A Strategic Framework for Quality and Sustainability Integration in High-Rise Construction: A Structural Equation Modeling Approach

J. Berlin P. Juanzon
Graduate School of Engineering, Pamantasan ng Lungsod ng Maynila

Arnold B. Mendoza
Graduate School of Engineering, Pamantasan ng Lungsod ng Maynila

Vien Carlo M. Amora
Graduate School of Engineering, Pamantasan ng Lungsod ng Maynila

Rodelle C. Lavarias
Graduate School of Engineering, Pamantasan ng Lungsod ng Maynila

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J. Berlin P. Juanzon[1], Arnold B. Mendoza[1], Vien Carlo M. Amora[1], Rodelle C. Lavarias[1]
[1]Graduate School of Engineering, Pamantasan ng Lungsod ng Maynila
Corresponding author email: jbpjuanzon@plm.edu.ph

Abstract: *This study examines how Quality Management System (QMS) implementation and Sustainable Construction Practices (SCP) impact organizational performance in high-rise residential condominium construction firms in the Philippines. Anchored in Deming's Theory of Profound Knowledge and the Triple Bottom Line framework, the research explores the direct effect of QMS and the mediating and moderating roles of SCP. Using a quantitative correlational design, data were gathered via stratified random sampling and analyzed through Partial Least Squares-Structural Equation Modeling (PLS-SEM). Results show that QMS significantly enhances performance, particularly through its psychological and knowledge-based dimensions. SCP partially mediates the QMS-performance relationship, strengthening its positive impact, but does not serve as a significant moderator. These findings reinforce the relevance of systems thinking and continuous improvement in construction, while also underscoring the mediating power of sustainability. The study offers a novel integrated model highlighting the synergistic roles of quality and sustainability in driving organizational success.*

Keywords: Quality Management System, Sustainable Construction Practices, Organizational Performance, Deming's Theory, PLS-SEM

1. INTRODUCTION

The construction industry, particularly in high-rise residential condominium projects, faces increasing demands for quality assurance and sustainable practices to enhance organizational performance. Implementing Quality Management Systems (QMS) has been shown to significantly improve project outcomes by standardizing processes and reducing errors [1]. Simultaneously, Sustainable Construction Practices (SCP) contribute to environmental conservation and long-term cost savings, aligning with global sustainability goals [2]. To analyze the complex relationships between QMS, sustainable practices, and organizational performance, this study employs Structural Equation Modeling (SEM). SEM is a robust statistical technique that allows for the examination of multiple interrelated dependencies in a single analysis, making it suitable for assessing the multifaceted nature of construction project performance [3].

By focusing on high-rise residential condominium construction, this research aims to provide insights into how integrating QMS and sustainable practices can lead to improved organizational performance, offering valuable guidance for industry stakeholders seeking to enhance efficiency and sustainability in their projects.

1.2 Background of the Study

The construction industry in the CALABARZON region of the Philippines is a critical driver of regional economic development but faces persistent operational and environmental challenges. Key issues include ineffective management of construction and demolition waste, which hinders the implementation of sustainable practices and increases project costs and inefficiencies [3]. Additionally, delays and cost overruns resulting from poor workforce planning and labor distribution further weaken project delivery, particularly in residential construction [4].

Despite global evidence that Quality Management Systems (QMS) such as ISO 9001 can enhance construction quality and organizational performance (Kim et al., 2011), their application in developing regions remains inconsistent. Studies in Nigeria and Saudi Arabia highlight challenges in sustaining quality performance post-certification, often due to weak implementation frameworks [5-6]. Furthermore, while sustainable construction practices are promoted globally for their environmental and economic benefits [7], adoption remains low in CALABARZON due to technical, regulatory, and cultural barriers.

There is a notable research gap in empirical studies examining the integrated effect of QMS and sustainable practices on organizational performance in emerging economies. Most existing literature lacks region-specific insights and fails to explore the mediating and moderating roles of sustainability in quality-performance relationships [8-9]. Moreover, contextual factors such as local regulations, workforce skills, and socio-economic conditions are often overlooked.

This study addresses these gaps by examining how QMS and sustainable construction practices individually and in combination affect organizational performance in high-rise residential condominium projects in CALABARZON. By employing Structural Equation Modeling (SEM), the study aims to offer a validated, context-specific model for improving performance through integrated quality and sustainability strategies.

2. MATERIALS AND METHODOLOGY

2.1 Theoretical Framework

This study draws on three interrelated theoretical frameworks Deming's System of Profound Knowledge (SoPK), the Triple Bottom Line (TBL), and the Balanced

Scorecard (BSC) to examine the relationships among Quality Management Systems (QMS), Sustainable Construction Practices (SCP), and Organizational Performance in high-rise residential construction projects. These frameworks collectively provide a multidimensional understanding of how quality and sustainability initiatives can enhance organizational outcomes in the construction industry.

2.1.1 Deming's System of Profound Knowledge (SoPK)

Deming's SoPK provides a systemic foundation for implementing QMS by emphasizing four interdependent components: appreciation for a system, knowledge of variation, theory of knowledge, and psychology, as shown in Figure 1.0. In the context of construction, this approach enables organizations to view project processes holistically, improving coordination, reducing inefficiencies, and enhancing project execution [10-11].

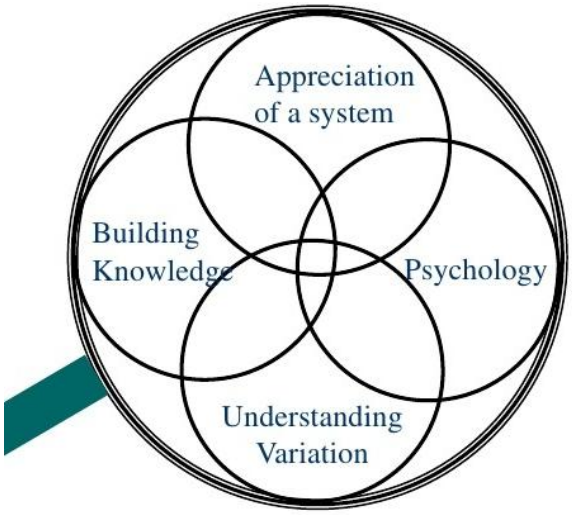

Fig. 1.0 Model of Deming's System of Profound Knowledge. *Source: USAID Health Care Improvement Project*

Appreciation for a system promotes a comprehensive understanding of interrelated construction processes, optimizing resource utilization. Knowledge of variation distinguishes between inherent process variability and anomalies requiring intervention, enabling data-driven quality control. Theory of knowledge advocates for evidence-based decision-making and continuous learning, both vital in adapting QMS to dynamic construction environments. Psychology emphasizes human factors, including leadership, motivation, and team cohesion, which are essential for cultivating a culture of quality and improvement [12]. These principles collectively reinforce QMS as a strategy that not only standardizes operations but also fosters innovation and organizational learning in construction firms.

2.1.2 Triple Bottom Line (TBL)

Elkington's Triple Bottom Line (TBL) framework expands the concept of organizational performance beyond traditional financial metrics to include environmental and social dimensions, as shown in Figure 2.0. In the construction context, TBL is instrumental in conceptualizing sustainable construction practices.

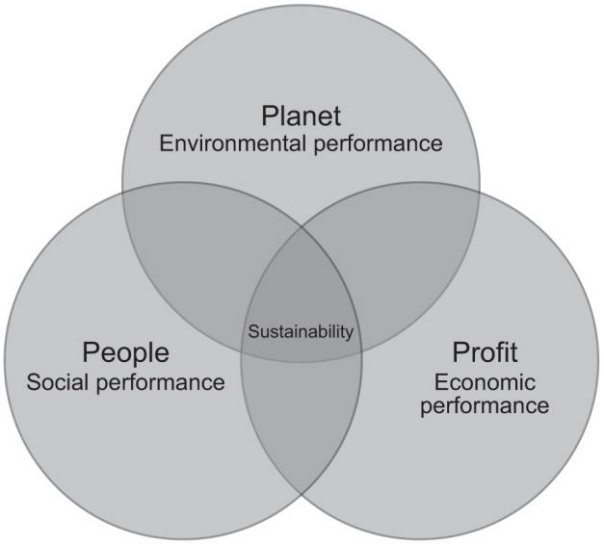

Fig. 2.0 Elkington's triple bottom line
Source: AQA - Teaching guide

Environmental sustainability encourages the use of green technologies, energy efficiency, and waste reduction. Social sustainability emphasizes fair labor practices, occupational health and safety, and community engagement. Economic sustainability focuses on long-term profitability and resource efficiency [13]. The integration of these three pillars provides a comprehensive lens through which the mediating role of SCP between QMS and performance can be examined, emphasizing that sustainability not only mitigates environmental and social risks but also contributes to strategic competitiveness.

Balanced Scorecard (BSC)

The Balanced Scorecard (BSC), as shown in Figure 3.0, developed by Kaplan and Norton [14] (1992), serves as a performance evaluation framework that links strategic objectives with measurable outcomes across four key dimensions:

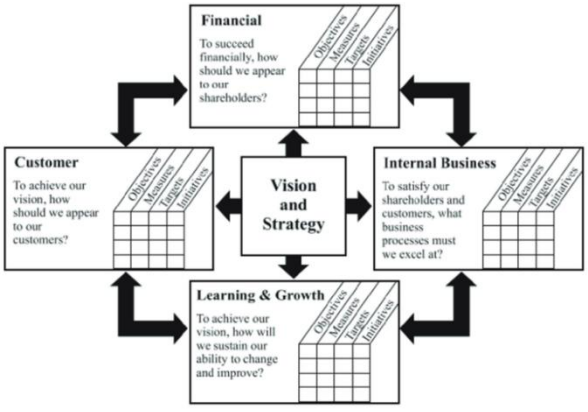

Fig. 3.0 Balance Scorecard. *Source: Kaplan & Norton*

Financial: Return on investment, cost-efficiency, and profitability resulting from QMS and SCP.

- Customer: Client satisfaction and retention as indicators of service quality and reputation.

- Internal processes: Operational efficiency, project delivery timelines, and adherence to quality and sustainability standards.
- Learning and growth: Capacity for innovation, employee training, and organizational adaptability [15].

BSC enables a multidimensional assessment of organizational performance, supporting the empirical validation of this study's model by connecting quality and sustainability efforts with tangible outcomes.

Theoretical Integration and Research Model Justification

These three frameworks are integrated to form the theoretical foundation for the proposed research model. SoPK offers the philosophical and operational underpinnings for QMS; TBL defines the scope and value of sustainability initiatives; and BSC provides a structured approach to evaluating performance outcomes.

This study hypothesizes that QMS positively influences organizational performance both directly and indirectly through SCP. It further explores whether SCP moderates the QMS-performance relationship. These hypotheses will be tested using Structural Equation Modeling (SEM), allowing for a nuanced examination of both mediating and moderating effects.

By grounding the study in these complementary theoretical perspectives, the research not only extends existing knowledge on quality and sustainability integration in construction but also provides a robust framework for practitioners seeking to align operational practices with strategic outcomes.

2.2 Key Variables

The effectiveness of organizational performance in the construction industry is increasingly influenced by the strategic implementation of quality and sustainability initiatives. This study investigates three key variables—Quality Management Systems (QMS) as the independent variable, Sustainable Construction Practices (SCP) as both a mediating and moderating variable, and Organizational Performance as the dependent variable. Each construct is grounded in theoretical and empirical literature and tailored to the context of high-rise residential construction projects in the Philippines.

2.2.1 Quality Management Systems (QMS)

QMS refers to a structured system of procedures and practices aimed at ensuring that an organization can consistently deliver products and services that meet customer and regulatory requirements. In this study, QMS is examined through the lens of ISO 9001:2015 and is conceptually supported by Deming's System of Profound Knowledge.

The four core dimensions of QMS in this study are adapted from Deming's framework:

- Appreciation for a system: Understanding interrelated project components to optimize integration and efficiency.
- Knowledge of variation: Distinguishing between inherent and special causes of variation in project performance.
- Theory of knowledge: Applying evidence-based management and continuous improvement.
- Psychology: Managing human elements like motivation, communication, and leadership to foster a quality-oriented culture [10-12].

Prior research emphasizes the positive relationship between effective QMS implementation and improved client satisfaction, time management, and cost control [16-18]. However, challenges such as low awareness, cultural resistance, and weak leadership support still affect implementation, especially in emerging markets [19-20].

2.2.2 Sustainable Construction Practices (SCP)

SCP are defined as the adoption of environmentally responsible, socially equitable, and economically viable construction methods throughout a building's life cycle—from design to demolition. The variable is conceptually framed by Elkington's Triple Bottom Line (TBL), which evaluates performance across three dimensions:

- Environmental sustainability: Efficient use of energy, materials, and resources; waste reduction; and minimal environmental footprint.
- Social sustainability: Fair labor conditions, worker health and safety, and community engagement.
- Economic sustainability: Lifecycle cost efficiency and project viability [21-22].

SCP is tested both as a mediator and moderator in the relationship between QMS and performance. As a mediator, SCP explains how QMS affects performance through sustainable operational improvements. As a moderator, SCP is tested for its ability to strengthen or weaken the direct effect of QMS on performance.

Literature suggests that sustainability adoption remains inconsistent due to high initial costs, limited technical knowledge, and weak regulatory enforcement, especially among small and medium construction firms [24-25].

2.2.3 Organizational Performance

Organizational Performance is the dependent variable and reflects the effectiveness and efficiency of construction firms in achieving their strategic objectives. This study adopts the Balanced Scorecard (BSC) framework developed by Kaplan and Norton [14], which assesses performance across four perspectives:

- Financial: Profitability, return on investment (ROI), and cost efficiency resulting from QMS and SCP initiatives.
- Customer: Client satisfaction, retention rates, and alignment with sustainability requirements.
- Internal Business Processes: Operational metrics such as quality compliance, project timelines, defect rates, and resource utilization.
- Learning and Growth: Organizational capacity to innovate, upskill employees, and adapt to quality and sustainability standards [15-25].

Studies suggest that while traditional performance metrics (e.g., cost and time) remain critical, non-financial indicators such as employee engagement, innovation capacity, and client perception increasingly determine competitive advantage in construction firms [26-27].

2.2.4 Construction Industry

The construction industry significantly impacts natural resource consumption and environmental pollution, necessitating sustainable practices. With the advancement in the construction industry there is a dire need for sustainability to curb the increasing pollution in the environment and to increase the dependency on sustainable construction practices for the building construction, thus the principle of sustainability is introduced [28].

2.2.4 Interrelationship of Variables

Based on the literature and theoretical frameworks, this study proposes a structural model where:

- QMS directly influences Organizational Performance.
- SCP mediates the relationship by translating quality initiatives into sustainability outcomes.
- SCP also moderates the relationship, potentially enhancing or diminishing the effectiveness of QMS depending on the level of sustainability integration.

This framework enables a nuanced understanding of how quality and sustainability are not isolated domains but interdependent systems that, when aligned, can drive superior performance in the construction sector.

2.3 Methodology

This study employed a quantitative, correlational research design to examine the relationships among Quality Management Systems (QMS), Sustainable Construction Practices (SCP), and Organizational Performance in medium to large construction firms in the CALABARZON region of the Philippines. The design was chosen to evaluate predictive relationships, including mediating and moderating effects. Stratified random sampling was applied to ensure proportional representation across provinces and firm types, while statistical power analysis guided the sample size determination to ensure adequate sensitivity for hypothesis testing.

Respondents included professionals from various organizational levels—top management, middle management, and operational staff—with direct experience in implementing QMS and SCP. Data was collected using a structured online survey distributed via Google Forms. The survey instrument was composed of validated items drawn from existing studies and structured around three main constructs: QMS (based on Deming's System of Profound Knowledge), SCP (using the Triple Bottom Line framework), and Organizational Performance (measured through the Balanced Scorecard).

A pilot test was conducted to verify the instrument's reliability and validity. Construct validity was assessed using Confirmatory Factor Analysis (CFA) for convergent and discriminant validity, while reliability was measured using Cronbach's alpha and composite reliability. These steps ensured that the survey instrument accurately and consistently captured the intended dimensions of each construct.

Descriptive statistics were used to profile respondents and evaluate variable levels. The primary analysis was conducted using Partial Least Squares - Structural Equation Modeling (PLS-SEM) via WarpPLS software, chosen for its suitability with complex models and smaller samples. This technique enabled the testing of direct, mediating, and moderating relationships among QMS, SCP, and organizational performance.

3. Results and Discussion

3.1 Profile of Respondents

Table 1.0 shows the sample distribution based on construction category. Firms were classified according to construction category as A (rank 1; 188 out of 280 respondents or 67%), AAA (rank 2; 81 out of 280 respondents or 21%), AA (rank 3; 28 out of 280 respondents each or 10%), and AAAA (rank 4; 4 out of 280 respondents each or 2%) are the total demographic.

Table 1.0 Profile of Respondents

Category	Counts	%	Rank
A	188	67	1
A	28	10	3
AAA	60	21	2
AAAA	4	2	4
Total	280	100	

3.2 Level of Implementation of QMS

Table 2 reports the level of QMS implementation across four dimensions based on Deming's System of Profound Knowledge: psychology, theory of knowledge, knowledge about variation, and appreciation for a system. The overall mean score (M = 3.37, SD = 0.709) suggests a very high level of QMS implementation among respondents.

Table 2.0 Level of QMS implementation

Indicators	Mean	SD	Rank	Interpretation
Appreciation for a System	3.23	0.712	4	High
Knowledge about Variation	3.34	0.717	3	Very High
Theory of Knowledge	3.37	0.686	2	Very High
Psychology	3.56	0.722	1	Very High
QMS	3.37	0.709		Very High

These results support existing research that highlights the role of human-centric factors—particularly the psychology of quality—in driving successful QMS practices [29]. The second highest-rate d component, theory of knowledge, reinforces the view that data-driven learning and continuous improvement are central to organizational effectiveness [30]. Conversely, the lower score in appreciation for a system reflects ongoing challenges in adopting systemic thinking, aligning with findings by [31], who noted that organizational silos and process fragmentation often limit the effectiveness of QMS.

Despite the promising overall ratings, previous studies

have shown that implementation challenges persist. For example, [16] observed that while QMS practices may influence time and cost, they often fail to significantly enhance the quality scope of construction projects in Metro Manila. Additionally, Uluskan [32] emphasized that readiness for change, including strong employee relationships and customer orientation is critical for the success of quality initiatives. This study's results validate these concerns and highlight the importance of strengthening system-wide thinking and change readiness to maximize QMS outcomes in the construction sector.

3.3 Level of Sustainable Construction Practices

Table 3.0 provides the level of implementation of Sustainable Construction Practices in terms of environmental, social, and economic sustainability. The findings indicate that the constructions industry environmental sustainability (M = 3.49, SD = 0.704) ranks first, followed by economic sustainability (M = 3.27, SD = 0.750) ranks second, and lastly Social sustainability (M = 3.23, SD = 0.705) ranks third. The first and second ranks are interpreted as "Very High" and the third as "High". Considering these indicators, the overall interpretation (M = 3.33, SD = 0.72) of the employee engagement in terms of knowledge, attitude, and practices among the respondents is "Very High."

Table 3.0 Level of Sustainable Construction Practices

Indicators	Mean	SD	Rank	Interpretation
Environmental sustainability	3.49	0.704	1	Very High
Social sustainability	3.23	0.705	3	Very High
Economic sustainability	3.27	0.750	2	Very High
Total	280		100	

The results align with previous research emphasizing the construction industry's prioritization of environmental and economic dimensions over social aspects. This trend validates prior studies that highlight strong environmental and economic performance due to regulatory pressures and cost-saving opportunities, while social sustainability often lags due to limited stakeholder engagement and enforcement [33]. These results validate prior findings while reinforcing the need for greater emphasis on social sustainability to achieve a balanced, comprehensive approach.

3.4 Level of Organizational Performance

Table 4.0 provides the level of organizational performance in terms of financial perspective, customer perspective, internal process, and learning and growth perspective. The findings indicate that the constructions industries financial perspective (M = 3.36, SD = 0.655) ranks first, followed by customer perspective (M = 3.23, SD = 0.699) ranks second, next is internal process (M = 3.21, SD = 0.73) ranks third, and lastly learning and growth perspective (M = 3.07, SD = 0.747) ranks fourth. The first rank is interpreted as "Very High", and the rest are "High". Considering these indicators, the overall interpretation (M = 3.22, SD = 0.70775) of the project performance in terms of financial perspective, customer perspective, internal process, and learning and growth perspective among the respondents is "High."

Table 4.0 Organizational Performance

Indicators	Mean	SD	Rank	Interpretation
Financial Perspective	3.36	0.655	1	Very High
Customer Perspective	3.23	0.699	2	High
Internal Process	3.21	0.730	3	High
Learning and Growth Perspective	3.07	0.747	4	High
Organizational Performance	3.22	0.708		High

The results agree with the implementation of Quality Management Systems (QMS), measuring organizational performance in the construction industry is critical for assessing efficiency, effectiveness, and the overall success of construction projects. Several theoretical frameworks have been developed to provide a structured approach to evaluating various aspects of project performance. These frameworks often encompass a range of performance dimensions, including time, cost, quality, safety, and stakeholder satisfaction.

Based on the results, attitude and adaptability may affect the organizational performance of the construction firm. When attitude and adaptability is low, it might negatively impact on the service quality of the firm and may generate unsatisfied customers. To increase customer satisfaction, management must provide ongoing training and development to enhance the skills and knowledge of its project members and promote a harmonious work environment where collaboration and innovation thrive, which also increases organizational efficiency.

3.5 Mediating Effect of SCP on the relationship between implementation of QMS and Organizational Performance in the construction sector

Table 5 shows the mediation analysis of sustainable practices on the relationship between implementation of QMS and organizational performance. Based on the analysis, the implementation of Sustainable Construction Practices significantly mediates the relationship between implementation of QMS and organizational performance where $z = 5.44$, $p < .001$. The mediating effect is positive, $\beta = 0.148$, $p < .001$, which means that sustainable construction practices can intensify the effect of implementation of QMS and organizational performance by 0.148. The direct effect represents the effect of implementation of QMS and organizational performance where $\beta = 0.115$, $p = 0.018$. Since both the indirect and direct effect are both significant, this is a case of a partial mediation wherein the relationship between implementation of QMS and organizational performance is not entirely dependent on the value of sustainable construction practices as a mediating variable.

The result of the mediation analysis causes the acceptance of the fourth hypothesis, which claims that there is a significant mediating effect of sustainable construction practices on the relationship between implementation of QMS and organizational performance.

Table 5.0 Mediating Effect of SCP to QMS and OP

Predictor	Estimate	SE	β	*z*	*p*
Indirect	0.148	0.027	0.147	5.44	< .001
Direct	0.115	0.048	0.114	2.38	0.018
Total	0.269	0.045	0.269	5.95	< .001
Overall Interpretation					**Hypothesis Accepted**

Theoretical evidence strongly supports the mediating role of sustainable construction practices in enhancing the relationship between Quality Management System (QMS) implementation and organizational performance in the construction sector. QMS frameworks, such as Total Quality Management (TQM) or ISO-based systems, provide a structured approach to improving processes, resource management, and stakeholder satisfaction. When these frameworks are integrated with sustainable practices, they amplify environmental, social, and economic benefits. For instance, TQM has been shown to positively impact sustainable performance by fostering efficiency, reducing waste, and enhancing stakeholder engagement across all sustainability dimensions [34].

Sustainable practices act as a bridge, translating QMS objectives into broader organizational outcomes. By adopting green construction techniques, companies reduce environmental impacts and operational costs, which enhances the overall effectiveness of QMS. Moreover, leadership competencies in implementing sustainability further strengthen this connection, as effective leaders align sustainable practices with organizational goals to maximize benefits [35]. Additionally, sustainability practices improve knowledge management and facilitate continuous improvement, enabling long-term benefits such as better environmental compliance and competitive advantage [36].

3.6 Moderating Effect Analysis of Sustainable Construction Practices

Table 6 shows the moderation analysis of the sustainable construction practices on the relationship between implementation of QMS and organizational performance. Based on the analysis, the sustainable construction practices do not moderate the relationship between implementation of QMS and organizational performance where, $\beta = 0.045$, p = 0.128. The p-value is higher than 0.05, which means the moderating effect is non-significant. It causes the rejection that there is moderating effect on sustainable construction practices on the relationship between implementation of QMS and organizational performance.

Table 6.0 Moderating Effect of SCP to QMS and OP

Predictor	Estimate	SE	β	*z*	*p*	Interpretation
QMS to Organizational Performance	0.045	0.0296	0.0481	1.521	0.128	Non-Significant
Overall Interpretation						Non-significant

Theoretical evidence provides some support for the notion that sustainable construction practices may not always have a significant moderating effect on the relationship between Quality Management Systems (QMS) implementation and organizational performance. Studies investigating the role of sustainability in construction often highlight its benefits but also reveal instances where the moderating effects of such practices remain inconclusive or negligible.

For example, while sustainable practices positively influence sustainability performance, leadership competencies rather than the practices themselves have been shown to be a stronger moderating factor [35]. Furthermore, empirical analyses suggest that the direct relationship between QMS and organizational performance is often mediated through other factors, such as organizational excellence or knowledge management, rather than moderated by sustainable practices [37].

3.6 Strategic Framework for Integrating QMS and SCP

The strategic framework developed in this study offers a structured model for integrating Quality Management Systems (QMS) and Sustainable Construction Practices (SCP) to improve organizational performance in high-rise residential construction firms, as shown in Figure 4.0.

At its core is leadership commitment, where sustainability-centered leadership is positioned as vital for aligning QMS efforts with environmental and social goals. Leaders are encouraged to set measurable key performance indicators (KPIs) encompassing both traditional quality metrics (e.g., defect rates, client satisfaction) and sustainability targets (e.g., energy efficiency, waste reduction). This dual focus ensures strategic coherence between quality assurance and sustainable development initiatives across all organizational levels.

The framework further emphasizes integrated planning and stakeholder capacity building. Construction firms are encouraged to adopt a unified management system that combines ISO 9001 (quality) and ISO 14001 (environmental) standards to support a cohesive operational strategy. A life-cycle approach is advocated, embedding sustainability principles from design to demolition. Additionally, employee training on QMS tools (e.g., Six Sigma, Kaizen) and sustainability methods is crucial, as is collaborative stakeholder engagement using platforms like Building Information Modeling (BIM). These practices foster transparency, cross-functional cooperation, and alignment of sustainability and quality objectives throughout the supply chain.

The final pillars of the framework focus on technology integration and continuous improvement. Digital tools such as the Internet of Things (IoT), Artificial Intelligence (AI), and BIM are recommended for real-time monitoring of sustainability and quality indicators. Continuous process optimization is driven by statistical process control, root cause analysis, and performance

audits. Regular feedback loops involving clients, employees, and stakeholders, help refine strategies and align actions with evolving project demands. Overall, this integrated strategic framework provides construction firms with a comprehensive roadmap to achieve regulatory compliance, operational excellence, and competitive differentiation in a sustainability-focused market.

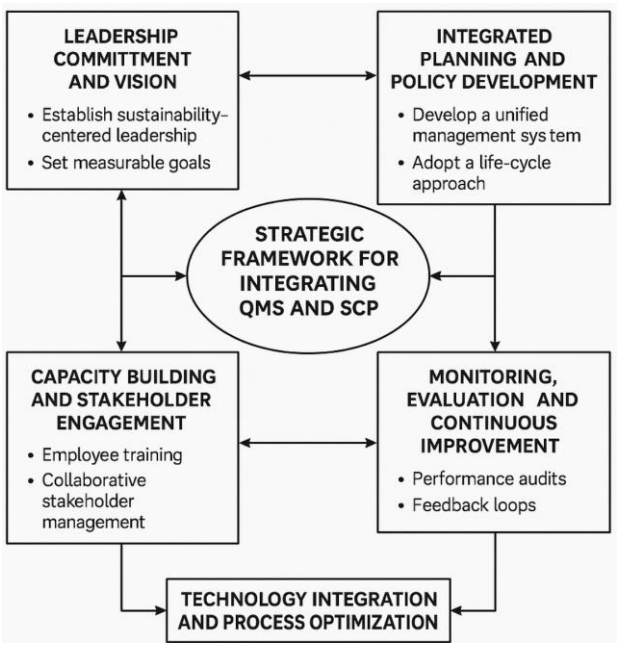

Figure 4.0 Strategic Framework for Integrating QMS and SCP

4.0 Recommendations

Future studies are encouraged to expand the scope beyond medium and large firms by exploring the implementation of QMS and SCP in small and micro enterprises. These smaller entities often face distinct barriers such as limited resources, lower awareness, and minimal regulatory support, which may affect their capacity to adopt and benefit from integrated quality and sustainability frameworks. Comparative studies across firm sizes or geographical regions—such as between CALABARZON and other parts of the Philippines or Southeast Asia—would also yield valuable insights into contextual influences on implementation effectiveness.

Additionally, future research would benefit from adopting longitudinal designs to assess the long-term impact of QMS and SCP integration on organizational performance. While this study used a cross-sectional approach, tracking firms over time could provide a more robust understanding of how quality and sustainability practices evolve and influence performance outcomes. Incorporating qualitative methods, such as interviews or case studies, could also enrich the findings by uncovering cultural, behavioral, and leadership dynamics that are not easily captured through quantitative tools.

Lastly, further investigation is needed into other mediating or moderating variables that may affect the QMS-performance relationship, such as innovation capacity, organizational culture, or digital readiness. Research could also explore post-implementation challenges, particularly in sustaining compliance and stakeholder engagement after initial certification. In addition to firm-level outcomes, future studies might consider broader sustainability impacts, such as environmental performance and social equity in construction, to assess the full value of integrated QMS and SCP strategies.

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