

10 PERSPECTIVE FOR CHINA'S LEGAL METROLOGY

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Legal metrology hereof stands for all the metrology laws, statutes, and technique regulations that have been instituted and enforced by the authorities concerned. With the rapid development of science and technology and the advent of a global economy, the category of metrology is accordingly enlarged and its function becomes increasingly important. This paper is intended to analyze the present situation of China's legal metrology, give an account of the likely challenges, and provide a prospective for its development in the next 20 years.

1 Present Situation of China's Legal Metrology

Since the implementation of reform and open policy, the social and economic systems have undergone remarkable changes in China; a framework of socialist market economy has been constructed. Accordingly, an administrative system for legal metrology has also been developed in China, covering metrology administration, metrological technique institutes, and legal institutions of metrology. These institutions have played an indispensable role in the development of China's metrology enterprises and the socio-economic development. The established state system of primary metrological standards includes 10 categories of primary metrological standards with 191 items, state standards for 2452 types of materials, and more than 43000 metrological standards of various grades for public applications. Of the legal metrology services 28 are responsible for the pattern evaluation of new-produced metrological instruments. Up to now, they have implemented the pattern approval for 475 series of imported measuring instruments, and done prototype testing for 21094 types of new metrological instruments. On average, more than 700,000 sets/pieces of standard measuring instruments and more than 23,000,000 sets/pieces of working measuring instruments have undergone compulsory verification by these institutes per year. In addition, they have worked in cooperation with governmental metrology administration departments to effect product quality supervision sampling examination on more than 700,000 sets/pieces of measuring instruments and supervision sampling examination on more than 500,000 batches of prepackaged commodities with fixed content per year, and undertake more than 800 arbitrational verifications of metrological disputes. However, since the Metrology Law of the People's Republic of China was enacted in 1985 in response to the needs of a planned economy at that time, it is necessary to meet the new requirements of legal metrology called for by a market economy.

a) Management of measuring instruments

Currently, there are a large number and variety of measuring instruments subject to the legal metrology management in China. They fall into three broad catalogues: A) Catalogue of measuring instruments supervised in accordance with the law of the people's Republic of China (400 kinds); B) Catalogue of working measuring instruments subject to compulsory verification of the people's Republic of China (116

kinds); C) Catalogue of imported measuring instruments (18 kinds). Moreover, China has also effected legal management of the primary standard measuring instruments, standard instruments and standard materials. On the one hand, the management is too wide-ranging; on the other hand, there is insufficient management of the measuring instruments used in such fields as resource control, safety, chemical metrology and governmental execution.

b) Transfer of the value of a quantity (Traceability)

According to the recent provisions of China's metrological laws and regulations, the major method for transferring the value of a quantity is verification rather than metrology calibration. The trial calibration work has been carried out in some areas of the country, but no well-defined national management system of calibration has been established yet. There have neither been specified subjects and objects of calibration management, nor norms and market of it.

c) Measurement of the quantity of commodities

There is no specific stipulation for measuring the quantity of commodities in the Metrology Law of the People's Republic of China. What can be applied are only such as The Provisions Regarding the metrological Supervision over Weighing of Retail Goods, The Provisions Regarding the metrological Supervision over Prepackaged Goods With Fixed Content, The Rules for the Punishment of Violations Against The measurement of the Quantity of the Commodities, The Rule of Metrological Inspection for Net Content of Prepackaged Commodities With Fixed Content, which were issued by the former state Bureau of Quality Technical Supervision in the light of the new development of the socialist market economy. Although these regulations are complementary to the Metrology Law of the People's Republic of China, and some international recommendations of OIML have been adopted, there is still much room for improvement in aspects such as their legal rationale and manipulation ability.

Besides, there is still a gap between what has been done and what is required by OIML in the aspects of the management of metrological technical regulations, the conformity assessment and the adoption of international recommendations. All these above-mentioned have shown that there is still much to be done on China's legal metrology in the future; otherwise, the authority and equity of legal metrology will be unfavorably affected. Moreover, the legal metrology will not efficiently stand up for the benefit of customers, ensure the health and safety of the public and protect the environment, etc.

2 Challenge to Legal Metrology

The rapid development of science and technology in such fields as biology-engineering, digital measurement, computer network and nanometer technology will lead to changes not only in the mode of economic activities, but also in people's way of living and thinking. These, in turn, will have an effect on the category of legal metrology. Moreover, the influence of globalization cannot be neglected, for the globalization of economy will lead to the globalization of trade, which will inevitably influence the legal metrology everywhere.

a) The influence of the new fields of legal metrology

Currently, the scope of legal metrology is well beyond the limits of weighting and measuring; it has entered many new fields such as the following:

- A. Trade: This includes retail and wholesaling, domestic and foreign trade in substantial amount. These activities primarily entail the measurements of weight, volume of flow and prepackaged commodities with fixed content. According to statistics, the volume of goods to be measured accounts for 60%~80% of GDP, and will undergo repeated measurements by various metrological instruments in the whole process from producer to customer.
- B. Service: This field involves a variety of measuring meters, such as the fuel dispensers with tax function, taximeter with revenue function, all kinds of time and price meters and retail appliances for vegetable oil. In addition, it covers the range of measurement from that of running water, natural gas, coal gas to that of electrical energy, heating.
- C. Medical metrology: Medical measuring instruments include the medical thermometer, sphygmomanometer, radiant dosimeter, computer tomography, electrocardiography, electroencephalography, the medical ultrasonic diagnostic equipment, etc. In recent decades, the diagnosis and therapy measuring instruments have been rapidly developed. Since medical metrology is concerned with the quality of life and even determines the difference between survive and death, it is vital to ensure the accuracy, congruity and dependability of measurement.
- D. Safety and protection: The safety of life, in particular, becomes increasingly dependent on accurate measurement and on-time control over the system. For example, the accuracy of the meters, such as the instruments on the transportable facilities (ship, plane, automobile), radar velocity meters, mileage meters for cars, detectors for alcoholic quantity from breath-out gas, the pressure meters on the pressure vessel and mechanical meter for architecture, is in close connection with life safety.
- E. Environmental protection and pollution control: This is a field requiring the management by law and substantially entails legal metrology. For example, the physics, chemistry, biology measurements are always applied to a variety of situation, such as the supervision measurement for nuclear power station, the measurement for the CO, CO₂, SO₂ and suspended particulates in the air, the supervision control for environmental noise, car exhaust fume and the poisonous pollution to water, soil and gas, etc. In the 21st century, as an effective means for the environment protection and pollution control, the metrology will give rise to more concern of the politics, the public, the economics and the law.
- F. Resource control: In the management of petroleum, minerals, fishing quantity, and water quota, we can hardly do without the application of legal metrology. Many kinds of resources on earth, especially those unproductive ones, are faced with the danger of exhaustion. Every country in the world, out of either political or economic consideration, becomes increasingly concerned with the utilization and exploitation of their resources, which demands more and sometimes extremely accurate measurements.

- G. Lawsuit: In this field, legal metrology has a preventive effect. For example, when lawsuits involve medical service, life safety, or pollution control, the result of measurement sometimes becomes important evidence for the judge to go by. Additionally, there is also demand for legal metrology in measuring contract and financial administration, tax collection and law enforcement.

b) Influence of WTO/TBT

WTO/TBT treaty is in effect the Agreement on Technical Barriers to Trade, which mainly addresses three issues: A. Standards; B. technical regulations; C. Conformity assessment. Nowadays, conformity assessment develops very rapidly in China and other countries. The main cause is a drive for the promotion of commercial intercourse. The conformity assessment is a process whereby a product, a process, a service, or a system is evaluated against a standard. If a government issues some regulations, such as the pattern evaluation of new-produced metrological instruments, to require products or services to conform to certain technical specifications or standards, it can be regarded as a case of conformity assessment. In order to reduce repetitive assessments, lower the cost and enhance the authority, it is necessary to build up the worldwide confidence through bilateral accreditation, that is, the bilateral accreditation of each other's system. The development of the conformity assessment is a motivation to the development of legal metrology because the conformity assessment, particularly the laboratory accreditation and product quality accreditation, is based on metrology and the bilateral accreditation of metrology system is one of the bases of bilateral conformity assessment. The worldwide confidence must call for a global metrology system.

c) Challenge to administration reform

With the rapid development of globalization of economy, administration reform is inevitable, which present a new challenge to legal metrology. Firstly, the public investments and governmental appropriations of many countries tend to be geared to projects with short-term effect and quick return resulted from market economy. As the trend of globalization develops rapidly and the competitions between countries become stiff, every country has to stimulate its own economic growth and strengthen the competitiveness of its domestic enterprises. Consequently, it is natural of them to invest in projects that have a quick return and attach importance to market economy. Secondly, the general trend for the reformation of government agencies is to streamline the size of government, reduce the cost and reposition the institutions serving for politics and economy. This is a universal trend. In order to accelerate the economic growth and the development of trade, government agencies are bound to reform themselves step by step and gradually make distinction between its supervision function, public administration function and service function. Thirdly, it is a global trend to loosen the regulation and even cancel some ones. As a matter of fact, the reforms in China are mainly intended to make preparations for entering WTO and tend to loosen or cancel regulations, approval procedures and supervision. The main reason is to promote economic and commercial evolution.

d) Effect of technology and management on metrology

Technological and managerial progress may have some negative effect on metrology or make it face new challenges.

- A. Automatic measurements, especially digital ones, may pose challenge to the traditional metrological consciousness. This problem is by no means a new one in the international community of legal metrology. Before the use of digital measurement, weighing was a technology, no matter it involved the use of scale or balance. The concept of uncertainty could be conveniently demonstrated; the measured value of quantity may vary with person who makes the measurement. With the use of automatic measurement, especially digital one, the result of measurement is always accurate and consistent once the object is put on weighing. Since no professional is needed in the process, the concept of uncertainty is difficult to detect. Therefore, it is even more necessary now to develop and popularize the consciousness of metrology among the public.
- B. As more new fields of legal metrology emerge, it becomes difficult for the regular governmental agencies of legal metrology to effect an all-encompassing administration in this field. Consequently, the management of legal metrology becomes the concern of many instead of one department. This is actually the case everywhere in the world. This trend in legal metrology administration is quite disadvantageous for attaining the goal of a concerted management by the metrological departments and thus is often mentioned by OIML as a common problem. Presently, it seems feasible that the metrological departments, in cooperation with other departments concerned, implement the management of such new fields in legal metrology as medical care, environmental protection, resources monitoring and traffic safety.
- C. In the agreements of WTO/TBT, there is little mentioning of metrology. This means the problems arising from metrology are not taken into consideration for settling problems arising from technical barriers to trade. Moreover, there is the problem of product verification. In China, systematic verification develops fast, which also includes requirement for metrology. Unfortunately, such requirement is often neglected. Since product verification involves testing, it is closely related to metrology. However, the requirement for product verification is often covered up by that of systematic verification, which makes it easy for the customers to think that the certificate of systematic verification is effective for all situations. Actually, it is not feasible that the issue of quality is tackled only by means of quality management system. As a developing country, China must attach importance to product verification; otherwise, it will pay the price.

3 Prospect of China's Legal Metrology in the Following 20 years

According to the world developing tendency, the present situation and the challenge of China's legal metrology, there is much legal metrological work to do in the following twenty years that is faced consequential reformation.

a) The Adjustment and fulfillment of Metrology Law and Regulation

The modification to the Metrology Law of the People's Republic of China is a prime assignment of following China's legal metrology. The rationale of legal metrology is metrology law and regulation, therefore the modification to the Metrology Law is necessary and important to the following China's twenty-year legal metrology, which will have a far-reaching effect on the social, economic, technical and metrological work.

Under the premise of abiding the WTO treaty and the OIML relevant recommendation, the Metrology Law completion should take into full account of China's present situation and apply effective protection for the country's estate and market according on the request of market economy. So the metrological legislation should be carried out in three aspects, which is the unification of metrology unit, the accuracy of the value of quantity and the regulation of market metrological action. Specially, it should be adjusted and fulfilled in the following directions:

Build up the national metrology system fitted in with the global metrology system; lessen the range of management to emphasize the legal metrology; expand the field but reduce the sort of compulsory verification; strengthen the metrological supervision for the commodity quantities to regulate the market metrological action; reinforce the admonishment of law and aggrandize the penalty.

b) The Fulfillment of National Metrology System

My country's present metrology system was integrally came into being and stipulated in accordance with the requirements of that planned economy, though partly adjusted, there is an insufficient estimation of market economy and it can't fit in with the WTO rules in some parts. Therefore, with the fulfillment of metrology laws and regulations, in the following twenty years, a fulfilled national metrology system is a fundamental condition to do the legal metrology well.

- Stipulate the relevant technical law and regulation when we abide by and accept the WTO rules. Therefore, we ought to refer to the relevant files and regulations of the BIPM, the OIML, the ILAL and the WTO and combine them with China's situation to set up a sort of metrology system fitted in with the WTO rules and inner character.
- Future metrology system should be a communicative, competitive and harmonious system. We should take part in the international and regional metrological activities and calibration, measuring activities, which include participate the important international comparisons and the accreditation of the measuring and calibration competence of the metrology institute, the discussion of quality management system and the uncertainty of measurement. Through these methods, we can acquaint the knowledge, describe the review, stand up for the benefit and try for the advantage. On fixing up, adjusting and fulfilling the national metrology system, on the one hand we should abide by and accept the rules of the international metrology organization and the WTO, on the other hand we must make the full use of the items to stand up for the benefit of China in the course of participating the competition.
- The development of the field of legal metrology makes it difficult to carry out the trace of the value and management. The increasing trend is that a department

exerts the universal supervision management and several departments put into force the trace to the primary standard and international comparisons.

- Future services of legal metrology will have the impact on not only measurement but also measuring technology and will become the measuring technical research center . It is not only a part of the trace of the value of quantity but also a very important research institute in the metrology system.
- Make best use of social resource. It is obvious that the legal metrology is a government action, however, it doesn't mean only the government controls the assignment of legal metrology. On making perspectives for China's legal metrology, we find that a larger amount of assignment, particularly the task of the verification, calibration and measurement of metrological instruments, can be undertaken by non-governmental organizations, which involve private laboratory and even the factory itself. It can make the control efficiency of the legal metrology effective and flexible. Of course, the stipulation and ultimate determination must under the control of the government.

c) Go on in the Way of Global Metrology System

Make perspectives for future legal metrology, the world will build up a global metrology system for the reason that the demand of the globalization of trade requests the consistency, dependability of the measuring result in the world and the business enterprise field request a measurement and a certificate will go through all over the world. To make the result of inspection or measurement interchangeable, the most important base is the global metrology system or else the result of inspection or measurement can't be interchanged. Third there are some technical and economic matters touched on the metrology that ought to be accurately described and effectively resolved on the base of the global metrology system. For instance, the question of the global warm, without a global metrology system it will hardly assured that the result of measurement would be accepted by each part. The establishment of global metrology system can apply the bilateral accreditation mode of the primary standard of every country's metrology institution. The establishment isn't a unique global metrology system but an intercourse and compatibility among the countries. Therefore, the metrology system of every country should use the International System of Units, apply the reproducibility of materials, set up the national primary standard and a set of integrated trace system which has an unique standard of conformity assessment.

The establishment of global metrology is a main tendency of the development of present international metrology and a metrological challenge faced in future several ten years. It should be seen that the region metrology is a primary scheme of legal metrology. Lots of activities will be executed much more easily among the regions than all over the world, for example the comparisons, cooperated training and technical help. The next ten-year developing trend is to strengthen the regional cooperation in the field of legal metrology and participate the development of world economy. The OIML has the responsibility to ensure necessary cooperation between different regions. It should be acquainted that the globalization of economy makes it hard for the single organization to get the satisfactory result. Hence, the OIML should keep in close touch with other international organizations such as the Agreement of Meter, the IMEKO and the unit ILAC, the LAF relevant to calibration, the ISO, the IEC and The WTO, etc.

We think that the legal metrology is faced rigorous challenge in the tendency of globalization. Although the legal metrology has drawn up the regulations, the stipulation of metrology law and regulation is within the sovereignty of every country. The adoption of the OIML international recommendation is a moral responsibility of each nation but not a legal responsibility. The participation of the OIML doesn't absolutely request the adoption of the international recommendation such that at present then international recommendation is hard to expand. In order to achieve the freedom of trade, the WTO/TBT treaty demands to reduce or abolish the barriers to trade. But for a certain proper reasons, the technical barriers can be set up as usual. It includes the requirement in the directions of life safety, the health of human beings and animals, environmental protection and the national safety. Even though the technical barriers were existed in these aspects, the TBT treaty doesn't cut off them. At the same time the legal metrology covers up the fields. As a result, there must have some international restrains more tough than the TBT treaty so as to carry out the international cooperation in the metrological field, or else it is no use to regulate among the countries.

All in all, the 21 century is beginning, we can see three substantial tendency of following some ten-year legal metrology: first, with the establishment of the widespread applicable system of metrology unit based on the physical constant, each nation's metrology system will become a global metrology system step by step. Though it is not a unique metrology system, it could at least enhance the confidence among the countries. Second, the field of legal metrology will become much more important with the wide of the globalization of trade and the development of science and technology. Third, the authority of the OIML can be strengthened and the legal metrology of each country is bound to be harmony and interchange.