

Legal Metrology

11.1 INTRODUCTION

Legal metrology is the technical regulation side of metrology. Whereas scientific and industrial metrology provides society with accurate and trustworthy measurements over a broad spectrum, legal metrology is specifically concerned with the accuracy of measurements where these have an influence on the transparency of economic transactions, health and safety, and law enforcement. Legal metrology may have originated from the need for fair trade, but it has developed a much wider scope in recent decades.

The main objective of a modern legal metrology regime is to protect citizens from the negative consequences of false measurements—for example, in law enforcement, commercial transactions, labor environments, and health and safety systems. All over the world, governments lay down requirements in legislation for measuring instruments, measurement and testing methods, and prepackaging insofar as they are necessary to realize these objectives. Preventive as well as repressive measures are applied.

Preventive measures include the type approval of measuring equipment before it may be marketed. It includes the calibration and verification of such instruments before they are put into operation, as well as the recalibration and reverification of such instruments after a specified time.¹ *Repressive measures* include market surveillance to reveal any illegal usage of measuring instruments or noncompliance with prepackaging requirements.

People using measuring instruments in the field of legal metrology will not be metrological experts, and hence the government must take responsibility for the credibility of such measurements. Therefore, measuring instruments falling within the scope of legal metrology measures should guarantee correct measurement results under working conditions, throughout the whole period of use, and within permissible errors. Such measuring instruments are type-approved to ensure their fitness for purpose.

It should be quite obvious that legal metrology measures can become major barriers to trade. For example, differences in prepackaging requirements will hinder cross-border trade in prepackaged goods. Countries are therefore urged to harmonize their legal metrology measures with international norms and in common markets. These are frequently enforced as

top-down regional legislation, such as the Measurements Instrument Directive of the European Union (EU).

The International Organization of Legal Metrology (OIML) was established in 1955 specifically to promote the global harmonization of legal metrology measures, and the OIML has published many guidelines and model regulations that countries could use as the basis for national legal metrology legislation.

Legal metrology measures are very much influenced by the society they are designed to protect. It does not make sense, for example, to demand metered taxis when taxi fares are generally negotiated between taxi drivers and passengers. Nor does it make sense to establish sophisticated laboratories to conduct the type testing of measuring instruments when all of them are being imported with a type testing certificate from a recognized organization. It is therefore important to differentiate between the legal metrology needs of a least developed country from that of a fully industrialized, high-income country that may also be a member of an advanced common market.² This differentiation at four levels is shown in table 11.1; additional sublevels are also possible, if required.

Evaluation of the country's legal metrology regime is therefore heavily dependent on its level of development and the needs of society as a whole. It is therefore incomplete without knowledge of the actual needs of society and authorities and the capacity for implementation of industry and suppliers.

The building blocks of the legal metrology regime relating to the four pillars are listed in table 11.2.

To depict the pillars and building blocks in a graphical way that would indicate the state of legal metrology in a country at a glance, they can be put together as shown in figure 11.1. For a complete description of the construction, interpretation, and use of this graphic or of the matching radar diagram, see section 1: Comprehensive QI Assessment.

TABLE 11.1 Maturity levels of a country's legal metrology, by characteristic

CHARACTERISTIC	RUDIMENTARY (VERY LITTLE IN PLACE)	BASIC (LOW- TO MIDDLE-INCOME COUNTRY APPROACH)	ADVANCED (ECONOMYWIDE APPROACH, SECTORAL APPROACH)	MATURE (INNOVATIVE, CUTTING-EDGE TECHNOLOGY)
Legal metrology measures	Weights and measures for goods traded over the counter, such as mass of consumer goods	Weights and measures for goods traded over the counter, such as mass and volume of consumer goods and fuel	As under "basic," but extended to prepackaged goods, water and electricity meters, and selected law enforcement scopes	Measures covering the whole spectrum of trade, law enforcement, and health and safety
Legal metrology authority	Government department responsible for all legal metrology measures	Government department responsible for all legal metrology measures	Government authority responsible for all legal metrology measures Designated private sector metrology entities conducting selected calibration and verification activities	Government authority accountable for all legal metrology measures Designated private sector metrology entities conducting a wide range of legal metrology activities
Legal metrology laboratory infrastructure	Working measurement standards for the calibration and verification of mass within the scope of legal metrology measures	Working measurement standards for the calibration and verification of mass and volume within the scope of legal metrology measures	Working measurement standards for the calibration and verification of all measuring equipment within the scope of legal metrology measures Laboratory for verifying the type testing of a few significant measuring instruments	As under "advanced," but extended to high-level laboratories for type testing of at least all measuring equipment manufactured in the country

continued

TABLE 11.1 *continued*

CHARACTERISTIC	RUDIMENTARY (VERY LITTLE IN PLACE)	BASIC (LOW- TO MIDDLE-INCOME COUNTRY APPROACH)	ADVANCED (ECONOMYWIDE APPROACH, SECTORAL APPROACH)	MATURE (INNOVATIVE, CUTTING-EDGE TECHNOLOGY)
Membership	None	Active RLMO member (where relevant)	Active RLMO member (where relevant) OIML membership	Active RLMO member (where relevant) OIML membership Active in OIML committees Signatory of OIML Certification System
Services	Calibration and verification service	Type approval of measuring equipment Calibration and verification services Market surveillance	Type approval of measuring equipment Market surveillance Calibration and verification services; some calibration services liberalized	Type approval of measuring equipment Prepackaging certification scheme Market surveillance; calibration and verification services largely liberalized
Human resources	Training on the job	Training on the job Training through donor projects	Training on the job Training courses in legal metrology	Training on the job Training courses in legal metrology Legal metrologist as a professional profile
Demand orientation	None	Demand surveys, mostly through donor projects	Demand surveys Stakeholder participation and consultative mechanism	Strong instruments and constructs to ensure demand orientation

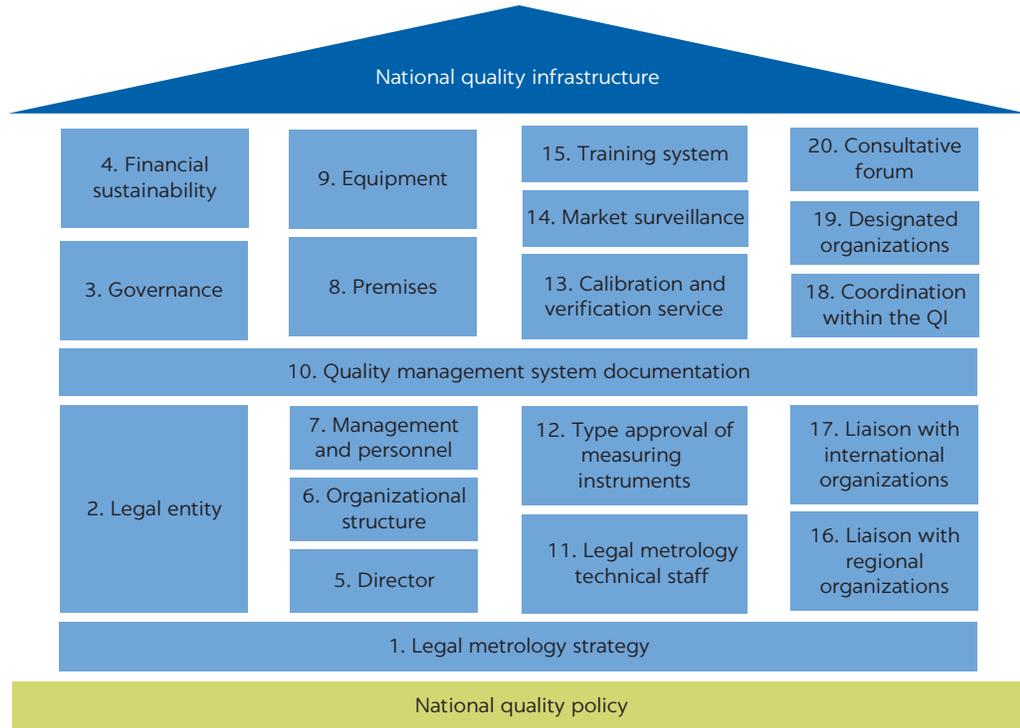
Note: OIML = International Organization of Legal Metrology; RLMO = Regional Legal Metrology Organization.

TABLE 11.2 Pillars and building blocks of the legal metrology regime

PILLAR	BUILDING BLOCK	
	NO.	DESCRIPTION
1: Legal and institutional framework	1	Legal metrology strategy
	2	Legal entity
	3	Governance
	4	Financial sustainability
2: Administration and infrastructure	5	Director
	6	Organizational structure
	7	Management and personnel
	8	Premises
	9	Equipment
	10	Quality management system documentation
3: Service delivery and technical competency	11	Legal metrology technical staff
	12	Type approval of measuring instruments
	13	Calibration and verification services
	14	Market surveillance
	15	Training system
4: External relations and recognition	16	Liaison with regional organizations
	17	Liaison with international organizations
	18	Coordination within the QI
	19	Designated organizations
	20	Consultative forum

Note: QI = quality infrastructure.

FIGURE 11.1
House of legal metrology for a national quality infrastructure



Note: QI = quality infrastructure. The four “pillars” of the QI—represented by the blue columns containing the “building block” numbers—are as follows (left to right): “legal and institutional framework,” “administration and infrastructure,” “service delivery and technical competency,” and “external relations and recognition.”

11.2 PILLAR 1: LEGAL AND INSTITUTIONAL FRAMEWORK

11.2.1 Benchmark and significance

Legal metrology is, in the first instance, the responsibility of government because it is the technical regulation expression of metrology. Government must enact the necessary legal metrology legislation, and it has to establish the legal metrology authority with the mandate to enforce such legislation.³ Without this legal mandate—which should include the appointment of legal metrology inspectors and their powers of entry and search—the legal metrology authority will find it difficult to enforce legal metrology legislation.

Regarding its governance, the legal metrology authority should have a head, frequently called the legal metrology director, who has the executive responsibility for the legal metrology system. The director should have a direct link to the top levels of the relevant ministry, and even to the relevant minister, because of the trade- and society-related—and sometimes very political—impacts of legal metrology legislation enforcement. The director could be supported by a legal metrology council or representative committee that can advise him or her on legal metrology needs.

An international recognition mechanism for legal metrology authorities does not exist. However, membership of the OIML is highly desirable. Active participation in its technical committees and in the OIML Certification System (OIML-CS) will bring about benefits for the country regarding

harmonization of legal metrology measures as the maturity levels of industry and suppliers, and the sophistication of consumers, increase over time.

Because of the necessity of market surveillance, legal metrology is not a good candidate for a regional implementation organization. Yet, legal metrology measures are one of the major trade-related issues to be harmonized at the regional level or within common markets, and coordination organizations are frequently established for this purpose. In such cases, the national legal metrology authority must participate actively in such regional legal metrology organizations (RLMOs).

11.2.2 Legal metrology strategy (building block no. 1)

What is meant

Major	<p>Following on from the quality policy (see module 10 of the QI Toolkit), a legal metrology strategy gives meaning to the implementation of the quality policy regarding the establishment and maintenance of a legal metrology regime in the country. The legal metrology strategy is about</p> <ul style="list-style-type: none"> • Making the right choices regarding the legal metrology focus in the short, medium, and long terms; • Establishing and supporting the legal metrology authority; and • Building capacity in the public and private sectors to establish and maintain an effective and efficient legal metrology regime.
-------	--

How can it be demonstrated?

The legal metrology strategy (also known as the legal metrology policy) should detail the development and implementation of the legal metrology regime over the short, medium, and long terms, including the following:

- The promulgation of new or revised legislation
- Road map for the implementation of legal metrology measures over time with regard to specific measuring equipment, whether related to trade, law enforcement, or health and safety
- Alignment of regulations with OIML recommendations
- Introduction of prepackaging requirements or the revision of older regulations
- Harmonization of legal metrology regulations with regional requirements
- Establishment of legal metrology inspection offices across the country
- Legal metrology–related laboratory capacity development
- Capacity development with regard to inspection equipment for market surveillance
- Training system for legal metrology experts
- Awareness and education of consumers regarding weights and measures
- Road map for the liberalization of calibration and verification activities—that is, designation of private sector organizations to take over these functions from the state

The legal metrology strategy should be a formal document approved at least by the relevant ministry, and in some countries, even by the minister or cabinet, depending on national custom and practice. The legal metrology strategy should be publicly available—that is, on the ministry website or in hard copy. The activities, business plans, and budgets of the legal metrology authority should be aligned with the legal metrology strategy to ensure its implementation.

Existing information/reporting/monitoring

- Relevant ministry (for example, Trade and Industry) website
- Relevant ministry papers
- Legal metrology authority website
- Annual reports of the legal metrology authority

11.2.3 Legal entity (building block no. 2)**What is meant**

Fundamental	The legal metrology authority shall be a legal entity, or a defined part of a legal entity, with the mandate to establish and maintain the legal metrology regime in order to safeguard the interests of society regarding measurements. The legal metrology authority is invariably a governmental department or a public institution (such as a statutory body). It may be an independent institution, but it can also be combined with scientific or industrial metrology.
-------------	---

How can it be demonstrated?

The legal metrology authority should be established by a legislative instrument—that is, a Legal Metrology Act or a similar law. The legislative instrument should be of an enabling nature but must define at a minimum the governance, financial provisions, and responsibilities and functions of the legal metrology authority, and it must provide for the appointment and powers of entry and search of legal metrology inspectors. It should also provide for the promulgation of second-tier legal metrology regulations containing the details of measuring equipment or prepackaging. The responsibilities should include representing the country in regional and international legal metrology forums. A useful guidance document is “Elements for a Metrology Law, OIML D 1” (OIML 2004).

Specific details, such as type approval, calibration and verification, methods of use, and so on concerning specific measuring equipment, should be contained in regulations that are promulgated in terms of the Legal Metrology Act without having to revise the Act itself. These can then be promulgated in accordance with an agreed-upon road map by the authorities, or they can be revised and updated as technology develops. They should be based on the relevant OIML recommendations or harmonized regional regulations. The same applies to the prepackaging requirements.

In smaller economies, the legal metrology authority is frequently also responsible for the establishment and maintenance of the national measurement standards (see subsection 4.2.5 in section 4: Metrology). This may be a workable solution, and the model metrology legislation published by the OIML even provides for such a combination (OIML 2004). It may be necessary for dealing with scarce metrology resources, but it poses a serious challenge. Scientific metrology and legal metrology share the same technology, but their approaches to service delivery are totally different. Scientific metrology is a scientific, voluntary function, whereas legal metrology is a regulatory function. The operational focus of the personnel will of necessity also be very different. Anecdotal evidence suggests that one or the other, usually legal metrology, becomes the main focus of activities and the other one is neglected. Operational measures to combat this neglect must be in place, or the scientific metrology part should be separated and placed in another organization if it is too small to be established as an independent entity; the national standards body (NSB) may be a good choice.

Existing information/reporting/monitoring

- Legal Metrology Act, decree, regulations, or similar law
- Legal metrology authority's website and annual reports

11.2.4 Governance (building block no. 3)**What is meant**

Fundamental	The legal metrology authority is by nature a governmental-type organization—either a government department or a statutory body. As a government department, it will be part of the civil service structures. Depending on the country's custom and practice, it may have a council in the case of a statutory body. Whatever the governance construct, it should have the mandate to approve the strategy, business plans, and budget of the legal metrology authority, and it should hold the director to account.
Major	If a council has been established, then good governance models suggest that the members of the council should be individuals with specific knowledge regarding legal metrology and market realities.

How can it be demonstrated?

If the legal metrology authority is a government department, then its director will be accountable to the senior management levels of the relevant ministry, which will be responsible for strategy and fiduciary oversight. Because of the impact that legal metrology measures have on society and the potential political fallout if things go wrong, it is good practice if the director has a direct communication link to the relevant minister.

If a council constitutes the governance of the legal metrology authority, then the balance between private sector members and public servants is important. The more-progressive legal metrology authorities have private sector representatives on their councils as well as public servants. The council members should be appointed in their individual capacities because of their knowledge, experience, or qualifications relating to the functions of legal metrology, and not only as representatives of business or industry associations or specific public institutions.

Good governance principles suggest that the director of the legal metrology authority should be a full member of the council but should not be allowed to hold a leadership position on the council, such as chair, vice-chair, or secretary. If the national metrology institute (NMI) is an institution separate from the legal metrology authority, then it is good practice for senior management representatives of both the NMI and the NSB to serve on the council. The council should have the mandate or authority to (a) approve the business strategies; (b) appoint the director and consider his or her performance; (c) approve the budget and monitor performance of the organization against the budget; and (d) approve the organizational structure.

Existing information/reporting/monitoring

- Legal Metrology Act, decree, regulation, or similar law
- Ministerial decrees, if relevant
- Legal metrology authority's council policy papers
- Legal metrology authority website and annual reports
- Government regulations regarding public entities

11.2.5 Financial sustainability (building block no. 4)

What is meant

Fundamental	Being a regulatory body, the legal metrology authority has to have its finances provided by government sources. Services, such as type approval, calibration, and verification, may have to be paid for by clients but are usually controlled by legislation; hence they are not market-related. Whatever the source of funding, measures should be in place that also ensure the financial sustainability of the legal metrology authority for the medium to long term.
-------------	--

How can it be demonstrated?

As a regulatory authority, the legal metrology authority should have its market surveillance-related activities funded by the government. Clients needing type approval of instruments or calibration and verification services may have to pay for these, but because they relate to regulations (that is, clients have no choice in the matter), they are frequently determined by legislation and hence are seldom market-related. This puts pressure on the finances of the legal metrology authority, and government assurances that appropriate funding will also be forthcoming in the medium to long term are essential.

Care should be taken that the financing model for the legal metrology authority does not rely heavily on service fees due to a strain on government finances. These then quickly become the focus of survival for the authority, with a concomitant neglect of the market surveillance function, which should remain a major responsibility. Once the calibration and verification services are starting to be liberalized and private sector organizations are designated to provide these, the market surveillance function will eventually be the main remaining activity (other than type approvals) for the authority.

The legal metrology authority's overall financial situation of the past three to five years would be a good indication of its financial sustainability. The situation should show a positive trend over the years under review. A formal government commitment to support the legal metrology authority to carry out its responsibilities regarding the implementation of legal metrology legislation, as well as specific financial support for its international and regional liaison activities, are positive indicators of the legal metrology authority's financial sustainability.

Existing information/reporting/monitoring

- National quality policy
- Annual government budget allocations
- Annual reports of the legal metrology authority
- Monthly and annual financial statements of the legal metrology authority

11.3 PILLAR 2: ADMINISTRATION AND INFRASTRUCTURE

11.3.1 Benchmark and significance

Legal metrology activities have a preventive as well as a repressive focus. It follows that the organizational structure and facilities of the legal metrology authority should support both as effectively and efficiently as possible. This means that, over and above a head office with laboratories, the legal metrology authority also has to have inspection offices to cover all the regions of the country; it should be as close to the market as possible to optimize surveillance activities.

Good governance principles require the legal metrology authority to have a proper management executive, and the subject fields of legal metrology indicate that the “advanced” or “mature” authority should have divisions dedicated to type approval activities, calibration and verification services in the field, and inspectors dedicated to market surveillance—all of which need to be ably supported by the necessary corporate services, such as finance, human resources, training, and facility services. The director, as the executive head, has specific legal responsibilities dealing with approval of instrument types, as well as the initiation of sanctions should illegal usage of measuring instruments or improper prepackaging be uncovered.

Facilities are a vital factor in the success or otherwise of legal metrology. Without laboratory space and environmental controls appropriate for the specific legal metrology fields and accuracy levels the legal metrology authority is engaged in, proper testing and calibration of measuring instruments will be difficult. An additional challenge is the availability of mobile calibration and verification equipment of appropriate accuracy in all regional offices to be used in the field.

11.3.2 Director (building block no. 5)

What is meant

Major	The director (whatever the actual title) is responsible for the execution of the legal metrology authority’s responsibilities as provided for in legislation and for the implementation of its medium- to long-term development plans. The director acts as a direct liaison between the ministry or council and management of the authority, and communicates to the ministry or council on behalf of management. The director is the public face of the authority.
Minor	Depending on the legislation, custom, and practice relevant to the legal metrology authority, the director may be appointed by the relevant minister or the council. Recent tendencies suggest that the director should be appointed for a limited period only, typically five years. He or she can be reappointed if relevant key performance indicators are more than fulfilled.

How can it be demonstrated?

There is no standardized list of the major functions and responsibilities carried out by the director of a legal metrology authority, but some typical functions include the following:

- Supports operations and administration of the ministry or council by advising and informing its members, interfacing between the ministry or council and staff
- Oversees the design, marketing, promotion, delivery, and quality of services with regard to legal metrology
- Recommends the annual budget for ministry or council approval and prudently manages the legal metrology authority’s resources within those budget guidelines according to current laws and regulations
- Effectively manages the human resources of the legal metrology authority according to authorized personnel policies and procedures that conform with current laws and regulations, especially the training and appointment of legal metrology inspectors
- Assures that the legal metrology authority and its mission, programs, and services are consistently presented using strong, positive images to relevant stakeholders, including the relevant minister and ministry

- As the responsible executive, considers the type approval of measuring instruments and initiates sanctions when illegal use of instruments or inappropriate prepackaging is uncovered
- Oversees fundraising planning and implementation, including identifying resource requirements, researching funding sources, and establishing strategies to approach funders

Existing information/reporting/monitoring

- Relevant legislation (Legal Metrology Act or similar law)
- Official ministerial decisions
- Council decisions and minutes, if relevant
- Official director job description
- Agreed-upon director key performance indicators

11.3.3 Organizational structure (building block no. 6)

What is meant

Fundamental	Legal metrology has preventive and repressive components. It therefore follows that the organizational structure of the legal metrology authority must facilitate the effective and efficient execution of both and should have divisions that optimally support these groupings and their subject fields.
-------------	--

How can it be demonstrated?

For legal metrology authorities dealing primarily with trade-related issues, preventive components include type approval of instruments, calibration and verification of the same, and a certification scheme for prepackaging. They may also develop recommendations regarding legal metrology regulations that would be promulgated by the minister, for example, as mandated in legal metrology legislation.

The *repressive component* consists primarily of market surveillance. The *preventive component* consists of head office activities well as field services, whereas market surveillance is largely a field service activity. Over and above appropriate head office technical staff, an appropriate number of regional inspection offices are required for effective and efficient market surveillance close to markets.

For advanced legal metrology authorities operating in fields other than trade, such as law enforcement, health and safety, and so on, organizational structures to deal with these have to be in place. These would differ from those dealing with trade and have to be arranged in accordance with the needs of those sectors. Expert advice is indicated to evaluate these properly.

Other areas to consider in the organizational structure include

- Support functions, such as human resources and finance;
- Training and development responsibility for the common good in relation to the country's legal metrology infrastructure, such as calibration and verification; and
- A technical division for the maintenance and calibration of legal metrology reference and inspection measurement standards

Existing information/reporting/monitoring

- Approved organizational structure
- Ministry or council decisions
- Ministerial decisions
- Financial system documentation

11.3.4 Management and personnel (building block no. 7)

What is meant

Major	Legal metrology is primarily a people-based activity operating within a specific technical environment. The management and personnel must therefore have the appropriate skill sets assured by appropriate training, qualifications, and experience. These would include management and technical knowledge as required by the various activities within the legal metrology fields, such as the appointment of legal metrology inspectors with appropriate knowledge regarding their legal authority with regard to entry and search.
-------	--

How can it be demonstrated?

In the first place, the legal metrology authority should operate with an organizational structure approved by either the ministry or council. For each of the positions, the skill set (qualifications, training, and experience) should be clearly and formally stated. Special attention should be given to the training and appointment of legal metrology inspectors concerning not only their technical capabilities but also their knowledge of their legal authority with regard to entry and search. The ratio between technical and administrative staff is a good indicator of efficacy, with a good guideline being that administrative staff make up no more than 20 percent of the total.

Second, there should be few staff vacancies on either the management or technical levels; more than 95 percent of those positions should remain filled. Anything less indicates that the legal metrology authority cannot operate effectively or efficiently. Staffing challenges include a lack of skilled people in the country, but even more so, inadequate remuneration resulting in the departure of trained staff for more lucrative offers elsewhere.

Existing information/reporting/monitoring

- Approved organizational structure
- Training records of staff
- Appointment and withdrawal records of legal metrology inspector certificates
- Actual staffing levels
- Staff turnover figures

11.3.5 Premises (building block no. 8)

What is meant

Fundamental	Legal metrology is a partly technical, partly administrative endeavor. Specific requirements regarding laboratory space have to be observed. Appropriate accommodation for head office staff has to be provided, as well as appropriate accommodation in regional offices for inspectors and their equipment.
-------------	---

How can it be demonstrated?

Each of the legal metrology fields has specific requirements regarding the laboratory space within which it can operate at the required accuracy. These requirements include environmental controls (temperature, light levels, and so on). Some calibration equipment is large and heavy (for example, weights for calibrating weighbridges), and ease of access for such equipment must be considered. The same applies to fixed outside installations (for example, calibration installations for road tankers).

Appropriate office space for staff needs to be provided, as well as meeting rooms for individual customer discussions and meetings of legal metrology technical committees. Regional offices need appropriate office space, as well as storage space for inspection equipment.

Existing information/reporting/monitoring

- Consideration of the legal metrology authority premises in relation to design, environmental controls, access, and maintenance
- Review of laboratories and environmental controls
- Review of office space and meeting rooms
- Technical requirements, as advised by experts in specific legal metrology fields

11.3.6 Equipment (building block no. 9)

What is meant

Fundamental	A wide range of metrology equipment is necessary, as denoted by the measuring instruments falling within the scope of the legal metrology regulations. Regional and inspection offices should be issued with appropriate working standards and inspection equipment. Reference standards should be maintained against which working standards and inspection equipment can be calibrated continuously. Reference standards must be calibrated against national measurement standards at predetermined intervals.
-------------	--

How can it be demonstrated?

The equipment necessary to implement legal metrology requirements cover a vast range of measuring instruments. It ranges from high-technology scales for smaller quantities to very heavy weights for the calibration of weighbridges, outside tanks and rigs for calibrating road tankers, volumetric equipment mounted on trailers for the calibration of fuel dispensers—the list is endless. Expert advice is required to evaluate the range of instruments and their respective accuracy classes properly.

The accuracy of the legal metrology authority’s equipment should be above reproach. It is good practice to maintain instruments at three levels, where possible:

- At the highest level would be the legal metrology reference standards, which are calibrated against the national measurement standards at predetermined intervals (see subsection 4.3 in section 4: Metrology).
- The following level would be working standards that are calibrated at fairly short but still predetermined intervals against the reference standard.
- The third level would be the inspection equipment that inspectors use in the field, which is calibrated frequently against the working standards.

When no calibration laboratories are available, the legal metrology reference standards are also often used to calibrate the measuring instruments of clients.

Existing information/reporting/monitoring

- Consideration of the legal metrology fields of activity
- Demonstrable metrology equipment needs of the legal metrology authority
- Review of reference measurement standards

- Review of working standards
- Review of inspection equipment
- Review of maintenance measures for all measuring equipment

11.3.7 Quality management system documentation (building block no. 10)

What is meant

Major	It is good practice for the legal metrology authority to operate in accordance with a formal quality management system. This includes compliance with ISO/IEC 17025 regarding laboratory and on-site calibration services, as well as with ISO/IEC 17020 for its inspection activities.
-------	---

How can it be demonstrated?

The laboratories of the legal metrology authority should comply with the requirements of ISO/IEC 17025 (“General Requirements for the Competence of Testing and Calibration Laboratories”); it would even be appropriate to have been accredited. The same applies to on-site calibration and verification services.

As for its inspection activities, it is good practice to comply with ISO/IEC 17020 (“Conformity Assessment—Requirements for the Operation of Various Types of Bodies Performing Inspection”). Accreditation of inspection activities will likewise independently demonstrate the competency of the legal metrology authority, thereby enhancing its standing among stakeholders and supporting the authority in legal disputes.

For both of these, quality management system documentation is required. It should be developed in three levels: policies, general procedures, and work instructions or standard operating procedures. Appropriate records are an important element of the quality management system. It is especially the type approval records, calibration and verification records, and inspection records that are important as legal documents indicating an effective implementation of the legal metrology legislation.

Existing information/reporting/monitoring

- Consideration of the legal metrology authority’s formal quality management system and its compliance with relevant standards, such as ISO/IEC 17020 and ISO/IEC 17025

11.4 PILLAR 3: SERVICE DELIVERY AND TECHNICAL COMPETENCY

11.4.1 Benchmark and significance

The preventive component of trade-related legal metrology consists of type approval of measuring instruments, calibration and verification of the same, and the management of a certification scheme for prepackaging. Type approval would largely be of an administrative nature with a technical content unless type approval testing is undertaken by the legal metrology authority itself. Calibration and verification services have a laboratory component, but they are largely concerned with providing such services in the field.

A prepackaging certification scheme is similar to a quality management certification scheme (see section 9: System Certification) with a focus on the compliance of prepackaging measurements with legal requirements.

Market surveillance is the repressive part of legal metrology. Registered legal metrology inspectors with some serious entry and search authority inspect market activities as they relate to legal metrology legislation and regulations. On uncovering illegal use of measuring instruments or inappropriate prepackaging, inspectors, in coordination with the director, institute sanctions and legal proceedings against the relevant suppliers. These constitute administrative-type sanctions handed down by the director, followed by court proceedings if the administrative sanctions are not appropriately responded to by the suppliers.

In a modern economy, the legal metrology authority needs to demonstrate its integrity and technical competency in order to engender trust among all stakeholders. It is therefore good practice if the legal metrology authority is accredited to ISO/IEC 17020 for its inspection activities and to ISO/IEC 17025 for its testing and calibration work, both in the laboratory as well as on-site.

11.4.2 Legal metrology technical staff (building block no. 11)

What is meant

Fundamental	Legal metrology is a technical endeavor. The people involved in legal metrology testing, calibration, and verification have to be trained and experienced in order to do justice to the technological level that is required.
Fundamental	The legal metrology inspectors should have not only good knowledge of the technology they operate in but also a full understanding of their responsibilities and authority regarding entry and search under legal metrology legislation. They should be appointed and issued with an inspector's identification, and this should be withdrawn if the inspector leaves the service.

How can it be demonstrated?

Technical staff of the legal metrology authority may come from various disciplines, such as physics, engineering, chemistry, and many more. Over and above the basic education at a university or technical college, further training, as well as experience in legal metrology practices, is an important element in developing metrologists. Legal metrology training courses at the tertiary level are indicated.

Legal metrology inspectors are generally empowered by legislation to enter and search premises and vehicles without a search warrant where they suspect activities subject to legal metrology legislation take place that they may wish to inspect. To ensure that they operate professionally and in compliance with the law, legal metrology inspectors must be trained in the legal aspects of their work. Thereafter, they are officially appointed as inspectors and issued a card identifying them as such. This identification card should be shown to the responsible persons when entering premises or vehicles for inspection. The identification card must be withdrawn once the inspector no longer is involved in inspections to ensure that it is not used in any disreputable practices.

Existing information/reporting/monitoring

- Approved organizational structure
- Formal job descriptions

- Personnel records regarding education, training, and experience
- Annual training plans and concomitant records
- Legal metrology inspector training records
- Records of legal metrology inspector cards issued and withdrawn

11.4.3 Type approval of measuring instruments (building block no. 12)

What is meant

Fundamental	A measuring instrument used in activities covered by legal metrology legislation has to be tested against defined standards and be type approved before it can be marketed.
-------------	---

How can it be demonstrated?

The preventive measures start with the type approval of measuring instruments. The type of instrument is tested against a defined technical regulation, either national standards or, better still, an OIML International Recommendation or its national adoption. Thereafter, the instrument is granted type approval by the legal metrology authority if it meets all the legal requirements. With serially manufactured measuring instruments, it shall be assured by calibration and verification that each instrument fulfills requirements before it is placed in use.

The testing of the instrument type can be conducted by the legal metrology authority if it has the capability to conduct all the tests; otherwise, it can subcontract the testing to an accredited laboratory. For low- and middle-income countries, such testing would normally be conducted in the country of origin of the measuring instruments. Establishing the infrastructure to conduct these types of tests is expensive, and the number of tests to be conducted would be minimal.

A measuring instrument can also be accompanied by an OIML test certificate denoting its compliance with an OIML International Recommendation. Such a test report can be used by the legal metrology authority (after assuring its authenticity and applicability for the requirements set in the national technical regulation) to issue the type approval. This would be the most elegant solution for smaller legal metrology authorities.

The legal metrology authority must keep proper records regarding all the measuring instruments it has type approved and must be able to provide this information on request or make it publicly available on information technology (IT) platforms.

Existing information/reporting/monitoring

- Formal type approval procedures of the legal metrology authority
- Type approval records of the legal metrology authority

11.4.4 Calibration and verification services (building block no. 13)

What is meant

Fundamental	The legal metrology authority must provide calibration and verification services for measuring instruments within the scope of legal metrology regulations insofar as they are not provided by designated private sector organizations.
-------------	---

How can it be demonstrated?

All measuring instruments within the scope of legal metrology regulations have to be calibrated and verified within stated intervals. In smaller economies, the legal metrology authority will undertake these activities. The legal metrology authority should have the appropriate calibration equipment, transportation facilities, and manpower to do so because most of such services will have to be rendered in the field.

As industry and trade develops, the country's legal metrology authority will no longer be in a position to service all such instruments. Designated organizations can then be empowered to provide such services (see building block no. 19). The owner of such measuring instruments is legally responsible to see to it that the instruments are calibrated and verified as provided for in the regulations.

Existing information/reporting/monitoring

- Working plans of the legal metrology authority
- Records of calibrations and verifications
- Records of designated organizations

11.4.5 Market surveillance (building block no. 14)**What is meant**

Fundamental	The legal metrology authority must operate a market surveillance system to ensure that measuring instruments in the marketplace are type approved and appropriately calibrated and verified. In addition, prepackaging must be inspected to ensure that it complies with legal metrology requirements. Illegal instruments, uncalibrated instruments, or unverified and illegal prepackaging must be identified and sanctions initiated against suppliers.
-------------	--

How can it be demonstrated?

Appropriate market surveillance is a major responsibility of the legal metrology authority. The market surveillance should be fully planned, with some time allocated for unplanned visits following complaints. The market surveillance must be conducted by legal metrology inspectors from the head office and regional offices where these have been established, because they have the necessary authority to enter and search premises or vehicles where legal metrology-related activities are suspected.

When illegal measuring instruments are uncovered, or type approved instruments that have not been calibrated and verified as required, the operations related to these measuring instruments must cease and further sanctions must be initiated against their suppliers or the persons responsible for their use. The same applies to the inspection of prepackaged goods in the marketplace.

Whereas the above measures are appropriate for trade-related measuring instruments, others, such as those used in law enforcement or health and safety, must be inspected in accordance with their defined market surveillance programs. Expert opinion is necessary to evaluate the appropriateness or otherwise of such market surveillance activities.

Existing information/reporting/monitoring

- Market surveillance planning documents
- Market surveillance records
- Records of sanctions instituted

11.4.6 Training system (building block no. 15)

What is meant

Major	Trained and skilled legal metrologists are a vital component of an effective and efficient national legal metrology system. Training courses provided by the legal metrology authority or tertiary education institutions to train such legal metrologists are important.
-------	---

How can it be demonstrated?

High demands are placed on appropriately educated, trained, and experienced legal metrologists and technical staff. The legal metrology authority must therefore provide for the training of its own staff, a requirement that increases with the development of a whole legal metrology system. Initial training programs can be initiated by technical development programs but eventually have to be provided by the legal metrology authority in collaboration with tertiary technical education institutions.

Existing information/reporting/monitoring

- Training programs
- Training records

11.5 PILLAR 4: EXTERNAL RELATIONS AND RECOGNITION

11.5.1 Benchmark and significance

Legal metrology has a major impact on trade. It is therefore important for the country to align its legal metrology measures with internationally accepted standards. In this respect, active participation in the technical work of the OIML and relevant RLMOs is of paramount importance. At the national level, legal metrology, as one of the technical regulation outcomes, must be fully integrated into the country's technical regulation regime.

11.5.2 Liaison with regional organizations (building block no. 16)

What is meant

Major	If the country is a member of a regional construct, then the legal metrology authority may be required to participate actively in regional legal metrology activities if these are part of the regional agreements. This means also participating in technical committees at the regional level.
-------	--

How can it be demonstrated?

It is useful for a legal metrology authority to participate in relevant regional organizations. These provide a forum where legal metrology issues can be discussed and regional approaches can be harmonized. At the time of writing (January 2019), six regional metrology organizations were considered as liaison organizations by the OIML:

- Asia-Pacific Legal Metrology Forum (APLMF)
- Euro-Asian Cooperation of National Metrological Institutions (COOMET)
- European Cooperation in Legal Metrology (WELMEC)
- Intra-Africa Metrology System (AFRIMETS)
- Inter-American Metrology System (SIM)
- Gulf Association for Metrology (GULFMET)

In addition to these liaison organizations, regional metrology bodies have been established as the outcome of trade agreements leading to regional common markets. Some of these would be the same as the OIML liaison organizations, others not. In many cases, legal metrology authorities are members by default, having to represent their countries in these regional bodies. Some regional metrology bodies have full-time staff and premises; others are liaison-type committees with only a secretariat. Most are forums where a regional approach to legal metrology is discussed and agreed to for implementation in the regional common market.

In some cases, regional systems for the recognition of type approval certificates may have to be adopted by member states. The same applies to prepackaging requirements. It is therefore important that the legal metrology authority participate actively in such regional constructs.

Existing information/reporting/monitoring

- Membership of the legal metrology authority in the OIML liaison organizations
- Reports of participation by the legal metrology authority in the regional organization's activities
- Regional trade agreement membership status of the country
- Relevant regional treaties, protocols, agreements, or legislation on legal metrology
- Annual reports of the legal metrology authority
- Internal reports of regional metrology body meetings

**11.5.3 Liaison with international organizations
(building block no. 17)**

What is meant

Major	The relevant international organization from a legal metrology perspective would be the OIML. Hence, once the legal metrology authority moves from a basic to an advanced level (table 11.1), it should pursue membership in the OIML.
Major	Once the legal metrology authority moves from the advanced to a mature level (table 11.1), it should participate actively in the relevant technical committees of the OIML, and it should consider becoming a signatory of the OIML Certification System.

How can it be demonstrated?

The International Organization of Legal Metrology (OIML) is an intergovernmental treaty organization established in 1955 with the remit to promote global harmonization of legal metrology measures. Membership is on two levels: full membership or corresponding member. Corresponding members have observer status in OIML activities. The OIML collaborates closely with the International Bureau of Weights and Measures (BIPM) on international harmonization on metrology matters.

The OIML publishes metrological guidelines for the elaboration of national and regional requirements concerning the manufacture and use of measuring instruments for legal metrology. The OIML also publishes model regulations that provide members with an internationally agreed-upon basis for the establishment of national or regional legislation on various categories of measuring instruments. The publications are developed by technical committees and

subcommittees composed of representatives of member countries. Cooperative agreements exist between the OIML and the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), with the objective of avoiding conflicting requirements in international standardization.

The OIML Certification System gives suppliers of measuring instruments the possibility of obtaining an OIML certificate or test report to indicate that a given instrument type complies with the requirements of the OIML International Recommendation. These are issued by OIML member states that have established Issuing Authorities responsible for processing applications from manufacturers wishing to have their instruments certified. These certificates may be accepted for type approval purposes by national legal metrology authorities.

Membership and participation by the legal metrology authority in the activities of the OIML and its committees is therefore extremely helpful in facilitating the harmonization of the national legal metrology measures with international good practices.

Existing information/reporting/monitoring

- Legal metrology strategy and its implementation plans
- OIML membership data
- OIML technical committee data
- Annual reports of the legal metrology authority
- Business plans and minutes of the legal metrology authority's technical committees
- Formal communication records of the legal metrology authority with the OIML

11.5.4 Coordination within the QI (building block no. 18)

What is meant

Fundamental	Coordination between the legal metrology authority and the fundamental quality infrastructure (QI) organizations (the NSB, NMI, and national accreditation body [NAB]) is important to ensure that the legal metrology measures integrate seamlessly with national standardization measures—in other words, that national standards, national measurement standards, and accreditation are optimally used in the implementation of legal metrology legislation.
-------------	---

How can it be demonstrated?

Legal metrology legislation implementation is dependent on national standards (for example, adoption of OIML International Recommendations); metrology (for example, traceable calibration of legal metrology reference standards to national measurement standards); and accreditation (for example, of designated calibration and verification laboratories). Hence, coordination between the legal metrology authority and the NSB, NMI, and NAB will be important to ensure effective and efficient legal metrology legislation implementation.

If the NSB, NMI, and NAB are governmental organizations, then their line ministries are in a good position to ensure such coordination, especially to ensure that all are implementing the quality policy measures. Otherwise, the director of the legal metrology authority should initiate formal communications in this

regard on a regular basis. A technical regulation coordination office (whatever its name) coordinates the activities of the regulatory authorities (the legal metrology authority) with the rest of the QI regarding the development and implementation of technical regulations, ensuring that costly overlaps and gaps in service delivery are kept to a minimum.

Legal metrology should also maintain a good working relationship with ministries responsible for health, labor, the environment, and other areas where accurate measurements are the basis for regulatory interventions, especially if the legal metrology legislation goes beyond the traditional weights and measures used in trade and incorporates measuring instruments used in such regulation. The same applies to relationships with consumer organizations that would be able to support the legal metrology legislation implementation through advocacy.

Existing information/reporting/monitoring

- Line ministry policies, pronouncements, and documentation
- Legal metrology authority annual reports
- Minutes of liaison meetings between the legal metrology authority and the NSB, NMI, and NAB
- Technical regulation coordination office mandate and pronouncements

11.5.5 Designated organizations (building block no. 19)

What is meant

Major	As the legal metrology regime matures, calibration and verification services will be more than the legal metrology authority can handle, and it will have to designate technically competent organizations to render such services on its behalf.
-------	---

How can it be demonstrated?

As the legal metrology regime matures and more and more suppliers have to be serviced to ensure that their measuring instruments fall within the scope of legal metrology legislation, the legal metrology authority can no longer cope with this increase in services required. Private sector organizations involved in the supply of measuring instruments and calibration laboratories will have to be authorized—that is, designated—by the legal metrology authority to provide such services on its behalf.

Accreditation to ISO/IEC 17020 or ISO/IEC 17025, as appropriate, would be the starting point for such designation, with the legal liability at the national level of the to-be-designated organization an additional requirement. Appropriate legislation (for example, specific articles in the Legal Metrology Act and its regulations) is also required to provide guidance on the designation process and to protect both the legal metrology authority and designated organizations against spurious claims in this regard.

Existing information/reporting/monitoring

- Legal metrology legislation and regulations
- Formal procedures for designating institutes
- Official documentation of designated organizations
- Work program of the legal metrology authority
- Annual reports of the legal metrology authority

11.5.6 Consultative forum (building block no. 20)

What is meant

Minor	Stakeholders play an important role in determining choices regarding the legal metrology regime. Stakeholders would include the suppliers of measuring instruments, retail organizations, and consumer organizations. A consultative forum representing stakeholders can provide useful advice to the legal metrology authority.
-------	--

How can it be demonstrated?

It is good practice for the legal metrology authority to understand the needs of the stakeholders for developing and maintaining the legal metrology regime. Hence, a consultative forum representative of stakeholders is a useful construct to provide such feedback. The consultative forum should meet at least once annually, or more frequently, if indicated by circumstances.

Existing information/reporting/monitoring

- Legal metrology strategy and its implementation
- Communication strategy or plan and its implementation
- Minutes of consultative forum meetings
- Key performance indicators of senior management
- Stakeholder mapping results

NOTES

1. *Calibration* establishes the relationship between the value indicated by the measuring instrument and the actual value of a metrology standard. *Verification* determines whether this indicated value falls within limits of accuracy as specified by regulation.
2. Least developed countries (LDCs) are low-income countries confronting severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human assets. There are currently 47 countries on the list of LDCs, which is reviewed every three years by the United Nations (UN) Committee for Development (CDP), a subsidiary body of the UN Economic and Social Council.
3. The legal metrology authority may be a government department or a public sector agency or authority established by relevant legislation. Whatever its organizational form, it should have the mandate to implement and enforce legal metrology legislation and its regulations.

STANDARDS REFERENCED IN SECTION 11

ISO and IEC (International Organization for Standardization and International Electrotechnical Commission). 2012. “ISO/IEC 17020: Conformity Assessment—Requirements for the Operation of Various Types of Bodies Performing Inspection.” 2nd ed. Ref. no. ISO/IEC 17020:2012(E), ISO, Geneva.

—. 2017. “ISO/IEC 17025: General Requirements for the Competence of Testing and Calibration Laboratories.” 3rd ed. Ref. no. ISO/IEC 17025:2017(E), ISO, Geneva.

REFERENCE

OIML (Organization of Legal Metrology). 2004. “Elements for a Law on Metrology.” International document OIML D 1, Edition 2004 (E), OIML, Paris. <http://workgroups.oiml.org/tcsc/tc-03/tc-03-d1/D001-e04.pdf>.

