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ijtimoiy-iqtisodiy, innovatsion texnik, fan va ta'limga oid ilmiy-amaliy jurnal

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INTERNATIONAL TECHNICAL ASSISTANCE, DIGITALIZATION, AND HUMAN CAPITAL IN THE MODERNIZATION OF UZBEKISTAN'S NATIONAL QUALITY INFRASTRUCTURE



Orifboev Abdullakhon Asadullo ugli
Head of the Department of International Cooperation and Integration Agency for Technical Regulation under the Cabinet of Ministers of the Republic of Uzbekistan

Annotatsiya. Tadqiqotning maqsadi O'zbekiston milliy sifat infratuzilmasini modernizatsiya qilishda xalqaro texnik ko'mak, raqamli transformatsiya va inson kapitalini rivojlantirishning rolini aniqlash hamda 2023–2025-yillarda ushbu mexanizmlarning o'zaro bog'liqligini ochib berishdan iborat. Tadqiqotda hujjatlarni tahlil qilish, jarayonlarni xaritalash hamda manbalar va tahliliy materiallardagi ma'lumotlarni institutsional talqin qilish usullaridan foydalanilgan. Xalqaro malaka oshirish dasturlari, grantlar hisobidan sinov infratuzilmasini rivojlantirish, ISOlutions platformasi va Texnik jihatdan tartibga solish milliy axborot tizimini (TRIS) joriy etish, shuningdek, yoshlarning xalqaro standartlashtirish tadbirlaridagi ishtiroki orqali istiqbolli kadrlar zaxirasini shakllantirish holatlari o'rganilgan. Tahlillar natijasida 500 nafardan ortiq xodim xorijda malaka oshirgani aniqlangan. Koreya Respublikasi hukumati tomonidan ajratilgan 2,3 million AQSh dollari miqdoridagi grant doirasida maishiy konditsionerlarning energiya samaradorligini sinovdan o'tkazish laboratoriyasi ishga tushirilgan. Qiymati 8,5 million AQSh dollariga teng bo'lgan quyosh panellarini sinovdan o'tkazish laboratoriyasi loyihasi esa 2026–2029-yillarga mo'ljallangan bo'lib, erishilgan natija sifatida emas, balki istiqbolli loyiha sifatida baholangan. ISOlutions va TRIS raqamli platformalari axborot almashinuvini jadallashtirish hamda tartib-taomillar shaffofligini oshirishga xizmat qiluvchi infratuzilmaviy mexanizmlar sifatida talqin qilingan. Tadqiqotda quyidagi jarayon modeli taklif etilgan: xalqaro texnik ko'mak → bilim va texnologiyalar transferi → kasbiy kompetensiyalarni rivojlantirish → laboratoriya va raqamli infratuzilmani shakllantirish → xalqaro talablarni qo'llash → muvofiqlikni baholash natijalariga bo'lgan ishonchni oshirish. Moliyaviy, texnologik, raqamli va kadrlar salohiyatiga yo'naltirilgan investitsiyalar o'zaro uyg'unlashgandagina barqaror samaraga erishish mumkinligi asoslangan.

Kalit so'zlar: texnik ko'mak, grantlar, raqamlashtirish, ISOlutions, TRIS, inson kapitali, laboratoriya infratuzilmasi, standartlashtirish, metrologiya, muvofiqlikni baholash, O'zbekiston.

Аннотация. Цель исследования заключается в определении роли международной технической помощи, цифровой трансформации и развития человеческого капитала в модернизации национальной инфраструктуры качества Узбекистана, а также в раскрытии взаимосвязи указанных механизмов в 2023–2025 годах. В исследовании использованы методы документального анализа, картирования процессов и институциональной интерпретации информации, содержащейся в источниках и аналитических материалах. Рассмотрены примеры международных программ повышения квалификации, развития испытательной инфраструктуры за счёт грантового финансирования, внедрения платформы ISOlutions и Национальной информационной системы технического регулирования (TRIS), а также формирования кадрового резерва посредством участия молодёжи в международных мероприятиях по стандартизации. Установлено, что более 500 сотрудников повысили квалификацию за рубежом. В рамках гранта Правительства Республики Корея в размере 2,3 млн долларов США была введена в эксплуатацию лаборатория для испытаний энергоэффективности бытовых кондиционеров. Проект лаборатории по испытанию солнечных панелей стоимостью 8,5 млн долларов США предусмотрен на 2026–2029 годы и рассматривается как перспективное направление, а не как уже достигнутый результат. Цифровые платформы ISOlutions и TRIS интерпретируются как инфраструктурные механизмы ускорения информационного обмена и повышения прозрачности процедур. Предложена процессная модель: международная техническая помощь → передача знаний и технологий → развитие компетенций → формирование лабораторной и цифровой инфраструктуры → применение международных требований → повышение доверия к результатам оценки соответствия. Обосновано, что устойчивый эффект достигается при взаимодополняющем характере инвестиций в финансовые ресурсы, технологии, цифровые решения и кадровый потенциал.

Ключевые слова: техническая помощь, гранты, цифровизация, ISOlutions, TRIS, человеческий капитал, лабораторная инфраструктура, стандартизация, метрология, оценка соответствия, Узбекистан.

Abstract. The aim of this study is to determine the role of international technical assistance, digital transformation, and human capital development in modernizing Uzbekistan's national quality infrastructure and to examine the interrelationships among these mechanisms during 2023–2025. The study employs documentary analysis, process mapping, and institutional interpretation of information from source documents and analytical materials. The cases examined include international professional development programmes, grant-funded development of testing infrastructure, the introduction of the ISOlutions platform and the National Information System of Technical Regulation (TRIS), and the development of a talent pool through young people's participation in international standardization events. The findings indicate that more than 500 employees received professional training abroad. Under a grant of USD 2.3 million provided by the Government of the Republic of Korea, a laboratory for testing the energy efficiency of household air conditioners was commissioned. The solar panel testing laboratory project, valued at USD 8.5 million, is planned for 2026–2029 and is therefore considered a prospective initiative rather than an accomplished result. The ISOlutions and TRIS digital platforms are interpreted as infrastructural mechanisms for accelerating information exchange and enhancing procedural transparency. The study proposes the following process model: international technical assistance → knowledge and technology transfer → competence development → laboratory and digital infrastructure development → application of international requirements → increased trust in conformity assessment results. The findings suggest that sustainable outcomes are more likely to be achieved when investments in financial resources, technology, digital solutions, and human capital complement one another.

Keywords: technical assistance, grants, digitalization, ISOlutions, TRIS, human capital, laboratory infrastructure, standardization, metrology, conformity assessment, Uzbekistan.

INTRODUCTION

Modernizing the national quality infrastructure requires not only regulatory renewal but also the accumulation of technical, digital, and human-resource capabilities. Even harmonized standards do not deliver the expected effect if there are no competent specialists, modern laboratories, sustainable information systems, and organizational mechanisms that translate international requirements into everyday practice. In this sense, quality infrastructure is a system of capabilities, not merely a set of regulatory documents.[1]

In 2023–2025, international cooperation in Uzbekistan was increasingly combined with mechanisms of technical assistance, training of specialists, creation and modernization of laboratories, and digitalization of processes. The source material makes it possible to identify three interrelated channels of modernization: international technical assistance and grant resources; digital transformation; and the development of human capital over current and prospective horizons.

Of scientific interest is the question of how these channels interact. An isolated purchase of equipment does not build lasting competence without trained personnel; training of specialists has a limited effect in the absence of a technical base; and digital platforms do not deliver an institutional result if the processes and data they serve are not embedded in the decision-making system. This study therefore emphasizes the complementarity of modernization mechanisms.

The aim of the study is to analyze the role of technical assistance, digitalization, and human capital in the development of Uzbekistan's national quality infrastructure and to propose a process model that links the input resources of international cooperation with technical and institutional results.

LITERATURE REVIEW

The modernization of national quality infrastructure has been widely examined in studies focusing on standardization, metrology, accreditation, conformity assessment, and international trade. Harmes-Liedtke et al. (2025) emphasize that effective quality infrastructure development depends on institutional capacity, international cooperation, and alignment with national economic priorities. The World Bank's research highlights the importance of technical assistance and international development programmes in strengthening testing facilities, improving regulatory systems, and facilitating access to global markets.

Digital transformation is another important factor in improving the efficiency and transparency of quality infrastructure. Research on the digitalization of metrology demonstrates that digital technologies can accelerate measurement processes, improve data exchange, and strengthen conformity assessment systems.

Furthermore, the OECD (2025) underlines the importance of coordinated governance, institutional cooperation, and integrating standards and quality assurance into regulatory policymaking.

Human capital development complements these processes by equipping specialists with the technical knowledge and competencies required to implement international standards and operate modern laboratory

1 United Nations Industrial Development Organization. Quality Infrastructure for Sustainable Development and Trade Facilitation. — Vienna: UNIDO, [n.d.].

and digital systems. However, the combined effects of international technical assistance, digitalization, and workforce development in Uzbekistan's national quality infrastructure require further systematic examination. This study addresses this gap by analyzing how these three factors interact to support institutional modernization and improve the international recognition of conformity assessment results.

RESEARCH METHODOLOGY

The empirical basis of the study consists of the materials of the source article, including information and analytical data on the international cooperation of Uzbekistan's national technical regulation system in 2023–2025, official materials on the National Information System of Technical Regulation (TRIS) and the ISOlutions platform, and the ISO, IEC, OIML, BIPM, ILAC, IAF, WTO, and UNIDO documents listed in the source.[2]

The research method combines qualitative content analysis and process mapping. First, the facts were grouped into four categories: financial and technical resources, knowledge transfer, digital infrastructure, and human resource capacity. Then, for each element, the immediate result and the presumed functional contribution to the quality infrastructure were determined. On this basis, a causal-logical, but not statistically causal, chain of conversion of resources into institutional capabilities was built.

In the interpretation, a temporal distinction was maintained between results actually achieved and those planned. In particular, the laboratory for testing the energy efficiency of household air conditioners, established under a grant of USD 2.3 million from the Government of the Republic of Korea, belongs to the results realized, whereas the solar panel testing laboratory project, worth USD 8.5 million, is declared for 2026–2029 and is treated in this article as a prospective element of further development.

A limitation of the methodology is the absence of detailed data on cost structure, laboratory utilization, the number of services provided, time savings resulting from digitalization, and the career trajectories of trained specialists. The conclusions on effectiveness are therefore based on institutional logic and the recorded intermediate results, not on an assessment of return on investment or of a causal economic effect.

ANALYSIS AND RESULTS

In 2023–2025, international technical assistance performed several functions simultaneously. It provided access to expert resources, professional development programs, and material and technical renewal. The source material states that, through international programs, more than 500 employees improved their qualifications abroad in the fields of standardization, metrology, accreditation, conformity assessment, and laboratory testing.[3] Analytically, this means an expansion not only of individual competencies but also of the potential capacity of organizations to absorb and implement international practices.

The most visible example of the materialization of technical assistance was the launch of a laboratory for testing the energy efficiency of household air conditioners, established under a grant from the Government of the Republic of Korea in the amount of USD 2.3 million.[4] The significance of this case lies in combining equipment, test methods, and energy efficiency requirements within a single national testing infrastructure. Such a laboratory expands the ability to verify imported and domestically produced products against modern technical requirements.

The source material also records a project to create a solar panel testing laboratory under a grant from the Government of the Republic of Korea of USD 8.5 million for 2026–2029. This project does not belong to the results actually achieved in 2023–2025, but it reflects the direction of further development of testing infrastructure in the renewable energy segment. Analytically, it shows the shift of international technical assistance from general institutional strengthening to specialized technological competencies.

The second mechanism of modernization is digitalization. In 2023–2025, the ISOlutions platform and the National Information System of Technical Regulation (TRIS) were launched. According to the source material, their introduction is associated with the automation of work with standards and technical regulations, faster information exchange, greater transparency, and wider access to information for stakeholders.[5] In this logic, digital solutions perform not an auxiliary but an integrating function: they link the body of regulations,

2 Agency for Technical Regulation of the Republic of Uzbekistan. Information and analytical materials on activities and international cooperation in 2023–2025; Official information materials on the National Information System of Technical Regulation (TRIS); Official information materials on the ISOlutions platform.

3 Agency for Technical Regulation of the Republic of Uzbekistan. Information and analytical materials on activities and international cooperation in 2023–2025.

4 Ibid.

5 Official information materials on the National Information System of Technical Regulation (TRIS); Official information materials on the ISOlutions platform.

administrative procedures, and users of the system.

The third mechanism is human capital. Its development manifests itself over two time horizons. The first is the professional development of current specialists responsible for the direct implementation of international requirements. The second is the formation of a long-term talent pool. On 12–14 August 2024, at the 19th International Standards Olympiad in the Republic of Korea, schoolchildren from Uzbekistan won 3 gold and 3 silver medals.[6] This fact in itself does not measure the quality of the personnel system, but it reflects early educational involvement of young people in the subject of international standardization.

Considering the three mechanisms together makes it possible to present modernization as a sequential chain: international grant and technical assistance → transfer of knowledge and technology → development of professional competencies → modern laboratory and digital infrastructure → testing and conformity assessment under international requirements → increased trust in results and reduction of technical barriers. This chain reproduces the logic of the source article but clarifies the distinction between resources, intermediate capabilities, and potential economic results.

Table 1.
Mechanisms for modernizing the national quality infrastructure and their functional significance

Mechanism	Instrument	Recorded result	Analytical significance
International technical assistance	Grants, expert programs, internships	More than 500 employees improved their qualifications	Knowledge transfer and expansion of organizational competence
Laboratory development	Grant from the Government of the Republic of Korea — USD 2.3 million	Laboratory for air conditioner energy efficiency launched	Expansion of testing capabilities
Prospective laboratory infrastructure	2026–2029 project — USD 8.5 million	Solar panel testing laboratory planned	Building competencies for “green” technologies
Digitalization	ISOlutions, TRIS	Automation and information exchange	Improved accessibility, transparency, and manageability
Talent pool	International educational events	3 gold and 3 silver medals at the 2024 Olympiad	Early development of interest and competencies in standardization

The results make it possible to regard international technical assistance not as an external financial resource but as a mechanism of institutional learning. The most lasting effect arises when funding simultaneously supports three components: the technological base, the training of specialists, and organizational procedures. If one component is missing, the effectiveness of investment declines: equipment may be underused, knowledge may not become embedded in processes, and digital solutions may turn into isolated information products.

From this point of view, the laboratory case is instructive. Creating a testing laboratory has a broader meaning than increasing the amount of equipment. It builds a national capacity to confirm specific product characteristics, compare results with international requirements, and provide services to manufacturers and importers. In the longer term, it is precisely such capabilities that can reduce the need for repeat testing abroad and help lower conformity assessment costs. However, the source base contains no data on the number of tests performed, laboratory utilization, or savings for enterprises, so this effect should be regarded as an expected mechanism rather than an already quantitatively proven result.

Digitalization should likewise be assessed not by the fact that a platform has been launched but by how it changes processes. For ISOlutions and TRIS, promising performance indicators could be the share of procedures carried out electronically; the average time to find and provide regulatory information; the number

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of users; the volume of interagency data exchange; the reduction in repeated data entry; and the share of services available without paper-based document flow. Such an approach turns digital transformation from a technological description into a measurable management category.

Human capital serves as the link between international norms and national practice. The training of more than 500 employees builds a short- and medium-term human resource, while the involvement of schoolchildren in the international olympiad belongs to the long-term talent horizon. To assess the sustainability of this line of work, it is advisable to track the subsequent professional trajectory of participants, the participation of specialists in technical committees, the number of national experts in international working groups, and the share of organizations with sustainable internal knowledge-transfer programs.

Institutional theory makes it possible to interpret the processes described as the formation of organizations' ability to absorb external rules and translate them into stable internal practices.[7] From an economic point of view, standards and compatible conformity assessment procedures reduce uncertainty and increase the comparability of requirements in markets.[8] International assistance, digitalization, and personnel development are therefore most productive when they are embedded in a single system of indicators linking input resources with technical competence and market application.

It is proposed to use a five-level model for monitoring: resources → activities → immediate results → institutional capabilities → economic effects. Resources include grants, equipment, expert support, and specialists' time; activities include training, creation of laboratories, and digitalization; immediate results include the number of trained specialists, facilities commissioned, and electronic services; institutional capabilities include recognized competence, quality of processes, and availability of services; and economic effects include the reduction of technical barriers, lower costs for enterprises, and expanded export opportunities. It is precisely the transition between the fourth and fifth levels that requires further empirical verification.

CONCLUSIONS AND RECOMMENDATIONS

The modernization of Uzbekistan's national quality infrastructure in 2023–2025 was characterized by a combination of international technical assistance, development of the laboratory base, digitalization, and investment in human capital. The recorded results include the professional development of more than 500 employees, the launch of a laboratory for testing the energy efficiency of household air conditioners under a USD 2.3 million grant, and the introduction of ISOlutions and TRIS.

The solar panel testing laboratory project, worth USD 8.5 million, belongs to 2026–2029 and should be assessed as a prospective project, not as a result of the 2023–2025 period. Such a temporal distinction is fundamental for correct scientific interpretation.

The main analytical conclusion is that the sustainable development of quality infrastructure arises not from an individual grant, digital platform, or training program, but from their mutual reinforcement. International assistance creates maximum value when it is transformed into knowledge, technical competence, digital manageability, and genuinely used conformity assessment services. Subsequent research requires indicators of infrastructure utilization, use of electronic services, international recognition of results, and economic effects for enterprises.

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