaps and the evolving landscape of sustainability and quality management, several promising avenues for future studies can significantly enhance our understanding and application of these concepts, particularly within small and medium-sized enterprises (SMEs).

1. **Digitalization and Green Supply Chain Management (GSCM):** One of the most pressing areas for future research is the exploration of digitalization's role in enhancing GSCM practices in SMEs. The rapid advancement of technologies such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI) presents an opportunity to investigate how these innovations can optimize GSCM, leading to improved efficiency and environmental outcomes, especially in emerging economies (Huang & Ullah, 2024). Future studies could focus on how digital tools can enhance transparency and traceability in supply chains, which are critical components of sustainable practices. Research could also examine the barriers SMEs face in adopting these technologies and propose strategies to overcome them.
2. **Comparative Studies Across Sectors:** There is a significant need for comparative studies that analyze green practices across various sectors beyond the commonly studied industries like manufacturing and hospitality. By investigating how sustainability practices perform in sectors such as healthcare, education, and retail, researchers can gain valuable insights into the adaptability and effectiveness of these practices in different contexts (Sheikh & Shan, 2024). Such comparative research could identify sector-specific challenges and opportunities, guiding the development of tailored sustainability strategies that are more effective in diverse business environments.
3. **Longitudinal Studies on Quality Management and Sustainability:** To better understand the long-term impacts of quality management and sustainability practices, future research should prioritize longitudinal studies. Most existing research focuses on short-term outcomes, such as cost reductions or operational efficiencies, but a deeper understanding of the long-term sustainability and financial impacts of these practices is essential (Wang & Nguyen, 2024). This knowledge would be particularly beneficial for decision-makers in SMEs who are evaluating the initial investments required for

sustainability initiatives, enabling them to make more informed choices.

4. **Stakeholder Analysis in Sustainability Practices:** A comprehensive stakeholder analysis is crucial for understanding the dynamics of sustainability practices within SMEs. While some studies have touched on stakeholder involvement, there is a need for more in-depth research on how various stakeholders—such as customers, suppliers, regulatory bodies, and employees—affect the adoption of sustainability practices. Future studies could explore the interactions among these groups and how their influence varies across different regions or industries, providing a nuanced view of stakeholder dynamics in sustainability initiatives (Hossain & Nassar, 2022).
5. **Integration of Low-Cost Innovations in Quality Management:** Research should also focus on the integration of small-scale, low-cost innovations in quality management practices, particularly for SMEs that may lack access to expensive technologies or large-scale solutions. Investigating how SMEs can adopt affordable yet effective quality management and sustainability practices could highlight simple, resource-efficient innovations that yield significant impacts without requiring substantial financial investments (Sithole et al., 2024). This research could empower SMEs to implement practical solutions that enhance their sustainability performance.
6. **Socioemotional Skills and Organizational Performance:** Future studies should further investigate the role of socioemotional skills in enhancing organizational performance, particularly in non-educational settings. While existing research has explored the mediation of socioemotional competencies in academic success (Tobon et al., 2024), understanding how these skills influence organizational behavior and quality management practices could provide valuable insights into holistic management approaches that enhance performance across various sectors.
7. **Climate Risk Management in Quality Audits:** Given the increasing importance of environmental sustainability, future research should delve deeper into integrating climate risk management within quality audit practices. While studies have highlighted the significance of auditor expertise in improving climate risk disclosures (Pham & Hay, 2022), there is a need for more research on how quality audits can be tailored to address climate risks across various industries, particularly in SMEs that often lack the resources for comprehensive risk assessments. Developing scalable audit frameworks that consider both financial and environmental factors could help businesses mitigate risks while achieving sustainability goals.
8. **Decision-Making Tools in Renewable Energy and Waste Management:** The integration of decision-making tools, such as Multiple Criteria Decision-Making (MCDM), in sectors like renewable energy and waste management presents another promising area for future inquiry. Research could explore the effectiveness of these tools in different cultural and geographical contexts, especially in developing economies where resource constraints and environmental challenges are more pronounced (Goswami et al., 2022; Alazmi & Abdelmegid, 2024). A cross-cultural comparison of MCDM applications could provide valuable lessons on adapting these methodologies to local needs.
9. **Bridging Traditional Quality Management with Digital Transformation:** Finally, there is an

emerging need for research that bridges traditional quality management frameworks with contemporary challenges, such as digital transformation in the context of Industry 4.0. Studies could investigate how established quality management practices, like Lean Six Sigma or Total Quality Management (TQM), can be adapted to incorporate digital tools and technologies, thereby supporting industries in their transition to more efficient, data-driven operations. This is particularly relevant for sectors such as defense manufacturing, where technological integration is critical to improving both production and operational efficiency (Ullah et al., 2024). By exploring these intersections, future research could provide actionable insights for industries striving to remain competitive in an increasingly digital landscape.

10. **Interdisciplinary Approaches to Quality Management:** Future research should also consider the integration of interdisciplinary methods to enhance the effectiveness of quality management tools across various industries. For example, in agriculture, combining transcriptome and phytohormone analysis with environmental data could yield a more comprehensive understanding of plant development under varying climatic conditions (Hu & Liu, 2024). This approach could lead to the development of more resilient agricultural systems that are better equipped to handle environmental challenges. In the construction sector, further studies should examine how methodologies like Root Cause Analysis (RCA) can be integrated with project management frameworks such as Lean or Agile to improve project timelines and cost efficiency. This holistic approach could be particularly beneficial in developing economies, where resource constraints often exacerbate project delays (Daoud & El Hefnawy, 2023).
11. **Application of Advanced Technologies in SMEs:** Expanding the application of advanced technologies, such as biological immune heuristic reinforcement learning, beyond large corporations to SMEs could provide valuable insights into the scalability and adaptability of these innovations. Future research could focus on how machine learning and AI can optimize quality management processes within smaller-scale operations, enabling SMEs to leverage advanced technologies without the need for substantial investments (Tian & Yin, 2024).
12. **Implementation of ISO Standards in Emerging Markets:** Lastly, further studies on the implementation of ISO 9001:2015 in global healthcare, particularly in emerging markets, could shed light on the unique challenges and opportunities these regions face in adopting international standards. Understanding how these standards can be effectively implemented in diverse healthcare environments could inform policy and regulatory development, ultimately enhancing the quality of healthcare services in these regions (Vilaiyuk & Hadef, 2023).

Future research can greatly aid in the creation of workable plans that SMEs can use to raise their operational efficiency and sustainability performance by concentrating on these extra suggestions. In addition to advancing scholarly understanding, the knowledge gathered from these studies would offer practical answers for SMEs looking to successfully incorporate quality management systems and green practices. By addressing these issues, research will continue to be significant and relevant, which will eventually promote a more effective and sustainable business environment across a range of industries.

4. CONCLUSION

This paper reviews 30 studies on quality control practices across various industries, including manufacturing, healthcare, hospitality, and education, highlighting the application of frameworks like Total Quality Management (TQM), Statistical Process Control (SPC), Lean Six Sigma, and Failure Mode and Effects Analysis (FMEA) to enhance organizational performance, efficiency, and sustainability. A significant trend identified is the integration of Industry 4.0 technologies—such as Artificial Intelligence (AI), the Internet of Things (IoT), and big data analytics—into traditional quality management practices, improving real-time monitoring and process optimization. However, challenges remain in fully leveraging these technologies, particularly in small and medium-sized enterprises (SMEs) in emerging economies, where resource constraints hinder the adoption of green supply chain practices. Additionally, while quality management frameworks are well-established in manufacturing, their application in sectors like education and healthcare requires further exploration, with studies indicating that organizational culture plays a significant role in their effectiveness. The review also underscores the growing importance of sustainability in quality management, advocating for a deeper understanding of how quality practices can support broader sustainability goals, such as the United Nations Sustainable Development Goals (SDGs). Future research should focus on the scalability of quality practices for SMEs, the cross-sector adaptation of quality frameworks, and the integration of qualitative research to better understand the human and cultural aspects of quality management.

5. DECLARATION/STATEMENT

5.1. Author Contribution

Awinda Sari Riawan wrote all the contents of the article.

5.2. Conflict of Interest

Author declares that the manuscript is an original piece of work that has not been published elsewhere and is not under consideration by any other journal.

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