



## Quality Infrastructure and Digital Transformation

We are currently going through a digital transformation. New opportunities are arising almost daily in households, trade and industry through a flow of digital data. This transformation is a major challenge to the system of quality infrastructure (QI), consisting of metrology, standardization, accreditation, conformity assessment and market surveillance. At the same time, it also has an impact on development cooperation. In this way, digital change can have the effect of reinforcing already existing economic or social differences.

Encouraging the partner countries to actively participate in digitalization processes can also promote the economic integration and harmonization of systems. The International Cooperation group of the Physikalisch-Technische Bundesanstalt (PTB) supports QI digitalization worldwide in close cooperation with PTB departments and partner institutions.

# Initial Situation

The mission of a national QI is to ensure the quality of products and processes in order to protect humans and the environment in that country, to increase the competitiveness of the national industry and to facilitate the international exchange of goods and services. This is how QI contributes to sustainable development at various levels. These important tasks must also be fulfilled in a digitalized world. The increasing digitalization of the means of production and service deliveries reflects the continually increasing data volume and has led to some profound changes and innovations in a wide range of areas. This involves opportunities but also challenges for the QI structure in partner countries including their possibility to contribute to sustainable development.

The effective digitalization of QI services allows processes and working methods to be optimized. In addition, it facilitates the customers' access to information and services. Digitalization also increases the potential use of data and information: Certificates in accreditation, metrology and conformity assessment can be digitally created, machine-readable and made available to multiple users with differentiated access via email or cloud-based services at any time, nationally, regionally and internationally. Digital systems permit the automated use of the data contained in the certificates. Similar processes will also be used in standardization in the future. In addition, simulations, augmented reality and artificial intelligence are applicable within QI. As a result, the overall QI continues to evolve in a sustainable and comprehensive manner.

At the same time, QI must also offer new instruments and solutions to support the digital change in all aspects of life. In Germany, PTB is working together with central QI actors as part of the QI-Digital initiative to test digital tools and processes for the design of a modern QI. To ensure international harmonization in this dynamic environment, exchanges and joint developments at international and regional level are especially important.

QI institutions in partner countries are facing enormous challenges. For many, it is the first step of moving from paper-based processes to digital data and information formats. It is crucial to recognize that the process of digitalization is not merely the conversion of analogue processes. Instead, it is necessary to redefine processes and to harmonize workflows in order to be able to map them in a meaningful and efficient digital manner. Concurrently, it is imperative that QI institutions participate in the evolution of new developments, such

as sharing their insights in international panels pertaining to digitalization. This approach is indispensable for achieving a sustainable digital transformation.

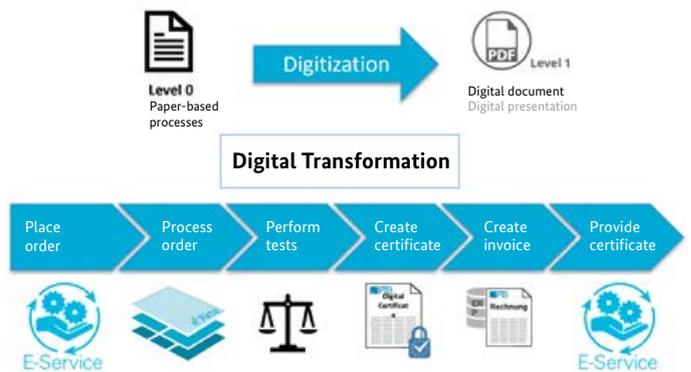


Figure 1: Digital systems permit an automated use of the data contained in the certificates.

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The hesitant implementation and consideration of digital possibilities and needs, inadequately trained staff and a lack of hardware and software may result in institutions in partner countries being unable to keep pace with the rapid developments in digitalization. Concurrently, these institutions have the potential to circumvent certain developmental stages and collaborate with advanced QI institutions in other countries on an equal footing with regard to digitalization. In addition to an increasing necessity for consultation and assistance, opportunities are also available to assist in the shaping, joint development, and enhancement of pioneering digital solutions.

The BMZ Digital Strategy identifies several key areas related to QI in the partner countries and their digitalization efforts. These include in particular the *Promotion of digital public goods and infrastructure, the fair regulation of the digital economy and the promotion of digital skills and feminist development policy.*

# Our Contribution

QI serves as the foundation for a multitude of digital transformation processes, which are based on measurement values, data, algorithms, mathematical and statistical methods, as well as communication and security architectures.

In the field of metrology, the International System of Units (SI) has served as the foundation for all metrological data for over a century. For smart, digital, metrological data, the International Committee for Weights and Measures (CIPM) has established a group of experts that elaborates recommendations for the digital representation of the SI as well as for the fundamental structures for the exchange of digital metrological certificates. In addition, in a joint declaration of intent, international QI actors have expressly stated that they will make the necessary efforts to support the digital transformation of the international QI through a digital framework concept for the SI, the *SI Digital Framework*. These measures are pivotal for ensuring the uniformity of metrology in a digitalized world and for serving as a promotor of measurement trueness, measurement stability and measurement testability. PTB has been a key contributor to these developments for several years, through its involvement in EU-funded cooperation projects and its participation in international research panels.

In PTB's international cooperation work, the interdisciplinary topic of digitalization encompasses nearly all ranges of activity. For example, it includes consulting on the digitalization of processes with the aim of setting up a digital customer portal. Other important cross-sectional topics include the development of competence among the partner institutions' staff, for example in the area of cybersecurity, the procurement of hardware and software, as well as digital project management and the digitization of administration.

Moreover, the partner countries have shown a strong interest in the deployment of the aforementioned SI Digital Framework and the associated digital metrological certificates, which are not interoperable with existing systems. The certificates, which are based on open-source technology, meet the FAIR criteria of being *Findable, Accessible, Interoperable and Reusable*, and they thus constitute an appropriate foundation for the establishment of a modern digital QI. These developments are pivotal to the measurement data formats that will prevail in emerging digital domains, such as the *Internet of Things* and the error-free communication not only between machines, but also between humans and machines. These efforts are seamlessly integrated into the thematic areas of the BMZ digitalization strategy, namely the *Support of digital public goods and infrastructure* and the *Fair regulation of the digital economy*. In particular, the latter is focused on the inclusion of different perspectives in harmonization processes.

The scope of application of a digitalized QI is multifaceted and can be observed across the full spectrum of PTB's international cooperation project portfolio. To illustrate, digital quality assurance processes and the generation of new data in the fields of renewable energies and environmental analysis are supported in accordance with the principles of a Just Transition. In the context of the BMZ digitalization strategy, project work is oriented towards the Support of digital skills and Feminist development policy. This is achieved through initiatives that facilitate the enhancement of capabilities in key areas, including cybersecurity, the digitalization of processes and services, and the facilitation of participation in regional and international forums that promote the digital transformation of QI.

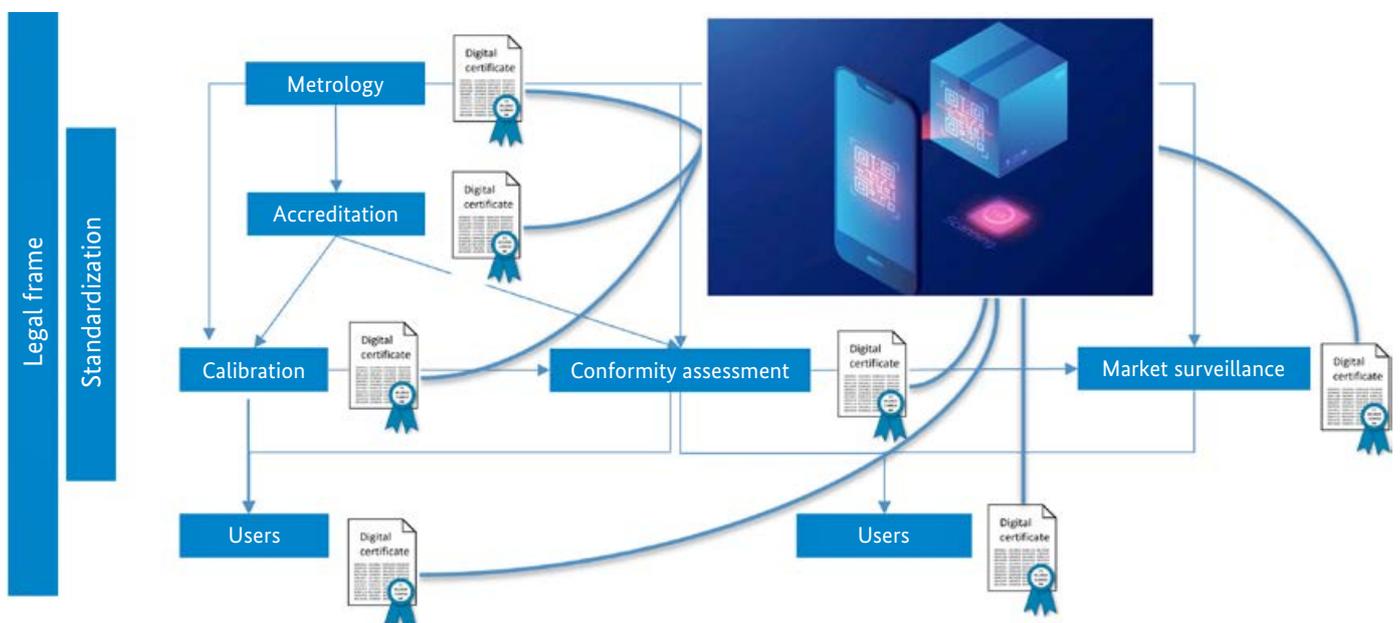


Figure 2: Digitally based certificates form the basis for the development of a modern digital QI.

To ensure that all individuals have equal access to appropriate training measures and forums, as well as to the QI services in general, is an important aspect that is systematically taken into account.

The focus of the measures is to provide advice on individual digital components in existing projects, with a particular emphasis on the creation and use of regional synergies. The knowledge acquired is documented for use in other projects, allowing for the targeted reuse of experience and knowledge. In addition to project consulting, the digitalization of project management is also a key goal, pursued particularly as part of *International Cooperation 2.0*.

**In summary, the measures are based on three focal points:**

- Consulting on the digitalization of quality-assurance services and QI for the digital transformation
- Designing digitalization for project management in PTB's international cooperation work (*International Cooperation 2.0*) and respective support for the partner institutions
- Raising awareness about the topic of digital transformation in QI in projects and committees, as well as collecting and providing information and writing publications

One of our objectives is to provide support to partner organizations and countries in the domain of digitalization. Another is to enhance the efficiency and environmental sustainability of PTB's international project management through digital solutions. And a third objective is to facilitate the promotion of innovative initiatives from partner countries through development cooperation on an equal footing, thereby engaging these countries in subsequent joint projects.

## The Impact of Our Work

The digital transformation has had a pervasive impact on all economic and social areas. Simultaneously, digital change can offer solutions to global challenges. The role of QI in the digital transformation extends beyond the mere provision of technical prerequisites for technological development; it encompasses the facilitation of such advancement.

QI must also offer new instruments and solutions to support the digital transformation and its contribution to development policies.

The systematic preparation of QI in partner countries for important digitalization trends will thus contribute to achieving Sustainable Development Goals (SDGs) in a better way and with a broader impact.

The following objectives are being pursued in the areas of focus identified above:

**Digitalization of QI services:**

- Promoting digitally sovereign structures, for example through open, reusable components of information and communication technology, such as open-source data formats and reliable platforms
- Building competencies by digitalizing processes and supporting the development of digital transformation strategies (e.g. establishing a digital customer portal)
- Developing standards in the field of digital QI that are designed with worldwide participation and thus contribute to the fair regulation of the digital economy

**International Cooperation 2.0:**

- Increasing virtual project implementation that allows us to reduce emissions and lower resources given to flights and to design project implementation as efficiently as possible
- Supporting digital capacities (e.g. by targeted capacity development measures), in order to build up capabilities in partner countries and to support globally networked activities
- Raising awareness about digital transformation: Political decision-makers will become more aware of the importance of this topic and the associated opportunities and challenges

PTB's International Cooperation group is thus helping to implement the BMZ's digitalization strategy, and the joint declaration of intent initiated by the International Committee for Weights and Measures for the digital transformation of the QI. Our work furthermore supports the use of digitalization potentials to achieve these goals for sustainable development.