Developing a metrology system for the future

Responding to a changing world

The economies and societies supported by national metrology systems are constantly changing and developing. Accordingly, metrology systems need to be able to adapt to the changing needs of the economy and society in which they operate. Technology change in particular presents new challenges for metrology systems, changing the products and processes which need to be measured and the ways in which businesses operate and societies are organized and protected. At the same time, technology change and market opportunities can provide new ways in which metrology systems can function, introducing new opportunities for operating more efficiently and effectively.

A recent example of a technology change to which metrology systems have had to respond comes from the transportation-for-hire industry, in which distance measurement (for determining ride fares) is transitioning from vehicle-based mechanical and electronic components (taximeters) to GPS and software-based distance systems. This has required both new traceability pathways, along with the regulatory enforcement of the changes and the development of public trust in their accuracy and fairness.

Implications for metrology policy and metrology systems

For metrology systems to be responsive to these changes (and others which cannot be predicted right now), it is important that flexibility is built into the arrangements that are introduced. Five main areas to consider are:

- **Policy development:** provision should be made for a regular review of both the national policy and the way in which different parts of the metrology system work together. If the system contains an advisory council or board, this could be a mechanism to conduct the review.

- **Institutional structures:** it is likely that the various institutions within the metrology system, both public and private, will need to change and adapt. It is important that issues such as funding and management structure should enable this to occur.

- **Legislative arrangements:** in most countries, it can be difficult to change top-level laws such as a law on metrology. The law on metrology should be short and general, with details set out in by laws and regulations that are easier to modify.

- **Personnel training and development:** technological changes and the introduction of new working methods will require all parts of the metrology community to develop new skills and competences. Training and continuing professional development are therefore vital for a robust metrology system.

- **Engagement with the public and society:** consumers and public groups have an important part to play in safeguarding their own interests. The law on metrology should facilitate voluntary networks and institutions playing an active role. For this to be effective, consumers need to be aware of both their rights and how to exercise those rights. Means must be available to report problems to regulatory/enforcement authorities, and the public needs to have confidence that action is taken by the authorities to correct problems.

Example of future developments: current challenges in digital transformation

Although the future is inherently difficult to predict, some future trends are already apparent:

- More and more transactions will be paperless, including the reduced use of hard currency.

- The redefinition of the SI is likely to lead to increased used of intrinsic standards and self calibrating instruments and sensors.

- The "internet of things" will lead to more complex measuring systems, with more and more sensors, data exchange, and interconnectivity of IT systems.

- Artificial intelligence will become an increasingly important feature in the software of measuring instruments.

- There will be continued introduction of digitization in all areas of business and society.

The digital transformation will affect many aspects of metrology and international scientific and quality infrastructure. Some aspects of this are already becoming apparent, such as a full digital representation of the SI, reliable foundations for digital data interchange and management, and the adoption of FAIR principles (Findable, Accessible, Interoperable, and Reusable) for digital metrological data. Successfully effecting and integrating into such a digital transformation, and ensuring that its benefits are fully realized, will require the active participation of the national metrology system.