Academy journal for Basic and Applied Sciences (AJBAS) Volume 7 issue 2, 2025..

Study of Conformity Assessment in Libya, with Insights from the Cement Industry

Dr. Abdelrazak Ben Jaber
Department of Engineering Project Management
School of Applied Sciences and Engineering
Libyan Academy for Postgraduate Studies
Tripoli, Libya
a.benjaber@academy.edu.ly

Mohammed Rasem AlShadeed
Department of Engineering Project Management
School of Applied Sciences and Engineering
Libyan Academy for Postgraduate Studies
Tripoli, Libya
m.eshadeed@Gmail.com

***Abstract*— This study examines the current state of conformity assessment (CA) in Libya, with a specific focus on the cement manufacturing sector as a case study. Conformity assessment, encompassing testing, inspection, certification, and accreditation, plays a critical role in ensuring product quality, safety, and market access. Libya faces challenges in implementing effective CA practices, hindering its economic diversification. This research evaluates stakeholder awareness, infrastructure adequacy, legal/institutional frameworks, and alignment with international standards using a mixed-methods approach. A stakeholder survey (N=54) and qualitative analysis of Libyan legal and regulatory documents were employed. Key findings reveal nominal CA awareness (82.69%), yet practical implementation gaps exist due to inadequate infrastructure (18.8% of respondents citing this as an obstacle), weak enforcement (18.8%), and limited technical expertise. The cement sector showed low Quality Management Systems (QMS) adoption (48%) and inconsistent adherence to the Libyan Portland Cement Standard LNS 340:2009. While support for aligning with international standards is strong (average rating 4.04/5), obstacles like lack of awareness (31.1%) and technical expertise (30.2%) impede progress. The study proposes actionable recommendations to strengthen Libya's CA system, including developing a unified national framework, investing in accredited laboratories, and promoting collaboration.**

Keywords*— *Conformity Assessment, Cement Industry, Libya, Quality Standards, Economic Diversification, Stakeholder Awareness.

I.INTRODUCTION.

The accelerating pace of globalization has profoundly reshaped the global economic landscape, presenting both opportunities and challenges that necessitate robust regulatory frameworks to ensure fair trade practices, consumer protection, and environmental sustainability [1], [2]. Within this interconnected marketplace, the harmonization of standards, promoted by international bodies such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), has become vital for facilitating international trade and fostering interoperability [3], [4]. Conformity assessment (CA)—encompassing testing, inspection, certification, and accreditation—plays a crucial role in verifying that products, services, and systems meet specified requirements, thereby building trust and ensuring quality and safety in global supply chains [5], [6]. The World Trade Organization (WTO) actively encourages member countries to base their technical regulations on international standards through the Agreement on Technical Barriers to Trade (TBT Agreement) [4].

For developing economies, a well-functioning CA system is a cornerstone of the broader quality infrastructure, which underpins industrial development, enhances trade competitiveness, and strengthens consumer protection [7], [8]. Libya, with its historical dependence on oil revenues, faces the imperative of economic diversification to achieve sustainable and resilient growth [9], [10]. An effective CA system is essential for supporting Libya's diversification efforts by ensuring the quality and competitiveness of Libyan products. However, Libya's CA framework currently faces several critical challenges, including limited practical awareness and understanding of CA principles, inadequate testing and calibration infrastructure, weak enforcement mechanisms, institutional fragmentation, and insufficient alignment with international standards [11]. These shortcomings impede Libya's ability to compete effectively and achieve its economic development goals..

This study aims to:

1. Assess stakeholder awareness and understanding of CA in Libya, particularly in the cement sector.
2. Examine perceptions of testing and calibration infrastructure adequacy.

DOI:10.5281/zenodo.18099870

3. Evaluate the legal/institutional frameworks and their perceived effectiveness.
4. Identify barriers to aligning Libyan standards with international norms.
5. Develop recommendations to strengthen CA systems in Libya.

II. CONFORMITY ASSESSMENT IN THE LIBYAN CONTEXT

A. Defining Key Concepts and Theoretical Underpinnings

Conformity Assessment (CA) is the "demonstration that specified requirements relating to a product, process, system, person or body are fulfilled" [12]. It includes first-party, second-party, and third-party assessments, with third-party CA providing the highest level of independent assurance [12]. Core components of CA include standards (international, regional, national, industry), technical regulations, testing, inspection, certification, and accreditation [12]. Institutional Theory, which considers regulative, normative, and cultural-cognitive pressures [13], and Stakeholder Theory, emphasizing the interests of all parties affected by an organization's actions [14], provide valuable frameworks for analyzing CA systems.

B. The Libyan Legal and Institutional Framework for CA

Libya's formal CA system is built upon a series of laws and decrees establishing key institutions and their mandates. The cornerstone is Law No. 5 of 1990, which established the Libyan National Center for Standards and Metrology (LNCSM) and tasked it with developing, adopting, and promoting national standards [15]. The organization and specific functions of the LNCSM were further detailed in Decision No. 61 of 1991 [16].

Broader commercial activities, encompassing product quality and consumer protection, fall under Law No. 23 of 2010 on Commercial Activity [17]. Control over imported goods and enforcement of national regulations at borders are responsibilities of the Customs Authority, established by Decision No. 815 of 1990. Environmental regulations impacting industrial sectors like cement production are outlined in Law No. 15 of 2003 Concerning the Protection and Improvement of the Environment.

Specifically for the cement industry, the Libyan National Standard LNS 340:2009 (Portland Cement) defines technical specifications and quality requirements [18]. Other relevant bodies include the Industrial Research Center, established by Law No. 25 of 1970 with a mandate in quality standards, and the Ministry of Economy and Trade, whose structure and broad responsibilities in economic policy and market regulation were detailed in decisions such as No. 59 of 2012 and No. 235 of 2021. These documents collectively form the intended structure of Libya's CA system.

III. METHODOLOGY

This study employed a mixed-methods convergent parallel research design. Qualitative data from the analysis of Libyan legal and regulatory documents and quantitative data from a stakeholder survey were collected concurrently in November 2024. These datasets were analyzed independently before being integrated to provide a comprehensive understanding.

A. Document Analysis

A selection of nineteen key Libyan laws, governmental decisions, and national standards pertinent to CA and the cement industry were chosen based on relevance, authority, and currency. These documents underwent thematic analysis to identify core themes related to the formal CA framework, including legal foundations, institutional mandates, standardization processes, CA procedures, enforcement mechanisms, and the approach to international alignment.

B. Stakeholder Survey

A purposive, non-probability sampling technique was employed to select N=54 participants possessing specific knowledge and direct involvement in the Libyan CA ecosystem. The target population included professionals from key government bodies (e.g., LNCSM, Ministry of Economy), cement manufacturing companies (management and quality control personnel), testing/certification bodies, and independent industry experts [11]. This approach was chosen due to the exploratory nature of the study and the lack of a centralized stakeholder database. The sample composition (31.5% Government, 14.8% Manufacturers, 25.9% Experts, 9.3% Testing Bodies) ensures a diverse range of perspectives relevant to the cement sector.

The survey instrument utilized closed-ended questions (multiple-choice, Likert scales) to gather data on:

- Awareness and perceived importance of CA.
- Familiarity with and perceived effectiveness of the legal/institutional framework.
- Identified obstacles to effective CA implementation.
- Specific CA practices within the cement industry (QMS adoption, testing frequency).
- Barriers to inter-institutional collaboration and international alignment.

C. Data Analysis

Qualitative data derived from the document analysis were structured around identified themes. Quantitative data from the stakeholder surveys were analyzed using descriptive statistics (frequencies, percentages, means, standard deviations) with Microsoft Excel.

D. Scope and Limitations

This study focuses specifically on the conformity assessment landscape in Libya, using the cement manufacturing sector as a representative case study due to its strategic importance for reconstruction. Geographically, the scope is limited to Libyan operations. Methodologically, the study utilizes descriptive statistics appropriate for the sample size (N=54) and purposive sampling method; inferential statistics were not employed. Consequently, findings offer

DOI:10.5281/zenodo.18099870

initial empirical insights rather than statistically generalizable results for the entire population.

IV. RESULTS

A. *Document Analysis Insights*

The analysis of legal and regulatory documents confirmed an established legal foundation for CA in Libya. The LNCSM is mandated as the national standards body, with provisions for national standard development and an explicit policy aim to harmonize with international norms. Various ministries and authorities hold CA-related responsibilities. However, the primary laws reviewed offered limited specifics on operational resources for CA bodies, detailed inter-agency coordination protocols, or codified procedures for third-party certification and laboratory accreditation based on international standards.

B. *Stakeholder Survey Findings*

The respondent demographics are diverse, with 31.5% from Government/Regulatory Bodies, 14.8% Cement Manufacturers, 9.3% Testing/Certification Bodies, 25.9% Experts/Consultants, and 18.5% Other. A significant portion (55.6%) reported having over 10 years of experience in the field.

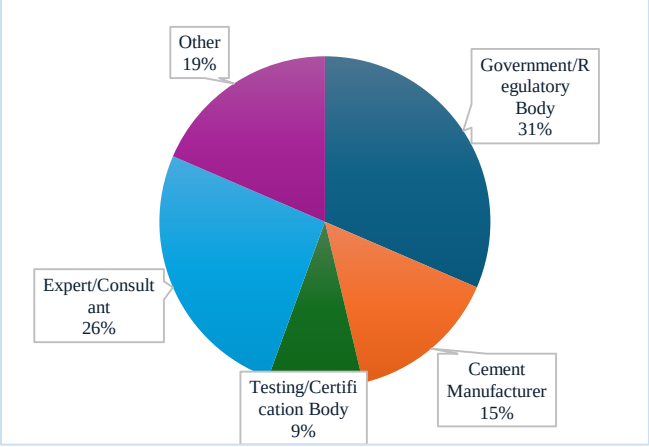


Fig. 1. Respondent Demographics

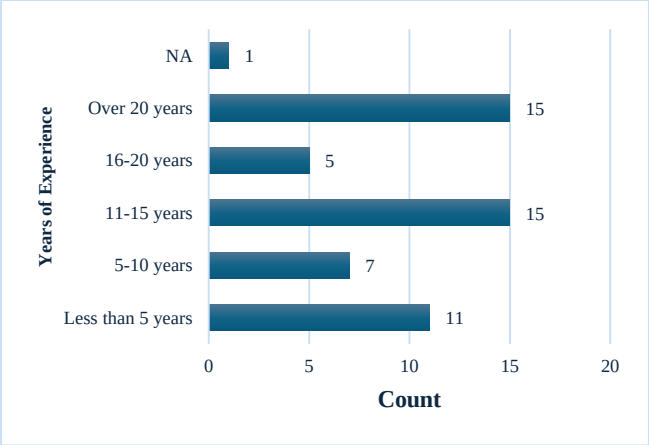


Fig. 2. Respondent Experience

1) *Awareness and Importance of CA:*

A substantial 82.69% of respondents indicated they had heard of the term "conformity assessment." The importance of CA for Libya's economic development was rated highly, with an average score of 4.41 out of 5 (74.5% of respondents selecting "Very Important").

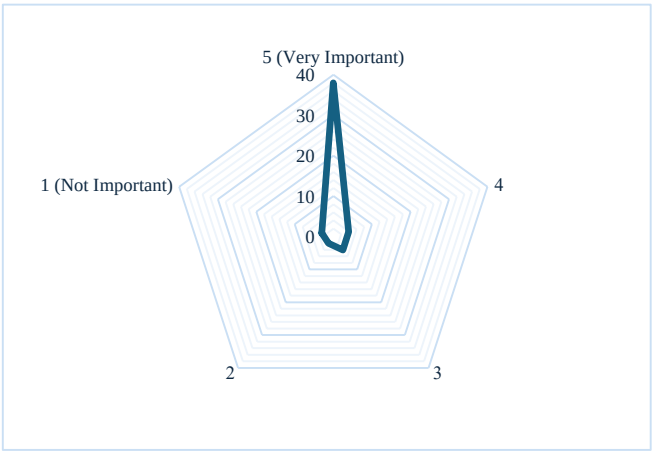


Fig. 3. Importance of Conformity Assessment

2) *Legal and Institutional Framework Perceptions:*

Familiarity with key legal instruments was found to be moderate. For instance, Law No. 5 of 1990 had an average familiarity rating of 2.8/5, while Law No. 23 of 2010 scored 2.3/5.

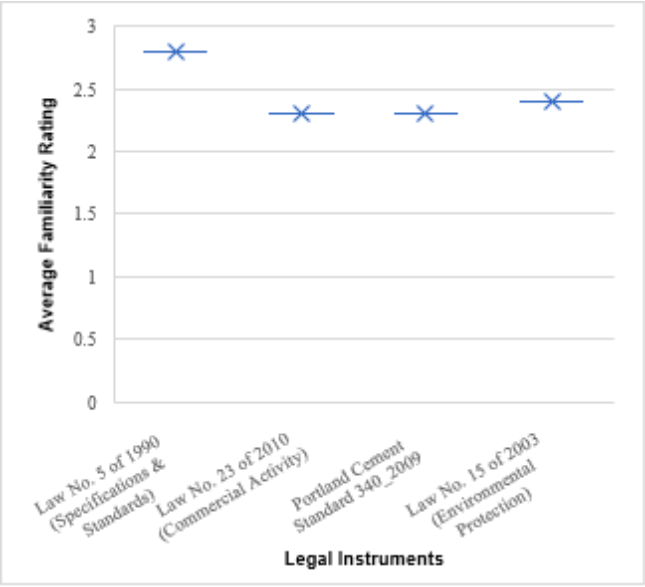


Fig. 4. Familiarity with Laws and Standards

DOI:10.5281/zenodo.18099870

The LNCSM's effectiveness in supporting CA was rated 3.3/5 on average by stakeholders.

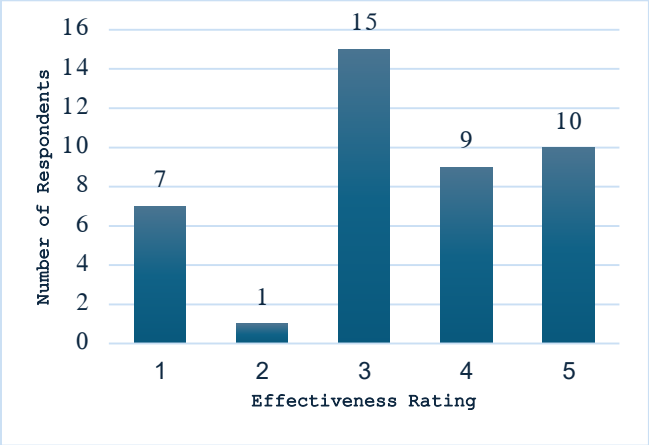


Fig. 5. LNCSM Effectiveness

3) Obstacles to Effective CA:

Major obstacles identified by respondents are detailed in Table I. "Lack of Awareness" (regarding CA specifics, procedures, and benefits) was cited by 24.8% of respondents, followed by "Inadequate Infrastructure" (18.8%) and "Weak Enforcement" (18.8%).

TABLE I. Obstacles to Effective Conformity Assessment

Obstacle	Count	Percentage
Lack of Awareness	37	24.80%
Inadequate Infrastructure	28	18.80%
Weak Enforcement	28	18.80%
Lack of Skilled Personnel	27	18.10%
Corruption	26	17.40%
Other (Please specify)	2	1.30%

4) CA Practices in the Cement Industry:

- *QMS Adoption:* 48% of relevant respondents from the cement sector reported having a Quality Management System (QMS).

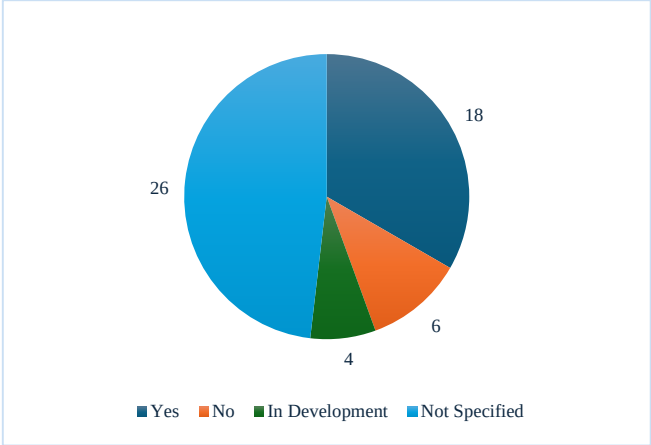


Fig. 6. QMS Implementation

ISO 9001 was the most commonly cited standard among those with a QMS.

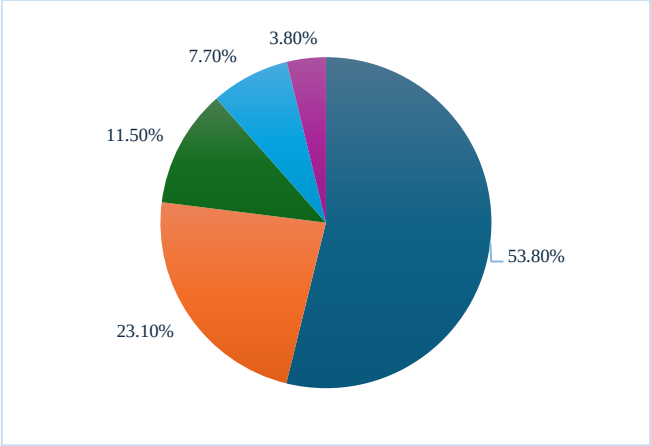


Fig. 7. QMS Standards Used

- *Adherence to LNS 340:2009:* 26% of total survey respondents (14 individuals) stated their organization adheres to the Libyan Portland Cement Standard LNS 340:2009.

DOI:10.5281/zenodo.18099870

- *Testing Practices:* Many cement companies reported utilizing internal laboratories for testing. Key challenges associated with using external labs included turnaround time and the limited availability of accredited facilities.

Fig. 8. Lab Usage for Testing

Fig. 9. Challenges with External Labs

5) Inter-Institutional Collaboration:

Significant barriers were found to impede effective collaboration among institutions involved in CA. "Lack of awareness" (of the importance of CA and the need for collaboration) was identified as a primary barrier by 37% of respondents in this context, with "Lack of technical expertise" cited by 33%.

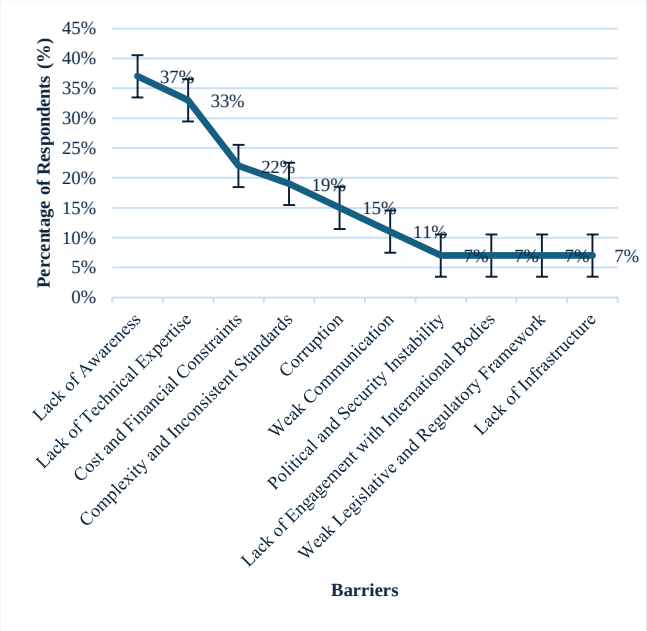
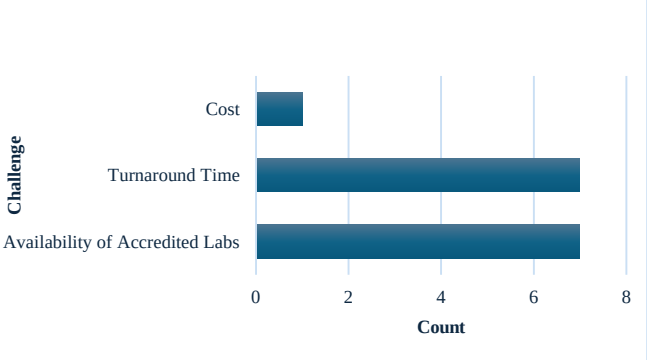


Fig. 10. Barriers to Inter-Institutional Collaboration

6) Alignment with International Standards:



There was strong stakeholder support for aligning Libyan standards with international norms (average rating 4.04/5).

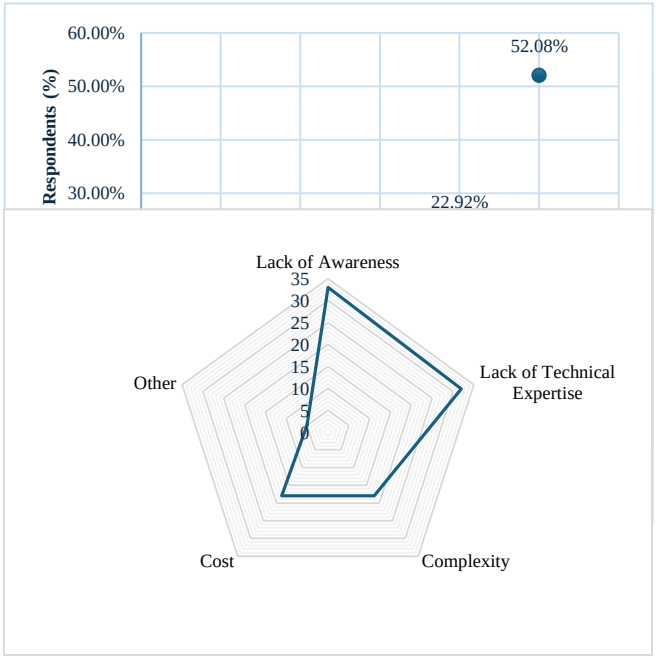


Fig. 11. Importance of Aligning with International Standards

However, the main obstacles to adopting international standards were perceived to be "Lack of awareness" (31.1% of respondents) and "Lack of technical expertise" (30.2%), followed by complexity (17.0%) and cost (17.0%).

Fig. 12. Obstacles to adopting International Standards

7) Export Activities and Competition:

No survey respondents from the cement sector reported current export activities. A notable portion (42.1%) of relevant respondents indicated that their organizations face competition from imported cement..

V. DISCUSSION

The integrated findings reveal a significant gap between the formally documented CA framework in Libya and its perceived effectiveness and practical implementation by stakeholders. While foundational laws [15], [17] and key institutions such as the LNCSM [16] are in place, stakeholder familiarity with these specific legal instruments is only moderate. Furthermore, the LNCSM's perceived effectiveness suggests considerable scope for improvement, a view corroborated by "weak enforcement" being identified as a major obstacle to CA.

An "awareness paradox" is a key theme: high nominal recognition of the term "conformity assessment" contrasts sharply with a widespread perception among stakeholders that

DOI:10.5281/zenodo.18099870

a lack of deeper, practical awareness (regarding specific procedures, benefits, and strategic necessity) is a primary barrier to effective CA implementation, robust inter-institutional collaboration, and the adoption of international standards.

The document analysis confirmed a policy intent towards developing and enforcing national standards, such as LNS 340:2009 for cement [18], and aligning with international norms [15], [16]. However, survey data indicate low reported adherence to this key national standard and limited uptake of international QMS like ISO 9001 within the cement sector. This disparity suggests that the mere establishment of standards is insufficient without active support mechanisms to facilitate their adoption, including technical capacity building and strategies to address cost and complexity concerns.

"Inadequate infrastructure" emerged as a critical, stakeholder-perceived bottleneck. While the legal framework assigns roles for testing (e.g., to the Industrial Research Center), the survey findings highlight significant practical limitations in physical infrastructure, such as accessible and accredited laboratories compliant with standards like ISO/IEC 17025 [19]. These challenges mirror the experiences of other developing economies. For instance, Ghana's recent efforts to overhaul its quality infrastructure highlighted similar gaps in stakeholder coordination. Conversely, the successful integration of CA in countries like South Korea and Costa Rica was driven by strategic state investment in accredited laboratory infrastructure and the aggressive adoption of international standards to boost export competitiveness [11]. The Libyan context is distinct due to the post-conflict environment, where "inadequate infrastructure" (cited by 18.8% of respondents) presents a more severe barrier than in stable developing economies, necessitating a prioritization of physical capacity building alongside regulatory reform.

The multi-institutional CA structure evident in Libyan legal documents logically requires effective inter-agency collaboration for coherent system functioning. However, survey responses strongly indicate that such collaboration is currently perceived as weak, primarily due to the aforementioned gaps in practical awareness and technical expertise, as well as poor communication channels.

VI. CONCLUSION AND RECOMMENDATIONS

This study provides initial empirical insights into Libya's CA landscape, particularly within the strategically important cement sector. It highlights that while a formal CA framework is in place, its effectiveness is undermined by challenges in practical awareness, infrastructure adequacy, enforcement consistency, technical capacity limitations, and weak inter-institutional collaboration.

To enhance Libya's CA system and support its national economic objectives, the following recommendations, derived from the study's findings, are proposed:

- Develop and Implement a Unified National CA Framework and Strategy: This should clarify roles, enhance the LNCSM's capacity, mandate compliance, and establish clear coordination mechanisms among all CA-related bodies to reduce fragmentation and improve consistency..
- Invest in and Modernize CA Infrastructure: Prioritize public and public-private partnership (PPP) investments to establish and upgrade a network of accessible, accredited testing laboratories and calibration facilities, ensuring compliance with international standards such as ISO/IEC 17025 [19].
- Build Human Capital and Enhance Practical CA Awareness: Launch comprehensive and sustained training programs for personnel in CA bodies, regulatory agencies, and industries. Implement targeted awareness campaigns to educate all stakeholders on the practical procedures, benefits, and specific requirements of national and international standards.
- Strengthen Regulatory Enforcement and Market Surveillance: Enhance the capacity and resources of regulatory bodies for effective, consistent, and transparent market surveillance and enforcement of CA requirements and quality standards.
- Foster Robust Inter-Institutional and Stakeholder Collaboration: Establish formal and active platforms, including clear protocols for regular communication, data sharing, and joint planning initiatives among all government agencies, industry associations, CA bodies, and consumer groups.
- Promote and Facilitate Alignment with and Adoption of International Standards: Actively support Libyan industries in adopting and implementing relevant international standards (e.g., ISO 9001, ISO 14001) and quality/environmental management systems through technical assistance, guidance documents, workshops, and exploration of financial incentives where feasible.

Addressing these interconnected areas systematically will be crucial for improving product quality, enhancing consumer safety and trust, facilitating trade, and bolstering Libya's journey towards economic diversification and sustainable development.

VII. ACKNOWLEDGMENTS

The authors would like to express their sincere appreciation to the Libyan Academy for Postgraduate Studies for providing the institutional support necessary to conduct this research. We also extend our gratitude to all the stakeholders, industry experts, and professionals in the cement sector who generously contributed their time and insights during the data collection process, making this study possible.

VIII. REFERENCES

[1]. AccessIt Group, "Globalization and the regulatory landscape: Navigating the challenges of a connected world," 2024. [Online]. Available: www.accessitgroup.com. [Accessed: May 7, 2025].

DOI:10.5281/zenodo.18099870

[2]. IMD, "Globalization in 2024: The clouds are clearing," Dec. 30, 2023. [Online]. Available: www.imd.org. [Accessed: May 7, 2025].

[3]. European Commission, "Harmonised standards," [Online]. Available: single-market-economy.ec.europa.eu. [Accessed: May 7, 2025].

[4]. ANSI, "WTO TBT Committee adopts new guidelines to support conformity assessment and international trade," Mar. 28, 2024. [Online].

[5]. Signify, "The role of conformity assessment in global markets," Nov. 5, 2024. [Online].

[6]. CNAS, "China issues new regulation to encourage accreditation," Jan. 14, 2024. [Online]. Available: iaf.news.

[7]. APEC, "Guidance on strengthening good governance on the implementation of standardization," Jan. 23, 2025.

[8]. UNIDO, "Implications of remote conformity assessment for developing countries," May 12, 2022.

[9]. World Bank, "Libya overview: Development news, research, data," Jan. 2024.

[10]. Qabas, "Understanding the Libyan economy in 2025," Jan. 19, 2025.

[11]. M. R. AlShadeed, "Study of Conformity Assessment in Libya," M.S. thesis, Libyan Academy for Postgraduate Studies, Tripoli, Libya, 2025.

[12]. V. Kumar and S. A. Al-Bashrawi, "Quality infrastructure: Metrology, accreditation, and standards," in Handbook of Quality System, Accreditation and Conformity Assessment, Singapore: Springer, 2024.

[13]. T. Kostova, K. Roth, and M. T. Dacin, "Institutional theory in the study of multinational corporations," Acad. Manage. Rev., vol. 33, no. 4, pp. 994-1006, Oct. 2008.

[14]. R. Albuquerque, R. Durand, and O. Hawn, "Stakeholders, stakeholder theory and corporate social responsibility," Int. J. Corp. Soc. Responsib., vol. 9, no. 1, 2024.

[15]. Libyan Gov., Law No. 5 of 1990 Regarding Specifications and Standards, May 15, 1990.

[16]. Libyan Gov., Decision No. 61 of 1991 on the Organization of the National Center for Specifications and Standards, Jan. 27, 1991.

[17]. Libyan Gov., Law No. 23 of 2010 on Commercial Activity, Jan. 28, 2010.

[18]. LNCSM, LNS 340:2009 Portland Cement, Tripoli, Libya, 2009.

[19]. ISO, ISO/IEC 17025:2017: General requirements for the competence of testing and calibration laboratories, Geneva: ISO, 2017.

DOI:10.5281/zenodo.18099870