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Optimization of The Accreditation Processes of Testing Laboratories

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Abstract: This article examines the scientific, methodological, and practical aspects of optimizing the accreditation processes of testing laboratories. Based on the requirements of the international standards ISO/IEC 17025:2017 and ISO/IEC 17011:2017, the current state of the accreditation process is analyzed, and key systemic challenges are identified, including excessive documentation, a shortage of technical experts, inconsistencies in assessment practices, and the limited implementation of digital solutions. The study substantiates several priority directions for optimization, including the implementation of a unified electronic accreditation platform, the application of a risk-based assessment model, the development of hybrid assessment methods, continuous professional development of technical experts, and the adoption of a process-based management approach supported by Key Performance Indicators (KPIs). The experiences of international accreditation bodies are reviewed, and practical recommendations are proposed for improving the national accreditation system.

Keywords: Accreditation, Testing Laboratory, ISO/IEC 17025, ISO/IEC 17011, Technical Competence, Risk-Based Approach, Digitalization, Remote Assessment, Proficiency Testing, Measurement Uncertainty, Quality Infrastructure, ILAC MRA

1. Introduction

In the modern economy, testing laboratories play an indispensable role in ensuring the quality of goods and services, protecting consumer rights, and enhancing a country's export potential. The reliability and international recognition of the results produced by testing laboratories depend directly on the effectiveness of the accreditation system. Accreditation is the formal recognition by an authorized accreditation body of a laboratory's technical competence to perform specific testing activities and constitutes one of the most important components of the national quality infrastructure.

In recent years, the Republic of Uzbekistan has undertaken comprehensive reforms aimed at aligning its national quality infrastructure with international requirements [1]. In particular, the legislative framework governing technical regulation has been updated, the national accreditation body has been reorganized in accordance with international standards, and cooperation has been strengthened with international organizations such as the International Laboratory Accreditation Cooperation (ILAC) and the International Accreditation Forum (IAF). Nevertheless, several systemic challenges remain in the practical implementation of accreditation processes, including prolonged accreditation timelines, complex documentation procedures, a shortage of qualified technical experts, and the insufficient adoption of digital technologies. This study examines the scientific, methodological, and practical approaches to optimizing the accreditation processes of

testing laboratories and proposes appropriate recommendations for improving the national accreditation system [2].

2. Materials and Method

Regulatory and Methodological Foundations of Accreditation

The accreditation of testing laboratories is primarily based on two internationally recognized standards. The first is O'z DSt ISO/IEC 17025:2019 (ISO/IEC 17025:2017), "General Requirements for the Competence of Testing and Calibration Laboratories," which establishes requirements for technical competence, impartiality, and the consistent operation of laboratories. The second is ISO/IEC 17011:2017, "Conformity Assessment — Requirements for Accreditation Bodies Accrediting Conformity Assessment Bodies," which specifies the requirements for accreditation bodies themselves and serves as the methodological foundation of the accreditation process.

The revised edition of ISO/IEC 17025:2017 introduced several important conceptual changes that significantly influence the optimization of accreditation processes. Most notably, the standard incorporates risk-based thinking, requiring laboratories to systematically identify risks and opportunities associated with their activities and implement proportionate measures to address them. Furthermore, the standard strengthens the process-based approach by focusing on performance-oriented requirements rather than prescriptive procedures, thereby providing laboratories with greater flexibility in designing their management systems. Consequently, accreditation bodies are required to revise their assessment methodologies, shifting from formal compliance-oriented evaluations toward assessing actual technical competence.

Another essential document influencing accreditation is the Guide to the Expression of Uncertainty in Measurement (GUM). Accredited laboratories are required to establish documented procedures for evaluating measurement uncertainty for every testing method within their scope of accreditation. In practice, developing uncertainty budgets and ensuring metrological traceability remain among the most technically challenging aspects of laboratory accreditation.

3. Results and Discussion

Current State and Major Challenges of the Accreditation Process

The conventional accreditation process consists of several sequential stages, including application submission, preliminary document review, on-site assessment, correction of identified nonconformities, accreditation decision-making, and periodic surveillance assessments. Each stage requires considerable time and resources, and the overall accreditation process may extend from six months to one year.

The analysis reveals several major challenges affecting the efficiency of accreditation.

First, extensive documentation requirements remain a significant burden. Laboratories are required to prepare and submit comprehensive documentation packages, including quality manuals, procedures, work instructions, and operational records [3]. This not only increases administrative workload but also complicates document version control and maintenance.

Second, there is a shortage of qualified technical experts. The limited availability of specialists in highly specialized technical fields frequently delays assessment scheduling and prolongs the accreditation process.

Third, inconsistencies in assessment practices arise because different assessors may interpret accreditation criteria differently. Such inconsistencies reduce the predictability of assessment outcomes and create uncertainty for laboratories [4].

Fourth, procedures for expanding or modifying the scope of accreditation often follow nearly the same procedures as initial accreditation, placing unnecessary administrative burdens on rapidly developing laboratories seeking to broaden their testing capabilities.

Finally, the limited utilization of digital technologies throughout the accreditation process significantly reduces overall operational efficiency. Many accreditation activities continue to rely heavily on manual document processing and traditional administrative

procedures, limiting opportunities for automation, transparency, and faster decision-making.

Priority Directions for Optimizing Accreditation Processes

One of the most effective approaches to optimizing accreditation processes is their comprehensive digitalization. A unified electronic accreditation platform enables laboratories to submit applications online, upload documentation electronically, monitor the status of each stage of the accreditation process in real time, and maintain official communication with the accreditation body [5]. Such a platform significantly reduces the time required for document review, as experts can access application materials remotely, document version control is automated, and standard nonconformities can be identified through automated verification algorithms.

At the laboratory level, the implementation of a Laboratory Information Management System (LIMS) automates essential processes, including the registration of test results, calibration scheduling for equipment, and maintenance of personnel qualification records. Providing the accreditation body with controlled access to LIMS data enables remote monitoring and reduces the scope of periodic surveillance assessments. Consequently, digitalization not only decreases administrative burdens but also enhances the transparency, traceability, and objectivity of the accreditation process [6].

Risk-Based Assessment Model

The ISO/IEC 17011:2017 standard requires accreditation bodies to adopt a risk-based approach when planning assessment programs. The practical implication of this principle is that the frequency, duration, and scope of assessments should be proportional to the laboratory's risk profile.

Reducing the extent of surveillance assessments for laboratories that consistently demonstrate high performance while allocating greater attention to laboratories with weaker performance represents the primary mechanism for the efficient allocation of accreditation resources. Such a differentiated approach enables accreditation bodies to focus their limited expert resources on higher-risk areas while simultaneously encouraging laboratories to maintain consistently high standards of technical competence [7].

Remote and Hybrid Assessment Methods

Experience gained during the COVID-19 pandemic demonstrated the practical feasibility of remote assessment methods. The experiences of ILAC and other international accreditation organizations indicate that document reviews, assessments of quality management system elements, record verification, and interviews with laboratory personnel can be effectively conducted through video conferencing technologies.

Activities requiring direct observation of technical competence—such as witnessing testing procedures or inspecting laboratory equipment—should continue to be conducted through on-site assessments. This hybrid assessment model reduces travel costs and assessment time, accelerates accreditation procedures for laboratories located in remote regions, and expands opportunities to engage highly specialized technical experts regardless of geographical location [8]. However, implementing remote assessments requires appropriate regulations addressing information security, confidentiality, and the adequacy of assessment evidence.

Enhancing Expert Competence and Ensuring Assessment Consistency

The quality of accreditation depends directly on the competence of assessors and technical experts. Therefore, one of the key priorities for process optimization is expanding the pool of qualified experts while ensuring their continuous professional development.

To achieve this objective, technical expert training programs should be established in cooperation with universities, research institutions, and leading testing laboratories. Transparent qualification and certification criteria should be introduced, accompanied by regular monitoring of expert performance. Consistency in assessment can be strengthened through the development of methodological guidelines for classifying common nonconformities, conducting assessor calibration workshops, and implementing quality

assurance mechanisms for assessment reports [9], [10]. Establishing a common interpretation of accreditation requirements will increase laboratories' confidence in the accreditation system while reducing the number of appeals and disputes.

Process-Based Management and Continuous Improvement

The process approach together with the PDCA (Plan–Do–Check–Act) cycle represents one of the principal methodological tools for optimizing the internal operations of accreditation bodies. Every accreditation process—from application receipt to the final accreditation decision—should be clearly defined in terms of inputs, outputs, responsible personnel, timelines, and Key Performance Indicators (KPIs).

In practice, accreditation bodies should monitor performance indicators such as the average time from application submission to accreditation decision, the average duration of document review, the percentage of laboratories accredited on their first assessment, the number of appeals and complaints, and overall laboratory satisfaction. Analysis of these indicators enables the identification of process bottlenecks and supports the development of targeted improvement measures [11].

Furthermore, applying Lean management principles—specifically identifying and eliminating activities that do not add value—provides an effective means of reducing accreditation processing times while improving the overall efficiency and quality of accreditation services.

Development of the Proficiency Testing and Interlaboratory Comparison System

One of the most reliable methods for objectively demonstrating the technical competence of a laboratory is regular participation in proficiency testing (PT) and interlaboratory comparisons (ILC). The ISO/IEC 17025:2017 standard requires laboratories to participate in such activities as part of their program for ensuring the validity of test results [12]. Accreditation bodies, in turn, use PT results as one of the primary inputs when planning assessment programs.

The limited availability of national proficiency testing providers often forces laboratories to participate in expensive international PT schemes or leads to only formal compliance with this requirement. From the perspective of process optimization, establishing a national network of proficiency testing providers in accordance with ISO/IEC 17043 offers significant advantages. On the one hand, it provides laboratories with an accessible and cost-effective mechanism for confirming technical competence. On the other hand, accreditation bodies can reasonably reduce the scope of on-site assessments for laboratories that consistently achieve satisfactory PT results. Consequently, PT outcomes become an objective foundation for a risk-based assessment model, enabling more efficient allocation of inspection resources.

International Experience and Opportunities for National Implementation

The experience of accreditation bodies in developed countries provides valuable guidance for optimizing accreditation processes [13]. The German accreditation body (DAkkS) has implemented comprehensive programs focused on digital transformation, expansion of the assessor network, and improvement of service transparency. Similarly, the United Kingdom Accreditation Service (UKAS) is recognized as one of the leading organizations in developing methodologies for remote assessments [14], [15].

Many accreditation bodies have adopted modular accreditation systems, where extensions to the accreditation scope are processed through simplified procedures integrated with scheduled surveillance assessments.

4. Conclusion

One of the most strategic objectives for the national accreditation system is strengthening and expanding full participation in the ILAC Mutual Recognition Arrangement (ILAC MRA). Test reports issued by laboratories accredited under this agreement are internationally recognized by all signatory countries, eliminating duplicate testing costs for exporters and facilitating international trade.

Therefore, accreditation process optimization should be regarded not merely as an administrative reform but also as a strategic instrument for enhancing national export

competitiveness. Compliance with international peer evaluation (peer review) requirements demands that all processes of the national accreditation body fully conform to ISO/IEC 17011:2017, further emphasizing the importance of the proposed optimization measures.

Expected Economic and Social Benefits of Optimization

The benefits of optimizing accreditation processes can be evaluated from several perspectives. For laboratories, shorter accreditation timelines accelerate market entry while reducing administrative costs. According to current estimates, the implementation of digital document management systems together with hybrid assessment methods can reduce the overall accreditation process duration by approximately 25–35%.

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