The role and prospects of digitalization, standardization and technical regulation in the field of conformity assessment

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Abstract: The article discusses the processes of digitalization in the conformity assessment system, the importance of international and national standardization, the impact of technical regulation on efficiency. The role of modern digital technologies in certification and control, new solutions based on artificial intelligence, big data (Big Data) and the Internet of Things (IoT) are analyzed. As a scientific innovation, an integrated digital ecosystem model of conformity assessment is proposed.

Keywords: digitalization, standardization, technical regulation, conformity assessment, metrology, artificial intelligence, IoT, blockchain

In the context of globalization and increased competition, the issues of quality, safety and recognition of manufactured products and services in the international market are gaining relevance. The conformity assessment system - certification, inspection, accreditation, metrological support - plays a central role in this. In recent years, these processes have undergone strong reforms aimed at digitization , harmonization of standardization and optimization of technical regulation.

Therefore, the purpose of this study is to analyze modern trends in the field of conformity assessment and propose new scientifically based approaches.

of electronic document management in conformity assessment processes, certificates, test protocols, and accreditation documents are being generated through a single platform, which reduces the impact of the human factor, speeds up inspections, and increases the transparency of information.

Big Data The volume of data collected in testing and inspection processes is increasing dramatically. With the help of Big Data technologies: compliance errors are analyzed, risk factors in production are predicted in advance, and product quality is monitored in real time.

Internet of Things (IoT) IoT devices are being used as quality control sensors on production lines. For example, measuring instruments can continuously send data to a central system, allowing immediate detection of deviations in the technical parameters of a product.

Scientific innovation - “Integrated digital ecosystem” model

The article proposes the following new model. The model consists of three layers in practical terms:

1. *Infrastructure layer*

Electronic document platforms, accreditation registry, blockchain registry.

2. *Data collection and monitoring layer*

IoT sensors, metrologically calibrated measurements, API interfaces for data flow.

3. *Analysis and intellectual layer*

Big Data systems, machine learning modules (anomaly detection, forecasting), automatic adaptation (standardization).

The model is characterized by centralizing data and securing it via blockchain while maintaining *metrological traceability* , as well as focusing on continuous optimization through AI modules. This concept provides the following practical advantages: increased trust between partners, reduced risk of counterfeiting, and accelerated international recognition of certificates.

Compliance and standards: implications for the national and international trading arena.

Harmonization of standards (ISO/IEC/OIML) - together with a digital ecosystem, reduces technical barriers. In the case study, it was observed that exporting companies have reduced the time and costs of obtaining international certificates, as well as increased the ability to quickly submit documents during customs inspections. This is a positive factor for increasing export volumes in economic terms.

Research methodology

- Analysis of regulatory and legal documents.
- Comparing statistical data.
- Experimental modeling (digital ecosystem concept).
- Expert evaluation method (on the example of 15 enterprises in Uzbekistan).

Research results

Digitization efficiency

Indicator	Traditional system	Digitized system	Difference (%)
Certificate issuance deadline	20 days	6 days	-70%
Error rate	7%	2%	-71%
Data accuracy	85%	98%	+13%
Document turnover cost	100%	40%	-60%

Comparison with international experience

Country	Unified electronic registry	Has blockchain been implemented?	Is AI used?	Comparison with Uzbekistan
China	Yes	Yes	Yes	Not yet implemented in Uzbekistan
Germany	Yes	Partially	Yes	At the pilot project stage
Russia	Yes	No	Partially	Similar to Uzbekistan
Uzbekistan	Yes (step by step)	No	No	Under development

Standardization results

Uzbekistan has nationalized more than 1,000 international standards in the last 5 years. As a result:

1. Technical barriers to product exports decreased by 35%,
2. quality control mechanism strengthened,
3. The level of international recognition has increased.

Scientific innovation

An integrated digital ecosystem model has been developed. The model includes the following components:

1. *Blockchain-based certificate registry* - eliminates forgery.
2. *IoT devices* - monitor production in real time.
3. *AI algorithms* - analyze data to predict and identify errors.

4. *Big Data* - makes effective use of large amounts of data.

Recommendations (for implementation)

1. Creation of a blockchain-based certificate registry at the national level: to be implemented gradually through pilot projects.
2. Develop uniform technical regulations for IoT and metrological calibration; this will ensure consistency of measurements.
3. Establish transparent algorithms and audit mechanisms when implementing Big Data and AI modules.
4. Harmonize standards (ISO/IEC) with national regulations and establish training programs on them.

Conclusion

The study showed that the digitalization of conformity assessment systems significantly increases efficiency: the time to issue certificates and errors are reduced, and the costs of document management are reduced. The proposed integrated digital ecosystem model allows for process automation and acceleration of international harmonization while maintaining metrological consistency. In the future, the model should be further validated with a larger sample and a full economic analysis.

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6. IEC (International Electrotechnical Commission) - elektr va elektronika standartlari.

7. OIML (International Organization of Legal Metrology) - metrologiya bo‘yicha xalqaro tavsiyalar.

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