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Analysis of Readiness for ISO 17025 Implementation in Laboratories in Indonesia (Case Study: iRATco Laboratory Services Bogor)

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Abstract: This study aims to assess the readiness of iRATco Veterinary Laboratory Services Bogor in implementing the ISO 17025 standard. Using a descriptive approach and the *Analytical Hierarchy Process* (AHP) method, the research reveals that the laboratory's readiness is at a fairly good level, viewed from three main dimensions: individual, group, and organizational structure. Commitment is identified as the most influential determinant of implementation readiness, followed by competence, supervision, evaluation, consistency, and communication. Overall, employees' perception of ISO 17025 implementation is positive; however, improvements are still needed, particularly in the consistency of procedure execution and the effectiveness of internal communication. The validity and reliability tests of the research instrument also confirmed that the measurement tool used was appropriate for assessing organizational readiness. Thus, iRATco has significant potential to implement ISO 17025 effectively, provided that managerial and technical aspects are strengthened comprehensively and sustainably. The success of ISO 17025 implementation in this laboratory largely depends on the synergy between leadership commitment, human resource readiness, and the support of a well-structured and well-documented quality management system.

Keywords: ISO 17025, Organizational Readiness, Commitment, Competence, Quality Management, Veterinary Laboratory.

INTRODUCTION

Economic activities in general can affect the performance of laboratories that conduct testing and calibration. The initial aspect that needs quality improvement in economic activities is standardization. Standardization is the process of creating and using standards that serve as benchmarks for values, quality, quantity, and others. Standardization results in improved product and service quality, which is one of the key factors influencing competitiveness in economic activities. It also strengthens the quality and reliability of test results by regulating procedures, techniques, and management required to achieve the desired level of accuracy.

In the context of the national economy, competition is necessary to improve quality in order to face already well-established competitors. Standardization, such as the International Organization for Standardization (ISO) 17025, helps improve the quality of products and services, strengthen corporate reputation, and minimize risks. At the national level, standardization aims to enhance company performance, apply general requirements, and ensure the quality of products or services produced.

Relevant national data for standardization in economic activities includes statistical data on demographics, social, socio-economic, agriculture, and others. Such statistical data plays an important role in the development of national standards, such as the Indonesian National Standard (SNI), which serves as infrastructure to protect the domestic market. In this regard, ISO 17025 is an internationally recognized accreditation standard that demonstrates a company's capability to meet global requirements established by ISO and accredited by the National Accreditation Committee (KAN). Standardization, such as ISO 17025, is one way to reduce the negative impact of economic activities on laboratory performance, particularly in veterinary laboratories. ISO 17025 is an international standard that sets general requirements for the competence of testing and calibration laboratories, covering technical competence, quality management systems, and handling of samples and test results.

ISO 17025 certification is a global recognition of a laboratory's ability to conduct accurate and reliable testing and calibration. This standard aims to assist laboratories in implementing quality systems and to demonstrate that they are technically competent and capable of producing valid and dependable results. The implementation of ISO 17025 transforms overall management systems, builds customer trust, enhances competence, reduces risks, provides international recognition, and ensures regulatory compliance. The standard reinforces the quality and reliability of test results by regulating procedures, techniques, and management necessary to achieve the desired level of accuracy.

The application of ISO 17025 can provide various benefits, such as improving the quality of test results, strengthening effective management systems, and expanding market access. Companies that implement ISO 17025 can obtain several advantages: (1) Quality of test results: Companies can produce more consistent and reliable results due to the effective and transparent management system provided by ISO 17025. (2) Employee competence: Companies have more competent employees who are capable of developing effective management systems to monitor testing processes with high accuracy. (3) Testing management system: Companies gain a more effective management system to monitor and control testing processes more efficiently. (4) Governance: Companies achieve more consistent and reliable governance through effective and transparent management systems established under ISO 17025.

Conversely, companies that have not implemented ISO 17025 may face challenges in developing effective management systems to oversee testing processes, control test data, and ensure accurate testing.

iRATco Veterinary Laboratory Services Bogor (iRATco Labs), the commercial name of *Commanditaire Vennootschap* (CV) Gemawang Putera, is one of the companies studied. iRATco Labs manages various aspects in its veterinary laboratory, including Clinical Pathology, Microbiology, Immunology, Anatomical Pathology, Molecular Biology, Animal Health Monitoring, Laboratory Certification, Research and Development, and more.

The implementation of ISO 17025 at iRATco aims to Improve the quality and credibility of test results, Enhance customer trust, Create opportunities for cooperation with other parties., Facilitate access to international markets.

The considerations for iRATco in adopting ISO 17025 include increasing competitiveness in the veterinary laboratory industry, meeting customer demands for reliable test results, strengthening its reputation as a trustworthy and professional laboratory, and supporting its vision and mission to become a leading veterinary laboratory in Indonesia.

Most registered laboratories (such as PT Syslab, the National Center for Veterinary Drug Quality Testing and Certification, Saraswanti Indo Genetech, PT Bogor Labs, the Research Institute for Freshwater Aquaculture and Fisheries Extension, the School of Veterinary Medicine and Biomedical Sciences at IPB University, and PT Vaksindo Satwa Nusantara) have implemented ISO 17025. These laboratories have obtained certification at various dates ranging from April 2019 to June 2023. The implementation of ISO 17025 demonstrates their commitment to adhering to quality guidelines and ensuring test result validity, which is particularly important for veterinary laboratories. Meanwhile, there are still two laboratories that have not adopted ISO 17025: iRATco Veterinary Laboratory Services Bogor and Lab V-Stem, with no certification dates available. This indicates that both have not yet met the ISO 17025 requirements or obtained certification at the time the data was collected.

In Bogor, the application of ISO 17025 in veterinary-related testing laboratories serves as an important indicator in assessing the quality and reliability of laboratory results. The implementation of this standard plays a crucial role in providing a strong framework for laboratories in West Java, especially regarding quality management and operational safety. However, it should be noted that iRATco has not yet adopted ISO 17025, implying that it does not meet the standard requirements or has not yet been certified.

ISO standards, particularly ISO 17025, are critical choices because they provide a strong foundation for laboratories to manage quality and testing reliability. Applying quality management and safety principles in accordance with ISO 17025 not only ensures test accuracy but also compliance with applicable regulations. This directly contributes to building trust among stakeholders served by the laboratory. Therefore, it is important for laboratories such as iRATco to consider ISO 17025 implementation in order to improve operational quality, gain client trust, and meet internationally recognized standards in veterinary laboratory testing (Tjandrawinata, 2016).

The implementation of ISO 17025 in veterinary laboratories provides numerous benefits that reinforce the importance of this standard. ISO 17025 is an international standard that governs laboratory competence, consistency, and accreditation. The benefits include:

1. Competence: Ensures laboratories possess sufficient technical capability for proper testing and calibration.
2. Consistency: Guarantees test and calibration results are consistent and reliable.
3. Accreditation: Enables laboratories to obtain accreditation as proof of meeting widely accepted international standards.
4. International cooperation: Facilitates collaboration with laboratories worldwide due to broad acceptance of the standard.
5. Quality of test results: Ensures high-quality, reliable test outcomes.

When iRATco Veterinary Laboratory Services Bogor has not yet implemented ISO 17025, several weaknesses arise, such as:

1. Lack of competence: Potentially insufficient technical capability for accurate testing and calibration.
2. Unreliable test results: Absence of strong management systems may result in inconsistent and unreliable outcomes.
3. No accreditation: Inability to obtain international accreditation.
4. Limited international cooperation: Restricted opportunities for global collaboration.
5. Lower test quality: Absence of ISO 17025-based management systems may reduce the reliability of test results.

METHOD

Framework

The framework for this study focuses on the implementation of the ISO 17025 standard at iRATco Veterinary Laboratory Services. The expected activities include developing a strategy for implementing an effective laboratory quality management system, thereby supporting the achievement of iRATco Laboratory Services Bogor goals of improving the credibility of test and calibration results and strengthening iRATco Laboratory Services Bogor competitiveness. It is hoped that after the implementation of ISO 17025, the quality system developed will foster the development of technical and managerial capacity at iRATco Veterinary Laboratory Services, particularly in ensuring the validity of results and increasing the trust of customers and other stakeholders. This framework is shown in Figure 1.

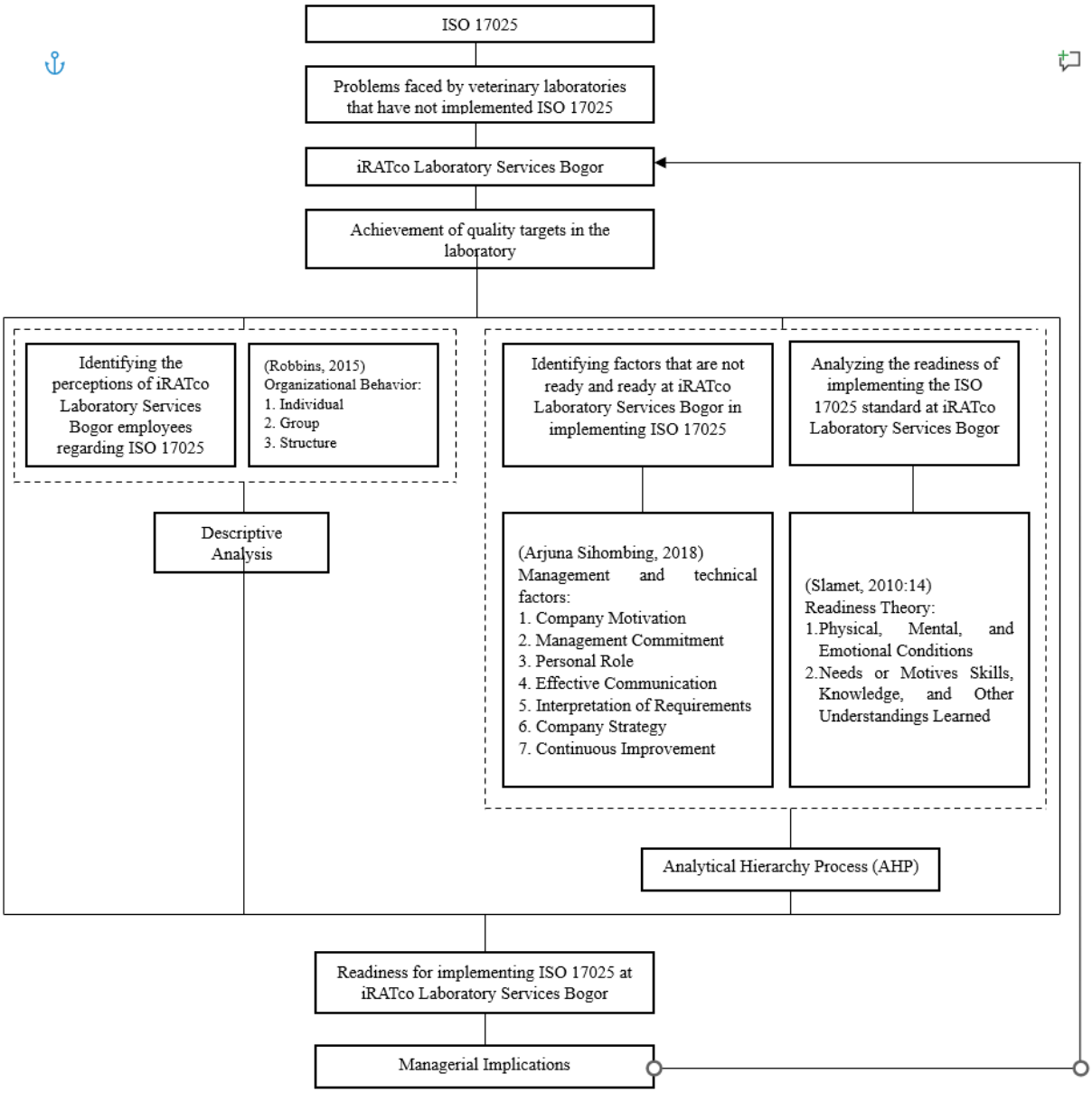

Figure 1. Framework

The implementation of the ISO 17025 standard at iRATco Veterinary Laboratory Services Bogor requires a thorough understanding of the laboratory's internal and external conditions that can influence the successful implementation of the quality management system. Therefore, this study began with the identification of internal factors such as personnel competence, facility completeness, and the effectiveness of the existing quality system, as well

as external factors such as regulatory requirements, customer needs, and developments in laboratory technology.

To obtain valid and representative data, Focus Group Discussions (FGDs) and questionnaires were distributed to parties directly involved in laboratory operations. The collected data were then analyzed using the Analytical Hierarchy Process (AHP) method, which allowed researchers to prioritize key elements in ISO 17025 implementation based on the perceptions and importance of the experts.

A qualitative descriptive approach was applied to complement the quantitative findings, deepening the meaning behind the quantitative findings, resulting in a holistic and contextual understanding of the dynamics within the laboratory. Thus, this analysis not only provides a numerical overview of the influencing factors but also presents a strategic interpretation that can be used as a basis for formulating policy recommendations for a more effective and sustainable implementation of ISO 17025 within iRATco Veterinary Laboratory Services.

Research Location and Time

This research will be conducted at iRATco Veterinary Laboratory Services Bogor, a veterinary laboratory located in the Dramaga Cantik Residence Housing Complex, Ruko Block, Dramaga, Bogor, West Java, Indonesia. The study will be conducted from November 2024 to December 2024.

Data Type and Source

This research is descriptive with a quantitative research approach. Quantitative data is data that can be measured using a specific measuring tool in the form of numbers. Qualitative data, on the other hand, is data that is not in the form of numbers, namely data in the form of words, sentences, diagrams, and images, and is sourced from primary and secondary data. The data collected are both primary and secondary data.

Primary data is data collected directly from the field from filling out questionnaires given to respondents, namely all employees at iRATco Veterinary Laboratory Services Bogor, also conducted in-depth interviews (informants) to enrich the discussion. While secondary data is data collected from indirect sources or second sources. Generally obtained through agencies/services/institutions engaged in the process of data collection, both government and private agencies, in this study used various literature such as books, journals, theses, the internet, data from the Ministry of Education, Culture, Research, and Technology as well as other library materials related to this research.

Data Collection Methods

Data collection techniques in this study included questionnaires, focus group discussions (FGDs), and in-depth interviews. Printed questionnaires were distributed directly to all iRATco Veterinary Laboratory Services employees, with a total of 30 respondents participating in the survey. The census method was chosen to ensure that each employee had the opportunity to provide their opinions. The FGDs were conducted to gather qualitative information from the staff involved. The number of FGD participants was set at four: the Director, Consultant, Human Resource Development (HRD), and Human Resources (HR) staff, selected to represent diverse perspectives within the organization. The discussion aimed to understand their perspectives and experiences regarding ISO 17025 implementation readiness. In-depth interviews were then conducted using semi-structured methods, meaning the interviewer prepared their own questions but did not rule out the possibility of additional questions.

In this study, questionnaires were chosen as the primary data collection method due to their ability to reach a larger population and provide quantitative data that could be analyzed statistically. Using questionnaires allows researchers to identify patterns and trends in the

responses and systematically measure relevant variables. Following the initial questionnaire analysis, focus group discussions (FGDs) were conducted to delve deeper into the emerging findings. In these sessions, a select group of relevant participants were invited to discuss the questionnaire results and identified key issues. The FGDs allowed researchers to understand the context behind the figures and data collected and to gather perspectives that may not have been captured in the questionnaire. These discussions served to reinforce and clarify the existing quantitative results. As a final step, in-depth interviews were conducted with several key respondents who had provided compelling answers to the questionnaire or who actively participated in the FGDs. These interviews were semi-structured, allowing researchers to explore further and obtain rich qualitative data. Through these interviews, researchers were able to clarify information, explore personal stories, and gain deeper insights into individual experiences and perspectives regarding the readiness of ISO 17025 implementation at iRATco Veterinary Laboratory Services.

RESULTS AND DISCUSSION

Determining ISO 17025 Implementation Strategy Priorities with AHP

Rationale for Choosing AHP

Implementing ISO 17025 requires not only a technical approach but also consideration of various strategic aspects of the organization, such as human resources, infrastructure, and management commitment. Due to the large number of interrelated variables that are difficult to measure directly, AHP is a relevant method because it can:

1. Simplify complex decisions into a hierarchy.
2. Incorporate subjective expert judgments into a pairwise comparison matrix.
3. Generate priority weights that can be used as a basis for strategic decision-making.

AHP Hierarchical Structure

The hierarchy in this study is divided into five main levels:

1. Level 1 (Primary Objective): Determine the best strategy for ISO 17025 implementation at iRATco.
2. Level 2 (Readiness Factors): These factors consist of six key elements considered to influence the success of ISO 17025 implementation:
   a. EF1: Organizational Structure
   b. EF2: Human Resources (HR)
   c. EF3: Quality Documentation
   d. EF4: Methodology and Validation
   e. EF5: Management Commitment
   f. EF6: Infrastructure and Equipment
3. Level 3 (Additional subfactors/criteria, if necessary): Not used explicitly in this study due to the focus on primary strategy development.
4. Level 4 (Strategic Alternatives): The strategic alternatives evaluated in the AHP model include:
   a. A1 – Immediate implementation: The organization immediately implements ISO 17025 fully with existing resources and policies.
   b. A2 – Phased implementation: Implementation is carried out in stages according to the unit's readiness stage.
   c. A3 – Strengthening HR and infrastructure first: Initial focus on internal improvements before full implementation.

Pairwise Comparison Process and Consistency

The AHP process was conducted by developing a pairwise comparison questionnaire completed by four expert respondents from iRATco: a quality manager, a laboratory head, an external consultant, and a senior analyst. Each respondent rated the importance of one factor relative to another on a scale of 1–9.

The data from the respondents was processed using a geometric mean approach to obtain a representative aggregate of ratings. Then, matrix normalization and eigenvector calculations were performed to determine the relative weights of each factor. The calculation results show the following priority weights:

Table 1. Priority Weight Calculation Results

Readiness Factor	Weight
EF2 – Human Resources	0.276
EF5 – Management Commitment	0.228
EF1 – Organizational structure	0.163
EF6 – Infrastructure & Equipment	0.125
EF3 – Quality Documentation	0.098
EF4 – Methodology & Validation	0.110

The Consistency Ratio (CR) value from the pairwise comparisons was <0.1, indicating that the experts' decision-making was within an acceptable level of consistency.

Analysis of Strategy Priority Results

Based on the weighting of these factors, each alternative strategy was evaluated against its ability to address the needs of each factor. The final results show the following order of strategy priorities:

Table 2. Final results showing the order of strategy priorities

Alternative Strategy	Priority Weight
A1 – Direct application	0.487
A3 – Strengthening Human Resources & Infrastructure	0.330
A2 – Phased implementation	0.183

Interpretation of the results above indicates that the immediate implementation strategy received the highest weighting. This indicates that the organization is perceived as having the fundamental readiness and sufficient internal support to begin the accreditation process immediately, without having to wait for the gradual process. However, the human resource and infrastructure strengthening strategy still received significant weighting, indicating that the success of the immediate implementation strategy must be accompanied by intensive training programs and increased technical support.

Meanwhile, the gradual implementation strategy received the lowest weighting, indicating that the gradual approach is less suitable for iRATco's context, likely due to the risk of inconsistency between units or slow integration of the overall quality system.

AHP Hierarchy Structure

Table 3. AHP Hierarchy Structure

Level	Hierarchical Elements	Information
Level 1	Purpose	Determining the best strategy for implementing ISO 17025 at iRATco
Level 2	Readiness Factor	- Human Resources (HR) - Organizational Structure - Management Commitment - Infrastructure

		- Testing Methods - Calibration Process
Level 3	Subcriteria (if any)	Not used explicitly in this study
Level 4	Sub-criteria (if any)	Not explained in detail, because it is directed directly to alternative strategies.
Level 5	Alternative Strategy	- A1: Immediate implementation - A2: Gradual implementation - A3: Strengthening human resources and infrastructure first

In this study, the AHP hierarchical structure was used to organize strategic issues into a systematic decision hierarchy. The primary objective was to select the best strategy for implementing ISO 17025 at iRATco Veterinary Laboratory Services. This hierarchy is divided into five main levels:

1. Level 1 – Objective
   The highest level in the AHP hierarchy is the primary objective, which is to determine the best strategy for implementing ISO 17025 at iRATco's laboratory. This objective serves as the focus of the entire decision-making process in this study.
2. Level 2 – Readiness Factors
   This level contains key factors influencing the success of ISO 17025 implementation. These factors were determined based on laboratory quality literature and the organization's actual conditions, namely:
   a. Human Resources (HR): staff competence, training, and awareness of quality.
   b. Organizational Structure: clarity of roles and responsibilities within the quality system.
   c. Management Commitment: the extent to which leaders are involved and support implementation.
   d. Infrastructure: the completeness and readiness of facilities, equipment, and supporting infrastructure.
   e. Testing Method: the existence of valid procedures and technical standards.
   f. Calibration Process: ensuring the traceability of measuring and testing instruments.
   g. These factors serve as the basis for a pairwise comparison process to determine the weight of each factor's importance.
3. Level 3 – Sub-Criteria (if any)
   This level is generally used to further decompose the factors at level 2 into subcomponents. However, in this study, it was not used explicitly, as the focus was directed directly to assessing strategies based on the primary factors.
4. Level 4 – Sub-Sub-Criteria (if any)
   This level is also optional and provides more detail than the previous levels. In this study, the sub-sub-criteria are not described in detail, considering that the goal is to determine strategies, not develop micro-indicators.
5. Level 5 – Alternative Strategies
   The final level displays alternative solutions or strategies that will be selected based on the overall weighting of the entire hierarchy. The three alternative strategies developed are:
   a. A1: Direct Implementation – Immediately adopt ISO 17025 under current conditions.
   b. A2: Phased implementation – Implement ISO in stages based on unit readiness.
   c. A3: Strengthen human resources and infrastructure first – Conduct internal improvements before full implementation.

This alternative is assessed against readiness factors (level 2) to determine the best implementation priority.

Pairwise Comparison Results

In the decision-making process using the Analytical Hierarchy Process (AHP) method, pairwise comparisons are made between elements at one level to determine the relative importance of each element to the higher-level objective. In this study, four expert respondents from iRATco, consisting of a quality manager, a laboratory head, a senior analyst, and an external consultant, were asked to complete a questionnaire comparing readiness factors for ISO 17025 implementation.

Each respondent compared six key readiness factors in pairs using an intensity scale of 1–9 developed by Saaty (1980). To combine all respondents' assessments into a single aggregate matrix, the geometric mean was used, a standard method in AHP for proportionally processing multi-respondent data.

Geometric Mean Results and Factor Weights

From these combined results, a pairwise comparison matrix was obtained, which was then normalized to produce the relative weights or priorities for each readiness factor. The results are as follows:

Table 4. Geometric Mean Results and Factor Weights

Readiness Factor	Priority Weight
Human Resources (HR)	0.276
Management Commitment	0.228
Quality Management System	0.179
Researchers & Infrastructure	0.140
Testing & Calibration Process	0.110
Facilities & Infrastructure	0.067

The table above explains the following:

1. The Human Resources (0.276) factor has the highest weighting. This indicates that the success of ISO 17025 implementation is primarily determined by the competence, readiness, and awareness of personnel within the laboratory environment. This aligns with the ISO 17025 principle, which places competent personnel as the primary pillar of test result validity. This means that a laboratory can have a good quality document, but without competent and trained human resources, implementation will be difficult to achieve effectively.
2. Management Commitment (0.228) is the second most important factor. Managerial commitment in the form of budget support, quality policies, and active involvement in internal audits and management reviews is considered crucial to the direction of implementation. A lack of leadership involvement can cause quality initiatives to lose legitimacy and drive in the field.
3. Management System Quality (0.179) is ranked third. Although important, the quality management system is considered a consequence of the two previous factors—human resources and management. This means that a good quality document will only be effective if there are capable human resources and management that consistently supports its implementation.
4. Facilities and Infrastructure (0.140) has a relatively low weight. This reflects that although infrastructure is technically important, in the context of iRATco, the condition of the infrastructure is considered adequate and not a major obstacle at this time. This could also indicate that the organization is focusing more on non-physical improvements (people and policy).
5. Testing and Calibration Processes (0.110) is in fifth place. This may indicate that some methods are already in place and implemented, but are not yet fully supported by accredited

instrument validation or calibration documentation. The low weight of this factor could also indicate that technical processes are routinely carried out but not yet integrated into a documented quality system.

6. Facilities and Infrastructure (0.067) is the factor with the lowest weight. This means that the availability of physical facilities is not a major obstacle to readiness for ISO 17025 implementation, or it could be because facilities are available but have not yet been systematically managed and integrated into the laboratory's quality system.

This weighting priority illustrates that ISO 17025 implementation requires more investment in people and managerial aspects, rather than technical aspects such as facilities or equipment. Therefore, the strategy chosen by the organization should focus on human resource training, internalizing a quality culture, and strengthening managerial leadership. These results also form the basis for selecting the "Direct Implementation" strategy as the top priority in the accreditation process.

Consistency and Validity of AHP Results

In the Analytical Hierarchy Process (AHP) method, consistency of judgment is a crucial element that determines the reliability of the final results. AHP allows for subjective judgments between elements in the form of pairwise comparisons. However, because it involves human judgment, there is a risk of inconsistency in the matrix. Therefore, logical consistency testing is necessary to ensure that the weighting results are rational and reliable.

Understanding Consistency

Consistency in AHP means that if element A is more important than B, and B is more important than C, then A should be more important than C. If these judgments are inconsistent, the weighting can produce biased or logically invalid priorities.

To measure this level of consistency, two main indicators are used:

1. Consistency Index (CI): Measures the deviation from perfect consistency in pairwise judgments.
2. Consistency Ratio (CR):
3. Compares the actual CI with the Random Index (RI), which is the average index of random inconsistency across a number of matrices of the same size.

As a general guideline, a CR $\leq$ 0.1 (10%) indicates an acceptable level of consistency. If the CR > 0.1, revisions to the comparison matrix are required.

Consistency Calculation Results

In this study, the pairwise comparison process was conducted by four expert respondents. After combining the results with the geometric mean, a combined matrix was obtained, which was used to calculate the eigenvalues and CI.

The calculation results show:

1. Consistency Index (CI): < 0.1
2. Consistency Ratio (CR): < 0.1

A low CR value indicates that respondents formed their assessments logically and rationally. Therefore, the weighted results obtained from the AHP process are considered structurally valid and can be used as a basis for strategic decision-making.

Analysis of AHP Validity Implications

High consistency has important implications in the context of managerial decision-making, including:

1. Decisions based on AHP results are reliable and free from logical bias.
2. The strategic priority weights can be used as a basis for resource allocation and ISO 17025 implementation planning without the need for structural revisions.
3. This provides management with confidence that this decision model is evidence-based, despite the subjective aspects involved.

Furthermore, the validity of the AHP also strengthens the recommendation that the direct implementation strategy (A1) is academically and operationally sound, as the results are not mere opinions but are based on a structured and consistent methodology.

ISO 17025 Implementation Strategy Priorities

Based on data processing using the Analytical Hierarchy Process (AHP) method through Expert Choice software, the priority weights for three alternative ISO 17025 implementation strategies at iRATco Veterinary Laboratory Services are as follows:

Table 5. Shows the results of data processing using the AHP method

Strategy	Priority Weight
A1 – Direct application	0.487
A3 – Strengthening human resources and infrastructure	0.330
A2 – Phased implementation	0.183

From the results above, strategy A1 (Immediate implementation) received the highest weighting of 0.487, indicating that this approach is considered most appropriate for iRATco's current internal conditions. This strategy indicates that the organization has:

1. An adequate level of internal readiness, particularly in basic aspects such as organizational structure, management support, and some laboratory infrastructure.
2. High management commitment, as reflected in the weighting of the "management commitment" factor, which is a dominant element in the AHP hierarchy.
3. A willingness to undergo comprehensive transformation, indicating that quality system implementation should not be delayed through a phased approach.

However, immediate implementation is not without risk. This strategy requires rapid and comprehensive execution, which can put pressure on operational capacity if not balanced with internal strengthening. Therefore, the AHP results also show that strategy A3 (Strengthening Human Resources and Infrastructure First) has a relatively high weighting (0.330), indicating that internal strengthening remains a crucial prerequisite. This reflects iRATco's need to:

1. Provide systematic training for laboratory staff on ISO 17025 principles and procedures.
2. Ensure that laboratory infrastructure (including measuring instruments and calibration documentation) meets accreditation requirements.
3. Align understanding across units regarding quality standards and reporting of test results.

Meanwhile, strategy A2 (Phased Implementation) received the lowest priority (0.183). This indicates that respondents believe a phased approach could create coordination challenges, inconsistencies between units, and potential delays in achieving accreditation targets. In the context of an organization like iRATco, which is relatively lean and integrated, a phased implementation may slow the pace of change and complicate the cross-divisional standardization process.

Therefore, the immediate implementation strategy is recommended as the primary alternative, with the caveat that implementation must be planned and structured, and supported

by a program to strengthen human resources and quality documentation. This strategy is expected to accelerate the process towards ISO 17025 accreditation, strengthen iRATco's competitive position as an internationally recognized veterinary laboratory, and build a sustainable quality system.

Visual AHP Results

To provide a comprehensive overview of the decision-making structure in this study, the following is a visualization of the AHP hierarchy, showing the interrelationships between factors, actors, objectives, and alternative strategies in determining readiness for ISO 17025 implementation at iRATco Veterinary Laboratory Services.

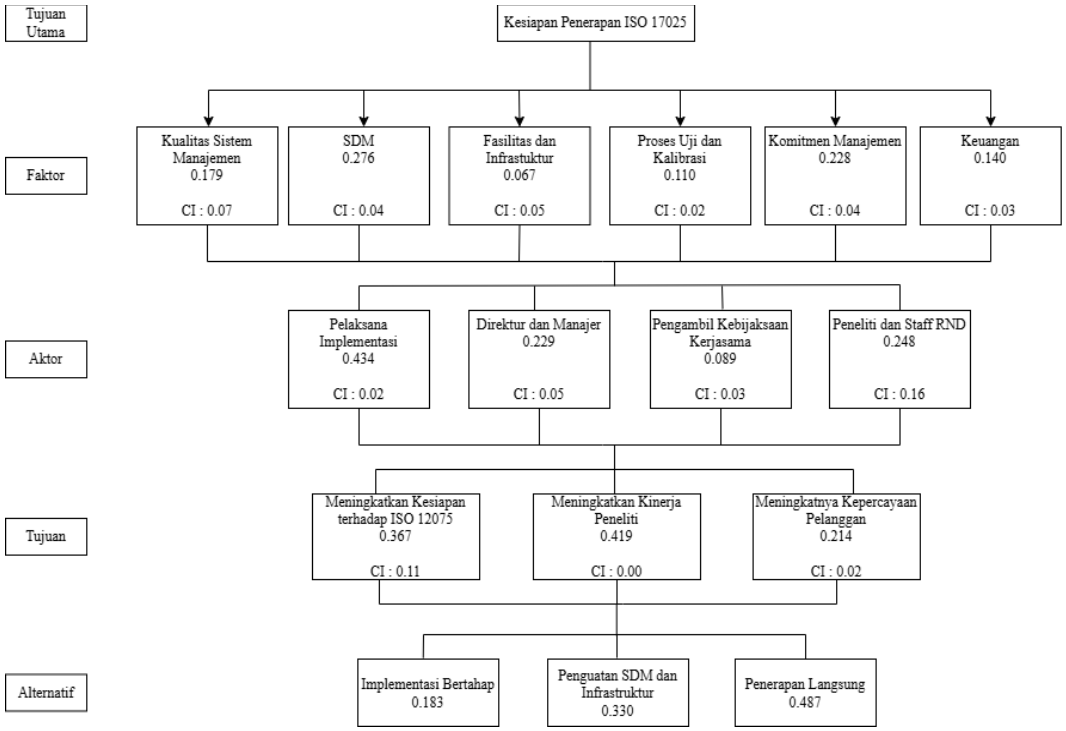

Figure 2. AHP Hierarchy Diagram of ISO 17025 Implementation Readiness

Figure 2 displays the AHP hierarchical structure from primary objective to alternative strategies. At (1) the first level, the primary objective of the study is to assess readiness for ISO 17025 implementation. (2) The second level consists of six main factors, with the highest weighting for Human Resources (HR) at 0.276, followed by Management Commitment (0.228) and Management System Quality (0.179). This means that organizational readiness is strongly influenced by personnel competence and leadership support. (3) The third level identifies key actors within the organization. Implementation officers have the highest weighting (0.434), confirming that technical operators play a dominant role in the success of the quality system. This highlights the importance of technical training and field understanding. (4) The fourth level displays intermediate objectives such as improving researcher performance (weighting 0.419), indicating that accreditation will directly impact the quality of laboratory research results. (5) The fifth level shows the weightings of alternative strategies:

1. Immediate implementation (0.487) is the primary choice.
2. Strengthening human resources and infrastructure (0.330) as a supporting strategy.
3. Gradual implementation (0.183) as the lowest priority option.

All levels showed Consistency Index (CI) values below 0.1, indicating that the assessment structure is consistent and suitable for use as a basis for strategic decision-making.

Managerial Implications

The results of the AHP analysis in this study provide a basis for developing strategic and operational managerial implications, particularly in the context of ISO 17025 implementation readiness at iRATco Veterinary Laboratory Services. These implications serve as policy guidance for laboratory management in formulating effective and sustainable implementation steps.

Enhancing Structured Managerial Commitment

Management commitment is a highly weighted dimension in the AHP hierarchical structure. This indicates that the success of ISO 17025 implementation is largely determined by top management involvement, both in the form of policy support and resource allocation. Therefore, it is necessary to strengthen commitment through:

1. Establishing a strategic quality direction in the laboratory's annual work plan.
2. Direct involvement of leadership in quality forums, such as management reviews and quality evaluation meetings.
3. Establishing a quality steering committee chaired directly by top management to ensure integrated implementation across all divisions.

This involvement should not be merely symbolic but should be manifested in operational policies that support a culture of quality and accountability.

Strengthening Human Resource Competencies

Human resources (HR) are the factor with the highest priority weight in the AHP results. This indicates that HR is the primary driver in ensuring the effectiveness of ISO 17025 implementation. Therefore, iRATco needs to develop a systematic HR training and development program, which includes:

1. Laboratory technical training in accordance with ISO 17025 standards (e.g., method validation, uncertainty estimation, quality assurance of test results).
2. Training on quality documentation and document control.
3. Internal audit and quality awareness training.

This training should be conducted on a regular basis and documented in the training management system to support tracking of personnel competencies.

Accelerating the Preparation and Harmonization of Quality Documents

Quality system documentation is an absolute requirement for ISO 17025 accreditation. Based on initial observations, it was found that documents such as SOPs, work instructions, and quality manuals did not fully comply with the requirements of the latest version of ISO 17025:2017. Therefore, the following steps are required:

1. Establish a documentation team consisting of representatives from work units with quality management supervision.
2. Harmonize document formats and structures for consistency and ease of search.
3. Digitize documents to expedite distribution and revision, and facilitate document control.

This step will strengthen integration between units and streamline the external assessment process.

Implementing Internal Audits and Accreditation Assessment Simulations

Internal audits are an important mechanism in the quality system for evaluating the suitability and effectiveness of standards implementation. As a non-accredited laboratory, iRATco is advised to:

1. Develop a periodic internal audit schedule covering all laboratory functions.
2. Train internal auditor personnel according to ISO 19011 and ISO 17025 guidelines.
3. Conduct external assessment simulations that simulate visits by assessors from KAN to identify technical and managerial gaps before the official audit.

This step helps create an evaluative and proactive culture in the accreditation process.

Strengthening Measurement Infrastructure and Traceability

Although infrastructure and measuring instruments are considered relatively less important, their presence remains essential as a technical prerequisite for accreditation. Possible implications include:

1. Re-inventorying all laboratory equipment and developing an annual calibration schedule.
2. Appointing an external calibration laboratory accredited by the National Accreditation Agency (KAN) as a permanent partner.
3. Developing a preventive maintenance system for equipment based on logbooks and digital reporting.
4. Allocating a dedicated budget for equipment procurement or replacement of equipment that cannot be recalibrated.

By ensuring traceability of test results to national and international standards, laboratories will be better prepared technically to obtain formal recognition from accreditation bodies.

CONCLUSION

The research results indicate that iRATco Veterinary Laboratory Services Bogor's readiness to implement the ISO 17025 standard is quite good, viewed from three main dimensions: individual factors, group factors, and organizational structure. Using a descriptive approach and the Analytical Hierarchy Process (AHP) method, commitment was found to be the primary determinant influencing implementation readiness, followed by competence, supervision, evaluation, consistency, and communication. Overall, employee perceptions of the importance of ISO 17025 implementation are positive, but several aspects still require improvement, particularly in terms of consistent procedural implementation and the effectiveness of internal communication. Validity and reliability tests of the research instrument also indicate that the measurement tool used is appropriate for assessing organizational readiness.

Therefore, it can be concluded that iRATco has the potential to implement ISO 17025 effectively, provided that managerial and technical aspects are strengthened comprehensively and continuously. The success of ISO 17025 implementation in this laboratory depends heavily on the synergy between leadership commitment, human resource readiness, and the support of a well-structured and documented quality management system.

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