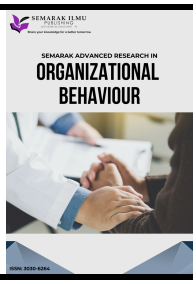
SEMARAK ILMU PUBLISHING

Semarak Advanced Research in Organizational Behaviour

Journal homepage:
https://semarakilmu.myindex.php/sarob/index
ISSN: 3030-6264



Investigating the Mediating Effect of Continuous Improvement towards the Relationships between Cost of Poor Quality and Operational Performance: The Case of General Electric

Sutiman Abd Shukor[1,*], Sabariah Yaakub[1]

[1] Othman Yeob Abdullah Graduate School of Business (OYAGSB), Universiti Utara Malaysia, Kuala Lumpur, Malaysia

ARTICLE INFO

Article history:
Received 3 February 2025
Received in revised form 18 March 2025
Accepted 30 April 2025
Available online 5 June 2025

Keywords:
Cost of poor quality; continuous improvement; operational performance; General Electric

ABSTRACT

This study investigates the complex interplay between continuous improvement (CI) practices, costs of poor quality (COPQ), and operational performance (OP) within General Electric. As organizations increasingly recognize the detrimental impact of quality-related costs on efficiency and performance, this research becomes crucial. Employing Smart PLS 4.0, the study utilized a two-step approach: measurement and structural modeling. The measurement model confirmed construct reliability and validity through rigorous tests, while the structural model revealed significant relationships among variables. The findings underscore COPQ as a critical factor influencing both CI and operational performance, with CI serving as a vital mediator. This emphasizes the necessity of a holistic approach in managing quality and operational performance, considering the interconnected nature of quality costs and improvement efforts. All research hypotheses were supported, demonstrating significant relationships between variables. This study's novelty lies in its elucidation of CI's mediating role between COPQ and operational performance. By addressing the gap in understanding interactions among quality costs, improvement processes, and performance outcomes, this research offers valuable insights for organizations aiming to enhance operational efficiency through CI strategies. The results highlight the importance of integrating COPQ considerations into CI initiatives to optimize operational performance. This research contributes to the evolving discourse on quality management and operational excellence, providing a foundation for future studies and practical applications in diverse organizational contexts.

1. Introduction

Companies in today's competitive business scene face a variety of obstacles, including fierce competition, quality standards, laws, technology improvements, and shifting consumer preferences [10,28]. To solve these problems, corporations are looking into ways to lower production costs while keeping high quality, making their products more accessible and inexpensive to a wider market [68].

* *Corresponding author.*
E-mail address: manabdshukor@gmail.com

https://doi.org/10.37934/sarob.6.1.3049

In the industrial manufacturing sector, leadership and senior management in private organizations are increasingly focusing on product quality as the key means of achieving organizational goals and meeting consumer expectations [55]. The negative effects of providing low-quality products and services are significant, as generating quality items helps to develop client loyalty, which leads to higher consumer satisfaction and trust [48,92]. Organizational management is responsible for ensuring that only approved standards are followed in order to generate quality products and services.

General Electric (GE) has received recognition for its dedication to quality improvement and business sustainability through the use of Total Quality Management (TQM) and Six Sigma processes [37]. These initiatives have been critical in increasing operational efficiency, lowering expenses, and cultivating a culture of continuous improvement inside the firm. The effective application of TQM methods has been related to increased quality outcomes and operational efficiencies, which are critical for sustaining corporate growth and achieving consumer expectations [76]. GE's commitment to sustainability is inextricably linked with its quality improvement programs. The organization has implemented strategies that attempt to increase product quality while simultaneously reducing environmental effect [57]. For example, GE has invested in renewable energy technologies and energy-efficient solutions to connect its commercial strategy with global environmental objectives [64]. This commitment is shown in the creation of hybrid microgrid systems that use renewable energy sources, improving energy quality and reliability while reducing carbon emissions [17]. GE's use of quality management principles, particularly TQM and Six Sigma, has been critical to its efforts to improve continuously and sustain the business. By establishing a quality culture and incorporating sustainable practices into its operations, GE not only improves its competitive advantage but also positively contributes to environmental sustainability.

The concept of Cost of Poor Quality (COPQ) and operational performance has received a lot of attention in recent years, as companies strive for continuous improvement [72]. COPQ refers to the costs associated with defects, failures, and inefficiencies caused by poor quality, all of which can have a negative impact on operational performance and overall business success [20]. Recent studies have shown that poor product quality has a direct influence on operational and financial performance, underlining the need of quality management systems that can detect and correct quality issues before they become more serious problems [1]. Operational capabilities mediate the relationship between collaborative supply chain management and operational performance [52]. According to research, firms that properly harness operational capabilities can dramatically enhance their performance measures, resulting in lower COPQ levels [85]. An emphasis on improving operational capabilities, such as process optimization and resource management, can result in higher quality outputs and lower costs associated with low quality.

Poor-quality practices in the manufacturing industry can result in significant operational inefficiencies, underlining the importance of stringent quality control procedures and training programs to align all stakeholders with quality standards [31]. Service strategy and quality are also important factors in operational efficiency, as firms that adjust their service plans to suit changing client expectations can considerably improve their operational performance. Leadership, constant improvement, and client orientation are all part of operational excellence. Prioritizing operational excellence enables firms to detect and address quality issues proactively, reducing the expenses associated with poor quality [75,100]. Integrating quality checks into the manufacturing process can help discover flaws early on and limit the need for costly rework [96-97]. Organizational culture is critical to operational success, since aligning it with operational strategy can dramatically increase innovation outcomes and operational performance [82]. As the corporate landscape evolves,

addressing quality issues and their related costs will remain an important area of research and practice.

This study explores the role of continuous improvement in mitigating the impacts of poor-quality costs on operational performance. Poor-quality costs, which can be internal, external, appraisal, and prevention costs, significantly impact an organization's efficiency and overall performance [72]. In General Electric, where innovation and reliability are paramount, understanding and mitigating these costs through effective continuous improvement strategies is essential for maintaining a competitive advantage [37]. Continuous improvement methodologies, such as Lean and Six Sigma, have been widely adopted to enhance operational performance by eliminating waste and improving processes. Aligning continuous improvement practices with operational goals is crucial for organizations striving to achieve excellence in performance metrics [62]. However, the sustainability of continuous improvement programs remains a challenge due to the lack of understanding of causality and feedback from other factors, such as soft human issues. Continuous improvement serves as a mediator between the expense of poor quality and operational performance, making it crucial for organizations to exercise caution when allocating resources and effort towards implementing continuous improvement [96,97]. This process involves the utilization of diverse tools, methodologies, and approaches aimed at enhancing quality and minimizing expenses [35].

Choosing the appropriate methodology for problem-solving and process improvement within an organization is a challenge [7]. Factors such as measurement and improvement, return on investment, management support, awareness, and strategic alignment contribute to poor continuous improvement implementation and cost of quality betterment [27,101]. The study emphasizes the importance of measuring the effectiveness of continuous improvement initiatives in mitigating poor quality costs. Organizations must establish robust performance metrics that accurately reflect the impact of continuous improvement efforts on operational performance, considering both financial metrics and qualitative aspects like employee satisfaction and customer feedback [7]. The study underscores the intricate relationship between the costs of poor quality and operational performance, with continuous improvement serving as a pivotal mediator. By implementing effective continuous improvement strategies, organizations like General Electric can significantly reduce the financial burden of poor-quality costs while simultaneously enhancing their operational performance. The findings of this study are expected to contribute to the broader discourse on quality management and operational excellence, providing valuable insights for practitioners and researchers alike**.**

2. Background of Study

This study covers an important operational management issue on how continuous improvement activities might mitigate the detrimental effects of low-quality costs on performance. The problem statement recognizes that low quality expenses can severely reduce an organization's operational efficiency and performance [93]. General Electric has long prioritized quality and operational excellence, making this relevant. Poor-quality costs include internal, external, appraisal, and preventative costs. These costs can account for 10% to 40% of total operational expenses in some organisations [29]. These costs effect customer satisfaction, brand reputation, and the bottom line. General Electric, which prioritizes innovation and reliability, must understand and mitigate these costs through continuous improvement efforts to stay competitive.

Continuous improvement is essential for market competitiveness as to stay competitive; firms must continuously improve quality [25]. Organizations' continuous improvement efforts often focus on optimizing production processes within the company's scope, ignoring external effects [3, 13, 42].

The company must be careful when allocating resources and effort to continuous improvement [98]. This process uses several tools, methods, and approaches to improve quality and reduce costs [8].

Continuous improvement assessment is complicated by the need for accurate quality cost methodologies, awareness, and direction for enhancement initiatives, as well as a lack of objective metrics like quality cost data [4,101]. Most organizations lack objective measurements like quality cost data, which can make it difficult to research continuous improvement as a mediator [2]. Unholistic optimization of continuous improvement procedures without addressing the impacts on the complete business network will prevent the enterprise and organization from seeing the entire business system or manufacturing network [74,96,101]. Effective CI initiatives can minimize poor-quality costs and improve operational performance for companies like General Electric [8].

2.1 Continuous Improvement

Continuous Improvement (CI) is a crucial principle in various fields, including business, education, and engineering, that aims to optimize performance and bring about lasting positive change [32,34]. Traditional CI approaches may struggle in fast-paced environments, leading to the proposal of novel data-driven methods [86]. CI is essential for increasing productivity and ensuring a company's development and survival in a constantly changing global market [91]. It promotes constant insertion of small incremental improvements, leading to better results in terms of efficiency and quality [65]. CI methodologies such as Lean, Kaizen, Six Sigma, and Agile are commonly used to enhance organizational processes [8]. Tools like Process Mapping, Gemba Walk, and Kaizen Events are recommended for continuous improvement [8]. Management support plays a significant role in strengthening the relationship between continuous improvement systems and internal process performance [87].

However, implementing CI initiatives within business organizations presents various challenges [32]. High failure rates are reported due to factors such as motives and expectations, culture and environment, management leadership, implementation approach, training, project management, employee involvement levels, and feedback and results [68]. Enablers for successful implementation include having a common area for collaboration between actors in a value chain, a systematic approach ensuring learning and lasting improvement, and a culture for continuous improvement [28]. Inhibitors include the lack of culture for continuous improvement and the absence of support management systems, hindering the entire workforce's involvement in the CI process [45]. Another significant challenge is the lack of adequate training and knowledge among employees regarding continuous improvement methodologies [51]. Organizations must prioritize training and development to equip their workforce with the skills needed to effectively engage in continuous improvement efforts [34,51].

CI is a critical process that organizations must integrate into their operations to improve performance and maintain competitiveness. However, it can be challenging due to external factors such as the business and investment climate, which can negatively impact the implementation of CI [45]. To mitigate this, organizations must ensure that CI initiatives are clearly linked to their strategic goals and understood by all stakeholders [38]. Another challenge is the poor use of adequate measurement systems for monitoring CI [67]. Without meaningful metrics, organizations may struggle to gauge the success of their CI efforts, leading to uncertainty about the value of the efforts [28]. A robust framework for measurement and evaluation is essential for tracking progress, identifying areas for further improvement, and demonstrating the impact of CI initiatives [67].

The key components of a successful CI process in lean manufacturing involve structured approaches, employee involvement, and the use of tools and techniques [13]. Organizational culture

and leadership play a crucial role in facilitating CI, while data analysis and performance measurement are essential for driving CI [81]. However, organizations may face challenges and barriers when implementing CI initiatives.

CI is significantly influenced by various factors, and it is crucial to manage them effectively by identifying appropriate metrics for each aspect [26]. CI should prioritize the involvement of individuals in ongoing improvement initiatives and activities, aiming to instill the belief in their capacity to contribute innovative ideas [54]. Aligning CI with strategic objectives ensures that improvement initiatives align with organizational goals, enhancing the likelihood of successful CI implementation and integration into daily operations [83]. The CI methodology is a systematic and ongoing approach used by organizations to gradually enhance processes, products, or services over time [26]. It involves the methodical process of identifying, analyzing, and executing enhancements to attain higher levels of efficiency, effectiveness, and overall excellence [65]. The core principle underlying CI is the dedication to CI, cultivating a culture of acquiring knowledge and adjusting accordingly [67]. CI methodology is not universally applicable; businesses have the flexibility to modify and tailor these concepts to suit their individual requirements and circumstances [26,28,67].

Organizational support is a crucial factor in the success of CI systems, as it refers to the level of managerial commitment and effort invested in constructing and maintaining them [33]. Standardized organizational structure plays a crucial role in influencing employees' engagement in practices associated with Total Quality Management (TQM) [54]. The commitment of top management establishes a framework for resource allocation, employee engagement, and the integration of CI practices into daily operations [57]. This alignment with strategic goals ensures that improvement efforts are not perceived as isolated projects but are integral to the organizational fabric [81]. Training is crucial for cultivating the necessary skills and knowledge among employees to actively engage in the company's innovation process [53,79,99]. Training and education play a pivotal role in determining employees' engagement in CI quality activities, as this impact can be observed either directly, with training and education positively influencing involvement, or indirectly through other variables such as self-efficacy [98,99]. Training fosters a shared understanding of improvement methodologies, such as Lean or Six Sigma, among employees at various organizational levels, creating a common language and facilitating collaboration [53].

The usefulness of participating in a perpetual enhancement initiative is vital for achieving organizational triumph [71]. Engaging employees at every hierarchical level in ongoing enhancement is crucial for multiple reasons [49]. Frontline staff have significant insights into everyday operational issues, which contribute to a thorough grasp of potential for change. Their participation cultivates a feeling of possession and dedication, augmenting the execution of enhancement endeavors. Involvement from employees at all hierarchical levels fosters a culture of cooperation and collective accountability, dismantling barriers between different departments within the firm [86]. Facilitating employee engagement in the CI process is crucial for cultivating a culture of ongoing learning and advancement within the firm [71]. When employees perceive it as convenient to give ideas and suggestions, they are more inclined to actively engage, resulting in a more resilient culture of CI [44]. Efficient involvement enables ongoing learning and adjustment, and employees are more inclined to participate in CI endeavors when the process is smooth and uninterrupted, enhancing the organization's capacity to respond to evolving market conditions [104].

2.2 Cost of Poor Quality

Cost of Poor Quality (COPQ) is a critical aspect of business management that significantly impacts an organization's financial performance [23,74,92,97]. It encompasses expenses incurred due to

substandard products or services and adversely affects the cost, scope, and schedule of projects, leading to reduced productivity and profitability [59]. Continuous quality improvement is crucial for competitiveness, and the correct application of quality tools can help identify the root causes of quality problems and enhance productivity and quality [9].

The implementation of a closed-loop analysis and improvement mechanism when establishing a measurement quality system in the manufacturing industry has been shown to significantly reduce quality failure costs [56]. The use of a quality cost model can be instrumental in measuring the overall performance of organizations and facilitating the improvement process of product quality [55]. The implementation of a COPQ system has been shown to decrease COPQ, increase labor productivity, and enhance profitability in construction projects [59, 60]. The classic PAF (Prevention-Appraisal-Failure) model classification has been used to develop a mathematical model for estimating COPQ within manufacturing supply chains [5]. Components of COPQ are categorized into prevention costs, appraisal costs, internal failure costs, and external failure costs [94]. A study in the construction industry demonstrated a significant reduction in COPQ from 36.41% to 15.07% after the implementation of a COPQ measuring system, highlighting the effectiveness of such systems in facilitating continuous improvement [60].

However, implementing a COPQ system can be a significant challenge for many organizations [96]. If the organization did not react on the quality matters, the quality problems and a defect rate greater than zero lead to a decrease in total production costs, indicating that production costs grow dramatically due to poor quality [18]. Lack of measurement and recording method is one of the challenges in implementation of the COPQ, as it remains hidden because it is not typically measured and recorded in existing accounting systems [60]. Management often fails to initiate timely corrective actions due to this lack of knowledge, adversely affecting the cost, scope, and schedule of projects [60]. Data analytics plays a vital role in identifying and addressing COPQ challenges by providing insights into quality management factors and enabling the measurement and reporting of the cost of quality [61]. Different industries approach the measurement and reduction of COPQ through specific strategies such as process monitoring and control plans in the construction field and the use of lean and Six Sigma approaches in manufacturing [8].

The COPQ framework identifies four main categories of costs: appraisal, prevention, and internal failure and external failure [20]. Appraisal costs are the expenses incurred by an organization to inspect, test, and assess items to ensure adherence to quality standards [20]. These costs are crucial for identifying and preventing problems before delivery of items to customers, contributing significantly to total quality assurance [27]. Prevention costs involve proactively implementing measures and strategies to prevent defects and quality issues in the manufacturing process [16]. These costs include establishing product specifications, quality planning, quality assurance, and training individuals in quality improvement systems [89]. These costs require investments from company executives to provide training, develop products, and establish quality improvement programs [71].

Internal failure costs refer to the financial burdens experienced by an organization due to defects and quality issues identified within the production process before the product reaches the customer [95]. These costs include rework, scrap, wasted labor and materials, overhead costs, supplier scrap and rework, failure analysis, lost time due to quality defects, opportunity costs, reinspection, and retesting [27]. Failure to address issues at this stage can lead to increased production costs or missed opportunities for business improvement [28]. External failure costs, on the other hand, refer to the financial impact incurred by an organization due to defects and quality issues identified by customers after the product has reached the market [16]. These costs include warranty claims, product recalls, customer returns, and potential damage to the organization's reputation [16]. Effectively controlling

and reducing expenses resulting from external failures is crucial for enhancing customer loyalty and maintaining a favorable brand reputation.

2.3 Operational Performance

Operational capabilities, such as quality and low cost, directly affect firm performance among service firms, with technological intensity strengthening the relationship between quality capabilities and business performance [46, 80]. OP significantly influences financial performance, with competitively distinct operations enabling high efficiency operations, which in turn positively affects financial performance [24, 50]. The alignment between the business environment and operating strategy positively influences OP in the manufacturing industry [66].

Operational performance (OP) significantly impacts overall firm performance, including sales, sales growth, profitability, and market share [58]. Key performance indicators (KPIs) are essential for evaluating operational efficiency and process effectiveness in various industries [40, 47, 92]. Implementing OP is challenging due to various organizational and cultural aspects, including alignment between the business environment and operating strategy, operational excellence practices like Lean and Six Sigma, and securing total support from top management to integrate performance management into the organizational culture [69].

In industries like oil and gas, achieving operational efficiency is challenging due to the complexity of remote and extreme operational environments [102]. The chemical industry faces challenges related to the lack of qualified personnel and resistance to change at various levels within organizations. To address these challenges, strategies such as full integration of assets and processes, joint implementation of technology and production strategies, and the use of new technologies are recommended [30,73].

Quality is crucial for OP, as it entails conformity to specified specifications and has emerged as a paramount concern for businesses offering both goods and services [71]. Quality-oriented practices across product design, supply chain management, and total quality management are crucial for optimizing operational performance in manufacturing [36,49]. Investing in quality improvement processes, supplier relationships, and supply chain integration can enhance productivity, reduce costs, and improve customer satisfaction [45,71]. Manufacturing flexibility is a crucial aspect of organizational performance that allows a manufacturing system to adapt to both internal and external changes [47-48]. It enhances business success by providing a variety in response repertoire to manage customer demand fluctuations, improving workflow and organizational efficiency [15, 41 77]. Lead time reduction is another significant indicator of OP, allowing the manufacturing segment to respond more quickly to customer demands and adapt more easily to market conditions, customer preferences, and technological advancements [6]. This flexibility enhances an organization's ability to stay competitive. Inventory management plays a pivotal role in OP across all businesses [15].

Efficient inventory management, enabled by real-time tracking and forecasting, allows manufacturers to hold less excess inventory, reducing costs associated with storing, managing, and financing unnecessary inventory [22]. By implementing the right inventory management techniques, manufacturers can enhance their operational performance, improve customer service, and gain a competitive edge [73,88]. Productivity is another important aspect of OP, as it helps balance non-financial and financial variables [85]. However, traditional performance metrics may inadvertently encourage overproduction by maximizing output from individual pieces of equipment or operators [43]. Productivity can streamline processes and eliminate waste through productivity improvements, leading to greater output per unit of input and increased profit margins [63]. Cost reduction is another key aspect of OP, as it aims to decrease total expenditure on a specific project or operation

[90]. Lean manufacturing, as a set of waste reduction strategies, is expected to improve cost performance, typically measured in terms of unit manufacturing cost [78].

3. Methodology

The study's scope is limited to 7540 respondents from One Field Services (OFS) within GE, representing all five operational zones globally. Several major considerations were used to justify the selection of GE field service staff as target respondents. These professionals are heavily involved in task execution at client sites, giving them personal familiarity with operational obstacles and quality issues. Their close closeness to operations provides vital insights into delivering quality services in real-world circumstances.

In this study, GE's operational areas will be divided into five regions: North America (NAM), Latin America (LATAM), Middle East (MEA), Asia Pacific (APAC), and Europe (EU). GE's operations are organized into five distinct regions, each with its own unique characteristics and contributions to the company's global strategy. GE's initiatives in these five locations reflect its commitment to innovation and continuous improvement, which are critical for reducing the costs associated with poor quality and enhancing operational performance. Every location has a unique role in GE's overall strategy and performance, which is critical to the company's continued success in the global marketplace.

Data collecting using questionnaires and surveys via email has become an important way for doing business research, particularly within firms [19]. This method enables researchers to collect quantitative and qualitative data swiftly and cost-effectively [12]. The use of email as a survey medium takes advantage of its widespread use in modern communication, giving it a realistic option for reaching a large number of people within a business [11].

This study collects data via email, and the focus group consists of GE employees who work expressly for the corporation. Keeping this in mind, the following benefits are considered. This is also considered, as the focus of this research will be on all five sites where GE operates across the world. The pilot study had 50 respondents who had no trouble understanding the format of the questionnaire, while the actual data collection involved 375 respondents.

This research addresses the following research questions:

3.1 Research Question 1: Does the COPQ have a significant relationship to CI?

To analyze the relationship between the COPQ and CI. The result is vital for firms seeking to improve their operational efficiency and production. This analysis elucidates how inefficiencies, flaws, and errors in processes influence overall quality costs and impede continuous improvement activities. This knowledge can assist practitioners in pinpointing areas for enhancement and distributing resources efficiently to reduce quality expenses, therefore promoting a culture of continuous improvement inside the firm.

3.2 Research Question 2: Does CI have a significant relationship to OP?

To investigate the relationship between CI and OP. The results will yield significant insights into the efficacy of enhancement initiatives in improving overall organizational performance. This research aims to clarify how CI methods, including lean management and Six Sigma, promote efficiency, minimize waste, and boost production. This knowledge can guide firms in adopting optimal practices and methods for enhancing their operational performance, therefore securing a competitive advantage in the market.

3.3 Research Question 3: Does CI mediate the relationship between the COPQ and OP?

To examine if CI mediates the relationship between COPQ and OP. It is essential for comprehending the fundamental mechanisms that propel performance enhancements. This investigation of the mediation effect can reveal how CI activities serve as a catalyst in alleviating the negative impacts of poor-quality costs on OP. This insight can assist firms in formulating more effective quality management strategies that stress continuous improvement to enhance operational efficiency and overall performance outcomes.

4. Results

The pilot study aimed to assess the scale's accuracy and reliability. To ensure exact and consistent measurement throughout time and across multiple instrument items, Cronbach's alpha was used to test the variables' internal consistency and reliability [14, 21]. Cronbach's alpha is commonly recognized as the standard approach for evaluating scales with numerous components [84].

The preliminary test findings suggested that the data acquired in the main study would be more dependable, yielding precise and convincing results. The results of the item reliability tests conducted on the pilot study outcomes revealed a high level of consistency among the items within each variable. Cronbach's Alpha values for each variable are displayed in the table below.

Table 1
Cronbach Alpha result from pilot study

Variables	Items	Cronbach's Alpha
COPQ	**24**	**.994**
- Prevention	6	.979
- Appraisal	6	.975
- Internal Failure	6	.976
- External Failure	6	.974
Continuous Improvement	**24**	**.978**
- Alignment	5	.976
- Methodology	4	.975
- Organizational Support	4	.967
- Training	4	.973
- Usefulness	4	.800
- Ease of Participation	3	.966
Operational Performance	**42**	**.997**
- Quality	8	.986
- Flexibility	6	.975
- Lead Time	7	.988
- Inventory	7	.982
- Productivity	8	.986
- Cost of Reduction	6	.979

4.1 COPQ Have a Significant Relationship with Continuous Improvement

The relationship between COPQ and Continuous Improvement (CI) is crucial for organizations like General Electric to enhance their operational performance. COPQ encompasses all costs arising from inadequate quality, including internal and external failures, appraisal costs, and prevention costs. Understanding how these costs impact CI initiatives is essential for organizations aiming to enhance their performance.

The study found that COPQ significantly influences CI, with a substantial effect size of 0.600. Enterprises with elevated COPQ levels are incentivized to implement Continuous Improvement activities to mitigate expenses related to quality concerns. Cost-reduction strategies such as enhanced evaluation, preventive, and failure cost management propel ongoing improvement processes. This aligns with current literature, indicating that organizations with elevated COPQ are generally more dedicated to enhancing procedures and eradicating inefficiencies. Furthermore, the analysis substantiated that the COPQ exhibits a substantial positive correlation with CI. The path analysis demonstrated a robust and statistically significant association (H1: $\beta = 0.612$, $t = 8.594$, $p < 0.001$), where H1: COPQ has a significant impact on CI.

Minimizing COPQ directly facilitates the promotion of Continuous Improvement within an organization. Organizations that proactively address and reduce COPQ are more likely to successfully implement and maintain CI initiatives. This highlights the significance of managing quality-related costs as a strategic initiative to foster sustainable enhancements. Continuous improvement (CI) is fundamentally about making incremental enhancements to processes, products, or services over time. The application of CI techniques, such as Lean and Six Sigma, has been shown to effectively reduce waste and improve efficiency, which in turn can lead to a decrease in COPQ. Investment in prevention and appraisal activities often see a reduction in failure costs, which are a significant component of COPQ.

Employee participation in CI initiatives is a key determinant of successful CI implementation. When employees perceive CI activities as beneficial and are encouraged to participate, organizations can leverage their insights to identify areas where COPQ can be reduced. Training and development are also critical components that influence the effectiveness of CI initiatives. Strategic focus of an organization plays a significant role in shaping its approach to CI and COPQ. A culture surrounding CI that promotes openness, collaboration, and learning from failures can significantly enhance the effectiveness of CI initiatives. Effective leadership can inspire and motivate employees to engage in CI activities, thereby enhancing the overall impact of these initiatives on CoPQ and operational performance.

4.2 Continuous Improvement Have a Significant Relationship with Operational Performance

The relationship between continuous improvement (CI) and operational performance (OP) is crucial for organizations striving for excellence in their operational processes. A study of the mediating effect of CI on the relationship between COPQ and OP, particularly in the case of General Electric, reveals that CI has a significant and positive impact on OP. This relationship is supported by various empirical studies that highlight the mechanisms through which CI enhances operational performance.

Continuous improvement activities have a favorable impact on operational performance because they save costs, increase flexibility, and boost productivity. However, CI is less significant than the direct association between COPQ and OP. CI has a strong positive impact on OP. The path analysis indicated a statistically significant connection (H2: $\beta = 0.278$, $t = 3.366$, $p = 0.001$), where H2 is CI has significant impact on OP. Despite a medium effect size ($f^2 = 0.129$), the results emphasize the significance of CI in improving operational performance. This research emphasizes the importance of CI strategies such as training, organizational support, and methodology in improving key operational indicators such as cost reduction, flexibility, inventory management, productivity, and quality. The findings show that CI is a major driver of OP because it allows firms to adapt to changing market needs, optimize resource utilization, and increase overall efficiency. For example, training staff and

aligning organizational goals with improvement projects can result in better decision-making and simpler operations, ultimately improving performance indicators.

CI encompasses various methodologies aimed at enhancing processes, reducing waste, and improving quality. The implementation of CI practices such as Lean and Six Sigma leads to substantial improvements in operational performance metrics, including efficiency, productivity, and quality of output. Total Quality Management (TQM) practices, which are closely aligned with CI, positively influence operational performance. The mediating role of CI in enhancing OP is further supported by research that emphasizes the importance of operational capabilities. The effective implementation of CI practices can enhance these capabilities and, in turn, improve overall performance.

Employee involvement in CI initiatives significantly enhances the effectiveness of these initiatives, leading to improved operational performance. Training and growth are critical factors in supporting the link between CI and OP. Effective training programs boost employees' self-efficacy, increasing their engagement in CI activities. Strategic alignment of CI initiatives with organizational goals is critical for maximizing their impact on OP. Organizational culture surrounding CI also plays a significant role in shaping its effectiveness. A culture that promotes openness, collaboration, and a willingness to learn from failures can significantly enhance the impact of CI initiatives on OP. Effective leadership can inspire and motivate employees to engage in CI activities, thereby enhancing the overall impact of these initiatives on operational performance.

The result for the relationship between COPQ to Continuous Improvement and Continuous Improvement to Operational Performance as below:

Table 2
Relationship between Cost of Poor Quality, Continuous Improvement and Operational Performance

	Beta	Standard deviation	T statistics	P values	result
H1: COPQ → Continuous Improvement	0.612	0.071	8.594	0.000	supported
H2: Continuous Improvement → Operational Performance	0.278	0.083	3.366	0.001	supported
H3: COPQ → Operational Performance	0.588	0.076	7.742	0.000	not supported

4.3 Continuous Improvement Mediate the Relationship Between COPQ and Operational Performance

The relationship between Quality Control Process (COPQ) and Operational Performance (OP) is a significant area of research, especially in organizations like General Electric. CI can serve as a critical mechanism through which the adverse effects of COPQ can be mitigated, leading to enhanced operational performance. CI not only addresses the costs associated with poor quality but also fosters a culture of ongoing improvement that is essential for achieving operational excellence.

The study's findings strongly supported, which indicated that CI mediates the link between COPQ and OP. The bootstrapping analysis revealed a significant mediation effect, suggesting that CI serves as a conduit for the drop in COPQ, which can lead to increased OP. The findings suggest that firms should not only focus on lowering COPQ but also invest in continuous improvement strategies to boost performance.

This finding confirms earlier research that has emphasized the relevance of CI in relating financial measurements like COPQ to operational success. The link between COPQ and operational performance is mediated by continuous improvement. The mediation analysis (H4: $\beta = 0.17$, $t = 2.389$, $p = 0.017$) revealed that CI is a significant mediating factor, where H4 is CI has a significant impact on

both COPQ and OP. CI strengthens the impact of COPQ on operational performance (H3: $\beta = 0.588$, $t = 7.742$, $p < 0.001$), where H3 is COPQ has significant impact on OP. This implies that, while COPQ has a direct impact on OP, it is partially transferred through CI. The findings imply that businesses can improve their operational performance not just by addressing COPQ directly, but also by using CI as a strategic intermediate. This mediation effect shows that firms can optimize the benefits of minimizing COPQ while also engaging in CI activities. For example, tackling COPQ through prevention and evaluation activities not only lowers quality-related expenses but also develops a culture of continuous learning and process improvement, which leads to superior operational outcomes.

Continuous improvement (CI) is a significant mediating factor, strengthening the impact of COPQ on operational performance. The study highlights the interconnection of these dimensions and the need of combining quality management and improvement tactics to attain higher performance. CI encompasses various methodologies aimed at enhancing processes, reducing waste, and improving quality. The implementation of CI practices, such as Lean and Six Sigma, has been shown to lead to substantial improvements in operational performance metrics, including efficiency, productivity, and quality of output.

The mediating effect of CI on the relationship between CoPQ and OP is further supported by the study, which indicates that CI initiatives are essential for achieving employee commitment and enhancing operational performance. Effective training and development programs enhance employees' self-efficacy, positively influencing their participation in CI activities. Strategic alignment of CI initiatives with organizational goals is critical for maximizing their impact on OP. Organizations that prioritize CI within their strategic planning are more likely to experience significant improvements in their operational performance. A culture surrounding CI also plays a significant role in shaping its effectiveness. Leadership is another critical factor influencing the relationship between CI and OP. Leaders who prioritize quality and continuous improvement create an environment where employees feel empowered to contribute to improvement efforts, essential for achieving long-term success.

The result for the mediating relationship between COPQ to Continuous Improvement to Operational Performance as below:

Table 3
Mediating Relationship between Cost of Poor Quality, Continuous Improvement and Operational Performance

	Beta	Standard Deviation	T statistic	P Values	result
H4: COPQ → Continuous Improvement → Operational Performance	0.17	0.071	2.389	0.017	Supported

5. Limitations

Quantitative research, particularly through email surveys distributed across multiple global regions, presents numerous limitations that can significantly impact the validity and reliability of findings. These include participant recruitment and engagement, survey fatigue, potential biases, logistical issues, ethical considerations, methodological rigor, geographical dispersion of respondents, and self-reported data. Participant recruitment and engagement are crucial for organizations like General Electric (GE), which operates in distinct cultural and economic environments across five regions. Culturally sensitive approaches are essential to ensure the quality of data collected. Survey fatigue can lead to lower response rates, compromising the representativeness of the sample.

Potential biases arise from relying on single respondents to represent broader organizational perspectives, which can obscure critical insights and lead to an incomplete understanding of the mediating effects of continuous improvement on operational performance. Logistical issues, such as differences in time zones, language barriers, and varying levels of access to technology, can hinder effective communication and follow-up with potential respondents. Researchers must be proactive in addressing these challenges by providing multilingual surveys or utilizing local intermediaries to facilitate communication.

Ethical considerations are also crucial, as informed consent is paramount and participants must understand the purpose of the study and how their data will be used. Methodological rigor is another critical aspect, as selecting appropriate survey instruments and ensuring clear, unbiased, and relevant questions can limit the effectiveness of quantitative research.

Geographic dispersion raises concerns about the generalizability of findings, as differences in regional economic conditions, regulatory environments, and cultural attitudes towards quality and performance can influence the outcomes of the study. Researchers must be cautious in drawing conclusions from data collected across diverse contexts, as these conclusions may not be universally applicable.

6. Recommendation

The investigation into the mediating effect of continuous improvement on the relationship between the COPQ and operational performance, particularly within the context of General Electric, presents a fertile ground for future research. This area is crucial as organizations strive to enhance operational efficiencies while minimizing costs associated with poor quality. Future research can focus on specific methodologies, knowledge management, the identification of quality expenses, the integration of digital technologies, the influence of organizational culture, supply chain management strategies, hidden costs, benchmarking practices, and regulatory implications.

Continuous improvement frameworks such as Lean, Six Sigma, and Total Quality Management have been shown to significantly influence operational performance by reducing waste and enhancing quality. A longitudinal design could be employed to assess how the implementation of these methodologies over time affects both quality costs and operational outcomes. Knowledge management systems that facilitate the sharing of best practices and lessons learned related to quality management could also be explored.

The identification and management of quality expenses is another critical subject for future research. Research could focus on creating a complete framework for examining the various components of COPQ, such as prevention, appraisal, internal failure cost and external failure cost, and how these components interact with continuous improvement initiatives. The incorporation of Industry 4.0 technologies, such as the Internet of Things (IoT) and data analytics, could transform how businesses monitor and enhance quality.

Organizational culture plays a significant role in the efficacy of continuous improvement projects. Future research should examine how the organizational culture at General Electric affects the adoption and efficacy of continuous improvement approaches, particularly in terms of CoPQ and operational performance. Benefiting against industry standards and best practices could provide significant insights into the efficacy of continuous improvement initiatives. Analyzing how compliance costs are integrated into a larger framework of quality expenses and how continuous improvement projects can be developed to meet or surpass regulatory standards is also essential.

7. Conclusions

In conclusion, the link between COPQ and CI has a considerable impact on operational performance. The significant drop in COPQ acts as a catalyst for CI, emphasizing the importance of addressing quality-related expenses in order to foster a culture of improvement. COPQ has a significant impact on CI, highlighting the importance of addressing quality-related expenses in order to build a culture of improvement. Organizations that recognize the costs associated with poor quality are more likely to implement CI efforts that not only reduce these costs but also foster a culture of continuous improvement. Employee involvement, training efforts, strategic orientation, company culture, and leadership all play important roles in shaping this relationship. This study illustrates that a comprehensive approach that includes these factors can result in large improvements in operational performance, giving significant benefits to the organization.

The link between CI and OP is important and varied. CI directly improves OP, highlighting its importance in achieving operational excellence. It significantly improves OP, demonstrating its usefulness in increasing operational efficiency and effectiveness. Organizations that recognize the importance of CI are more likely to explore projects that not only improve operational performance but also foster a culture of continuous improvement. Employee involvement, training, strategic emphasis, corporate culture, and leadership all play essential roles in determining this relationship. A comprehensive approach that includes these elements can lead to considerable improvements in operational performance.

Lastly, CI serves an essential and diverse role in moderating the relationship between the COPQ and the OP. CI acts as a link between COPQ and OP, amplifying the benefits of COPQ decrease for operational outcomes. CI bridges the gap between COPQ and OP, highlighting the significance of a comprehensive approach that includes quality management and improvement techniques. Organizations that recognize the importance of CI are more likely to explore projects that not only improve operational performance but also foster a culture of continuous improvement. Employee involvement, training, strategic emphasis, corporate culture, and leadership all play essential roles in determining this relationship. A holistic approach that includes these elements can result in considerable improvements in operational performance, benefiting organizations such as GE.

Acknowledgement

The authors express their sincere gratitude to General Electric for their substantial support and collaboration throughout this research endeavor. Their invaluable insights, resources, and expertise significantly contributed to the depth and quality of this study. The author particularly appreciates the assistance provided by the GE team in facilitating access to crucial data and industry perspectives. It should be noted that this research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

[1] Adem, Mulugeta Kebede, and Sandeep Singh Virdi. "The structural link between TQM practices and financial performance: the mediating role of operational performance." *International Journal of Quality & Reliability Management* 41, no. 1 (2024): 392-422. https://doi.org/10.1108/ijqrm-08-2021-0290.

[2] Aichouni, Ahmed Baha Eddine, Faizir Ramlie, and Haslaile Abdullah. "Process improvement methodology selection in manufacturing: A literature review perspective." *International Journal of advanced and applied sciences* 8, no. 3 (2021): 12-20. https://doi.org/10.21833/ijaas.2021.03.002.

[3] Alexander, Paul, Jiju Antony, and Bryan Rodgers. "Lean Six Sigma for small-and medium-sized manufacturing enterprises: a systematic review." *International Journal of Quality & Reliability Management* 36, no. 3 (2019): 378-397. https://doi.org/10.1108/ijqrm-03-2018-0074.

[4] Almasaeid, Ibtisam Salem. "The Impact of Applying the Theory of Constraints on the Competitive Advantage: Evidence from Jordan." *Management* 11, no. 4 (2021): 71-81. https://doi.org/10.6007/ijarafms/v11-i4/11808.
[5] Ayati, Ehsan, and Andrea Schiffauerova. "Study of cost of quality behavior in manufacturing supply chain based on the quality maturity status." In *ASME International Mechanical Engineering Congress and Exposition*, vol. 46637, p. V014T08A006. American Society of Mechanical Engineers, 2014. https://doi.org/10.1115/imece2014-39694.
[6] Balaji, M., S. N. Dinesh, S. Raja, Ram Subbiah, and P. Manoj Kumar. "Lead time reduction and process enhancement for a low volume product." *Materials Today: Proceedings* 62 (2022): 1722-1728. https://doi.org/10.1016/j.matpr.2021.12.240.
[7] Bandi, Nizam Hafiz, Ahmad Nazif Noor Kamar, and Cheng Jack Kie. "Investigating the Impact of Lean Manufacturing Practices on Operational Performance." *Journal of Modern Manufacturing Systems and Technology* 6, no. 2 (2022): 42-47. https://doi.org/10.15282/jmmst.v6i2.8563.
[8] Lapesa Barrera, David. "Continuous Improvement Methodologies and Tools." In *Aircraft Maintenance Programs*, pp. 317-330. Cham: Springer International Publishing, 2022. https://doi.org/10.1007/978-3-030-90263-6_29.
[9] Bhushi, Umesh, Lokpriya Gaikwad, and Vivek Sunnapwar. "Analysis of poor quality cost in auto industry: A case study." In *Proceedings of International Conference on Intelligent Manufacturing and Automation: ICIMA 2022*, pp. 3-14. Singapore: Springer Nature Singapore, 2023.https://doi.org/10.1007/978-981-19-7971-2_1.
[10] Blaga, Petruța. "The importance of human resources in the continuous improvement of the production quality." *Procedia manufacturing* 46 (2020): 287-293. https://doi.org/10.1016/j.promfg.2020.03.042.
[11] Bond, Diana M., Jeremy Hammond, Antonia W. Shand, and Natasha Nassar. "Comparing a mobile phone automated system with a paper and email data collection system: Substudy within a randomized controlled trial." *JMIR mHealth and uHealth* 8, no. 8 (2020): e15284. https://doi.org/10.2196/15284.
[12] Bougie, Roger, and Uma Sekaran. *Research methods for business: A skill building approach*. john wiley & sons, 2019
[13] Buer, Sven-Vegard, Marco Semini, Jan Ola Strandhagen, and Fabio Sgarbossa. "The complementary effect of lean manufacturing and digitalisation on operational performance." *International Journal of Production Research* 59, no. 7 (2021): 1976-1992. https://doi.org/10.1080/00207543.2020.1790684.
[14] Bujang, Mohamad Adam, Evi Diana Omar, and Nur Akmal Baharum. "A review on sample size determination for Cronbach's alpha test: a simple guide for researchers." *The Malaysian journal of medical sciences: MJMS* 25, no. 6 (2018): 85. https://doi.org/10.21315/mjms2018.25.6.9.
[15] Chaudhuri, Atanu, Harry Boer, and Yariv Taran. "Supply chain integration, risk management and manufacturing flexibility." *International Journal of Operations & Production Management* 38, no. 3 (2018): 690-712. https://doi.org/10.1108/ijopm-08-2015-0508.
[16] Crowdle, Mary Margaret, Olivia McDermott, and Anna Trubetskaya. "A benefit costing process for Lean Six Sigma programs." *The TQM Journal* 35, no. 9 (2023): 369-387. https://doi.org/10.1108/tqm-06-2023-0194.
[17] Ihler, Juliana Berendt, Laene Oliveira Soares, Yana Amaral Alves, Cristina Gomez Souza, and Ronney Arismel Mancebo Boloy. "Global trends and opportunities in hybrid microgrid systems using renewable energies." *International Journal of Energy Economics and Policy* 12, no. 4 (2022): 263-273. https://doi.org/10.32479/ijeep.13175.
[18] Eben-Chaime, Moshe. "A note on: the economic effects of quality improvements." *Total Quality Management & Business Excellence* 24, no. 3-4 (2013): 374-377. https://doi.org/10.1080/14783363.2012.734952.
[19] Edwards, Philip James, Ian Roberts, Mike J Clarke, Carolyn DiGuiseppi, Reinhard Wentz, Irene Kwan, Rachel Cooper, Lambert M Felix, and Sarah Pratap. 2009. "Methods to Increase Response to Postal and Electronic Questionnaires." *Cochrane Library* 2010 (1). https://doi.org/10.1002/14651858.mr000008.pub4.
[20] Elsharif, Tarek Abdelhafid. "The application of quality Costs accounting in industrial Companies in Benghazi Libya." *Open Access Library Journal* 6, no. 05 (2019): 1. https://doi.org/10.4236/oalib.1105399.
[21] Emerson, Robert Wall. 2019. "Cronbach's Alpha Explained." *Journal of Visual Impairment & Blindness* 113 (3): 327. https://doi.org/10.1177/0145482x19858866.
[22] Eze, I. E., O. I. Inyiama, and I. Ezugwu. "Current assets management and operational performance of consumer goods firms in Nigeria." *European Journal of Business and Innovation Research* 12, no. 2 (2024): 67-83. https://doi.org/10.37745/ejbir.2013/vol12n26783.
[23] Fabianová, Jana, Jaroslava Janeková, and Daniela Onofrejová. "Cost analysis of poor quality using a software simulation." *Amfiteatru Economic* 19, no. 44 (2017): 181. https://doaj.org/article/1d7db76dbd9b415297be08f300ea720b.
[24] Faden, Christian. 2013. *Optimizing Firm Performance*. *Springer eBooks*. https://doi.org/10.1007/978-3-658-02746-9.
[25] Ferryanto, Liem. "Sustainable continuous improvement programs." *International Journal of Six Sigma and Competitive Advantage* 14, no. 2 (2022): 171-185. https://doi.org/10.1504/ijssca.2022.124973.

[26] Fryer, Karen, Susan Ogden, and Jiju Anthony. "Bessant's continuous improvement model: revisiting and revising." *International Journal of Public Sector Management* 26, no. 6 (2013): 481-494. https://doi.org/10.1108/ijpsm-05-2012-0052.
[27] Galli, Brian J. "How cost of poor quality factors into continuous improvement models." *International Journal of Applied Management Sciences and Engineering (IJAMSE)* 6, no. 1 (2019): 1-13. https://doi.org/10.4018/ijamse.2019010101.
[28] Galli, Brian J. "Optimization methods in continuous improvement models: a relational review." *International Journal of Applied Industrial Engineering (IJAIE)* 6, no. 1 (2019): 46-59. https://doi.org/10.4018/ijaie.2019010103.
[29] Galli, Brian J. "Relationship Between Cost of Poor Quality and Continuous Improvement: Reflection of Literature." *International Journal of Applied Logistics (IJAL)* 11, no. 2 (2021): 55-70. https://doi.org/10.4018/ijal.2021070103.
[30] Garrido-Vega, Pedro, Cesar H. Ortega Jimenez, and Michiya Morita. "Implementation of technology and production strategy practices: Relationship levels in different industries." *International Journal of Production Economics* 161 (2015): 201-216. https://doi.org/10.1016/j.ijpe.2014.07.011.
[31] Grieves, Michael. "Digital twin certified: Employing virtual testing of digital twins in manufacturing to ensure quality products." *Machines* 11, no. 8 (2023): 808. https://doi.org/10.3390/machines11080808.
[32] Gummer, Edith S., and Ellen B. Mandinach. "Landscape View of the Continuous Improvement Process." In *Data for Continuous Programmatic Improvement*, pp. 16-31. Routledge, 2018. https://doi.org/10.4324/9780429455032-2.
[33] Ha, Young Mok, and Hyung Jun Ahn. "Factors affecting the performance of Enterprise Resource Planning (ERP) systems in the post-implementation stage." *Behaviour & Information Technology* 33, no. 10 (2014): 1065-1081. https://doi.org/10.1080/0144929x.2013.799229.
[34] Hafida, Kahoul, Bouzerara Ramdane, and Chaib Rachid. "Application of Continuous Improvement Tools to Welding Processes: Case of ENGTP." *International Journal of Emerging Technology and Advanced Engineering, 12 (4)* (2022): 199-209. https://doi.org/10.46338/ijetae0422_24.
[35] Hagström, Malin Hane, Dag Bergsjö, Ashwin Sathyanarayana, and Chrisler Machado. "Quantifying and visualising wastes and losses in automotive production flows (across multiple plants and organisations) for increased accuracy in improvement prioritisations." *International Journal of Product Development* 27, no. 3 (2023): 245-264. https://doi.org/10.1504/ijpd.2023.133062.
[36] Henderson, Kim M., and James R. Evans. "Successful implementation of Six Sigma: benchmarking general electric company." *Benchmarking: an international journal* 7, no. 4 (2000): 260-282. https://doi.org/10.1108/14635770010378909.
[37] Hilverda, Jesse Jorian, Oskar Roemeling, Edin Smailhodzic, Kjeld Harald Aij, Eveline Hage, and Amal Fakha. "Unveiling the impact of Lean leadership on continuous improvement maturity: a scoping review." *Journal of healthcare leadership* (2023): 241-257. https://doi.org/10.2147/jhl.s422864.
[38] Hollender, Martin, Moncef Chioua, Jan Schlake, Lennart Merkert, and Heiko Petersen. "KPI-based Process Operation Management of highly automated processes." *ATP EDITION* 9 (2016): 52-61. https://publikationen.bibliothek.kit.edu/1000088502.
[39] Höse, Kristina, Afonso Amaral, Uwe Götze, and Paulo Peças. "Manufacturing flexibility through industry 4.0 technological concepts—impact and assessment." *Global Journal of Flexible Systems Management* 24, no. 2 (2023): 271-289. https://doi.org/10.1007/s40171-023-00339-y.
[40] Inan, Guven Gurkan, Zahit Ergun Gungor, Umit Sezer Bititci, and Sarina Abdul Halim-Lim. "Operational performance improvement through continuous improvement initiatives in micro-enterprises of Turkey." *Asia-Pacific Journal of Business Administration* 14, no. 3 (2022): 335-361. https://doi.org/10.1108/apjba-11-2020-0394.
[41] Jacobs, Brian W., Richard Kraude, and Sriram Narayanan. "Operational productivity, corporate social performance, financial performance, and risk in manufacturing firms." *Production and Operations Management* 25, no. 12 (2016): 2065-2085. https://doi.org/10.1111/poms.12596.
[42] Jagusiak-Kocik, Marta. "PDCA cycle as a part of continuous improvement in the production company-a case study." *Production engineering archives* 14 (2017). https://doi.org/10.30657/pea.2017.14.05.
[43] Jurburg, Daniel, Elisabeth Viles, Carmen Jaca, and Martin Tanco. "Why are companies still struggling to reach higher continuous improvement maturity levels? Empirical evidence from high performance companies." *The TQM Journal* 27, no. 3 (2015): 316-327.
[44] Jurburg, Daniel, Elisabeth Viles, Martin Tanco, Ricardo Mateo, and Álvaro Lleó. "Understanding the main organisational antecedents of employee participation in continuous improvement." *The TQM Journal* 31, no. 3 (2019): 359-376. https://doi.org/10.1108/tqm-10-2018-0135.
[45] Kang, Ningxuan, Cong Zhao, Jingshan Li, and John A. Horst. "A Hierarchical structure of key performance indicators for operation management and continuous improvement in production systems." *International journal of production research* 54, no. 21 (2016): 6333-6350. https://doi.org/10.1080/00207543.2015.1136082.

[46] Karkoszka, Tatiana. "Identification of the key operational parameters as an element of technological process' operational control." *System Safety: Human-Technical Facility-Environment* 1, no. 1 (2019). https://doi.org/10.2478/czoto-2019-0065.

[47] Karkoszka, Tatiana. 2019b. "Identification of the Key Operational Parameters as an Element of Technological Process' Operational Control." In *Sciendo eBooks*, 506–13. https://doi.org/10.2478/9783110605402-065.

[48] Keke, Yulianti, Vera Putrianto, Muhammad Basyar Azzuhri, and Erni Pratiwi Perwitasari. "An Analysis of Quality Control on Defective Products at PT. Signore." *KnE Social Sciences* (2023): 827-841. https://doi.org/10.18502/kss.v8i9.13396.

[49] Khan, Sharfuddin Ahmed, Mohamad Amin Kaviani, Brian J. Galli, and Palvisha Ishtiaq. "Application of continuous improvement techniques to improve organization performance: A case study." *International Journal of Lean Six Sigma* 10, no. 2 (2019): 542-565. https://doi.org/10.1108/ijlss-05-2017-0048.

[50] El Khatib, Mounir, Amna Kherbash, Aysha Al Qassimi, and Kaltham Al Mheiri. "How can collaborative work and collaborative systems drive operational excellence in project management?." *Journal of Service Science and Management* 15, no. 3 (2022): 297-307.https://doi.org/10.4236/jssm.2022.153017.

[51] Lai, Nai Yeen Gavin, Wai Choong Foo, Chon Siong Tan, Myoung Sook Kang, Hooi Siang Kang, Kok Hoong Wong, Lih Jiun Yu, Xu Sun, and Nadia Mei Lin Tan. "Understanding learning intention complexities in lean manufacturing training for innovation on the production floor." *Journal of Open Innovation: Technology, Market, and Complexity* 8, no. 3 (2022): 110. https://doi.org/10.3390/joitmc8030110.

[52] Lameijer, B. A., H. Boer, J. Antony, and R. J. M. M. Does. "Continuous improvement implementation models: a reconciliation and holistic metamodel." *Production Planning & Control* 34, no. 11 (2023): 1062-1081. https://doi.org/10.1080/09537287.2021.1974114.

[53] Lari, Alireza, and Arben Asllani. "Quality cost management support system: an effective tool for organisational performance improvement." *Total Quality Management & Business Excellence* 24, no. 3-4 (2013): 432-451. https://doi.org/10.1080/14783363.2012.733258.

[54] Li, Jingshan, Chrissoleon T. Papadopoulos, and Liang Zhang. "Continuous improvement in manufacturing and service systems." *International Journal of Production Research* 54, no. 21 (2016): 6281-6284.https://doi.org/10.1080/00207543.2016.1228235.

[55] Liu, Jie, Dejuan Zhuang, and Wei Shen. "The impact of quality management practices on manufacturing performance: an empirical study based on system theory." *Soft Computing* (2023): 1-16. https://doi.org/10.1007/s00500-021-06606-3.

[56] Prashar, Anupama. "Characterization and examination of operational excellence deployment failures: mediation effect of technical and behavioral failure factors." *IEEE Transactions on Engineering Management* 70, no. 6 (2021): 2080-2092. https://doi.org/10.1109/tem.2021.3071294.

[57] Mahmood, Shahid, Syed M. Ahmed, Kamalesh Panthi, and Nadeem Ishaque Kureshi. "Determining the cost of poor quality and its impact on productivity and profitability." *Built Environment Project and Asset Management* 4, no. 3 (2014): 296-311. https://doi.org/10.1108/bepam-09-2013-0034.

[58] Mahmood, Shahid, and Nadeem Ishaque Kureshi. "Reducing hidden internal failure costs in road infrastructure projects by determination of Cost of Poor Quality, a case study." In *2014 International Conference on Engineering, Technology and Innovation (ICE)*, pp. 1-10. IEEE, 2014. https://doi.org/10.1109/ice.2014.6871608.

[59] Mahmood, Shahid, and Azam Ishaque. "Innovative system to determine hidden cost of poor quality to enhance labor productivity and profitability for construction entrepreneurs, a case study." In *2013 International Conference on Engineering, Technology and Innovation (ICE) & IEEE International Technology Management Conference*, pp. 1-12. IEEE, 2013. https://doi.org/10.1109/itmc.2013.7352676.

[60] Makhanya, BB S., Hannelie Nel, and Jan-Harm Christiaan Pretorius. "A systematic literature review of the implementation of cost of quality." In *2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, pp. 726-730. IEEE, 2018. https://doi.org/10.1109/ieem.2018.8607298.

[61] Manoharan, Kesavan, Pujitha Dissanayake, Chintha Pathirana, Dharsana Deegahawature, and Renuka Silva. "Assessing the performance and productivity of labour in building construction projects through the application of work-based training practices." *Construction Innovation* 24, no. 2 (2024): 558-583. https://doi.org/10.1108/ci-05-2022-0126.

[62] Mardani, Abbas, Devika Kannan, Robert E. Hooker, Seckin Ozkul, Melfi Alrasheedi, and Erfan Babaee Tirkolaee. "Evaluation of green and sustainable supply chain management using structural equation modelling: A systematic review of the state of the art literature and recommendations for future research." *Journal of cleaner production* 249 (2020): 119383. https://doi.org/10.1016/j.jclepro.2019.119383.

[63] Martins, Mariana, Maria Leonilde Rocha Varela, Goran Putnik, José Machado, and Vijaya Kumar Manupati. "Tools implementation in management of continuous improvement processes." In *Advances in Manufacturing II: Volume*

2-Production Engineering and Management, pp. 348-357. Springer International Publishing, 2019. https://doi.org/10.1007/978-3-030-18789-7_29.

[64] Masudin, Ilyas, Rafika Meilia Sari, Fien Zulfikarijah, and Dian Palupi Restuputri. "The effect of business environment and operational strategy on operational performance: Evidence from Indonesian manufacturing industry." In *AIP Conference Proceedings*, vol. 2927, no. 1. AIP Publishing, 2024.. https://doi.org/10.1063/5.0192320.

[65] McDermott, Olivia, Jiju Antony, Michael Sony, and Tom Healy. "Critical failure factors for continuous improvement methodologies in the Irish MedTech industry." *The TQM Journal* 34, no. 7 (2022): 18-38. https://doi.org/10.1108/tqm-10-2021-0289.

[66] McLean, Richard S., Jiju Antony, and Jens J. Dahlgaard. "Failure of Continuous Improvement initiatives in manufacturing environments: a systematic review of the evidence." *Total Quality Management & Business Excellence* 28, no. 3-4 (2017): 219-237. https://doi.org/10.1080/14783363.2015.1063414.

[67] McMillan, Chris. "Winning hearts and minds for performance management." In *The public productivity and performance handbook*, pp. 102-105. Routledge, 2021. https://doi.org/10.4324/9781003178859-9.

[68] Mircea, Raul Bogdan. "Analysis of the Profitability of an SME from the Perspective of Quality Management." *Valahian Journal of Economic Studies* 13, no. 2 (2022): 93-100. https://doi.org/10.2478/vjes-2022-0019.

[69] Mittal, Ankesh, and Pardeep Gupta. "The effect of TQM practices on organisational performance: a case study of Deming awarded Indian industry." *International Journal of Business Excellence* 32, no. 2 (2024): 148-161. https://doi.org/10.1504/ijbex.2024.136878.

[70] Olanrewaju, Abdul Lateef, and Alice Hui Jing Lee. "Investigation of the poor-quality practices on building construction sites in Malaysia." *Organization, Technology & Management in Construction* 14, no. 1 (2022): 2583-2600. https://doi.org/10.2478/otmcj-2022-0008.

[71] Opoku, Richard Kofi, Helen Mawuena Fiati, Gregory Kaku, Joseph Ankomah, and Faustina Opoku-Agyemang. "Inventory management practices and operational performance of manufacturing firms in Ghana." *Advances in research* 21, no. 10 (2020): 1-18.https://doi.org/10.9734/air/2020/v21i1030246.

[72] Osteen, B. John, Karthik Jeganathan, and Suresh Ramanan. "Optimizing the cost of software quality-a path to delivery excellence." In *2013 10th International Conference on Information Technology: New Generations*, pp. 754-756. IEEE, 2013.. https://doi.org/10.1109/itng.2013.118.

[73] Pandey, Anoop, and Anuj Kumar. 2015. "System Thinking Approach to Deal With Sustainability Challenges." *SSRN Electronic Journal*, November. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3724575.

[74] Peter, Ogundola Ilesanmi, and Aderotimi Oluwasesan Adeoti. 2023. "Evaluation of Total Quality Management Practices on Organizational Performance of Wires and Cables Manufacturing Industries in Ondo State, Nigeria." *Journal of Engineering Research and Reports* 25 (8): 9–19. https://doi.org/10.9734/jerr/2023/v25i8954.

[75] Pinheiro, José, Luis Filipe Lages, Graça Miranda Silva, Alvaro Lopes Dias, and Miguel T. Preto. "Effects of absorptive capacity and innovation spillover on manufacturing flexibility." *International Journal of Productivity and Performance Management* 71, no. 5 (2022): 1786-1809. https://doi.org/10.1108/ijppm-04-2020-0156.

[76] Pinto Junior, Marcos José Alves, and Juliana Veiga Mendes. "Operational practices of lean manufacturing: Potentiating environmental improvements." *Journal of Industrial Engineering and Management (JIEM)* 10, no. 4 (2017): 550-580.. https://doi.org/10.3926/jiem.2268.

[77] Pozzi, Rossella, Tommaso Rossi, and Raffaele Secchi. "Industry 4.0 technologies: critical success factors for implementation and improvements in manufacturing companies." *Production Planning & Control* 34, no. 2 (2023): 139-158. https://doi.org/10.1080/09537287.2021.1891481.

[78] Prajogo, Daniel I., Christopher M. McDermott, and Jayanth Jayaram. "The role of technological intensity in services on the capability to performance relationships–An examination in the Australian context." *Journal of Engineering and Technology Management* 31 (2014): 58-72.https://doi.org/10.1016/j.jengtecman.2013.10.005.

[79] Rollinson, Thomas James, Joy Furnival, Sarah Goldberg, and Aklak Choudhury. "Learning from Lean: a quality improvement project using a Lean-based improvement approach to improve discharge for patients with frailty in an acute care hospital." *BMJ Open Quality* 10, no. 4 (2021): e001393. https://doi.org/10.1136/bmjoq-2021-001393.

[80] Sahoo, Saumyaranjan. "Lean practices and operational performance: the role of organizational culture." *International Journal of Quality & Reliability Management* 39, no. 2 (2021): 428-467. https://doi.org/10.1108/ijqrm-03-2020-0067.

[81] Santos, Juliana Bonomi, Rafaella Scorsatto Lange, and Carlos Eduardo Lourenço. "BRK Ambiental Sumaré: Operational Excellence and Continuous Improvement." *Revista de Administração Contemporânea* 27 (2023): e220097. https://doi.org/10.1590/1982-7849rac2023220097.en.

[82] Saunders, Mark, Philip Lewis, and Adrian Thornhill. 2019. *Research Methods for Business Students, 8th Ed. Pearson eBooks*. http://dspace.uniten.edu.my/handle/123456789/18304.

[83] Saunila, Minna, Juhani Ukko, Tero Rantala, Mina Nasiri, and Hannu Rantanen. "Preceding operational capabilities as antecedents for productivity and innovation performance." *Journal of Business Economics* 90, no. 4 (2020): 537-561. https://doi.org/10.1007/s11573-019-00963-0.

[84] Schuh, Günther, Jan-Philipp Prote, Thomas Busam, Rafael Lorenz, and Torbjörn H. Netland. "Using prescriptive analytics to support the continuous improvement process." In *Advances in Production Management Systems. Production Management for the Factory of the Future: IFIP WG 5.7 International Conference, APMS 2019, Austin, TX, USA, September 1–5, 2019, Proceedings, Part I*, pp. 46-53. Springer International Publishing, 2019. https://doi.org/10.1007/978-3-030-30000-5_6.

[85] Hunjet, Anica. "Relationship between continuous improvement and internal process performance; the role of management support." *Tehnički vjesnik* 28, no. 6 (2021): 2109-2114. https://doi.org/10.17559/tv-20201208132214.

[86] Simwa, Joram Tovesi, and Peter Wamalwa Barasa. 2024. "Effects of Inventory Management Practices on Operational Performance in Mombasa County Government, Kenya." *Asian Journal of Economics Business and Accounting* 24 (4): 246–59. https://doi.org/10.9734/ajeba/2024/v24i41277.

[87] Sodhi, Harsimran Singh, Bikram Jit Singh, and Doordarshi Singh. "SWOT analysis of Lean Six Sigma: a review." *International Journal of Business Excellence* 29, no. 2 (2023): 162-184. https://doi.org/10.1504/ijbex.2023.10053491.

[88] Srinivasan, Kumar, Parikshit Sarulkar, and Vineet Kumar Yadav. "Operational excellence of the steel industry using the Lean Six Sigma approach: a case study." *International Journal of Quality & Reliability Management* 41, no. 3 (2024): 826-849.. https://doi.org/10.1108/ijqrm-08-2022-0250.

[89] Stadnicka, Dorota, and Katarzyna Antosz. "Continuous improvement practice in large enterprises: study results." *International Journal for Quality Research* 9, no. 1 (2015): 9. https://doaj.org/article/e92f0c22bebd477b94d7fc8f5df5bc17.

[90] Stricker, Nicole, András Pfeiffer, Emanuel Moser, Botond Kádár, and Gisela Lanza. "Performance measurement in flow lines–Key to performance improvement." *CIRP annals* 65, no. 1 (2016): 463-466. https://doi.org/10.1016/j.cirp.2016.04.031.

[91] Sturm, Sebastian, Gernot Kaiser, and Evi Hartmann. "Long-run dynamics between cost of quality and quality performance." *International Journal of Quality & Reliability Management* 36, no. 8 (2019): 1438-1453. https://doi.org/10.1108/ijqrm-05-2018-0118.

[92] Sürücü, Özlem, Yüksel Öztürk, Fevzi Okumus, and Anil Bilgihan. "Brand awareness, image, physical quality and employee behavior as building blocks of customer-based brand equity: Consequences in the hotel context." *Journal of Hospitality and Tourism Management* 40 (2019): 114-124. https://doi.org/10.1016/j.jhtm.2019.07.002.

[93] Tambunan, Tigor. "A conceptual framework of quality cost chain in strategic cost management." *The TQM Journal* 36, no. 3 (2024): 762-784.. https://doi.org/10.1108/tqm-09-2021-0281.

[94] Teli, S. N., V. S. Majali, U. M. Bhushi, L. M. Gaikwad, and V. G. Surange. "Cost of poor quality analysis for automobile industry: a case study." *Journal of The Institution of Engineers (India): Series C* 94 (2013): 373-384. https://doi.org/10.1007/s40032-013-0091-z.

[95] Teli, S. N., V. S. Majali, Umesh M. Bhushi, and V. G. Surange. "Impact of poor quality cost in automobile industry." *International Journal of Quality Engineering and Technology* 4, no. 1 (2014): 21-41. https://doi.org/10.1504/ijqet.2014.059842.

[96] Trang, Pham Thu. "Training and continuous improvement: the moderation effect of transfer climate and the mediation influence of self-efficacy." *The TQM Journal* 36, no. 4 (2024): 1212-1234. https://doi.org/10.1108/tqm-02-2023-0066.

[97] van Assen, Marcel F. "Training, employee involvement and continuous improvement–the moderating effect of a common improvement method." *Production planning & control* 32, no. 2 (2021): 132-144. https://doi.org/10.1080/09537287.2020.1716405.

[98] Van Dyk, Dirk Johannes, and Leon Pretorius. "A systems thinking approach to the sustainability of quality improvement programmes." *South African Journal of Industrial Engineering* 25, no. 1 (2014): 71-84.. https://doi.org/10.7166/25-1-696.

[99] Waichai, Wan, and Wong Yuklan. "Total quality management and the future of China." In *Business Transformation in China*, pp. 153-171. Routledge, 2018. 1. https://doi.org/10.4324/9780429429965-8.

[100] Wilson, Andrew. "Operational Excellence: Harmonising business goals and departmental priorities to create sustainable business." In *International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*. OnePetro, 2012. https://doi.org/10.2118/157349-ms.

[101] Yasa, I. Ketut. "The Implementation of Total Quality Management (TQM) in Housekeeping Department of W Bali-Seminyak." *International Research Journal of Management, IT and Social Sciences* 6, no. 2 (2019): 22-30.. https://doi.org/10.21744/irjmis.v6n2.603.

[102] Zhu, Chengke, Lijing Shen, and Yanping Shi. "Motivation Analysis of Market and Institution on Corporate Leasing Financialization from the Perspective of Regulatory Arbitrage: Evidence from Chinese Listed Companies." *Sustainability* 14, no. 19 (2022): 12581. 81. https://doi.org/10.3390/su141912581.