International Journal of Education, Vocational and Social Science
https://e-journal.citakonsultindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

The Role Of Competency, Training, And Change Management Through The Implementation Of The Iso/Iec 17025:2017 Quality Management System On Employee Performance At The Fluid Mechanics Laboratory – Brin

Natanael Murjono
Pamulang University, Indonesia
Hamsinah B
Pamulang University, Indonesia
Hadi Supratikta
Pamulang University, Indonesia

Corresponding Author: natanael.prtp@gmail.com

Abstract

This study examines how employee performance is affected by competency, training, and change management at the National Research and Innovation Agency's (BRIN) Fluid Mechanics Laboratory using the ISO/IEC 17025:2017 Quality Management System (QMS). Saturated sampling was used to apply a quantitative explanatory design to all 152 laboratory employees. Structural Equation Modeling-Partial Least Squares (SEM-PLS) using SmartPLS 4 was used to evaluate the data, which was gathered using a structured five-point Likert questionnaire. The results demonstrate that QMS implementation is favorably and significantly impacted by competence (β = 0.384; p < 0.001), change management (β = 0.200; p = 0.034), and training (β = 0.297; p = 0.003). Employee performance is also significantly improved by competence (β = 0.124; p = 0.004), change management (β = 0.144; p = 0.021), and training (β = 0.144; p = 0.031). Employee performance is most directly impacted by QMS deployment (β = 0.641; p < 0.001). 43.6% of the variation in QMS implementation and 77.6% of the variation in employee performance can be explained by the structural model. The implementation of ISO/IEC 17025:2017 QMS serves as a partial mediator in all three relationships since indirect effects are significant for competence (β = 0.246; p < 0.001), change management (β = 0.128; p = 0.039), and training (β = 0.191; p = 0.003). The findings show that in an approved research laboratory, technical proficiency, ongoing training, and well-managed organizational change support the deployment of quality systems and worker

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

performance.

Keywords: Competence; Training; Change management; ISO/IEC 17025:2017; Quality management system; Employee performance; SEM-PLS.

INTRODUCTION

The dependability of findings in testing and calibration laboratories is dependent on a number of factors, including established controls, disciplined methods, technical proficiency, and ongoing progress. As a result, ISO/IEC 17025:2017 centers quality assurance around proficiency and reliable laboratory operations. An efficient quality management system may improve technical and scientific competency, knowledge management, organizational clarity, and trust in laboratory outputs, according to recent studies on research-testing laboratories (Martínez-Perales et al., 2021). More recent assessments also show that laboratories may face substantial compliance gaps when structural, resource, and process requirements are not systematically managed (Bennari et al., 2025).

Evidence published during 2023-2025 further confirms that ISO/IEC 17025:2017 implementation is not merely a documentation exercise. Delgado and Casco (2023) emphasize the importance of integrating quality requirements into testing-laboratory operations, while Manikandan et al. (2024) identify practical benefits of adopting the standard in calibration and testing laboratories. Indonesian studies similarly report that ISO/IEC 17025:2017 implementation can improve testing quality, human-resource competence, credibility, and stakeholder trust (Almaniar et al., 2025; Faradika and Paulina, 2025). These studies support the view that QMS implementation can become an organizational mechanism through which individual capabilities are translated into reliable performance.

The BRIN Fluid Mechanics Laboratory has adopted ISO/IEC 17025:2017 as the foundation for overseeing its testing operations. The laboratory must maintain consistency in document control, staff competency, internal audit, standard operating procedure compliance, and continuous improvement after organizational integration and modifications to work structures and processes. An average QMS implementation score of 3.43 is reported in the original article. Internal audit has the lowest indicator mean (3.09), while continuous improvement has the highest (3.68). Work quantity is the highest-rated factor (3.87), while work quality is the lowest (3.04). Employer performance also averages 3.43. These findings show that while the laboratory is operating rather well, there are still certain performance and quality aspects that need

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

improvement.

Competence is especially critical in a laboratory because personnel must be able to understand methods, operate equipment, interpret results, follow procedures, and make technically defensible decisions. Empirical evidence consistently links competence with employee performance. Afandi and Veritia (2024), Rahmat and Ubaidillah (2024), and Syauqi et al. (2024) report significant performance effects of employee competence in different organizational contexts. In a setting closer to the present study, Novianingsih and Sarah (2025) find that competence and training significantly influence employees performing chemical-laboratory testing functions. This makes competence a theoretically and practically relevant antecedent of both QMS implementation and performance.

Training complements competence by providing structured opportunities to update technical knowledge, procedural understanding, and work practices. Studies in Indonesia show that training and competence frequently reinforce employee performance directly or through other organizational mechanisms (Anggriawan et al., 2023; Nurunnisa and Rani, 2024; Setiawanto et al., 2025; Sibarani & Dwiarti, 2024). International and public-sector oriented evidence also indicates that training can improve performance through better learning, job fit, engagement, and employee capability (Balele et al., 2022; Farida and Hendarsjah, 2022; Putri and Karya, 2024). For an ISO/IEC 17025 laboratory, continuous training is therefore expected to support both compliance and work outcomes.

A first research gap concerns the integration of human-resource variables with laboratory quality-system implementation. Much of the employee-performance literature evaluates competence and training directly, whereas the ISO/IEC 17025 literature generally concentrates on accreditation, conformity, technical requirements, or laboratory governance. Few studies combine competence, training, and change management in one structural model and position ISO/IEC 17025:2017 implementation as an intervening mechanism. The present study addresses this gap by linking individual capability and organizational change to an operational quality system and then to employee performance.

A second gap concerns organizational change. Research shows that change management can significantly influence performance in public institutions and other organizations (Indriastuti and Fachrunnisa, 2021; Megawe et al., 2020; Prabhawanti and Prasojo, 2021). Kaphale and Namalima (2024) likewise highlight the performance relevance of change management in a public-organization context, while Lailla and Mardi (2022) synthesize evidence connecting organizational change with employee performance. At the Fluid Mechanics Laboratory, organizational

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

integration and procedural adjustment make this variable particularly relevant because ISO/IEC 17025 implementation requires personnel acceptance, communication, coordination, and adherence to changed routines.

A third gap concerns mediation. Training and development have been shown to build employee competencies As'ad and Tiarapuspa (2023), and contemporary research confirms that training and competence can affect performance through mediating mechanisms such as job satisfaction or organizational commitment (Putri and Karya, 2024; Setiawanto et al., 2025). However, the mediating role of ISO/IEC 17025:2017 QMS implementation is rarely tested. This study therefore evaluates whether competence, training, and change management influence performance not only directly but also indirectly through the quality system that governs laboratory work.

COMPETENCE AND EMPLOYEE PERFORMANCE

The knowledge, skills, talents, and work-related qualities that allow an employee to perform duties in accordance with established standards are referred to as competence. Because improper technique execution, equipment operation, or result interpretation can directly impact the validity of testing, competency in laboratory work involves a technical component. Competence and performance are positively correlated in both public and commercial enterprises, according to recent empirical research (Afandi & Veritia, 2024; Prabhawanti & Prasojo, 2021; Rahmat & Ubaidillah, 2024).

The same relationship appears in training-intensive contexts. Novianingsih and Sarah (2025) find that competence and training significantly explain performance among personnel in a chemical-testing function, while Nurunnisa and Rani (2024) report similar effects in a government administrative setting. Syauqi et al. (2024) further show that competence is a substantive performance determinant when considered jointly with employee discipline. These findings provide support for testing competence as a direct predictor of performance and as an antecedent of QMS implementation.

TRAINING, CAPABILITY DEVELOPMENT, AND PERFORMANCE

Training is a planned learning process used to strengthen the knowledge and skills required for current or future work. In a quality-controlled laboratory, training can include technical methods, equipment use, measurement practices, document control, internal audit, risk-based thinking, and corrective-action procedures. Anggriawan et al. (2023) and Sibarani and Dwiarti

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

(2024) show that training contributes to employee performance when combined with competence and related human-resource factors. Balele et al. (2022) also report a significant positive training-performance relationship.

Training may also operate through intermediate mechanisms rather than only through a direct path. Farida and Hendarsjah (2022) show that the effect of training on public-employee performance can be partially transmitted through job fit and work engagement. Putri and Karya (2024) report that competence and training enhance performance with job satisfaction as a mediating variable, and Setiawanto et al. (2025) examine employee commitment as a mediator. These results support the logic that ISO/IEC 17025:2017 implementation can serve as an organizational mechanism through which training is converted into performance improvements.

CHANGE MANAGEMENT AND PERFORMANCE

Change management refers to structured efforts to prepare people and systems for transitions in organizational structures, processes, technology, responsibilities, or culture. In public-sector settings, Prabhawanti and Prasojo (2021) find that change management and competence significantly affect civil-servant performance. Indriastuti & Fachrunnisa (2021) similarly show that readiness for organizational change is associated with individual performance, emphasizing the importance of adaptability and internalization of organizational values.

The performance consequences of change management are also visible in broader organizational studies. Megawe et al. (2020) report a significant effect of change management on employee performance, Astuti et al. (2025) find a positive effect of change management on subdistrict-employee performance, and Kaphale and Namalima (2024) demonstrate its importance in a public organization, Lailla and Mardi (2022) likewise synthesize evidence that organizational change influences employee performance. Accordingly, change management is expected to support QMS implementation by reducing resistance and improving acceptance of standardized laboratory processes.

ISO/IEC 17025:2017 Quality Management System

General standards for the proficiency, objectivity, and uniformity of testing and calibration laboratories are established by ISO/IEC 17025:2017. Therefore, a research laboratory has to incorporate staff competency, facility and equipment controls, technique validation, documentation, reporting, internal audit, management review, corrective measures, and continuous improvement. Martínez-Perales et al. (2021) that research-testing laboratories benefit

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

from quality systems but also face unique challenges because research activities are dynamic and less routine than industrial testing.

Recent studies reinforce the operational value of ISO/IEC 17025:2017. Bennari et al. (2025) identify compliance gaps and corrective-action needs in a university research laboratory; Delgado and Casco (2023) disscuss quality implementation in testing laboratories; and Manikandan et al. (2024) identify benefits associated with adopting an ISO/IEC 17025:2017 laboratory-management system. Indonesian reviews also associate implementation with stronger quality, competence, trust, and laboratory competitiveness (Almaniar et al., 2025; Faradika & Paulina, 2025).

QMS IMPLEMENTATION AS A MEDIATING MECHANISM

The mediation logic of this study is based on the idea that human-resource inputs affect performance partly because they strengthen the system through which work is standardized, monitored, and improved. Competent personnel are better able to interpret requirements; trained employees are better able to execute procedures; and well-managed change improves acceptance of revised processes. When these inputs strengthen QMS implementation, the laboratory is more likely to produce consistent work outcomes. Thus, ISO/IEC 17025:2017 implementation is not treated merely as a compliance label, but as an operational capability.

This mechanism is consistent with contemporary evidence that employee-development variables often operate through organizational mediators. show that training and development strengthen employee competencies, Putri and Karya (2024) demonstrate mediated competence and training effects on performance, and Farida and Hendarsjah (2022) identify mediated training-performance relationships in government employees. The present study extends this logic by using QMS implementation, rather than job satisfaction or commitment, as the intervening variable.

The study therefore hypothesizes positive direct effects from competence, training, and change management to QMS implementation and employee performance; a positive direct effect from QMS implementation to employee performance; and significant indirect effects from the three antecedents to performance through QMS implementation. The simultaneous significance of direct and indirect paths is interpreted as partial mediation in accordance with the source article's SEM-PLS analysis.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

RESEARCH METHOD

RESEARCH DESIGN AND DATA

From February to July of 2026, this quantitative explanatory investigation was carried out at the Fluid Mechanics Laboratory-BRIN, B.J. Habibie Science and Technology Area, South Tangerang, Banten. A five-point Likert scale was used to gather primary data, which was backed up by pertinent literature and organizational quality documentation.

The model includes competence (X1), training (X2), and change management (X3), ISO/IEC 17025:2017 QMS implementation as mediator (Z), and employee performance (Y). SmartPLS 4 was used for descriptive analysis, measurement-model evaluation, R-square, path coefficients, and bootstrapping of direct and indirect effects.

$$Z = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon_1$$

$$Y = \beta_4 X_1 + \beta_5 X_2 + \beta_6 X_3 + \beta_7 Z + \varepsilon_2$$

POPULATION AND SAMPLING

The population comprises 152 personnel of the Fluid Mechanics Laboratory - BRIN. Saturated (census) sampling was applied, so all 152 personnel were included as respondents.

Table 1. Research Design and Sample

No.	Research item	Procedure / description	Value
1	Research design	Explanatory	-
2	Research site	Fluid Mechanics Lab	BRIN
3	Research period	Feb-Jul	2026
4	Population	All personnel	152
5	Sampling technique	Census	152
6	Primary instrument	Survey	Likert 1-5
7	Main analysis	PLS-SEM	SmartPLS 4
8	Significance rule	Test	t>1.96; p<.05

Source: Source journal article and research-data processing, 2026.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

VARIABLE MEASUREMENT

Table 2. Research Variables and Operational Dimensions

Variable	Code	Operational dimensions
Competence	X_1	Knowledge; technical skills; work ability; task mastery relevant to laboratory requirements.
Training	X_2	Training needs; learning content; instructor/process quality; application of training outcomes.
Change management	X_3	Readiness for change; communication; participation; adaptation to revised structures and procedures.
ISO/IEC 17025:2017 QMS implementation	Z	Document control; personnel competence; internal audit; SOP compliance; continuous improvement.
Employee performance	Y	Work quality; work quantity; timeliness; procedural compliance; work responsibility.

Source: Operational definitions adapted from the source journal article.

PLS-SEM EVALUATION AND HYPOTHESIS TESTING

Outer loadings, Cronbach's alpha, composite reliability, AVE, and the Fornell-Larcker criterion were used to assess the measurement model. Every maintained loading was more than 0.70; the AVE criterion for convergent validity was set at 0.50, and the reliability barrier was set at 0.70.

The structural model was assessed with R-square and bootstrapping. Effects were significant at $t > 1.96$ and $p < 0.05$. Seven direct paths and three indirect paths through QMS implementation were tested; significant direct and indirect paths were classified as partial mediation.

RESULT

DESCRIPTIVE PROFILE OF QMS IMPLEMENTATION AND PERFORMANCE

The descriptive results indicate that ISO/IEC 17025:2017 QMS implementation and employee performance are generally in the good category, each with an overall mean of 3.43. Within QMS implementation, continuous improvement has the highest mean (3.68), followed by document control (3.57). Internal audit has the lowest mean (3.09), while personnel competence

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

(3.37) and SOP compliance (3.20) are also areas requiring attention. For employee performance, work quantity (3.87) and timeliness (3.78) are the strongest dimensions; work quality (3.04), procedural compliance (3.22), and work responsibility (3.24) are comparatively weaker.

Table 3. Descriptive Indicators of QMS Implementation and Employee Performance

Construct	Indicator	Mean	Category	Key interpretation	Priority
QMS	Document control	3.57	Good	Strong	Maintain
QMS	Personnel competence	3.37	Fair	Needs support	Improve
QMS	Internal audit	3.09	Fair	Lowest QMS	High
QMS	SOP compliance	3.20	Fair	Improve consistency	Improve
QMS	Continual improvement	3.68	Good	Highest QMS	Maintain
Performance	Work quality	3.04	Fair	Lowest performance	High
Performance	Work quantity	3.87	Good	Highest performance	Maintain
Performance	Timeliness	3.78	Good	Strong timing	Maintain
Performance	Procedure compliance	3.22	Fair	Improve	Improve
Performance	Responsibility	3.24	Fair	Improve	Improve
Overall	QMS / performance	3.43 / 3.43	Good	Both good	Targeted

Source: Descriptive results reported in the source journal article, 2026.

The pattern suggests that the laboratory is capable of sustaining output quantity and timeliness, but internal quality assurance and the precision of work need further strengthening. This is consistent with the broader literature: QMS benefits are strongest when quality activities

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

are integrated into day-to-day laboratory operations and when staff have sufficient competence and ownership of the system (Martínez-Perales et al., 2021). The lower internal-audit score is therefore important because audit findings can be used as structured inputs for corrective action and continuous improvement.

Table 4. Measurement Model Reliability and Convergent Validity

Construct	Cronbach's alpha	Composite reliability	AVE	Inference
QMS implementation	0.894	0.919	0.653	Reliable and convergent
Employee performance	0.925	0.937	0.598	Reliable and convergent
Competence	0.923	0.935	0.589	Reliable and convergent
Change management	0.818	0.880	0.647	Reliable and convergent
Training	0.825	0.877	0.588	Reliable and convergent

Source: SmartPLS 4 output reported in the source journal article, 2026.

Measurement and Structural Model Evaluation

The convergent-validity and reliability requirements are met by all five constructions. Composite dependability varies from 0.877 to 0.937, AVE ranges from 0.588 to 0.653, while Cronbach's alpha goes from 0.818 to 0.925. As a result, each number is higher above the specified reliability and AVE standards of 0.70 and 0.50, respectively. According to the Fornell-Larcker criteria, the source paper also reports sufficient discriminant validity. These findings suggest that the constructs are trustworthy enough for structural-path interpretation

Table 5. Structural Model Explanatory Power

Endogenous construct	R-square	Explained variance	Interpretation
QMS	0.436	43.6%	Moderate
Performance	0.776	77.6%	Strong
Measurement model	All outer loadings > 0.70	Indicators retained	Valid

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Discriminant validity	Fornell-Larcker criterion	Criterion satisfied	Adequate

Source: SmartPLS 4 structural-model output reported in the source journal article, 2026.

DIRECT EFFECTS ON QMS IMPLEMENTATION

Competence has a positive and significant effect on QMS implementation (β = 0.384; t = 6.410; p < 0.001), making it the strongest of the three antecedents of the mediator. Training also has a positive significant effect (β = 0.297; t = 3.014; p = 0.003), followed by change management (β = 0.200; t = 2.115; p = 0.034). Together, the three exogenous variables explain 43.6% of the variance in QMS implementation (R^2 = 0.436), which the source article classifies as moderate explanatory power.

DIRECT EFFECTS ON EMPLOYEE PERFORMANCE

Competence (β = 0.124; t = 2.872; p = 0.004), change management (β = 0.144; t = 2.314; p = 0.021), and training (β = 0.144; t = 2.154; p = 0.031) each have positive significant direct effects on employee performance. QMS implementation produces a substantially stronger effect (β = 0.641; t = 14.315; p < 0.001). The model explains 77.6% of the variance in employee performance (R^2 = 0.776), indicating strong explanatory power for the outcome construct.

Table 6. Direct-Effect Hypothesis Testing

Relationship	B	t-statistic	p-value	Direction	Decision
Comp. → QMS	0.384	6.410	0.000	Positive	Significant
Change → QMS	0.200	2.115	0.034	Positive	Significant
Training → QMS	0.297	3.014	0.003	Positive	Significant
Comp. → Perf.	0.124	2.872	0.004	Positive	Significant
Change → Perf.	0.144	2.314	0.021	Positive	Significant
Training → Perf.	0.144	2.154	0.031	Positive	Significant
QMS → Perf.	0.641	14.315	0.000	Positive	Significant

Source: Bootstrapping results from SmartPLS 4 reported in the source journal article, 2026.

Indirect Effects through QMS Implementation

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

All three indirect effects are significant: competence β = 0.246 (t = 5.716; p < 0.001), change management β = 0.128 (t = 2.066; p = 0.039), and training β = 0.191 (t = 2.970; p = 0.003). Because their direct effects also remain significant, QMS implementation partially mediates all three relationships.

Table 7. Indirect Effects and Mediation Classification

Indirect relationship	β	t-statistic	p-value	Mediation
Competence → QMS → Performance	0.246	5.716	0.000	Partial mediation
Change → QMS → Performance	0.128	2.066	0.039	Partial mediation
Training → QMS → Performance	0.191	2.970	0.003	Partial mediation

Source: Bootstrapping indirect-effect results reported in the source journal article, 2026.

DISCUSSION

COMPETENCE AND QMS IMPLEMENTATION

The competence-QMS path is positive and significant and is the largest antecedent path to QMS implementation. This indicates that personnel knowledge, technical skills, and work capability materially support compliance with ISO/IEC 17025:2017. The result is consistent with studies emphasizing scientific and technical competence as a core success factor in research-testing quality systems (Bennari et al., 2025; Martínez-Perales et al., 2021). Indonesian evidence also shows that competence is important for laboratory-testing performance Novianingsih and Sarah (2025), supporting the conclusion that competence contributes to both quality-system operation and individual output.

The practical implication is that competency management should be linked directly to QMS requirements. Training needs, authorization, method competence, equipment capability, audit findings, and corrective actions should be integrated rather than managed as separate administrative records. The significance of competence is also consistent with broader employee-performance evidence (Afandi & Veritia, 2024; Rahmat & Ubaidillah, 2024; Syauqi et al., 2024).

TRAINING AND QMS IMPLEMENTATION

Training significantly improves QMS implementation. This result indicates that repeated

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

learning and capability development help personnel understand and consistently execute ISO/IEC 17025:2017 requirements. Training is particularly important when procedures, methods, equipment, documentation, or accreditation requirements change. The result is consistent with evidence that training and competence jointly improve employee outcomes (Anggriawan et al., 2023; Nurunnisa & Rani, 2024; Sibarani & Dwiarti, 2024).

The finding also supports research showing that training can strengthen performance through intervening organizational or psychological mechanisms. Farida and Hendarsjah (2022) identify mediation through job fit and engagement, Putri and Karya (2024) identify mediation through job satisfaction, and Setiawanto et al. (2025) examine mediation through employee commitment. In the present study, the mechanism is more operational: training improves the quality system, and the improved quality system contributes to stronger employee performance.

CHANGE MANAGEMENT AND QMS IMPLEMENTATION

Change management has a positive significant effect on QMS implementation. The result is relevant to BRIN because organizational integration, structural changes, and revised procedures require personnel to adapt without weakening conformity to laboratory standards. Prabhawanti and Prasojo (2021) demonstrate that change management affects public-sector employee performance, while Indriastuti and Fachrunnisa (2021) show that employee readiness is important for successful organizational change and performance.

The result is further supported by Megawe et al. (2020), Astuti et al. (2025), and Kaphale and Namalima (2024), all of whom find performance consequences of well-managed organizational change. Lailla & Mardi (2022) similarly conclude that organizational change and employee performance are connected. For ISO/IEC 17025:2017 implementation, this means changes should be communicated through clear responsibilities, revised documentation, competency support, and monitored implementation rather than being treated only as structural announcements.

Direct Determinants of Employee Performance

Competence has a significant positive direct effect on performance. Although the coefficient (β = 0.124) is smaller than the QMS-performance coefficient, it indicates that personnel capability remains important even after QMS implementation is included in the model. This finding is consistent with Afandi and Veritia (2024), Novianingsih dan Sarah (2025), and Rahmat and Ubaidillah (2024), which identify competence as a meaningful determinant of employee

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

performance.

Training and change management also have positive significant direct effects on employee performance, each with β = 0.144. The training result is consistent with Balele et al. (2022) and with the more recent evidence of Dianofan and Nelsi (2026) that training effectiveness and competence jointly improve performance. The change-management result is consistent with Prabhawanti and Prasojo (2021), Megawe et al. (2020), and Astuti et al. (2025). Together, these results show that human-resource capability and organizational adaptation retain independent performance effects beyond their contribution to QMS implementation.

QMS implementation has the strongest direct effect on performance (β = 0.641). This finding indicates that a functioning quality system translates competence and organizational resources into standardized execution, documented control, consistent procedures, and continuous improvement. Studies of ISO/IEC 17025:2017 implementation report similar benefits in terms of testing quality, competence, credibility, and system effectiveness (Almaniar et al., 2025; Delgado & Casco, 2023; Faradika & Paulina, 2025; Manikandan et al., 2024).

Mediating Role of ISO/IEC 17025:2017 QMS Implementation

The competence-performance indirect effect through QMS implementation is 0.246 and statistically significant. Because competence also remains directly significant, the mediation is partial. This result implies that competence improves performance through two channels: personnel use their capability directly in completing work, and their capability strengthens the QMS processes that structure and control laboratory work. The latter channel is substantively larger than the direct coefficient, emphasizing the importance of translating personal competence into institutional routines.

The same pattern occurs for change management and training. The indirect effect of change management is 0.128, while the indirect effect of training is 0.191, and both are significant. The partial-mediation result supports the broader principle that development interventions generate stronger performance outcomes when they are embedded in organizational systems. As'ad and Tiarapuspa (2023) show that training and development build employee competencies, while Putri and Karya (2024) and Farida and Hendarsjah (2022) demonstrate that intermediate mechanisms can transmit employee-development effects to performance.

The mediation result also has a quality-management interpretation. The literature on research-testing laboratories identifies documentation, staff qualification, management commitment, adaptability, knowledge management, and resistance to change as critical issues in

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

sustaining quality systems (Martínez-Perales et al., 2021). Bennari et al. (2025) similarly show that compliance gaps can occur across structural, resource, and process requirements. Consequently, investments in competence, training, and change management should be evaluated by whether they improve the actual functioning of the quality system, not only whether activities were completed.

From a managerial perspective, the results prioritize internal audit and work quality as practical improvement targets because they have the lowest descriptive scores in their respective constructs. Strengthening risk-based internal audit, closing corrective actions, documenting competency evidence, reviewing training effectiveness, and reinforcing SOP compliance can directly improve the QMS dimensions that the structural model identifies as the strongest driver of employee performance.

CONCLUSION

This study examines the role of competence, training, and change management in employee performance through ISO/IEC 17025:2017 QMS implementation at the Fluid Mechanics Laboratory - BRIN. The research uses a census of 152 personnel and SEM-PLS with SmartPLS 4. The measurement model satisfies the reliability and validity criteria reported in the source article, while the structural model explains 43.6% of QMS implementation and 77.6% of employee performance.

First, competence, training, and change management each have positive and significant effects on QMS implementation. Second, all three variables also have positive significant direct effects on employee performance. Third, QMS implementation has the strongest direct effect on employee performance with $\beta = 0.641$ and $p < 0.001$, demonstrating that the laboratory quality system is a central operational driver of performance.

Fourth, QMS implementation significantly mediates the competence-performance, change-management-performance, and training-performance relationships. The indirect coefficients are 0.246, 0.128, and 0.191 respectively. Because the corresponding direct effects remain significant, all three mediation relationships are classified as partial mediation.

Overall, the findings indicate that employee performance in an accredited research laboratory is strengthened when competence, training, and change management are embedded in an effectively implemented ISO/IEC 17025:2017 quality system. The practical priority is therefore not to manage human-resource development and quality assurance separately, but to integrate competency development, training evaluation, change communication, internal audit,

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

SOP compliance, corrective action, and continual improvement into one performance-oriented management system.

FUTURE DIRECTIONS

For BRIN laboratory management, competency matrices should be aligned with authorized test methods, equipment, and ISO/IEC 17025:2017 responsibilities. Training should be based on identified competency gaps and audit findings, followed by post-training evaluation. Change initiatives should include communication, participation, document revision, role clarification, and follow-up monitoring. Such an integrated approach is consistent with evidence that competence, training, and organizational change each contribute to performance (Anggriawan et al., 2023; Dianofan & Nelsi, 2026; Kaphale & Namalima, 2024).

For quality managers, the strong QMS-performance path indicates that audit and continual-improvement activities should be treated as performance-management tools rather than accreditation formalities. The literature suggests that laboratory quality systems create value when they simplify control, strengthen knowledge and competence, and integrate quality events into day-to-day technical work (Martínez-Perales et al., 2021). This is particularly relevant for a research laboratory, where flexibility must coexist with traceability and technically valid results.

Future research can extend the model to other BRIN laboratories or compare accredited and non-accredited laboratories. Additional variables such as leadership, quality culture, organizational commitment, digital laboratory systems, and psychological readiness for change could be incorporated. Longitudinal designs would also help determine whether competency and training interventions produce sustained improvements in audit performance, nonconformity closure, turnaround time, and technical-result reliability.

REFERENCES

Afandi, F. T., & Veritia, V. (2024). Pengaruh Kompetensi dan Disiplin Kerja terhadap Kinerja Karyawan pada PT Aditama Inovasi Asia di Jakarta Selatan. *Jurnal Ilmiah M-Progress*, *14*(1), 50–64. https://doi.org/10.35968/m-pu.v14i1.1186

Almaniar, S., Rahmadiah, T., Nurjannah, H., Rismarini, Junainah, & Rahayu, W. N. (2025). Implementasi Sistem Manajemen Mutu ISO/IEC 17025 pada Laboratorium Diagnosa Penyakit Ikan dengan Fokus Tantangan dan Strategi di Negara Berkembang. *Jurnal Pengelolaan Laboratorium Sains Dan Teknologi*, *4*(2), 41–55. https://doi.org/10.33369/pelastek.v4i2.41536

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Anggriawan, B. S., Rusdianti, E., & Santoso, D. (2023). Pengaruh Kompetensi, Pelatihan dan Kompensasi terhadap Kinerja Pegawai dengan Komitmen Afektif sebagai Variabel Intervening. *Jurnal Riset Ekonomi Dan Bisnis*, *16*(1). https://doi.org/10.26623/jreb.v16i1.6397

As'ad, T. A., & Tiarapuspa. (2023). Apakah Training and Development, Employee Empowerment dan Performance Appraisal Memiliki Pengaruh terhadap Employee Competencies? *Bisman (Bisnis Dan Manajemen): The Journal of Business and Management*, *6*(1). https://doi.org/10.37112/bisman.v6i1.2366

Astuti, Y., Firdaus, V., & Andriani, D. (2025). Manajemen Perubahan, Keterlibatan Kerja, dan Motivasi Kerja terhadap Kinerja Pegawai Kecamatan. *Jurnal Maksipreneur: Manajemen, Koperasi, Dan Entrepreneurship*, *14*(2), 550–567. https://doi.org/10.30588/jmp.v14i2.1763

Balele, B., Hariyanti, H., & Kustiany, K. (2022). Pelatihan, Penilaian Kinerja, dan Kompetensi terhadap Kinerja Pegawai (Studi Kasus Perusahaan Umum Daerah). *Journal of Business Administration*, *2*(1). https://doi.org/10.31963/jba.v2i1.3450

Bennari, H., Omari, S. El, Habsaoui, A., Chaair, H., & Belouafa, S. (2025). Toward ISO/IEC 17025 compliance: challenges and strategies for a university research laboratory. *Accreditation and Quality Assurance*, *30*(1), 55–66. https://doi.org/10.1007/s00769-024-01628-4

Delgado, G., & Casco, J. S. (2023). Implementación de la calidad en los laboratorios de ensayos (ISO/IEC 17025:2017). *Revista Iberoamericana de Bioeconomía y Cambio Climático*, *9*(17), 2029–2047. https://doi.org/10.5377/ribcc.v9i17.15150

Dianofan, G., & Nelsi, M. (2026). Pengaruh Efektivitas Pelatihan dan Kompetensi Karyawan terhadap Kinerja Karyawan pada PT Bank BNI KC Melawai Raya Jakarta Selatan. *Jurnal Ilmiah Ekonomi Dan Manajemen*, *4*(2). https://doi.org/10.61722/jiem.v4i2.8893

Faradika, M., & Paulina, M. (2025). Implementasi Sistem Manajemen Mutu ISO/IEC 17025:2017 pada Laboratorium Pengujian Produk Pertanian dengan Studi Kasus di Indonesia. *Jurnal Pengelolaan Laboratorium Sains Dan Teknologi*, *2*(2). https://doi.org/10.33369/pelastek.v2i2.40988

Farida, N., & Hendarsjah, H. (2022). Peran Pelatihan dengan Mediasi Kesesuaian Pekerjaan, Pembelajaran, dan Keterlibatan Kerja terhadap Kinerja Pegawai Pemerintah Kota Madiun. *Jurnal Aplikasi Bisnis Dan Manajemen*, *8*(1), 302–313. https://doi.org/10.17358/jabm.8.1.302

Indriastuti, D., & Fachrunnisa, O. (2021). Achieving Organizational Change: Preparing Individuals

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

to Change and their Impact on Performance. *Public Organization Review*, *21*, 377–391. https://doi.org/10.1007/s11115-020-00494-1

Kaphale, J. C., & Namalima, B. (2024). Effects of Change Management on Employee Performance in Public Organisations in Malawi: The Case of Air Cargo Malawi Limited. *Journal of Public Administration and Development Alternatives*, *9*. https://doi.org/10.55190/JPADA.2024.311

Lailla, N., & Mardi. (2022). Organizational Change on Employee Performance. *Procedia of Social Sciences and Humanities*, *3*, 404–410. https://doi.org/10.21070/pssh.v3i.145

Manikandan, V., Ramakrishnan, P. R., & Shanmugam, H. (2024). The Advantages of Adopting the ISO/IEC 17025:2017 Lab Management System in Calibration and Testing Laboratories. *Indian Journal of Information Sources and Services*, *14*(4). https://doi.org/10.51983/ijiss-2024.14.4.20

Martínez-Perales, S., Ortiz-Marcos, I., & Ruiz, J. J. (2021). A proposal of model for a quality management system in research testing laboratories. *Accreditation and Quality Assurance*, *26*, 237–248. https://doi.org/10.1007/s00769-021-01479-3

Megawe, D. S., Mandey, S. L., & Trang, I. (2020). Dampak Penerapan Remunerasi, Manajemen Perubahan dan Budaya Organisasi terhadap Kinerja Pegawai. *JMBI UNSRAT (Jurnal Ilmiah Manajemen Bisnis Dan Inovasi Universitas Sam Ratulangi)*, *7*(1). https://doi.org/10.35794/jmbi.v7i1.30251

Novianingsih, A., & Sarah, S. (2025). Pengaruh Kompetensi dan Pelatihan Kerja terhadap Kinerja Pegawai Fungsi Pengujian Laboratorium Kimia di Balai Besar Pengawas Obat dan Makanan Bandung. *ECo-Fin*, *7*(1), 142–154. https://doi.org/10.32877/ef.v7i1.1967

Nurunnisa, S., & Rani, R. (2024). Pengaruh Pelatihan dan Kompetensi terhadap Kinerja Pegawai Bagian Umum Kepatuhan Internal Sekitjen KLHK Jakarta. *Jurnal Ekonomi Bisnis Antartika*, *2*(2), 99–108. https://doi.org/10.70052/jeba.v2i2.348

Prabhawanti, R. D. L., & Prasojo, E. (2021). Analisis Pengaruh Manajemen Perubahan dan Kompetensi terhadap Kinerja ASN pada Biro Hukum Kementerian Pertanian. *Transparansi: Jurnal Ilmiah Ilmu Administrasi*, *4*(1), 111–124. https://doi.org/10.31334/transparansi.v4i1.1615

Putri, L. A., & Karya, D. (2024). Exploring the Role of Competence and Training in Enhancing Employee Performance: The Mediating Effect of Job Satisfaction Among University Staff in Pekanbaru. *International Journal of Economics Development Research*, *5*(4), 3680–3690. https://doi.org/10.37385/ijedr.v5i4.6352

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Rahmat, R., & Ubaidillah, H. (2024). Enhancing Employee Performance through Job Involvement, Support, and Competency in Indonesia. *Indonesian Journal of Law and Economics Review*, *19*(2). https://doi.org/10.21070/ijler.v19i2.1110

Setiawanto, E. J., Indrawati, M., & Utari, W. (2025). Pengaruh Pelatihan dan Kompetensi Pegawai terhadap Kinerja dengan Mediasi Komitmen Pegawai pada Dinas Kependudukan dan Pencatatan Sipil Kabupaten Bojonegoro. *Jurnal Ilmiah Ekonomi Dan Manajemen*, *3*(9), 1–11. https://doi.org/10.61722/jiem.v3i8.6351

Sibarani, G. D., & Dwiarti, R. (2024). Pengaruh Pelatihan, Kompetensi, dan Pengembangan Karier terhadap Kinerja Karyawan PT Indah Kiat Pulp and Paper Karawang. *Jurnal Akuntansi, Manajemen, Dan Perencanaan Kebijakan*, *1*(4), 1–14. https://doi.org/10.47134/jampk.v1i4.195

Syauqi, A., Awan, E., Mubarok, I. A., & Zulkarnain, R. (2024). Unveiling the Dual Impact of Competence and Discipline on Performance in Indonesia. *Indonesian Journal of Law and Economics Review*, *19*(2). https://doi.org/10.21070/ijler.v19i2.1055

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License