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EFFECTS OF TOTAL QUALITY MANAGEMENT IN CONSTRUCTION SERVICES PROJECT PERFORMANCE IN INDONESIA'S STATE-OWNED ENTERPRISE

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ABSTRACT

Total Quality Management (TQM) has been widely implemented across various industries worldwide for decades, particularly in manufacturing, to enhance organizational performance and customer satisfaction. However, TQM's application in the construction sector remains relatively underexplored in Indonesia. This study investigates the impact of TQM implementation on project performance within Indonesian State-Owned Enterprises (SOEs) in the construction sector. The eight TQM practices examined in this research include Leadership, Strategic Planning, Customer Focus, Workforce Focus, Operational Focus, Measurement, Analysis, Knowledge Management, Training, and Employee Involvement. A quantitative approach was used to collect data from 99 respondents across various projects, representing different management levels. The analysis was conducted using SmartPLS 4 software through the Partial Least Squares-Structural Equation Modeling (PLS-SEM) technique. The findings reveal that five TQM elements, Strategic Planning, Workforce Focus, Operational Focus, Measurement and Analysis, and Employee Involvement, significantly impact project performance, which includes time effectiveness, cost effectiveness, quality of project outcomes, and customer satisfaction. On the other hand, the remaining three TQM practices, Customer Focus, Leadership, and Training, do not significantly influence project performance. This research contributes to the limited body of knowledge on TQM in the construction industry and provides valuable insights for both academics and practitioners seeking to optimize project outcomes within Indonesian SOEs. By highlighting the key TQM factors that affect performance, the study underscores the importance of effective implementation to achieve superior project results. This research is expected to serve as a foundation for further studies and practical applications of TQM in the Indonesian construction industry.

Keywords: Total Quality Management; project performance; State-Owned Enterprises; construction industry; performance improvement

1. Introduction

The construction industry in Indonesia has grown quickly in the past few years, mainly because the government has pushed for the building of essential infrastructure projects. However, underneath this growth are several long-term problems, such as project delays, cost overruns, and operational inefficiencies. Statistics Indonesia (Badan Pusat Statistik 2023) says that many infrastructure projects are behind schedule and over budget because of poor project management. These ongoing problems clarify that we need a more structured, flexible, and quality-focused way of managing projects to ensure they succeed.

Total Quality Management (TQM) is a well-known method for making projects more efficient and of higher quality. It is a complete management system that constantly improves things, gives employees more power, gets stakeholders involved, and makes customers happy. TQM is a helpful way to improve overall project performance and make internal processes more efficient on complicated and ever-changing construction projects (Jong *et al.* 2019).

More and more international research shows that TQM can significantly boost project productivity, make communication easier, and improve teamwork. For example, Alawag *et al.* (2023) showed in their study of IBS-based construction projects that TQM practices make projects run more smoothly, make customers happier, make teams work better together, make more money, and make things safer. In addition, TQM and knowledge management are becoming more and more linked as things that help new ideas come up. TQM improves how organizations share and use knowledge, leading to more innovation (Magd *et al*. 2021; Ong & Tan 2022). These skills are necessary for construction companies to stay competitive in a world that is becoming more globalized and where technology is changing quickly.

Even though there is more and more research on TQM in the manufacturing and service sectors, there is still not much research on how it is used in Indonesia's construction industry. Khalfan *et al.* (2020) point out that there is not much research on how quality culture and quality management practices affect project performance in Indonesian construction. Because construction projects are complicated and local businesses face many problems, it is becoming increasingly important to consider how TQM is used in practice.

This study focuses on a large state-owned construction enterprise (SOE) that plays a central role in Indonesia's infrastructure development. As one of the leading contractors mandated to deliver strategic national projects, the company represents a relevant case to examine the application of TQM in large-scale and complex environments. Although positioned as a strong performer with consistent growth, it continues to face challenges such as project delays, efficiency gaps, and contractual penalties. This makes it a suitable "good example" to explore how TQM practices can be enhanced in the construction industry. At the same time, it is important to note that SOEs often operate under stricter government oversight and broader public service objectives, while private construction firms may be more agile and profit-driven. These contextual differences mean that while some challenges may differ, the key principles of TQM are universally applicable, and thus the findings of this study can provide valuable insights for both SOEs and private construction companies.

This study aims to find out how well key TQM principles are being used in construction projects in Indonesia, with a special focus on a large state-owned construction enterprise that plays a strategic role in national infrastructure development. This study looked at eight main parts: leadership, strategic planning, focusing on customers, focusing on employees, focusing on operations, measuring, analyzing, and managing knowledge, training, and getting employees involved. This study aims to help improve quality management in Indonesia's construction industry by looking into the link between TQM practices and project performance. The study also wants to discover what problems and challenges people face when fully implementing TQM in the field. Construction companies should use the results as a guide to make their quality policies more flexible and long-lasting.

In the Indonesian construction sector, these challenges are particularly evident in state-owned enterprises that are mandated to deliver strategic national projects under strict budget, schedule, and governance constraints. Persistent issues such as design changes during execution, land acquisition delays, fragmented subcontracting structures, limited integration of project knowledge, and misalignment between corporate quality manuals and on-site practices contribute to time and cost overruns as well as contractual penalties. Within such a high-accountability but complex environment, TQM is expected not only to formalize procedures, but to translate quality philosophies into consistent project-level behaviors, data-driven monitoring, and empowered problem-solving routines. Yet, empirical evidence on how specific TQM dimensions operate inside Indonesian construction SOEs remains scarce, justifying the need for this focused investigation.

This study contributes empirically by testing an integrated eight-dimension TQM model within a large Indonesian construction SOE using PLS-SEM, revealing a differentiated pattern in which people and data-centered practices significantly drive project performance, while leadership, customer focus, and training show no significant direct effect. These findings provide context-specific evidence to refine TQM implementation in government-linked contractors and similar construction firms in emerging economies.

2. Literature Review

2.1. Total Quality Management (TQM)

TQM is a way of managing that aims to make customers happy by improving quality at all levels of the organization. Kareska (2023) says that everyone in an organization needs to be involved in quality improvement efforts, whether in production, services, or construction. Customer focus, which means putting customer satisfaction first, and continuous improvement, which means continuously improving processes and outputs, are two main ideas behind TQM. Organizational culture is also essential for giving employees power and getting them involved. A culture that encourages strategic planning and decision-making by everyone makes employees more likely to take responsibility for the quality of their work. According to research, A strong organizational culture improves service quality by giving employees more power. In other words, when an organization's culture improves, people feel more empowered, leading to better service and product quality (Haryono *et al.* 2021; Singhvi *et al.* 2022).

Research consistently shows that TQM relies heavily on data-driven decision-making to ensure choices are based on accurate, trustworthy information. This approach enables organizations to identify areas for improvement, monitor quality metrics, and implement corrective actions efficiently, leading to enhanced performance and customer satisfaction. Advanced Management Information Systems (MIS), big data analytics, and artificial intelligence further strengthen TQM by providing real-time, objective, and actionable insights for continuous quality improvement (Hossain 2024; Kim 2020; Obaid *et al.* 2024). Companies can better understand what customers want, make decisions faster and more accurately, and improve their business operations more effectively with this data. TQM is a quality improvement tool and a strategic business model that supports long-term sustainability and competitive advantage by combining these elements.

2.2. The basics of Total Quality Management (TQM)

The main ideas behind TQM help an organization run more smoothly and effectively. Jong *et al.* (2019) say that the following principles are especially important for companies that work in the construction services sector:

1. Leadership
   Leadership is important for ensuring that TQM principles are followed consistently throughout the organization and for setting a clear quality vision. Leaders also need to help their teams build a strong culture of quality.
2. Strategic Planning
   Setting quality goals aligned with project goals is part of strategic planning. This principle helps identify the most important steps and ensures that resources are used wisely to meet quality standards.
3. Customer Focus

This principle stresses the importance of knowing and meeting the client's needs. Utilization of customer feedback to improve company services and ensure construction projects meet their goals.

4. Workforce Focus
   Giving workers more power is an important part of TQM. Management, field workers, and everyone in between are all encouraged to participate in quality improvements through training and shared responsibility.
5. Operational Focus
   The operational focus is on making production and project management processes as efficient as possible by eliminating waste.
6. Measurement, Analysis, and Knowledge Management
   TQM is based on measuring and analyzing data. These help organizations find gaps in performance and make fact-based decisions. Good knowledge management ensures that insights that lead to ongoing improvement are shared.

2.3. Quality

Quality is essential for a product or service to be successful because it directly affects how well a company can meet or exceed customer expectations. Hadi *et al.* (2025) say that quality is a mix of product features, like how long it lasts, how reliable it is, what features it has, and how it looks, as well as service features, like how quickly it responds, how sure it is, how empathetic it is, and how real it is. TQM is a standard method of quality management that stresses the need for everyone in the organization, from top management to front-line workers, to be involved in ongoing efforts to improve quality (Naveena & Yokeswari 2024; Saxena & Srinivas Rao 2019). TQM aims to achieve customer satisfaction through coordinated efforts to develop effective quality strategies and integrate customer feedback and relevant data into planning.

In a business world with intense competition, quality is important not only to meet standards but also to make the company more valuable. According to Cvjetković *et al.* (2021) and Cheirkhanova *et al.* (2025), high-quality goods and services can make customers more loyal, build trust, and improve a company's reputation. So, good quality management is necessary to stay competitive and reach long-term goals. Companies can strengthen their position in the global market by using quality management principles in their business strategy.

2.4. Project performance

Project performance in the construction sector is how a project achieves its predetermined schedule, budget, quality, and client satisfaction goals. Stakeholder satisfaction, timeliness, cost-effectiveness, and output quality are critical dimensions frequently used to gauge project performance. Kerzner (2017) argues that meeting technical requirements and providing clients with satisfactory outcomes are as crucial to a project's success as staying within budget. The following are the primary performance metrics for construction projects:

1. Cost efficiency measures how well a project can stay within its allotted budget without going over.
2. Timeliness refers to the project's ability to adhere to planned deadlines and prevent delays that could harm operations and client relations.
3. The quality of deliverables includes how well the project complies with established guidelines and standards. High-quality results are essential to guaranteeing long-term durability and client satisfaction.

4. Customer satisfaction focuses on how the client views and assesses the project's conclusion. A crucial determinant of whether the project has fulfilled expectations is customer satisfaction.

2.5. Total Quality Management and project performance

TQM is an all-encompassing management strategy that encourages participation in ongoing quality improvement at all organizational levels. Leadership, customer focus, process management, employee engagement, and training and development are all components of TQM implementation in the construction industry. According to earlier research, incorporating TQM practices into construction projects can improve cross-functional systems, increase project implementation quality, and make it easier to accomplish project objectives (Jong *et al.* 2019; Kuo & Kuo 2010). These studies highlight how crucial organizational culture that aligns with quality principles and top management commitment is to creating flexible and effective workflows.

In the construction sector, client satisfaction, output quality, timeliness, and team effectiveness are all taken into consideration when evaluating project performance in addition to technical success. The literature currently in publication emphasizes how important TQM is for improving these aspects. The conclusion that thorough TQM adoption has a positive impact on planning, coordination, and project execution is further supported by research by Afzal *et al.* (2025), Faeq *et al.* (2021), and Vijayabanu *et al.* (2022). Studies also show that organizational preparedness, cultural fit, and the sustainability of quality assessment procedures are critical to TQM's success in Indonesia. These results imply that the effectiveness of TQM is not universal but depends on the organization's capacity to adapt quality practices to local conditions and project dynamics, as well as the integration of essential components.

Table 1: Studies of TQM practices and elements of performance

No.	Author	Title	TQM Adopted	Output Variable
1.	Kuo & Kuo (2010)	The Effect of Corporate Culture and Total Quality Management on Construction Project Performance in Taiwan	1) Leadership ability 2) Human research management 3) Process management 4) Continuous quality improvement & information 5) Cooperation firms management	Project performance: 1) Technology innovation 2) Successful ratio 3) Product quality 4) Cost/benefit analysis 5) Process improvement
2.	Ali & Rahmat (2010)	The Performance Measurement of Construction Projects Managed by ISO-Certified Contractors in Malaysia	ISO 9000 certification	Project performance: 1) Cost performance 2) Time performance 3) Quality performance 4) Client's satisfaction 5) Health and safety Functionality
3.	Ooi *et al.* (2012)	Does TQM Support Innovation Performance in Malaysia's Manufacturing Industry?	1) Leadership 2) Strategic planning 3) Customer focus 4) Information analysis 5) People management 6) Process management	Innovation performance
4.	Saeed & Hasan (2012)	The Effect of Total Quality Management on Construction Project Performance Case Study:	1) Top management commitment and leadership 2) Employee empowerment and involvement	Construction project performance: 1) Construction teamwork satisfaction

Table 1 (Continued)

		Construction Firms In Yemen	3) Employee participation and teamwork 4) Recognition and reward 5) Education and training 6) Change of construction design 7) Supplier quality management 8) Construction project design 9) Client focus	2) Quality of construction project implementation 3) Client satisfaction Construction project performance
5.	Talib *et al.* (2013)	An Empirical Investigation of Relationship between Total Quality Management Practices and Quality Performance in Indian Service Companies	1) Top management commitment 2) Customer focus 3) Training and education 4) Continuous improvement and innovation 5) Supplier management 6) Employee involvement 7) Information & analysis 8) Process management 9) Quality system 10) Benchmarking 11) Quality culture 12) Human resource management 13) Strategic planning 14) Employee encouragement 15) Teamwork 16) Communication 17) Product & service design	Quality performance 1) Product quality 2) Service quality 3) Process quality 4) Employee service quality
6.	Sadikoglu & Olcay (2014)	The Effects of Total Quality Management Practices on Performance and the Reasons of and the Barriers to TQM Practices in Turkey	1) Leadership 2) Knowledge and process management 3) Training 4) Supplier quality management 5) Customer focus 6) Strategic quality planning	Firm performance: 1) Operational performance 2) Inventory management performance 3) Employee performance 4) Innovation performance 5) Social responsibility 6) Customer results 7) Market and financial performance
7.	Jong *et al.* (2019)	The Relationship between TQM and Project Performance: Empirical Evidence from Malaysian Construction Industry	1) Leadership 2) Strategic planning 3) Customer focus 4) Measurement, analysis and knowledge management 5) Workforce focus 6) Operation focus	Project performance
8.	Khalfan *et al.* (2020)	The Effect of Quality Culture on Quality Management Practices and Projects Performance for Construction Companies – Conceptual Framework	1) Top Management Commitment 2) Employee involvement 3) Customer involvement 4) Quality tools 5) Information and Analysis 6) Continuous Improvement 7) Process Management 8) Supplier involvement	Project performance: 1) Reduce cost of poor quality and meet project 2) Customer requirements
9.	Khan *et al.* (2020)	Nexus between Total Quality Management Practices and Construction Firms' Performance in Pakistan	1) Organizational Leadership 2) Customer Focus 3) Policy & Strategy 4) Process Management	Construction firms performance: 1) Employee Satisfaction 2) Timely Completion

Table 1 (Continued)

10.	Faeq *et al.* (2021)	The Effect of Total Quality Management on Organizational Performance: Empirical Evidence from the Construction Sector in Sulaymaniyah City, Kurdistan Region – Iraq	1) Customer focus 2) Continuous improvement 3) Process management 4) Quality data and reporting 5) Training 6) Project design 7) Supplier management 8) Employee relations 9) Management leadership	Construction company performance
11.	Afzal *et al.* (2025)	Exploring the Impact of Total Quality Management Initiatives on Construction Industry Projects in Pakistan	1) Commitment 2) Employee involvement 3) Customer focus 4) Continuous improvement 5) Strategic planning 6) Operation focus 7) Measurement, analysis, and knowledge management	Project performance
12.	Vijayabanu *et al.* (2022)	Total Quality Management Practices and Its Impact on Indian Construction Projects	1) Benchmarking 2) Communication 3) Innovation 4) Employee involvement & empowerment 5) Quality objectives 6) Quality supervision 7) Supplier quality management 8) Team effectiveness 9) Technical factors 10) Top management commitment	1) Productivity 2) Cost reduction 3) Quality of service 4) Customer satisfaction 5) Timeliness of service
13.	Kipondya & Baleche (2023)	Effects of Total Quality Management on Performance of Construction Industry in Tanzania: A Case of Construction Companies in Mwanza	1) Participation of employees 2) Training of employees 3) Teamwork	Performance of construction industry: 1) Quality of work 2) Timely delivery of work 3) Value of money

The study's conceptual framework shows how project performance and the eight essential components of TQM are related. Leadership, strategic planning, operational, workforce, customer focus, measurement, analysis, knowledge management, training, and employee involvement are some of these components. It is assumed that every component directly contributes to enhancing project performance, which includes stakeholder satisfaction, quality, cost, and time. The model's arrows show the direction of causal relationships, indicating that more ideal project outcomes should result from the regular application of TQM principles. A conceptual framework is created to illustrate the connection between TQM components and project performance in this investigation, as seen in the figure below:

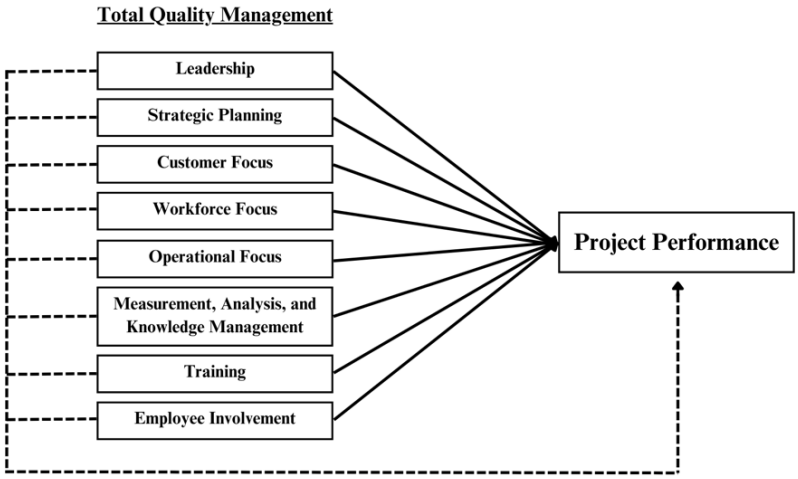

Figure 1: Conceptual framework of the study

3. Research Method

3.1. *Population and sample*

Three hundred twenty-five (325) current employees directly involved in 57 construction service projects run by one of Indonesia's largest and most respected State-Owned Enterprises (SOEs) in the construction industry make up the study's target population. According to Slovin's formula, 77 respondents are the minimum sample size required for a 10% margin of error. However, the researcher chose a sample size of 99 respondents, which yielded a margin of error of less than 10%, to improve the accuracy of estimates and the dependability of the analysis. To gather a thorough viewpoint on quality practices in projects, respondents were chosen through a purposive-stratified sampling technique that guaranteed representation from all managerial levels, from top management and middle management to operational-level employees. A Google Forms-based survey was used to gather data, and it was sent by email to staff members working on finished projects. This online approach was selected to reduce location bias, effectively reach respondents across multiple project sites, and facilitate real-time data consolidation.

3.2. *Research tool*

Both independent and dependent variables are used in this study. The factor that acts as the causal factor and is unaffected by other variables is the independent variable (X). The application of TQM is the independent variable in this study. The dependent variable (Y) refers to the outcome that results from the influence of the independent variable; in this case, the dependent variable is project performance. A five-point Likert scale, with one denoting "strongly disagree" and five denoting "strongly agree," was used to score each questionnaire item. The variables and corresponding indicators used in this study are explained in detail in the following section:

Table 2: The summary of questionnaire items

Variable	Element	Indicator	Source	Number of Statement
Total Quality Management	Leadership	Top management demonstrates an active and sustained commitment to quality improvement through direct involvement, adequate resource provision, and support for long-term strategies.	Flynn *et al.* 1995; Ahire *et al*. 1996; Anderson *et al.* 1998; Lau et al. 2004; Saraph *et al*. 1989.	3
	Strategic Planning	The company integrates quality values into its strategic and tactical planning, ensuring that continuous improvement efforts are integral to the organization's planning processes.	Lau *et al.* 2004; Lee *et al.* 2012.	2
	Customer Focus	The company's customer orientation is demonstrated through a long-term commitment, responsiveness to complaints as a basis for innovation and regular market research to enhance product quality.	Flynn *et al.* 1995; Ahire *et al*. 1996; Lau *et al.* 2004; Fotopoulos & Psomas 2010; Lee *et al.* 2012.	3
	Workforce Focus	The company's commitment to workforce development is reflected in comprehensive training programs, routine performance monitoring, and a work environment supporting employee health, safety, and well-being.	Saraph *et al*. 1989; Flynn *et al.* 1995; Lau *et al.* 2004; Fotopoulos & Psomas 2010.	3
	Operational Focus	The company's efforts in managing and controlling operational processes are implemented by establishing Key Performance Indicators (KPIs), regularly monitoring and evaluating process performance, and effectively communicating two-way with suppliers.	Saraph *et al*. 1989; Flynn *et al.* 1995; Lau *et al.* 2004; Lee *et al.* 2012.	3
	Measurement, Analysis, and Knowledge Management	The company's capability in knowledge management is shown through comprehensive data collection, periodic analysis and review of information, and benchmarking practices to compare product quality and procedures with other firms.	Saraph *et al*. 1989; Anderson *et al.* 1998; Lau *et al.* 2004; Lee *et al.* 2012.	3
	Training	The effectiveness of the company's training programs is evident in their role in improving construction project execution efficiency, supporting on-time completion, and ensuring the achievement of optimal quality outcomes.	Saraph *et al*. 1989; Flynn *et al.* 1995; Lau *et al.* 2004.	3

Table 2 (Continued)

	Employee Involvement	The company encourages active employee involvement in decision-making, quality audits, problem-solving related to quality issues, and technical support throughout the construction process to enhance efficiency and ensure the delivery of high-quality, timely project outcomes.	Saraph *et al*. 1989; Flynn *et al.* 1995; Lau *et al.* 2004; Fotopoulos & Psomas 2010.	4
Project Performance	Timeliness Cost Efficiency Quality of Outcomes Customer Satisfaction	The overall perception of project performance encompasses aspects such as timeliness, effectiveness of planning and cost control, stakeholder satisfaction, and achieving project results that exceed established standards and gain client recognition.	Shenhar *et al.* 2001; Ling *et al.* 2008; Yeung *et al.* 2009; Parasuraman *et al.* 1988; Agus & Hassan 2011; Kerzner 2017.	7

3.3. *Data analysis method*

The data-analysis method used in this study is Partial Least Squares–Structural Equation Modeling (PLS-SEM), which is implemented using SmartPLS 4. PLS-SEM was chosen because it can test latent variable relationships simultaneously, handle non-normal data distributions, and examine a conceptual model that connects eight TQM components to construction project performance. The outer and inner models, the two primary evaluation stages of the process, each guarantee measurement validity and structural accuracy.

Convergent validity (indicator loadings and AVE), discriminant validity (cross-loadings), and reliability (Composite Reliability and Cronbach's Alpha) tests are used in the first step, outer-model analysis, to evaluate the quality of the instrument. According to Hair *et al.* (2021), reliability is regarded as acceptable when both Composite Reliability and Cronbach's Alpha are ≥ 0.70, and indicators are considered valid and reliable when loadings are ≥ 0.70 (or ≥ 0.60 for exploratory studies) and AVE is ≥ 0.50. These standards confirm that each construct has high internal consistency and accurately measures the intended concept.

Three steps make up the second stage, inner-model analysis, which assesses the suitability of structural relationships:

(1) The coefficient of determination (R2) evaluates how much of the variance in the dependent variable can be accounted for by the independent variables.

(2) The Variance Inflation Factor (VIF) is used to check for multicollinearity; values ≤ 5.0 are still acceptable, and values below 3.3 are ideal, indicating no problematic inter-predictor correlations.

(3) To assess the significance of path coefficients, hypothesis testing is carried out using the bootstrapping technique. Relationships are significant when T-statistics ≥ 1.96 and p-values < 0.05 ($\alpha = 5\%$).

These measurements and structural evaluations guarantee that the study's findings are dependable, statistically valid, and relevant to improving construction project quality management theory and practice.

4. Findings and Discussion

This section presents model testing results, encompassing the measurement model (outer model) and the structural model (inner model), after the data collection and analysis process using the PLS-SEM technique. Interpreting and contrasting the findings with pertinent theories and earlier research provides a meaningful discussion of the results.

4.1. *Outer model*

The outer model evaluation was carried out to evaluate the connection between each indicator and the associated latent variable. The reflective measurement model was tested in this analysis using the SmartPLS version 4 software. Convergent validity, discriminant validity, composite reliability, and Cronbach's alpha tests were among the evaluations. These tests aim to ensure that the indicators are reliable and valid in capturing the latent variables being studied. The review of the measurement model yielded the following findings:

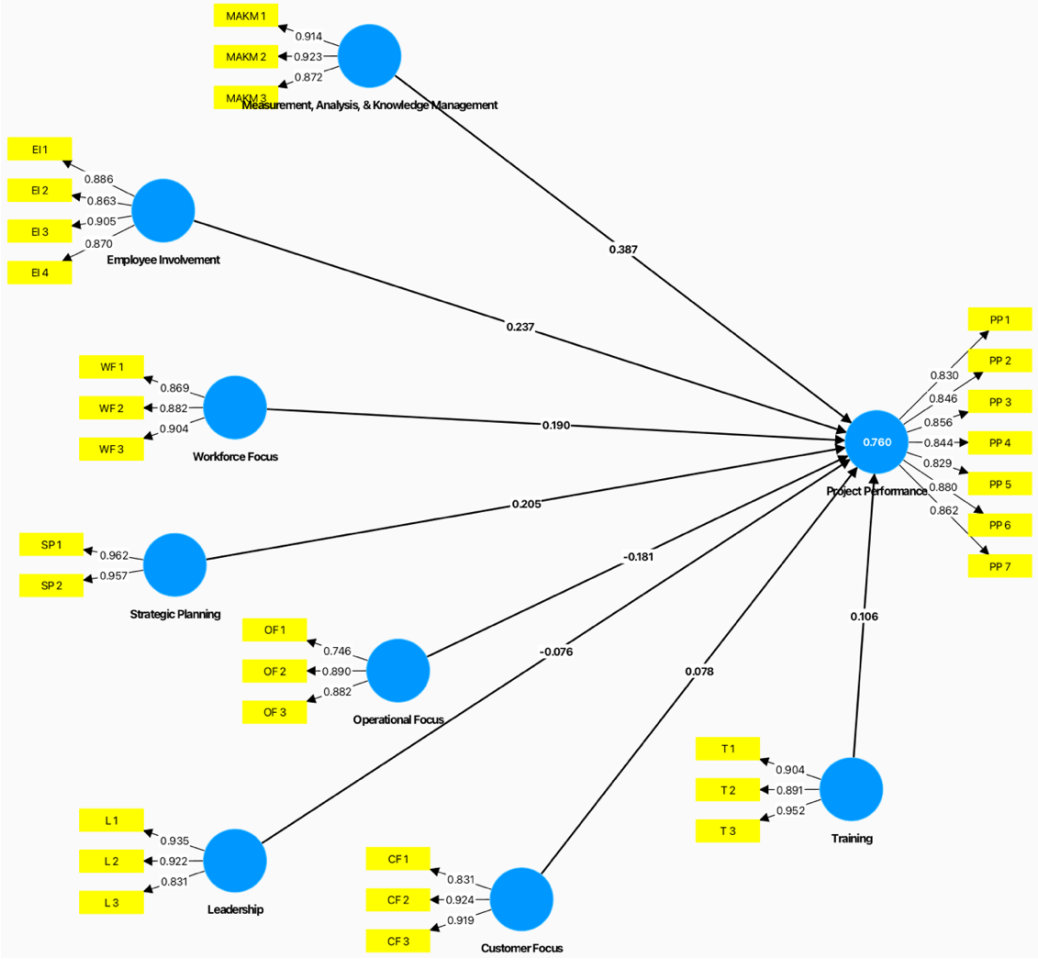

Figure 2: Research path model

The measurement model was assessed to ensure that the reflective indicators used to measure the latent constructs were valid and reliable. Since all Average Variance Extracted (AVE) values met the minimum threshold of 0.50 and all loading factor values (e.g., Leadership: 0.831–0.935; Measurement, Analysis, and Knowledge Management: 0.872-0.923; Customer Focus: 0.831–0.924; Project Performance: 0.829–0.880) exceeded 0.70, convergent validity was verified. According to these findings, the indicators faithfully capture the corresponding constructs.

A cross-loading analysis was used to establish discriminant validity, showing that each indicator had a higher loading on its associated construct than on other constructs. This attests to the constructs' uniqueness and representation of various dimensions. Furthermore, all constructs demonstrated respectable reliability levels; Cronbach's Alpha and Composite Reliability had values above 0.70, showing high internal consistency between the indicators.

Table 3: Cronbach's alpha, composite reliability, and AVE values

Variable	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Leadership	0.880	0.914	0.925	0.805
Strategic Planning	0.914	0.915	0.959	0.920
Customer Focus	0.871	0.884	0.921	0.796
Workforce Focus	0.862	0.868	0.916	0.784
Operational Focus	0.796	0.832	0.879	0.709
Measurement, Analysis, and Knowledge Management	0.888	0.900	0.930	0.816
Training	0.904	0.906	0.940	0.839
Employee Involvement	0.905	0.916	0.933	0.777
Project Performance	0.936	0.937	0.948	0.722

4.2. *Inner model*

The model's capacity to account for the variance in the dependent variable was assessed using the R-Square (R^2) test. This coefficient of determination gives an overview of the degree to which the independent variables affect the dependent variable. Project performance is the dependent variable in this study, and the R-Square (R^2) result is shown as follows:

Table 4: R-square value

Variable	R-Square
Project Performance	0.760

The eight TQM components together account for 76% of the variance in project performance, according to the R-Square (R^2) value for project performance of 0.760, demonstrating a very high predictive power. The Variance Inflation Factor (VIF) is used to assess multicollinearity, and all VIF values are less than 5.0, suggesting no serious

multicollinearity problems in the model. This guarantees the dependability of the estimated path relationships between variables and the stability of regression coefficients.

4.3. *Hypothesis testing and interpretation*

To investigate the direct impacts of the eight TQM components on project performance, hypothesis testing was done. With a significance level of 5% ($\alpha = 0.05$), the test used the bootstrapping technique in PLS-SEM. The path is deemed statistically significant if the P-value is less than 0.05 and the T-statistic value is greater than 1.96. The following table displays the findings of the hypothesis test:

Table 5: Path coefficient value

Variable	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-Statistics (|O/STDEV|)	P-Values	Decision
Leadership → Project Performance	-0.076	-0.068	0.075	1.008	0.313	Not Significant
Strategic Planning → Project Performance	0.205	0.194	0.104	1.967	0.049	Significant
Customer Focus → Project Performance	0.078	0.095	0.093	0.832	0.406	Not Significant
Workforce Focus → Project Performance	0.190	0.192	0.089	2.136	0.033	Significant
Operational Focus → Project Performance	-0.181	-0.181	0.090	2.019	0.044	Significant
Measurement, Analysis, and Knowledge Management → Project Performance	0.387	0.363	0.130	2.981	0.003	Significant
Training → Project Performance	0.106	0.105	0.129	0.824	0.410	Not Significant
Employee Involvement → Project Performance	0.237	0.242	0.109	2.179	0.029	Significant

Five of the eight TQM components, employee involvement, measurement, analysis, and knowledge management, operational focus, strategic planning, and workforce focus, significantly impacted project performance based on the findings. These results show that better project outcomes are influenced considerably by operational control, well-structured strategic planning, active employee participation, and efficient knowledge management. However, in the context of this study, the other three components, Customer Focus, Leadership, and Training, did not demonstrate a statistically significant impact on Project Performance. This could be

ascribed to leadership styles that are not entirely integrated with the project quality system, training programs that have not yet fully addressed the actual needs of ongoing projects, and the field's subpar application of customer-oriented practices. These findings point to the necessity of assessing and improving these components to guarantee a more significant influence on the success of subsequent projects.

4.4. *Discussion*

The study results provide crucial new information about how TQM is applied in construction service projects, especially in Indonesia's State-Owned Enterprises (SOEs). Five TQM components, Employee Involvement, Measurement, Analysis and Knowledge Management, Operational Focus, Strategic Planning, and Workforce Focus, significantly positively impact project performance out of the eight studied. This result supports earlier theory and data that demonstrated that a clear strategic direction, efficient organizational knowledge management, streamlined procedures, and active employee participation in decision-making all significantly influence project quality (Al-Saffar & Obeidat 2020; Haider & Kayani 2021; Lehyani *et al.* 2023). Notably, the Measurement, Analysis, and Knowledge Management construct's strong effect emphasizes how crucial data-driven decision-making is to project success. This aligns with Kampoowale (2025), Ferraris *et al.* (2019), and Garmaki *et al.* (2023), who emphasize how organizational knowledge and data analytics generate continuous improvement cycles and boost performance. According to Ishaque (2024), employee involvement is also significant because it shows that when employees actively participate in quality problem-solving, project efficiency and effectiveness significantly improve. This supports the idea that a high-involvement culture is fundamental to project quality management.

The non-significant effects of Leadership, Customer Focus, and Training on project performance warrant careful interpretation rather than being dismissed as theoretically unimportant. This contrasts with some literature highlighting customer orientation and transformational leadership as essential components of TQM (Ahmed & Sajid 2023; Bouranta 2020; Yadeta *et al.* 2022). First, the high mean scores and strong reliability values for these constructs suggest that they may have become “hygiene factors”, formally present and uniformly perceived as adequate, thus providing limited explanatory variance for differentiating project outcomes in this sample. Second, leadership practices in large SOEs are often concentrated at the corporate or strategic level, while project performance is heavily shaped by middle-management execution and site-level coordination; this structural gap may weaken the observable direct effect of leadership on project indicators. Third, customer focus activities within SOE projects are frequently mediated by regulatory and contractual procedures, which can reduce the visibility of client-oriented practices at the operational front line. Finally, the training construct in this study captures the existence of training programs, but not necessarily their relevance, timing, or transfer to on-site behaviors; misalignment between training content and project realities may explain the lack of significant impact. Collectively, these findings indicate that in mature, procedure-driven organizations, traditional “visible” TQM components may be necessary but not sufficient, and that organizations should reassess how leadership, client engagement, and capacity-building interventions are operationalized to create measurable improvements at the project level. These findings suggest that training methods should be realigned, quality-oriented leadership practices should be strengthened, and customer needs and feedback should be approached more comprehensively (Guerrero *et al.* 2018; Jong *et al.* 2019; Lee *et al.* 2019).

5. Conclusion

This study evaluated how much the eight fundamental components of TQM affect project performance in Indonesia's state-owned construction companies. Five factors, Employee Involvement, Measurement, Analysis and Knowledge Management, Operational Focus, Strategic Planning, and Workforce Focus, positively and significantly impact project performance, according to a PLS-SEM analysis of data taken from finished construction-service projects. Measurement, Analysis, and Knowledge Management were the best predictors, highlighting the significance of data-driven decision-making and ongoing learning cycles in achieving time, cost, and quality goals.

The study makes two significant contributions to knowledge. First, it broadens the empirical foundation of TQM research in Indonesian SOE contractors, a setting that has not gotten much attention. Second, it demonstrates that TQM's performance impact is inconsistent: while customer focus, leadership, and training have no discernible effect unless they are more thoroughly incorporated into project practice, people-centred and data-centred elements are the most important to project success.

From a management perspective, the results show that it is necessary to institutionalize strong data-collection and analytics procedures to maintain high project performance, enable cross-functional teams to handle quality issues immediately, and bolster workforce-oriented initiatives. On the other hand, companies need to reassess their training initiatives, customer feedback systems, and leadership styles to make sure they contribute to project success.

6. Limitation & Further Research

The results of this study may be interpreted differently due to several design and methodology-related limitations. First, it is difficult to fully capture the long-term effects of TQM implementation on project performance due to the cross-sectional research design, which limits the ability to observe dynamic changes among variables over time. Second, the study only looked at one state-owned construction company, which restricts how broadly the findings can be applied to other organizational settings. Third, perception-based questionnaires, which are prone to respondent subjectivity and might not accurately represent actual field conditions, were used to collect the data.

The current results provide several directions for further research. Future research should consider a longitudinal approach to monitor the long-term effects of TQM components throughout a project. External validity would be improved by reproducing the model in various organizational contexts, such as private companies, international projects, or other industry sectors. Future research may also test mediating or moderating mechanisms (e.g., quality culture, project complexity, contract type) to explain why certain TQM dimensions fail to show direct effects on performance in SOE environments. Lastly, using mixed-methods designs, which combine quantitative surveys, in-depth interviews, and field observations, could yield deeper, context-specific insights into the application of quality management.

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