

Article

Policy innovation and the sustainable quality management 4.0 framework for integrating sustainable services

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Abstract: Over the past twenty years, service organizations have adopted total quality management to enhance their service quality, significantly impacting business performance, customer satisfaction, and profitability. This study delves into policy development of sustainable quality management theory, benefits, and various service components, while reviewing its implementation in services industries and policy innovation. The concept of Sustainable Quality Management 4.0 (SQM 4.0) integrates sustainable management, traditional quality management, and Quality 4.0 principles to optimize resources, reduce environmental impacts, and enhance decision-making through Industry 4.0, IoT, AI, and big data analytics. The findings offer valuable framework and policy insights for managers and practitioners on quality management and service systems, providing an implementation framework for Sustainable Quality Management in the service sector. The paper outlines comprehensive elements and strategies for implementation as a SQM framework for attaining sustainable quality management in the services industry.

Keywords: policy development, quality 4.0; SQM 4.0; quality management; sustainable quality management; sustainability

1. Introduction

The service sector has experienced rapid growth and is now the largest part of the economy (Begg, 1993), presenting opportunities to achieve sustainability through the design of more sustainable services. These services can mimic nature's ecosystem services and include environmental services, green services, and eco-efficient services, all aimed at reducing environmental impact, known as clean services (Clean-Servs), they compete with conventional services by reducing resource use and emissions while promoting provider and customer responsibility, ultimately fostering sustainability-based service innovation (Wolfson et al., 2015).

Quality management is seen by many in the public sector as a solution to criticisms of inefficiency, waste, and detachment from the public they serve, aiming to reduce errors and enhance customer focus (Ancarani and Capaldo, 2001). However, its effectiveness is debated, with some claiming it leads to reduced service levels, job losses, and increased stress among public employees, raising doubts about whether "quality talk" results in actual improvement (Davison and Grieves, 1996; Hazlett and Hill, 2000) and explores the adoption and impact of quality management practices in the public sector compared to the private sector, seeking to differentiate between substantive improvements and superficial practices and assessing their effects on organizational efficiency and managerial roles. Despite initial enthusiasm, improvements have often failed to materialize, especially as quality management

practices, originally developed for manufacturing, struggle to adapt to the service sector. In the public sector, quality management is seen as a solution to various challenges, driven by legislative changes, cost pressures, and increased customer demands, although its effectiveness remains debated (Redman et al., 1995). Service quality, as perceived by customers, consists of two main dimensions: technical quality and functional quality. Technical quality refers to how the service is delivered, while functional quality focuses on the benefits customers receive from the service (Gronroos, 1990). In the context of internet services, (Gronroos, 2000) emphasized the importance of the user interface, which includes the functionality, outlook, logic, and usability of the site, and how it plays a crucial role in the overall service delivery.

Increased competition in the global marketplace has made quality a critical focus for organizations, leading to the widespread adoption of Total Quality Management (TQM). TQM has become a prevalent management system, despite being relatively unknown two decades ago. Mihail (2017) explores the importance of customer focus, leadership, employee engagement, and continuous improvement in enhancing organizational performance. The use of ISO 9001:2015 has been certainly embarked emphasizing the principles of strategic goals to improve customer and operational satisfaction. Ooi et al. (2012) study aims to develop a conceptual framework and research model for TQM implementation, particularly in service companies, by examining the relationship between TQM and company performance through quality performance indicators. This approach fosters continuous, sustained improvement in quality and productivity while alleviating employees' fear of change. Unas Zgirskas et al. (2021) highlights the benefits of quality management standards like ISO 9001, including reduced incidents, improved employee engagement, and increased customer satisfaction, driven by internal system enhancement and external market expansion and competitive advantage.

Dahlgaard-Park and Dahlgaard (2020) focuses on the utilization of quality management and sustainability in combination that helps to develop strategies in loop with industry 4.0. The Fourth Industrial Revolution, with digital transformation advancing in both the service and manufacturing sectors. Manufacturing focuses on technologies like CPS, robotics, and additive manufacturing, while the service sector emphasizes AI, data analytics, and big data. However, research on the role of Quality Management within these developments is limited, and this research of Rowlands and Milligan (2020) aims to address this gap by critically evaluating literature on the relationship between Industry 4.0 and Quality Management. This study investigates quality management professionals' awareness and future vision for developing quality management systems during the transition to Industry 4.0 technologies and principles. (Salimova et al., 2020) indicate that while innovative quality management methods and digital technologies are crucial, the transformation primarily involves managerial thinking, focusing on human-centric production and consumption, redefining stakeholder relationships, and transforming core decision-making principles.

The purpose of this study to provide a new framework for Sustainable Quality Management 4.0 (SQM 4.0) that is especially designed for the service sector. The objective of this framework is to improve quality management procedures by incorporating sustainable practices and cutting-edge digital technology. Furthermore, the study suggests all-encompassing guidelines to aid in the acceptance and execution

of SQM 4.0 in service-oriented businesses, guaranteeing a smooth shift to more effective and sustainable operations. This study is centered on theoretical and visual exploration to develop and illustrate the SQM 4.0 framework, prioritizing conceptual advancement over empirical research. It aims to establish a solid theoretical basis and practical directives for service sectors by integrating literature and theoretical constructs to offer actionable strategies.

2. Literature review

2.1. Quality management in services sectors

The services industry is faced with possibilities and problems never seen before at a time of fast technical progress and environmental concern. Service providers in a variety of sectors, including hospitality, healthcare, and transportation, have an obligation to provide excellent customer service while reducing their environmental impact (Siva et al., 2016). It is therefore critical to find creative solutions that combine sustainable practices and quality management concepts to meet these expectations. Businesses have benefited greatly from traditional methods to quality management in the past, which mostly focused on process optimization and customer satisfaction (Isaksson, 2006). But as the world economy changes and environmental issues gain prominence, there's an increasing understanding that quality management has to change to meet these new demands (McAdam and Leonard, 2003) and lies the application of the Sustainable Quality Management (SQM) concept. SQM incorporates sustainability concepts into all facets of service delivery, going beyond typical quality management. The development of Industry 4.0 and Industry 5.0 technologies presents a once-in-a-lifetime chance to completely transform quality management in the services industry (Zonnenshain and Kenett, 2020). The Quality Ecosystem 4.0 is a comprehensive approach to SQM that uses the most recent developments in technology and management ideas to promote excellence and protect resources for coming generations (Wang et al., 2023). The Quality Ecosystem 4.0 builds a dynamic and adaptable framework for long-term quality management by combining digital twins, IoT sensors, blockchain, artificial intelligence, AR/VR, and human-machine cooperation (Lee et al., 2019).

In the services sector, the absence of standardized quality management practices in the services industry often results in inconsistent service delivery. The success of service firms depends on maintaining high levels of consumer fulfillment. Sustainable quality management methods may enhance client experiences, resulting in improved retention rates and increased profitability. Numerous services depend on intricate supply networks that might include unethical behavior or unsustainable sources. Promoting openness across the supply chain and guaranteeing ethical sourcing are essential components of implementing sustainable quality management (Srivastava, 2007). Service firms have difficulties when integrating sustainable practices with technology improvements. To overcome these difficulties, they must invest in creative solutions and promote a continual improvement culture (Parasuraman et al., 1985b). Sustainable quality management necessitates keeping up with legislative changes and proactively modifying operations to satisfy compliance requirements, which poses a substantial problem for service firms in complying with growing rules and standards

(Università and Bocconi, 2009).

The **Table 1** provides an overview from previous research implementation approaches, highlighting the essential concepts and methodologies that guided the development of SQM 4.0 framework, as it summarizes the findings and contribution from the various articles to establish a thorough comprehension of sustainable quality management.

Table 1. Previous research implementation studies.

| Title/Reference | Findings |
|---|--|
| “Current health of quality management practices in service sector SME A case study of Pakistan.” (Kureshi et al., 2010) | There is a documented large disparity between SME entrepreneurs’ understanding of quality management systems and their use. The findings indicate a high use of CRM-related approaches and a low use of statistically extensive and supplier development-related procedures. The use of TQM and other quality management methods—in particular, six sigma and 5S—is proven to be significantly correlated. |
| “Quality management practices and quality results: A comparison of manufacturing and service sectors in Taiwan.” (Solis et al., 1998) | The eight key components of quality management that are the subject of this presentation are supplier quality, customer orientation, quality citizenship, quality leadership, quality information and analysis, human resources management, quality assurance, and company quality results. The analysis also reveals notable differences between service and manufacturing organizations, with manufacturing organizations outperforming service organizations in both quality outcomes and six essential quality management parameters. |
| “Impact of Total Quality Management and Service Quality in the Banking Sector” (Talib and Rahman, 2012) | The outcomes demonstrate that in order for TQM to be implemented successfully in banks, a few crucial aspects must be taken care of, namely: management support and commitment to TQM, staff motivation and training, and feedback-based customer need monitoring. In addition, it was discovered that service quality is a significant notion in the banking industry and that it falls into four main conceptual categories. |
| “Adaptability of total quality management to service sector.” (Juneja et al., 2011) | This highlights how TQM’s agility and domination over service quality are crucial in the service industry. It states that as society becomes more developed in terms of culture, education, and living circumstances, user expectations and requests for higher-quality services are rising. This is a contributing factor in the push on service firms to investigate total quality management (TQM) to instil quality improvement across all of their operations. |
| “Total quality management and service quality: An exploratory study of quality management practices and barriers in service industry.” (Talib et al., 2011) | This research aims to determine the TQM procedures that are essential for maintaining service quality across various service sectors. To help managers of service industries achieve service quality and consumer satisfaction, it also strives to investigate the obstacles to implementing TQM. |
| “Studying the impact of total quality management in service industries.” (Talib and Rahman, 2010) | To implement TQM, the service sector must cultivate a customer-centred culture. A significant job is starting and executing a TQM program across most of the service system. It necessitates a comprehensive and methodical examination of system operations, functionalities, and customer expectations in addition to the definition and establishment of quality metrics. This study explores the various critical success factors (CSFs), the processes involved in implementing TQM and how they affect the efficiency of several service industries. It also summarizes and analyses the impact of implementing Total Quality Management (TQM) in various service sectors. |
| “Total quality management in service sector: A literature review.” (Talib et al., 2012) | The results of the research provide a significant addition to TQM theory, highlight the many components of services, and discuss the theory’s application in the service industry. This study intends to enhance the comprehension of TQM, service systems concept, and TQM implementation in the service sector for business managers and quality consultants. |
| “Corporate social responsibility in a total quality management context: Opportunities for sustainable growth.” (McAdam and Leonard, 2003) | It has been discovered that CSR’s expanding function is diverse, including topics like business sustainability, environmental concerns, and employee welfare. Within this broad mandate, two essential viewpoints have emerged. Research demonstrates that Total Quality Management (TQM) not only contributes to business objectives and metrics but also has a strong ethical emphasis. Therefore, if CSR can be integrated into TQM models, processes, and change initiatives that are already in place, it may progress inside enterprises more quickly. As a result, a methodology for corporate social responsibility (CSR) based on TQM models was able to evaluate the CSR’s organizational improvement and ethical basis. |

Table 1. (Continued).

| Title/Reference | Findings |
|---|--|
| “Sustainable Quality Management Systems in the Current Paradigm: The Role of Leadership.” (Silva et al., 2021) | <p>The findings show that transformational leadership—which seems to be the predominant self-perceived style among the participating quality managers—is enhanced by leadership, which is a crucial component of QMS success.</p> <p>However, these professionals are aware of how challenging it may be to include every employee in the sustainability path. This study is a result of the theoretical and managerial implications.</p> <p>The SLR findings could provide a valuable resource for further studies on leadership and QM. The organizations might develop their QMS along the recommended route to assist solutions to some of the present issues.</p> |
| “Sustainable quality management: A strategic perspective.” (Svensson, 2006) | <p>Service sectors must consider and assess how long-lasting their principles, methods, and strategies are while doing business in the aftermarket and in the marketplace.</p> <p>They must also consider and assess how sustainable their methods, values, and instruments are considering the society in which they live. For most organizations, quality assurance and control are no longer sufficient for daily operations.</p> <p>It is essential that all organizational processes involved in company operations include sustainability assurance and control.</p> |
| “The impact of strategic quality orientation on innovation capabilities and sustainable business growth: Empirical evidence from the service sector of Pakistan” (Khan and Naeem, 2018) | <p>A clear correlation between strategic quality focus and innovation capacities as well as long-term company success, supporting the idea that quality management procedures have to be seen as the first step towards developing other management competencies like innovation.</p> <p>The results indicate that both exploration and exploitation of innovation capabilities mediate the direct relationship between strategic quality orientation and sustainable business growth, thereby highlighting the significance of these capabilities in promoting business sustainability of service organizations.</p> <p>Only exploration of innovation capabilities was found to have a significant positive impact on sustainable business growth. The research also shows that service firms place a greater emphasis on soft aspects of quality management than do industrial organizations.</p> |

2.2. Sustainability in services sectors

The integration of sustainability into the growing service industry, arguing that designing sustainable services is crucial for achieving sustainability objectives implies that various strategies, including optimizing resource use, enhancing value co-creation, and offering alternative sustainable alternatives resulting in the concept of ecosystem services, which encompass green, eco-efficient, and environmental services (Wolfson et al., 2015). For instance, the use of life cycle-based strategies in the food service industry for evaluating environmental sustainability suggested that treatments focusing on production phase, such as menu planning, have the most potential for change. However, initiatives focusing on meal preparation, food storage, and waste management have less promise (Takacs and Borrion, 2020). The logistics industry is increasingly prioritizing service quality and sustainability to gain a competitive advantage. In addition, companies are integrating economic, social, and environmental aspects of sustainability into their strategies to improve perceived quality culminating in the component analysis reveals that businesses are prioritizing enhancing quality perceptions within the context of corporate sustainability to meet rising consumer demands (Ozbekler and Ozturkoglu, 2020). Service innovation mediates the link between TQM and sustainability performance in the UAE’s public service industry, with TQM significantly influencing both. Public sector TQM and service innovation methods have a greater impact on social and environmental sustainability (Ali AlShehail et al., 2022). The emerging field of sustainability-focused service innovation (SOSI) emphasizes stakeholder collaboration, creative business

models, and legislative frameworks. SOSI offers benefits like improved resource efficiency and customer satisfaction (Calabrese et al., 2018).

2.3. Quality management 4.0

Quality management 4.0 practices can adapt to Industry 4.0's digital technologies, focusing on the correlation between these practices and digital innovation, accentuating the potential for improved quality in a digitalized production environment (Carvalho et al., 2021). Quality 4.0 also integrates traditional quality management techniques with modern technology indicating that balanced definition, outlining essential characteristics, technologies, applications, and challenges for technology that enhance service delivery and customer satisfaction, and offers guidance for stakeholders in adopting Quality 4.0 (Sader et al., 2022). Quality 4.0 framework, emphasizing the need for the quality profession to adapt to technological innovations in the fourth industrial revolution underscoring the importance of data-driven quality, modeling, health monitoring, and integrating innovation with quality. As a result, the framework is crucial for the services sector, fostering continuous improvement and maintaining competitive advantage (Zonnenshain and Kenett, 2020). The relationship between Industry 4.0 and the EFQM 2020 model, focusing on its implications for Quality 4.0 while both frameworks can aid in quality improvement and digital transformation, particularly for the services industry resulting in the importance of prioritizing knowledge, skills, and capabilities in implementing Quality 4.0 (Fonseca et al., 2021). The necessity for a substantial transformation in organizational culture, leadership, and management techniques, along with the use of new technology, to successfully implement Quality 4.0 in the services industry that emphasizes the coordinating technology with business strategy and focusing on human aspects to ensure long-term quality gains in digital transitions (Küpper et al., 2019). ISO 9001 is the international Quality Management System (QMS) that ensures organizations meet customer and regulatory requirements. It aligns with SQM 4.0, focusing on process standardization, continuous improvement, and customer satisfaction, promoting high-quality standards and sustainable practices (Zeng et al., 2007). ISO 14001 focuses on the reduction of environmental damage and helps to enhance performance through reduction in greenhouse gas emissions. Moreover, it also contributes in handling legal issues with the promotion of sense in people to focus on sustainability (Bravi et al., 2020). Both of these ISO i-e ISO 9001 and ISO 14001 can work in combination to increase functional efficiency of any process going on for both services and manufacturing sector.

3. Concept of sustainable quality management 4.0 (SQM 4.0)

The development of integrated concept of Sustainable Quality Management (SQM 4.0) for sustainable eco-friendly services, along with the subsequent incorporation of basic Quality Management (QM) aspects with Quality 4.0, produced a novel strategy that is capable of implementing advanced service standards in line with factors influencing strong sustainable governance. The Sustainable management entails the adoption of environment friendly techniques, efficient resource consumption, a sustainable logistics, and corporate social responsibility initiatives.

This approach mitigates the greenhouse gas emissions, energy conservation and waste reduction. In order to uphold superior standards for quality management includes, standardizing processes, gathering feedback from customers and implementing continuous quality improvement. Quality 4.0 aspires to enhance the overall quality standards by adoption of digital technologies such as Internet of Things (IoT), Artificial Intelligence (AI), and big data analytics. The objective of improving quality in services sector and securing potential sustainable alternatives as illustrated by model in **Figure 1**. The aim of this model is to boost quality services by implementing industry 4.0 and long-term viability.

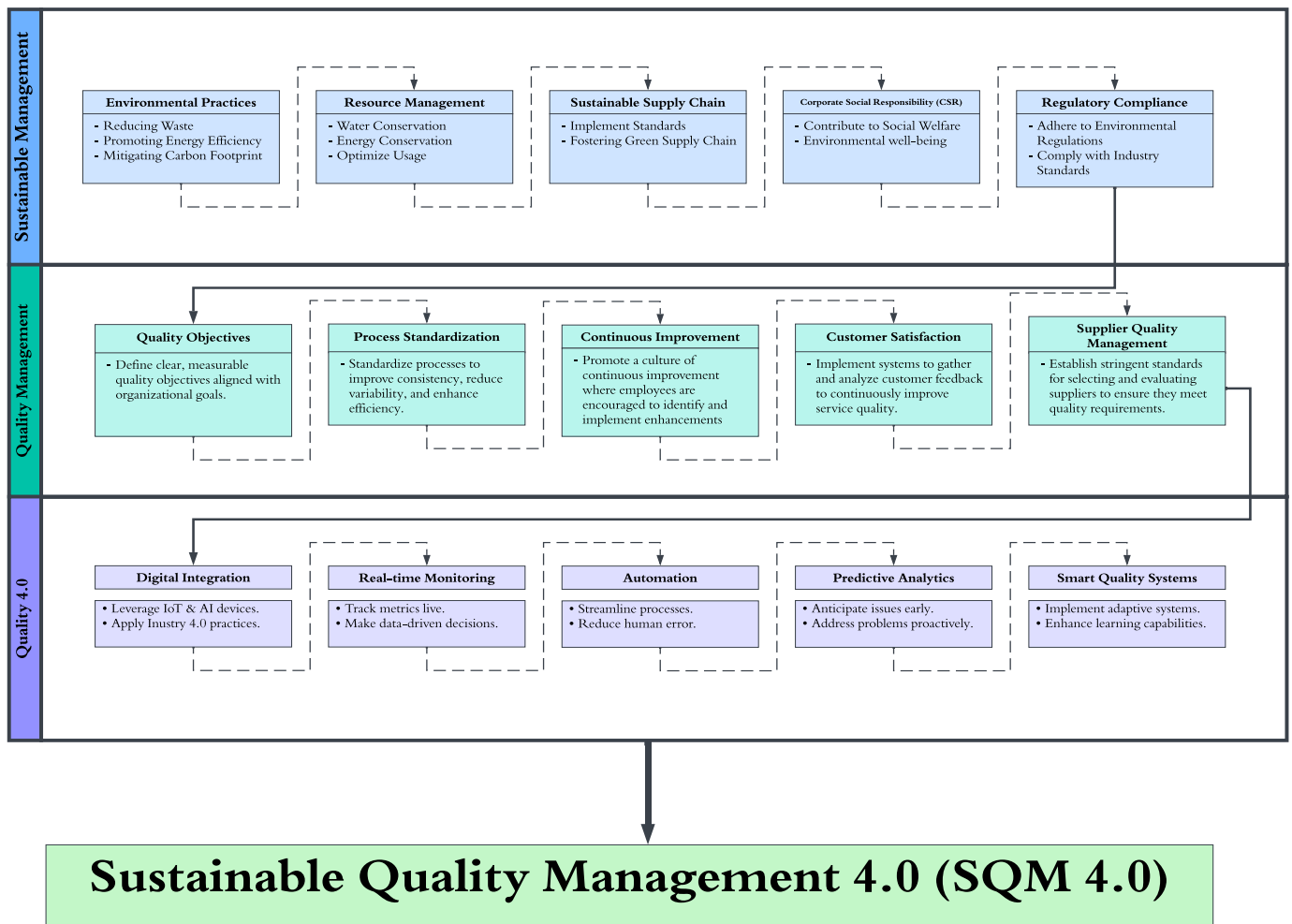


Figure 1. Proposed concept for sustainable quality management 4.0 (SQM 4.0).

4. Results and discussion

Framework in **Figure 2** presents the broad scope of the research that is unveiled below as a set of interrelated factors that are vital for creating long-term QM in the services sector. As mentioned earlier, the proposed framework for Sustainable Quality Management (SQM) for the services sector has flowing key components:

- Quality objectives & goals
- Regulatory compliance
- Process standardization

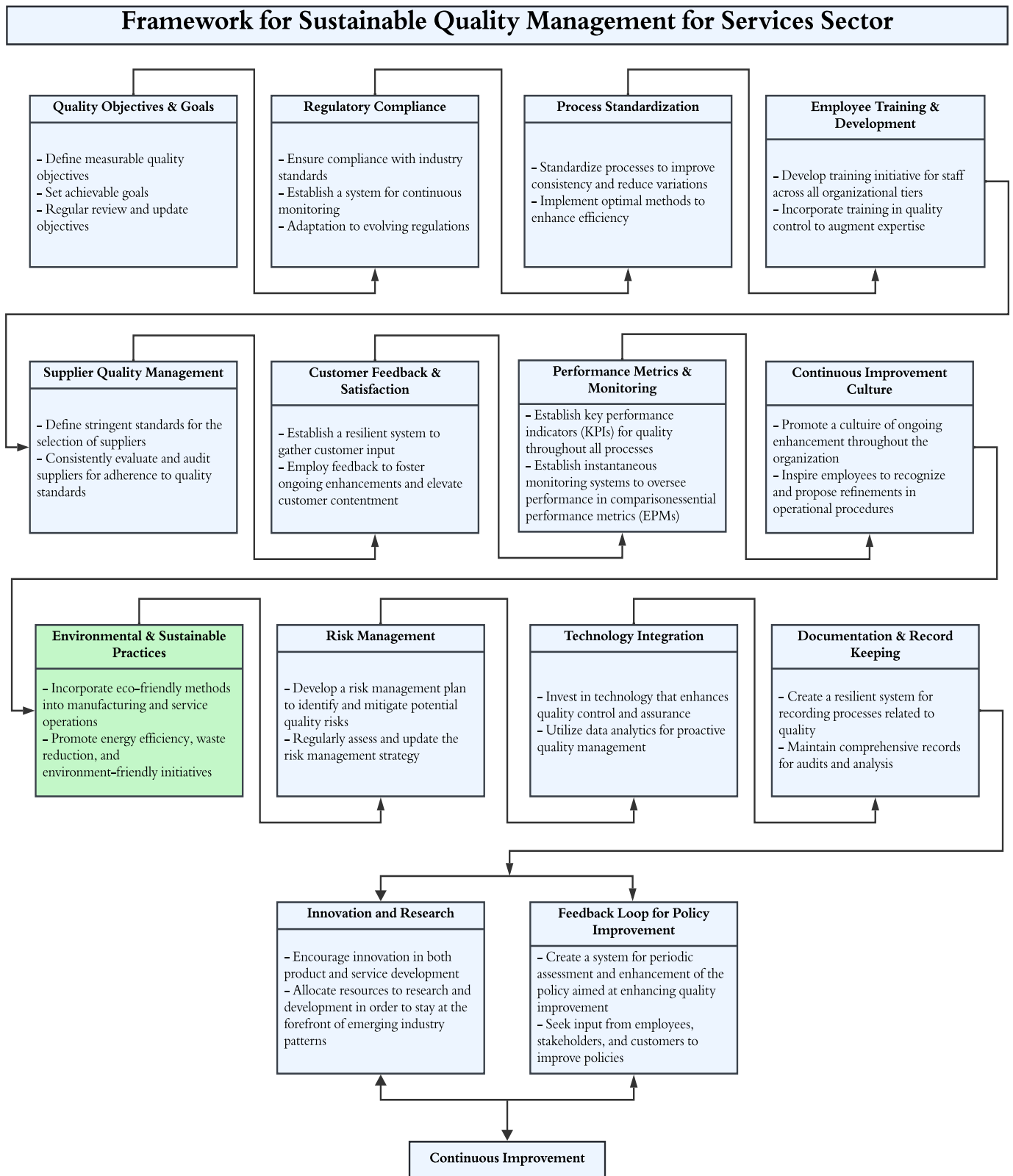


Figure 2. Framework or sustainable quality management for services sector.

- Employee training & development
- Supplier quality management
- Customer feedback & satisfaction

- Service Performance metrics & monitoring
- Risk management
- Technology integration
- Documentation & record keeping
- Innovation and research
- Feedback loop for policy improvement
- Continuous improvement culture
- Environmental & sustainable practices

These key components help in promoting a culture of continuous improvement encourages employees to recognize and propose refinements in operational procedures. This fosters an environment of innovation and proactive problem-solving, essential for sustainable growth. Incorporating eco-friendly methods into service operations, such as promoting energy efficiency, waste reduction, and environmental initiatives, is a cornerstone of sustainable quality management. This helps organizations minimize their environmental footprint. Developing a risk management plan to identify and mitigate potential quality risks is necessary. Regularly assessing and updating the risk management strategy ensures that organizations can proactively address challenges and maintain quality standards. Investing in technology that enhances quality control and assurance is crucial. Utilizing data analytics for proactive quality management enables organizations to anticipate and address quality issues before they escalate. Creating a resilient system for recording processes related to quality and maintaining comprehensive records for audits and analysis is fundamental. This ensures transparency and facilitates continuous improvement efforts. Encouraging innovation in product and service development and allocating resources to research and development helps organizations stay at the forefront of industry trends. This proactive approach fosters continuous improvement and competitive advantage. Establishing a system for periodic assessment and enhancement of policies aimed at improving quality is essential. Seeking input from employees, stakeholders, and customers helps refine and improve policies continuously.

To improve quality management procedures, the suggested framework for Sustainable Quality Management 4.0 (SQM 4.0) offers a thorough, systematic strategy that combines cutting-edge digital technology with sustainable practices. Fundamentally, the framework emphasizes how crucial it is to establish quantifiable and explicit quality goals, make sure that all regulations are followed, and standardize procedures to increase consistency and decrease variability. The difference in the framework for SQM 4.0 and SQM 4.0 in service sector is that the later encompasses (SQM 4.0 in services sector) focuses on monitoring and gauging performance matrixes specifically related to services sector and designed to tackle issues related to services sector standards with low visibility in manufacturing sector. Services industry heavily focuses on establishing high quality standards, complying to rules, standardizing operations, promoting staff education and monitoring of supply chain processes including risk management, customer feedback and sustainable business practices. These KPI's are utilizing during these processes, yet highly qualified individuals might discover it challenging. The importance of these KPI's on invention as a catalyst for policy adaptability will be emphasized through an additional robust system of continual enhancement as compared to simply process documentation. The framework

emphasizes the detail development of quality objectives that regulations must be adhered to these processes must be consistent, the expenditure for staff training must be covered and vendors should be subject to rigorous oversight. In addition, it also incorporates continuous improvement, feedback from clients, KPI's documentation, innovative thinking, and regulations for sustainability. By using these strategies, services industries can significantly improve quality management and the achievement of their long-term objectives.

5. Conclusion

The framework emphasizes the detail development of quality objectives that regulations must be adhered to these processes must be consistent, the expenditure for staff training must be covered and vendors should be subject to rigorous oversight. In addition, it also incorporates continuous improvement, feedback from clients, KPI's documentation, innovative thinking, and regulations for sustainability. By using these strategies, services industries can significantly improve quality management and the achievement of their long-term objectives. Services sector can preserve their adaptability, compliance, and responsiveness to alterations in economic conditions and laws by using the proactive and systematic approach shown in the framework. Furthermore, the principles of Quality Management 4.0, companies may enhance their quality control procedures, resulting in improved and profitable outcomes. This framework offers an integrated strategy for business in the services sector to attain sustainability in quality management, promoting social and ecological goals and ensuring corporate longevity. This comprehensive strategy promises continuing growth and improvement in addition to improving customer fulfilment and quality of service. The framework originated to provide service sector businesses a path forward for attaining ongoing operational and quality management enhancements. Although the SQM 4.0 framework offers a strong long-term approach to service quality management, future research may examine its further use in different industries of services and evaluate its long-term effects on quality results and sustainability.

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