Chapter 6

Master Plan

Chapter 6 Master Plan

6.1 Basic Concept

6.1.1 Vision, Mission and Strategy for Legal Metrology Management

The following is the vision, mission and strategy of overall master plan whose concepts should be incorporated into the Law of Legal Metrology and related regulations:

Vision	To protect the life of people as well as to promote the development of society and economy by realization of unified and rational measurement system, by establishment of measuring standards and guarantee of proper and fair measurement
Mission	1. To implement fair legal metrology system by establishment of an impartial and harmonious legal metrology system 2. To develop comprehensive measurement standard system and to maintain measurement standards that can be acknowledged and accepted internationally 3. To ensure implementation of proper legal metrology by supplying measurement standards and accurate measuring instruments, implementation of proper measurement, and fair execution of legal system
Strategy	1.1 To develop laws and regulations concerning legal metrology which corresponds to the decentralization by reviewing the existing legal metrology law and regulations 1.2 To clearly define the authorities of central government and local governments and specify them by regulations 1.3 To create circumstances to respect regulations by dissemination of legal metrology nationwide
	2.1 To unify measurement units for transaction and certification under SI units 2.2 To enhance the traceability of measurement standards by development of national measurement standard system 2.3 To enhance mutual understanding and internationalization by actively participating in international conventions to collect up-dated information as well as to exchange opinions
	3.1 To ensure supply of proper measurement standards by calibration of measurement standards and by giving accreditation of testing/calibration laboratories at internationally acknowledged level 3.2 To ensure supply of accurate measuring instruments by control of businesses related to measurement instruments (manufacturing, repair, import and selling), and proper implementation of type approval and verification 3.3 To implement proper measurement by conducting accurate measurement, use of proper measuring instruments, conducting surveillance, etc. 3.4 To execute fair legal system by consultation by a “Measurement Administration Council”, punishment against illegal actions and relief measures for unfair treatment

6.2 Legal Metrology Law and Related Regulations

6.2.1 Vision, Mission and Strategy

Vision	To develop legal metrology legislation system in order to ensure proper measurement in "transaction and certification
Mission	To promote development of proper legal system by adjustment of different organizations and subjects
Strategy	• To clearly specify the authorities between central and local governments • To establish impartial and harmonious legislation system • To enhance legal metrology legislation system to international level

6.2.2 New Articles or Amendments to Be Incorporated into Legal Metrology Law and/or Related Regulations

Chapter 5 describes the present situation concerning legal metrology system and related organizations, followed by problems and issues to be considered for legal metrology development. The master plan draws up the measures to improve legal metrology by solving these problems and issues.

Meanwhile, the legal metrology legally controls measurement for transactions or certifications to protect consumers as a primary objective. In order to implement what has been planned in the Master Plan, regulation by law is required, and amendments of law and regulations would be necessary in some cases. The following summarizes new articles or amendments to be incorporated into Legal Metrology Law and/or related regulations:

- Development of presidential decrees and/or ministerial decrees which should be established by referring to the Legal Metrology Law (e.g., designation of organization(s) to administrate national standards)
- Development of law and regulations concerning legal metrology; Consistency with the Autonomy Law (to define subjects that the central government controls)
- Definition of capacity range of legally controlled measurement instruments to be covered by the Legal Metrology Law
- Implementation organization (DOM) to conduct type approval testing and type approval
- Improvement of verification system for WH meters and water meters
- Preparation of guideline for verification fees
- Compulsory training of RVO staffs at MTC

- Guideline concerning requirements to establish new RVOs
- Establishment of regulations for punishment (instruction, public announcement, fines, etc.) against illegal conducts
- Responsibility of RVOs to report DOM or LMS Centers and preparation of reporting format
- Establishment of "Month of Measurement" for dissemination of legal metrology

1) Development of presidential decrees and/or ministerial decrees which should be established by referring to the Legal Metrology Law

In Article 11, Chapter 3 of the Law of Legal Metrology, the Item (1) specifies that the National Standard shall be managed by a Body specially established for that purpose, and the Item (2) specifies that the organizational structure and system of procedure of the Body shall be regulated with a Presidential Decree (see below). However, the corresponding presidential decree has not been established. Organizations concerned should discuss it to draw up the presidential decree.

Article 11

(1) The National Standard as referred to in Article 8 of this Law shall be managed by a Body specially established for that purpose;

(2) The organizational structure and system of procedure of the said Body referred to in Item (1) of this Article shall be regulated with a Presidential Decision.

2) Development of law and regulations concerning legal metrology and consistency with the Autonomy Law

Tasks and duties to be executed should be classified between central and local governments for specifying by regulations.

(1) Major roles and responsibilities by central government

The following is the major roles and responsibilities to be executed in view of the mission of unification for supply of measurement standards, required specifications of technical level, etc., including the implementation of type approval testing and type approval, decision of capacity range of legally controlled measuring instruments, unification of verification fees, study of utilization of vitality of private entities and privatization of some activities, collection of necessary reports from RVOs etc., and interpretation of laws and regulations:

- Design and development of metrology system

- Unification of measuring units
- Development, maintenance and supply of national measurement standards (DOM: mass national standard)
- Administration of measurement standard supply system (including control and maintenance of traceability system)
- Designation of legally controlled measuring instruments and implementation of type approval testing and type approval
- Establishment of unified technical standards (laws, governmental and ministerial decrees) for acceptable conditions of verification/re-verification and inspection for measurement certificates
- Designation of prepackaged goods to be covered by legal metrology and decision of allowances for weight or volume of prepackaged goods
- Establishment of other standards (including unification of verification fees)
- Assurance of compatibility of technical standards with international standards
- Dissemination of metrology concept nationwide
- Study of utilization of vitality of private entities and privatization of some activities (e.g. Designated Measuring Instrument Manufacturers, Certified Metrological Engineers, Proper Measuring Administration Business Entity, etc. in Japanese system)
- Collection of necessary reports from related organizations including RVOs and provincial governments
- Interpretation of laws and regulations

(2) Major roles and responsibilities by local government

The following is the major roles and responsibilities to be achieved by local governments as easily accessible governmental body in view of assurance of proper metrology implementation for protection of consumers and providing services to local inhabitants:

- Execution of verification/re-verification and inspection for certificate for metrology
- Execution of surveillance, etc. to measuring instrument manufacturers, shops and users of legally-controlled measuring instruments
- Execution of on-the-spot inspection to check the weight and volume of pre-packaged goods for sale

- Guidance for promotion of voluntary metrology management
- Keeping and enhancement of levels for execution of metrology administration work
- Enhancement of collaboration among RVOs
- Reporting of necessary information to DOM and/or LMS Centers
- Supply of information to regional inhabitants and dissemination of metrology concepts

3) Definition of capacity range of legally controlled measurement instruments to be covered by the Legal Metrology Law

The capacity range of legally controlled measurement instruments to be covered by the Law of Legal Metrology is not specified. Since the legal metrology aims at protecting consumers by implementing proper measurement in transactions or certification, the measurement for transactions or certification not involving consumers directly should be controlled by other methods. Namely, the legal metrology mainly deals with measurement of "B to C" (Business to Consumers) and not "B to B" (Business to Business). Measuring instruments used in "B to B" transactions include the ones with large capacity. By specifying the capacity range of legally controlled measuring instruments, the investment costs for type approval testing and verification become smaller. Table 6.2.2-1 shows the definition of capacity range of legally controlled measurement instruments

Table 6.2.2-1 Definition of Capacity Range of Legally Controlled Measurement Instruments

Legally Controlled Measuring Instruments	Capacity Range	Capacity Range (Japan)
Length		
Taxi meter	Not specified	Not specified
Mass		
NAWI	Min. measurement: 10mg No. of scale marks: 100-20,000	Min. measurement: 10mg No. of scale marks: 100-20,000
Weight	Weight: Over 10mg	Weight: Over 10mg
Volume		
Water meter	Diameter: Less than 350mm	Diameter: Less than 350mm
Fuel meter	Diameter: Less than 150mm	Diameter: Less than 50mm
LPG meter	Diameter: Less than 75mm	Diameter: Less than 40mm
Gas meter	Diameter: Less than 250mm	Diameter: Less than 250mm
Tank truck with length meter	Less than 32,000 liters	
Storage tank	Not specified	
Thermometer		
Glass Thermometer	From -30 to 360 Degree C	From -30 to 360 Degree C
Pressure Gauge		
Aneroid Pressure gauge		
WH meter	0.5%, 1%, 2%	

4) Amendment of regulation related to type approval

Type approval testing consists of structural tests and accuracy tests. However, at present in Indonesia, only accuracy tests are conducted for type approval testing except WH meters. PLNRD, a group company of PLN, is conducting type approval testing of WH meters, and some RVOs are conducting only accuracy tests for application of type approval of water meters etc. to DOM. According to the site survey of RVOs by the JICA survey team, it is questionable that RVOs, except Jakarta RVO, have facility and skills to conduct proper accuracy tests. The Master Plan proposes that DOM is an organization responsible for type approval testing and type approval. The regulations required for amendment for type approval are described below:

- DOM is the implementation organization to conduct type approval testing and type approval (to delete Item k, Clause 4 of 731/MMP/Kep/10/2002 and add it to Clause 3).
- Review and revise the contents and procedures of type approval testing
- Scope of type approval testing in case of model changes of measuring instruments with type approval
- Necessity of renewal of type approval (interval: every five years; examination of application documents for renewal: corresponding to technology development (phasing out of measuring instruments with old technology which are no longer on the market (no more application for renewal)); measuring instruments with improper type approval are subject to approval after new type approval testing (maintenance of performance and quality of measuring instruments); grasp of enterprises to conduct business and importation)

5) Improvement of Verification system of WH meters and water meters

Since re-verification of WH meters and water meters is only conducted in some areas, it is anticipated that a significant number of inaccurate meters are being used. For this reason, it is difficult to accurately grasp the demand of electricity and tap water, which affects the operation of electricity and city water suppliers to some extent. The following are recommendations concerning verification of WH meters and water meters:

- Initial verification of WH meters: Domestic manufacturers attended by an RVO inspector conduct the initial verification for their products. After five years, privatization of initial verification should be discussed for manufacturers satisfying a certain standard and conducting sufficient quality control (without attendance of RVO

inspector). For imported WH meters, a joint venture (see below) or qualified RVO in the area where the import is made is to conduct initial verification.

- Re-verification of WH meters: A joint venture (J/V) established with DOM and a group company of PLN (joining of RVO and/or private company acceptable) conducts the re-verification of WH meters. The J/V also makes necessary investment. The group company of PLN manages technical matters. PLN changes WH meters for re-verification. Existing verification facilities owned by PLN are first investigated, then a plan is made for re-verification with re-verification targets (e.g., first year: 20%, second year: 30%, third year: 40%, etc.). Based on this plan, additional plans such as the operation plan, HRD plan, etc., are drawn up. At present, some RVOs such as the Jakarta RVO and private companies have already start re-verification of WH meters. Such organizations can conduct re-verification of WH meters if they have technology, human resources, and facilities at a designated level.
- Initial verification of water meters: Manufacturers of water meters are responsible for initial verification with attendance of RVO. For imported water meters, RVOs in the area are responsible for initial verification of imported water meters by entrusting of verification to RVOs by the central government (see below).
- Re-verification of re-verification: RVOs conduct the re-verification of water meters. However, the verification facilities as well as human resources of most RVOs are not sufficient. It is not considered that these situations can be improved shortly. Therefore, the facilities should be developed by entrusting re-verification to RVOs by central government with assistance of DOM: DOM assists RVOs in developing facilities and LMS Centers instruct technology and manage operations. And RVOs set target for re-verification. The entrusting should be reviewed after five-year operation whether the operation be de-centralized or privatized, etc. The repair of water meters is conducted by private enterprises.

6) Preparation of guideline for verification (initial verification and re-verification) fees

After the de-centralization, provincial governments can decide verification fees freely by their regulations, leading to big differences of the fees among provinces which cause dissatisfaction from measurement instrument manufacturers and users of measuring instruments. Therefore, DOM draws up the guideline for verification fees for proposal to provincial governments.

7) Compulsory training of RVO staffs at MTC

The required number of inspectors is kept by compulsory training of RVO staffs at MTC.

8) Guideline concerning requirements to establish new RVOs (see Section 6.8 for details)

The guideline is prepared for newly established RVOs concerning requirements including facilities, technology and skills, human resources, tasks, reporting and budget. If possible, DOM applies it to existing RVOs.

9) Establishment of regulations for punishment against illegal conduct

"Chapter VII Illegal Conducts" in the Law of Legal Metrology specifies punishment against illegal conduct. The following violations, including violation against type approval regulation, fatal and false application or reporting which are added to the Law, are subject to punishment in the form of instruction, public announcement, fines, etc., .

Punishment

- Violation against type approval regulations
- Violation against verification regulations
- Violation against illegal repair and changes of measuring instruments
- Violation against fraud quantity of pre-packaged goods
- Violation against responsibility of reporting
- Fatal and false application or reporting

10) Responsibility of RVOs for reporting to DOM or LMS Center

DOM prepares reporting format of RVO, and RVOs have responsibility to report DOM or LMS Centers by the format.

11) Establishment of "Month of Measurement"

"Month of Measurement" is established for dissemination of legal metrology by planning and carrying out the following events:

- Dissemination of legal metrology
- Events on metrology
- Commendation system
- Intensive surveillance

6.2.3 Consistency with OIML International Document (OIML D 1)

Some recommendations mentioned in 6.2.2 are included in the OIML International Document

(OIML D 1).

1) Control of RVO by DOM

"CHAPTER III ORGANIZATION OF THE AUTHORITIRS" in "Part 4 Guidelines for setting up the structures" specifies as follows:

III.3 Central Metrology Authority (CMA) All the issues of the national metrology policy at the central level (e.g. scientific, industrial and legal) should be managed or coordinated by one single central authority of the country, hereafter called the Central Metrology Authority (CMA). It would be inconsistent and inadvisable to have different central bodies in charge of different aspects of the metrology policy without coordination. The missions of the CMA should be: (One of the missions is specified as below:) • Coordination of all legal metrology institutions, including the Local Metrology Authority (LMAs)

III.6 Coordination of the LMAs The coordination of the LMAs is an essential responsibility of the CMA in order to assure uniform application of the law. When the LMAs are not directly under the authority of the CMA, the law should include provisions to direct this coordination. Examples of such provisions could be the following:

2) Interpretation of Laws and Regulations

"CHAPTER III ORGANIZATION OF THE AUTHORITIRS" in "Part 4 Guidelines for setting up the structures" specifies as follows:

III.6 Coordination of the LMAs (One of the examples in III.6 is specified as below:) • No deviating requirements or interpretations of requirements should exist between LMAs; the CMA may ask an LMA to revise its interpretation of the regulatory requirements when this interpretation appears to deviate from common interpretation.

3) Responsibility of RVOs to identify and prosecute contravention

"CHAPTER III ORGANIZATION OF THE AUTHORITIRS" in "Part 4 Guidelines for setting up the structures" specifies as follows:

III.5 Local Metrology Authorities (LMAs) The missions of the LMAs should be to: (One of the missions is specified as below:) Identify contraventions of the law on metrology and prosecute (refer to prosecuting authorities).

4) Measurement Range of legally controlled measuring instruments

"CHAPTER V LEGAL METROLOGY" in "Part 3 Proposed legal provisions" specifies as follows:

V.2.4 in "V.2 Regulations on measurement" The regulations mentioned in V.2.1 may specify when necessary a measuring method, and may require the use of instruments subject to legal control in application of Section V.4. When necessary they shall specify the criteria for the choice of instruments such as accuracy class, measurement range, scale division, etc.

6.2.4 Action Plan

Development measures mentioned in 6.2.2 can be implemented as action plans summarized in Table 6.2.4-1. The action plans are divided into three: short-term, middle-term and long-term plans according to the periods for the implementation.

Table 6.2.4-1 Action Plans

Action Plan	Name of Action Plan
1) Short-term action plan	L-1: Development of legislation system
	L-2: Development of verification system of WH meters
	L-3: Development of verification system of water meters
	L-4: Establishment and implementation of "Month of Measurement"
2) Middle-term action plan	L-5: Discussion on amendment of the Law of Legal Metrology
	L-6: Study of use of private vitalities
3) Long-term action plan	L-7: Amendment of Law of Legal Metrology
	L-8: Realization of study results of use of private vitality

1) Short-term action plan

(1) Action plan L-1

a) Name of action plan: Development of legislation system

b) Background of proposed action plan:

After the de-centralization, the verification activities have been transferred to local governments. However, the related regulations are not well formulated to follow it. In some cases, there exists confusion due to different interpretations of regulations between central and local governments. In addition, a part of the existing law and regulations seems to be not adapted to the recent development of legal metrology. Therefore, it is necessary to review them, properly improve them, and promote sound legal metrology.

c) Purpose of action plan:

To establish legal metrology system based on proper legislation by development of laws and regulations related to legal metrology

d) Expected outcome:

The following outcomes will be obtained by establishment of legal metrology system based on proper legislation:

- The organization(s) to administrate the national standards is designated, leading to promote international activities, and NMI development is promoted.
- The authorities between central and local governments become well defined, enabling to provide proper legal metrology services.
- The range of legally controlled measuring instruments is clearly defined, leading to easy control of the instruments.
- Quality measuring instruments are provided by unification of control of type approval testing and type approval by DOM.
- Satisfaction of measuring instrument users increases by levying consistent verification fees according to the guideline on verification fees.
- Capacity building of RVO staffs is promoted and the required number of staffs is kept by compulsory training of RVO staffs at MTC.
- Newly established RVOs can provide quality services continuously by satisfying the designated requirements.
- Legal metrology is observed by developing regulations on punishment against illegal conducts and enhancement of guidance and surveillance.
- DOM can conduct proper legal metrology administration by imposing RVOs the responsibility of reporting.

e) Framework for implementation:

- ”Legislation Development Study Committee” chaired by DOM Director is established.

- A full-time chief secretary is appointed within the secretariat.

f) Activities of action plan:
- The plan for activities is prepared including the target for Legislation Development Study Committee.
- Legislation development plan is prepared.
- Legislation development plan is reviewed and discussed.
- The study report is prepared including necessary amendment of regulations and submitted to DG-DT of MOT.
- Necessary procedures are taken for amendment of regulations.

g) Required facilities and equipment, human resources, etc.:
- Facilities and equipment: Not necessary
- Human resources: Members of Legislation Development Study Committee (experts for legislation and DOM engineers)
- Others: Not required

h) Estimated budget: Not required

i) Implementation schedule: First-second years (two years)

(2) Action plan L-2

a) Name of action plan: Development of verification of WH meters

b) Background of proposed action plan:

In the past, PLN re-verified WH meters and RVOs attached re-verification seals and labels on the passing meters. However, it is criticized as lacking fairness because PLN, a provider of electricity, verifies WH meters to meter the supplied quantity. Therefore, it is decided that PLN does not conduct verification work. At present, re-verification of WH meters is not conducted except in some cases. While small number of WH meters is imported without sufficient initial verification. Therefore, system for verification of WH meters should be structured.

c) Purpose of action plan:

To build up organizations involving verification of WH meters as well as to construct effective verification system of WH meters

d) Expected outcome:
- WH meters that are properly verified are provided to electricity users (households etc.)
- Users can pay charges for electricity consumption that is measured by reliable WH meters.

e) Framework for implementation:

A joint venture (J/V) consisting of a group company of PLN and DOM (participation of RVO and/or private companies is possible) conduct verification work. RVOs and private companies that have already conduct verification of WH meters can continue their activities.

f) Activities of action plan:

- Amendment of related regulations
- Preparation of business plan of J/V (present situation, market, technology, organization, manning schedule, investment schedule, financing plan, operation plan, income projection, etc.)
- Establishment of J/V
- Inauguration of operation (PLN conduct removal and installation of WH meters)

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: WH meter verification facility (newly installed, or transfer or leasing from PLN)
- Human resources: Electrical engineers, skilled workers, RVO inspector
- Others: Know-How of WH meter verification and operating manual

i) Estimated budget: US$1 million (20 sets, excluding building construction cost)

j) Implementation schedule: Two years (first-second years) for development; Review of system after fifth year implementation

(3) Action plan L-3

a) Name of action plan: Development of verification of water meters

b) Background of proposed action plan:

In the past, the city water supply body (PDOM) re-verified water meters and RVOs attached re-verification seals and labels on the passing meters. However, it is criticized as lacking fairness because PDOM, a provider of tap water, verifies water meters to meter the supplied quantity. While significant large number of water meters is imported without sufficient initial verification. Therefore, system for verification of water meters should be structured.

c) Purpose of action plan:

To build-up organizations involving verification of water meters as well as to construct effective verification system of water meters

d) Expected outcome:

- Water meters that are properly verified are provided to tap water users

(households etc.)

- Users can pay charges for water consumption that is measured by reliable water meters.

e) Framework for implementation:

The central government entrusts verification of water meters to RVOs (DOM and/or LMS Centers support RVOs).

f) Activities of action plan:

- Amendment of related regulations
- Preparation of business plan (present situation, market, technology, organization, manning schedule, investment schedule, financing plan, operation plan, income projection, etc.)
- Installation of equipment and measuring instrument
- Instruction to RVOs by LMS Center
- Commencement of operation

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: Water meter verification facility (newly installed, or transfer or leasing from PDOM)
- Human resources: engineers for water meters, skilled workers, RVO inspector
- Others: Know-How of water meter verification, operating manual

h) Estimated budget: US$300,000 (presuming that 30 RVOs newly installed verification facilities (locally manufactured)

i) Implementation schedule: Two years (first-second years) for development; Review of system after 5 year implementation

(4) Action plan L-4

a) Name of action plan: Establishment and implementation of "Month of Measurement"

b) Background of proposed action plan:

Activities for dissemination and enlightenment of legal metrology are carried out occasionally, however, they do not take significant effects. Therefore, measures to activate dissemination and enlightenment of legal metrology should be implemented to enhance the awareness of legal metrology.

c) Purpose of action plan:

To set up "Month of Measurement" and decide its activities for implementation

d) Expected outcome:

- Understanding about legal metrology is promoted by extending undertakings of

dissemination and enlightenment nationwide.

- Staffs engaging in legal metrology become motivated by officially commending people who contributed to enhancement of legal metrology.

e) Framework for implementation:

"Project Team for Implementation of Month of Measurement" is organized within DOM (secretariat: Administration Dept.) to make implementation plan and carry out the events etc.

f) Activities of action plan:

(a) National Convention for Commemoration Day of Metrology: Plan and implementation

- Ceremony for Commemoration Day of Metrology (including official commending of Minister of Trade)
- Commemoration events (including official commending for excellent works in contests and excellent slogans; see below)
- Reception party

(b) Official commending by Minister of Trade:

- Preparation of selection standards
- Request for selection of qualified persons who contributed to enhancement of legal metrology to local governments
- Ceremony for official commendation

(c) Special lecture on Commemoration Day of Metrology

- Preparation of related papers
- Selection of lecturer(s)
- Conducting lecture related to Commemoration Day of Metrology

(d) Undertakings for dissemination and enlightenment of legal metrology (see below): Selection of events, plan, implementation, evaluation (PDCA)

- Preparation and distribution of posters for dissemination and enlightenment of metrology countrywide
- PR papers for dissemination of metrology
- Invitation of slogan for enlightenment of metrology and selection
- Invitation for contest of "Let's measure what you want" and selection of excellent works
- Carrying out of events (e.g. Panel exhibition on metrology, Contact square for metrology, Exact measurement contest, and Metrology quiz)
- Implementation of intensive surveillance (including participation of public)

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: Posters, and equipment, measuring instruments, etc.
- Human resources: Members of "Project Team for Implementation of Month of Measurement"
- Others: Not necessary

h) Estimated budget: US$200,000

i) Implementation schedule: One year for preparation and implementation for the next year and onward

2) Middle-term action plan

(1) Action plan L-5

a) Name of action plan: Discussion on amendment of the Law of Metrology

b) Background of proposed action plan:

Twenty-five years have passed since the Law of Legal Metrology was established in 1981. Since then, the circumstances surrounding legal metrology have changed significantly. Measurement technology has been developed, and de-centralization has been carried out. In order to cope with these changing circumstances, related regulations have been amended; however, it is not sufficient. It is necessary to start investigation on changes of the Law of Legal Metrology, which is the foundation of legal metrology, to keep consistency of regulations regarding legal metrology.

c) Purpose of action plan:

To start investigation of changes of the Law of Legal Metrology by further promoting development of regulations in action plan L-1

d) Expected outcome:

- Wide range of discussion can be made concerning the Law of Legal Metrology
- The outline of amendment of the Law of metrology and related regulations
- Schedule for amendment of the Law of Legal Metrology is drawn up.

e) Framework for implementation:

"Legislation Development Study Committee" chaired by DOM Director commences the study on the Law of Legal Metrology.

f) Activities of action plan:

- The Law of Legal metrology is reviewed to specify problems and issues to be solved.
- OIML Recommendation and metrology laws or legal metrology laws of developed countries are studied.

- Discussion on changes of the Law of Legal Metrology.
- Schedule for the changes of the Law is drawn up.
- Study report including outline of changes of the Law is prepared.

g) Required facility/equipment, human resources, etc.:
- Facilities and equipment: Not necessary
- Human resources: ”Legislation Development Study Committee” members
- Others: Not necessary

h) Estimated budget: Not required

i) Implementation schedule: Third-fourth years (for two years)

(2) Action plan L-6

a) Name of action plan: Study of use of private vitalities

b) Background of proposed action plan:

Concerning privatization, manufacturers of WH meters conduct initial verification work and RVO inspector attaches certification seals and labels. Privatization of other fields has not been accepted. In order to seek efficient legal metrology work, it is necessary to investigate transfer of some tasks to private entities who have capabilities with guarantee of reliability and impartiality (privatization).

c) Purpose of action plan:

Study on transfer of verification work to private entities is carried out. The study includes investigation of registration and judgment system for privatization.

d) Expected outcome:
- The procedure for privatization for verification work is defined.
- Advantage of privatization as well as demerit and issues to be solved are clarified.
- Best suited privatization plan is designed.
- Schedule for privatization is drawn up.

e) Framework for implementation:

“Promoting Committee for Privatization” within DOM investigates the privatization including necessary amendment of regulations.

f) Activities of action plan:
- Selection of businesses subject to privatization and study on present situation
- Identification of advantages, setbacks, and problems and issues to be solved
- Case study of Japanese and oversees system (Japanese privatization: Designated manufacturers, certified measurer system, Proper Measurement Management Entities, etc.: see Appendix 5.2.3)

- Investigation of amendment of regulations concerning privatization
- Investigation of privatization (including procedure for privatization and privatization schedule)
- Preparation of study report including above

g) Required facility/equipment, human resources, etc.:
- Facilities and equipment: Not necessary
- Members of "Promoting Committee for Privatization"
- Others: Not necessary

h) Estimated budget: Not required

i) Implementation schedule: Third-fourth years (for two years)

3) Long-term action plan

(1) Action plan L-7

a) Name of action plan: Amendment of Law of Legal Metrology

b) Background of proposed action plan: Refer to action plan L-5.

c) Purpose of action plan:

The Law of Legal Metrology is amended as investigated in action plan L-5.

d) Expected outcome:
- Uniform and consistent metrology system is established.
- Measures for internationalization, technology development and development for protection of consumers' profit can be taken.
- Management of legal metrology supported by proper regulations can be made.

e) Framework for implementation:

"Legislation Development Study Committee" and "Council for Metrology Administration" consisting of central governmental organizations concerned, local governmental organizations concerned, intelligent persons, business entities, representatives from consumers, etc.

f) Activities of action plan:
- In response to the report from "Legislation Development Study Committee," "Council for Metrology Administration" discusses the amendment of the Law of Legal metrology and makes recommendation report.
- In response to the recommendation report, DOM proceeds for the amendment procedures and submit the draft to the Parliament.
- New Law of Legal Metrology is enacted by approval of Parliament.

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: Not necessary
- Members of ”Legislation Development Study Committee” and “Council for Metrology Administration", and legislation administration staffs of DOM
- Others: Not necessary

h) Estimated budget: Not required

i) Implementation schedule: After 5 years

(2) Action plan L-8

a) Name of action plan: Realization of study results of use of private vitality

b) Background of proposed action plan: Refer to action plan L-6.

c) Purpose of action plan:

Privatization is implemented according to the investigation results of action plan L-6.

d) Expected outcome:

- Private capabilities are effectively utilized in manufacturing, repair and verification.
- Supply of quality measuring instruments is maintained by strict quality management by designated manufacturers.
- Re-verification work of RVOs is relieved using certified measurer system.

e) Framework for implementation

“Promoting Committee for Privatization”

f) Activities of action plan:

- Legislation of privatization
- Setting up of standards and procedure for privatization, and preparation of application forms
- Dissemination and enlightenment of privatization including
- Legislation of certified measurer system and conducting certified tests

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: Not necessary
- “Promoting Committee for Privatization” members and DOM staffs concerned
- Others: Not required

h) Estimated budget: Not required

i) Implementation schedule: After 5 years

6.3 Development of Legal Metrology System in Conformity with International Standards

6.3.1 Review of the Previous Discussion

We discussed the categories of metrology (5.1.1), recent activities and present conditions of the international metrology (5.1.2, 5.1.3), and the present metrology system of Indonesia (5.1.4). Furthermore, we pointed out some of the problems contained in the Indonesian system and proposed improvements for them as well (5.1.5, 5.1.6). Below is a brief review of our discussions so far followed by recommendations and action plans to promote the project. This will make the recommendations and action plans easy to understand since the readers need not revisit discussions in preceding sections.

1) Current Activities of International Metrology and Legal Metrology

The following description of the activities of international metrology and legal metrology will make the goal and problems of Indonesia's metrology system clear by comparing its present conditions and international ones.

(1) International Metrology

The current activities of international metrology have been mainly managed by BIPM under supervision by CIPM comprised by 18 representatives out of signatories of the Metre Convention. The main activity of the BIPM has been focusing on the implementation of CIPM MRA, which aims to provide the mutual recognition of calibration and measurement certificates issued by NMIs. This is accomplished by establishing equivalence of the national standards maintained by the participating countries. The equivalence among the national standards maintained by the NMIs is ensured by that:

- the NMI participates in the international comparisons through a regional metrology organization (RMO), and
- the NMI accredited through the procedures specified by CIPM-MRA.

Finally, the measurement capability of the NMI is registered in the data base of CMC (Calibration and Measurement Capability) maintained by BIPM.

(2) Organization of International Legal Metrology (OIML)

The activities of OIML have mainly been focusing on development of international framework for type approval testing of legally controlled measuring instruments and

development of recommendations of technical requirements for them. The recent outcome is the conclusion of the mutual acceptance arrangement for the data of type approval testing (OIML MAA).

2) Current Indonesia's Metrology System

(1) Measurement Standards

The national measurement standards of Indonesia are maintained by 4 national institutes: DOM, KIM-LIPI, KIMIA-LIPI and BATAN. DOM, the counterpart of this project, maintains the two national standards of the measurement units out of the 7 base units of SI, i.e., Indonesia's prototype of kilogram (K-46) and the Indonesia's prototype of meter (X-27). The other national standards are maintained by the other institutes than DOM.

As described above, a NMI needs to have membership of the RMO and to be a principal or a designated member for participation in the CIPM-MRA. So far only KIM-LIPI is a member of APMP, the RMO of the Asia-Pacific Region.

(2) Legal Metrology

DOM is responsible for all activities related to Indonesia's legal metrology. Its activities cover development of policy on legal metrology, implementation of metrological control on measuring instruments and technical instruction to RVOs. Currently administrative control on RVOs has been transferred to the provincial governments after enforcement of law on administrative decentralization in 2001. This problem will be discussed later section of DOM and RVOs.

3) The Problems of Indonesia's Metrology System

The above review of previous discussions suggests the problems of Indonesia's metrology and legal metrology. The following are the categorized problems underlying in its system:

(1) Metrology System

The Indonesia's metrology system is supported by the above four different national institutes. Serious problems on the activities of DOM have been caused by the facts that physical measurement standards are separated into two groups and that DOM has not been designated as a member of APMP and CIPM-MRA. Therefore, DOM has not been able to participate in international metrology activities. Whereas KSNSU developed a

recommendation to unify the four institutes, there seems to be little progress on this matter.

(2) Metrological Activities

a) Coverage of Services

In the Ministry of Trade there were two groups of technical laboratories. One is RVOs and the other is BPSMBs. Both groups of laboratories belong to local governments. The laboratories of both groups now belong to each provincial government. Even though they are different in transaction of testing and in the products that they deal with, from the technical point of view they have almost the same functions. Therefore, in the long term planning they should be unified, and they will be able to provide manufactures and consumers with their services through their calibration and verification of products.

b) Effort to find needs from industries

Another problem is the activities of metrology. In general, the techniques of metrology are provided through a traceability system to the users. But since individual calibration laboratories in Indonesia are not so developed, the national institutes directly supply standards to each industry. In fact, many of the accredited calibration laboratories belong to each manufacturing company, and tend to provide services to the products of their own. This will cause overlap of investment in the testing and calibration facilities of the private sector and hampers their efforts to find needs in the new industry and to extend their market.

c) Lack of proficiency

Survey was conducted on some BPSMBs, RVOs and private calibration laboratories on their facilities and capabilities. It seems that many of laboratories lack equipment based on modern technologies, technical proficiency, and insight into the needs of the regional industries.

d) Contribution to regional industries

Testing on importing and exporting product,s and calibration and verification services are separated into small laboratories (RVOs and BPSMBs) of each provincial government. Therefore, it is quite difficult for them to extend their fields as well as their abilities.

This fact makes the provincial laboratories difficult to contribute to the regional industries through their technical services and consultancy, and the regional industries have to develop testing facilities and equipment by themselves.

(3) Traceability

When traceability system of a country is to be constructed, not necessarily all the 7 base units should be realized by the definitions of SI. Indonesia's traceability system, however, seems to be categorized as a small laboratory with no national or primary standards. In principle, the national standards, except mass standard, should be the primary standards (i.e., the national standards should be developed by the method recommended by BIPM to realize the base units, SI). Since some of the Indonesia's national standards have not yet been realized by the above methods or lack a transfer standard, they must be traceable to the standards of the other foreign countries. This type of traceability would be the one which may be applied to a developing country. Now Indonesia should begin research on developing realization of base units according to the recommendations by BIPM.

a) Not to use E0 for grade of weight

Some institutes use a nomenclature E0 for the highest grade of weights, or a transfer standard for the national standard of mass. But this is not in accordance with international nomenclature since there is no international definition of E0, and quite confusing with the definition of grade of weight by OIML. The nomenclatures that OIML recommends using are E1, E2, F1, F2, M1, and M2.

6.3.2 Considerations

1) Basic idea of metrological system of Indonesia

The separation of metrological system of Indonesia into four institutes apparently gives serious problems on their international activities in this field. As KSNSU recommended, the government should promote unification of these four institutes in early possible stage. DOM and KIM-LIPI share the national standards in the physical and mechanical fields, and divide the Indonesia's measurement traceability into two branches, legal metrology and industrial metrology. Among the four institutes, DOM and KIM-LIPI should be unified to avoid overlapped investment and to establish a coherent traceability. The advantages of the unification will be as follows.

- To promote cooperation and collaboration of work
- To clarify responsibilities of each department
- Equal access to the international organizations
- To avoid overlap of investment

2) Establishment of NMI and development of the project

The establishment of NMI Indonesia will take considerable time since the institutes involved in it belong to two ministries and each institute has its own history and interests. Therefore, this issue should be developed stepwise as follows:

(1) Organizing NMI promoting office

The two ministries (the Ministry of Trade and the Ministry of Research and Technology) organize an office (NMI office) to facilitate establishment of NMI. The NMI office also plays a role of representative to deal with international matters. When Indonesia or an individual participating institute is invited to an international meeting, the NMI office selects suitable person(s) from the participating institutes, and the participant(s) must report the results to the NMI office.

(2) Exchange of researchers

KIM-LIPI and DOM exchanges its researchers each other. The justification of the exchange is as follows:

- Researchers can understand each other what other institute does.
- KIM-LIPI can understand real needs of measuring standards from consumers and industry.
- DOM can learn research work of KIM-LIPI.
- Both institutes can exchange important information.
- Both institutes will be influenced each other to improve technology and performances.

(3) Review of the results

Both institutes review the outcome from the above and identifies what is an obstacle to establish NMI, and discuss how to facilitate NMI establishment.

(4) Organizing committee for investigation of NMI establishment

When the timing is matured, both ministries organize a committee to investigate NMI establishment to forward further.

(5) Review of the results

Both institutes review the outcome from the above and identifies what is an obstacle to establish NMI, and discuss how to facilitate NMI establishment.

(6) Organizing committee for investigation of NMI establishment

When the timing is matured, both ministries organize a committee to investigate NMI establishment to forward further.

3) Necessity of regional state administration to industry by LMS centers

(1) Activation of regional private sectors

We pointed out that the national metrology institutes of Indonesia mainly have been providing calibration services directly to the private manufacturers. And it seems that there are not so many calibration laboratories in regional areas. Most RVOs and BPSMBs do not seem to have capability of providing regional industries with testing and calibration services, and provincial government do not have financial power to establish their own testing and calibration laboratories, except prosperous provinces like Surabaya. Therefore, it would be better to establish a new scheme to provide testing and calibration services to provincial private sector, and it will avoid overlapping investment of equipment necessary for individual industries to develop new products.

(2) Coverage of work

The coverage of the laboratories to be established by new scheme (LMS Centers) should not overlap with RVOs and BPSMBs. LMS Centers should cover testing and calibration on request and supply of standards to RVOs, and should not conduct verification on legally controlled measuring instruments unless of which capacities are out of RVOs', while RVOs should cover verification compulsory by law and market surveillance on legally controlled measuring instruments.

(3) Unification of RVOs and BPSMBs

Both RVOs and BPSMBs belong to the provincial governments, and conduct verification of measuring instruments and testing of importing and exporting products, respectively, following each specific law. Verification is a kind of quantitative

mandatory testing on measuring instruments, and similar to the testing on products conducted by BPSMBs. Furthermore, RVOs and BPSMBs are too small to perform their duties and restrict contents of their work.

For this reason, in a mid-/long-term plan, both organizations should be unified, and instruments of RVOs and BPSMBs will be commonly controlled in a traceability of legal metrology.

6.4 Plan for Enhancement of DOM's Functions

6.4.1 Vision, Mission and Strategy

Below is a table of vision, missions and strategies, which DOM should fulfill in the near future by following the previous discussions.

Vision	Establishment and implementation of a transparent and internationally harmonized metrological system
Mission	1. Policy development for overall legal metrology system 2. Promotion of internationalization of metrological system 3. Development of human resources with a broad view and expertise necessary for metrology 4. Development of techniques necessary for metrology and legal metrology, and returning its outcome to the society
Strategy	1.1 To make the difference and consistency clear between DOM and the other organizations 1.2 To get common awareness among staffs of DOM on the current and mid(5 years)/long(10 years) term needs to Indonesian metrology system 1.3 To develop a scrap-and-build plan including other organizations to fulfill the needs described above
	2.1 To make research on metrological systems of the other countries and develop a plan to establish a system suitable for Indonesia 2.2 To cooperate with international organizations concerning metrology and reflect the results obtained
	3.1 To develop a plan for recruiting and HRD by checking out the current and mid/long term work plan 3.2 To develop a training program necessary for each job class 3.3 To introduce a performance evaluation system 3.4 To keep transparency of the work and make all staffs understand their obligations and

		accountability
	4.1	To develop a research system on metrology especially for mass and length standards
	4.2	To develop a new decree on type approval testing and verification on measuring instruments and make them public
	4.3	To introduce calibration of the measuring instruments and testing of material into the work plan, and implement on request
	4.4	To make clear the party capacity and accountability of the each job class
	4.5	To make clear the functions and capability of DOM, and open them to the public

6.4.2 Action Plan for Enhancement of DOM's Function

Table 6.4.2-1 lists the action plans for DOM classified as short-term, mid-term and long-term to complete the above strategies.

Table 6.4.2-1 Action Plans

Action Plan	Name of Action Plan
1) Short-term action plan	D-1: Setting-up planning section
	D-2: Enhancing international activities
	D-3: Enhancing HRD program and bringing-up experts
2) Mid-term action plan	D-4: Transformation of staff assignment
	D-5: Upgrading technical infrastructure and metrological services
3) Long-term action plan	D-6: Implementation of type approval testing and calibration of testing equipment

1) Short-term action plan

(1) Action plan D-1

a) Name of action plan: Setting-up planning section

b) Background of proposed action plan

DOM does not have a planning section. It seems that an appropriate people selected for a specific issue, when it arises, by the director for settling the problem. This system would be neither suitable for developing a long-term plan nor sharing a problem among staffs and sections of an organization. We propose to organize a planning section for developing strategies and policy making.

c) Purpose of action plan

The purpose of this action plan is to organize a section that has a responsibility for

planning of the activities of the institute including budget, coordination of the issues among sections concerned. It will also play a role of the spokesman for public relations.

d) Expected outcome

It is necessary to develop a long-term strategy when an organization is to step-up its functions and competence. This is certainly impossible for a single person or a tentative group. It will be enabled by setting up a permanent section to develop a long-term strategy with functions to manage activities of the institute by coordinating issues of inter-sections and keeping consistency with the long-term policy. This section will functions under supervision of the director and will support him/her.

e) Framework for implementation

First, a team should be set-up for planning an overall organization of DOM including LMS centers. The functions of the planning section will be determined through the discussion of the team, including those described above.

f) Activities of action plan

<u>First phase:</u>

- To design over all departments and sections, as well as their functions, vision, mission and strategies.
- To work out an immediate, mid-term and long-term plan for each section.

<u>Second phases</u>

- To settle a planning section for coordination of work plans developed by other sections.
- To work out a comprehensive implementation plan by compiling work plans developed by other sections.

g) Required facilities and equipment, human resources, etc.

The working group for designing an over all organization should consist of senior staffs including heads of the current system. The staffs of the planning section to be established should consist of rather young members headed by a person with experience of about 10 years, just before promotion to a head of the section. The outcome of the planning section should be checked with the director and be discussed at the committee comprised with the heads of the departments.

This is because designing an organization requires negotiation with the other organizations, and experience with wider view over the activities of the institute. While the planning section may be a place of education for young members to obtain

wider and impartial views, and learn the process of extending the work of the institute.

h) Estimated budget: Not applicable

i) Implementation schedule: Immediately.

(2) Action plan D-2

a) Name of action plan: Enhancing international activities

b) Background of proposed action plan

DOM does not have an international relations office for metrological activities. This fact makes it difficult for the outside people to understand the process of developing the strategies of the international/regional activities of DOM, and for DOM to keep consistency of the policy in accordance with the other national metrology institutes of the Indonesia. As is the case for usual activities of the institute, it is necessary to set up a section for developing strategies and work plan for international metrological activities.

c) Purpose of action plan

The purpose of this action plan is to set up a section responsible for developing strategies and work plan of DOM's international activities. This section should also be responsible for coordination of the policy making with the other national metrology institutes for the international activities of Indonesia.

d) Expected outcome

- To enable DOM to develop systematic strategies easy to understand and transparent to outside people in cooperation with the proposed planning section
- To make the policy known to everybody of the staffs and the outside
- To keep consistency of the policy of the international activities with the other national metrology institutes
- To enable DOM to develop policy and process of accessing the international organizations and regional organizations

e) Framework for implementation

The work plan of this section, as well as the planning section, should be determined in the process of comprehensive planning of the organization.

f) Activities of action plan

<u>First phase</u>

- To design overall departments and sections including the section for international metrological activities
- To settle a section for international metrological activities

- To work out an immediate, mid-term and long-term plan of DOM's international activities

Second phase

- To participate in APMP
- To develop a plan to host international meetings and training courses
- To develop an annual plan for participation of the international meetings and training courses
- To work out a program for participating in the international comparisons and budget for these activities
- To work out a budget system for dispatching staffs abroad

g) Required facilities and equipment, human resources, etc.

The working group of establishing a section of international activities will be the same as that of the planning section.

The staffs of the international metrology section to be established should be comprised by various ages of the staffs, and will be required to speak English fluently.

h) Estimated budget: Not applicable

i) Implementation schedule: Immediately.

(3) Action plan D-3

a) Name of action plan: Enhancing HRD program and bringing-up experts

b) Background of proposed action plan

So far, DOM seems to have given priority to clerical work more than engineering work and not to have paid attention to the technical needs from the market and industries. This seems to be because DOM has been focusing most attention on the administration of RVOs. Furthermore, technical staffs of UTTP have been rotated every two weeks changing measuring instruments that they have to work on. These facts caused lack of technical experts of legal metrology and prevented DOM from bringing-up experts in each field of legal metrology and enhancing the sense of needs from the market and industries.

c) Purpose of action plan

The purpose of this action plan is to bring-up experts of the techniques necessary for type approval testing, verification, measurement technologies of each metrological field.

d) Expected outcome

- To bring-up experts of each legally controlled measuring instrument

- To enable developing technical standards of the instruments in conformity with the international ones.
- To enhance the activities at the international technical meetings
- To transfer techniques to RVOs, private sector and other fields requesting those techniques
- To transfer techniques to the following generation in DOM
- To facilitate the maintenance of the equipment for type approval testing and verification

e) Framework for implementation

- To set-up a committee for planning of equipment necessary for services such as type approval testing, calibration, verification, testing, etc.
- To analyze the techniques necessary for managing and maintaining each equipment
- To make a plan for recruitment of researchers and technicians

f) Activities of action plan

- To conduct training courses by foreign researchers
- To give priority of recruitment to technical staffs such as researchers and engineers
- To stop the current bi-weekly working rotation for UTTP technicians and extend the period of rotation to 5-8 years
- To develop a training program by collaborating with a nearby university
- To enhance education system for staffs to study in universities
- To participate in training courses held by international organizations
- To hold training courses for RVOs staffs

g) Required facilities and equipment, human resources, etc.

- A library with technical books, treatises, material and data, concerning physics, applied physics, mechanics, scientific instrumentation, measurement technology, metrology, legal metrology, current laws and regulations
- Librarians
- Technical staffs to develop equipment and training plan

h) Estimated budget: 30,000 USD for subscribing journals and material

i) Implementation schedule: Immediately

2) Middle-Term action plan

(1) Action plan D-4

a) Name of action plan: Transformation of staff assignment

b) Background of proposed action plan

Administration of RVOs is now subject to provincial governments. But as far as management of personnel affairs concerns, most of human resources of DOM seem to be allocated for supervision and administration of RVOs, and less human resources are allocated for implementation of technical work such as type approval testing and calibration, etc. Furthermore, comparing amount of current work and human resources, there seems to be a great mismatch between them.

Considering the above fact, transformation in personnel assignment of clerical work and engineering work should be performed since DOM should extend its missions over outside of legal metrology.

c) Purpose of action plan

The purpose of this action plan is to enhance the current technical services and enable to extend services into calibration and testing.

d) Expected outcome

- To upgrade type approval testing in accordance with international recommendations
- To extend technical services into calibration of standard measuring instruments maintained by private sector
- To provide testing services on request

e) Framework for implementation

To setup a working group for developing a work plan including survey on needs and current conditions, necessary equipment, staff assignment, budget, etc.

f) Activities of action plan

- To survey needs of technical services concerning measurement standards, measurement technology, calibration, testing, including their quantities, ranges, uncertainty, existing institutes providing those services and their conditions, etc.
- To select contents of services that meet the needs of the industries, and those possible for DOM
- To develop an equipment plan, staff assignment plan and training program in cooperation with a nearby university.

g) Required facilities and equipment, human resources, etc.

The equipment and facilities necessary for technical services should be supplied by action plans D-5 and D-6.

h) Estimated budget: Not applicable

i) Implementation schedule: Immediately in mid-term

(2) Action plan D-5

a) Name of action plan: Upgrading Technical Infrastructure and Metrological Services

b) Background of proposed action plan

DOM is responsible for both legal metrology and measurement standards of mass and length. This means that DOM should maintain both capabilities of metrological control on the society and of research on the measurement standards that it maintains.

As for the current conditions of DOM's technical infrastructure concerning legal metrology, they are generally not in good condition. This seems to come from the following reasons.

- Few experts on the techniques of legal metrology and measurement technologies
- Law operation rate and lack of maintenance of the equipment

The conditions of technical infrastructure of measurement standards are a little bit different from the above. Since DOM maintains the national standard of mass, the equipment necessary for this is not so bad. But, if DOM wish to participate in international comparisons of mass, higher-performance equipment and skills would be required.

The line gauge standard, X-27, is also maintained by DOM. But instruments required for disseminating the standard are quite old and do not seem working. This is due to the facts described below.

- Few technical specialists required to maintain the equipment
- Little information on the needs from industries including measurement uncertainty

c) Purpose of action plan

The purpose of this action plan is to upgrade technical services on legal metrology, measurement technology and testing based on the needs from the industries. Since DOM maintains the national standards of mass and length, it should develop and maintain the national standards for the quantities derived from these base quantities,

such as force, pressure, torque, density, etc. These quantities are closely related with the material testing frequently used in the basic industries. Therefore, DOM should also develop the traceability system for these derived quantities.

Furthermore, DOM should start the research on the relationship between traceability of the above mentioned quantities and material testing, since it has not yet been established in Indonesia. DOM also should maintain the standards necessary for those testing.

d) Expected outcome

- To develop wide area traceability system of mechanical quantities
- To extend calibration services on mass and length related quantities
- To establish relationship of the traceability of mechanical quantities and material testing
- To enable calibration and testing services traceable to DOM
- To enable to participate in international comparisons of quantities derived by mass, length, and material characteristics quantities.

e) Framework for implementation

- To setup a working group on promoting the action plan
- To develop a plan for human resources necessary for new fields, equipment, needs from industries and market
- To make an advisory specialist stay at DOM while developing overall system

f) Activities of action plan

- Enhance HRD for mass and length standards
- Improve DOM's research environment by establishing a new building with a library, information system
- Enhance communication with the other institutes of Indonesia and overseas
- Recruit qualified staffs
- To prepare fundamental material and documents on metrology and legal metrology.
- To prepare equipment for calibration and testing on request, and make services for the needs from industries and social activities.
- To make contents of the services public through internet and associations of the industries.

g) Required facilities and equipment, human resources, etc.

- New equipment for mass standards, length standards, force standards, pressure

standards, density standards, etc

- Temperature and humidity controlled new buildings to install the above equipment
- Postgraduate degree staffs to promote research on the above fields

h) Estimated budget: US$6,940,000 for equipment for calibration

i) Implementation schedule: 3 years after starting the project

3) Long-term Action Plan

(1) Action plan D-6

a) Name of action plan: Implementation of type approval testing and calibration of testing equipment

b) Background of proposed action plan

As far as the JICA study team surveyed, type approval testing on legally controlled measuring instruments has not been implemented in conformity with OIML recommendations, nor has calibration services been implemented for measuring instruments on request. Now that the verification has been transferred to the provincial government, and that is the world trend, DOM should not restrict its work to the control of the RVOs. DOM should enhance the ability of type approval testing and extend its skill into the testing and calibration of instruments and material, since type approval and verification are only a legally regulated part of general testing and calibration. Otherwise DOM will not be able to survive only by currently conducted type approval testing and control of RVOs.

c) Purpose of action plan

The purpose of the action plan is to develop fields necessary for DOM to bring out its ability after decentralization and catch up to the international standards.

d) Expected outcome

- Enable to extend DOM's coverage of work balancing its human resources
- Extend DOM's services to the international level of type approval testing, calibration services, research on material testing based on the needs from industries
- Upgrade the services to RVOs, regional industries and market

e) Framework for implementation

- To set up working groups for each measuring instrument subject to type approval testing and calibration and testing
- To make an advisory specialist stay at DOM while developing over all system

f) Activities of action plan

- To conduct survey on the needs of calibration and testing
- To perform total update and improvement of the equipment necessary for services described in this action plan
- To improve SSTK and/or develop instructions for operations
- To conduct training on the new equipment
- To dispatch specialist to oversea institutes for training
- To set-up management committees for each field of work

g) Required facilities and equipment, human resources, etc.

- To install facilities and equipment necessary for the above work in accordance with the master plan presented by the JICA study team
- To recruit postgraduate degree staffs and re-educate in the institute, nearby universities and oversea institutes

h) Estimated budget: US$16,000,000 for type approval testing

i) Implementation schedule: 5 years after starting the project

6.5 Establishment of Legal Metrology Standardization Centers

6.5.1 Vision, Mission and Strategy

Organization: LMS Center

Vision	To contribute establishment of fundamentals for regional industrial activities by developing legal metrology infrastructure
Mission	1. Technical assistance to the regional verification offices (RVOs) and HRD. 2. To keep liaison functions and measurement traceability between central and regional organizations 3. To make services of verification and calibration services for large scale and special measuring instruments unable by RVO. 4. To contribute regional industries through calibration and testing on request
Strategy	1.1 To establish a system for services matching the needs from regional industries 1.2 To grade up skills of calibration by comparisons of measuring instruments among RVOs 1.3 To make the missions of LMS Centers well-known to regional industries and RVOs 1.4 To hold training courses matched with the needs from regional activities

	2.1	To prepare equipment and system necessary for traceability
	2.2	To provide standards to RVOs and technical assistance
	2.3	To collect data and information concerning RVOs, and report them to DOM
	3.1	To grasp needs from regional industries
	3.2	To implement verification, calibration and testing matching with regional needs but unable by RVOs
	3.3	To prepare instruction manual and equipment necessary for activities described above
	4.1	To make functions of Balai SML public to regional industries and organizations
	4.2	To accept testing on request
	4.3	To develop a system for proper distribution of the testing fee

6.5.2 Action Plan

Action Plan	Name of Action Plan
1) Short-term action plan	B-1: Study on Establishment of LMS Centers
2) Middle-term action plan	B-2: Providing services to RVOs and regional industries

1) Short-term action plan

(1) Action plan B-1

a) Name of action plan: Study on establishment of LMS Centers

b) Background of proposed action plan

As is discussed in the interim report and the previous section, and recommended in the report presented by the JICA study team in 1994, establishment of the LMS Centers will be necessary. They recommended that the LMS Centers should cover the services to the regional industries, and after the survey into provinces by this study, almost the same conclusion has been obtained from the point of view of the LMS Centers' functions. But in the previous study, it is recommended that the LMS Centers should be allocated evenly in consideration of the balance over the country and classified into three classes according to the size of the cities where a LMS Center is to be located.

But this study reached the following conclusions, somewhat different from the previous one, from the point of view of locations;

- that the cities in which the LMS Centers to be located should not be selected considering the balance among the regions, but be selected considering whether there are needs to the functions of the LMS Centers,

- that the LMS Centers should be located very near to or in the site of the needs such as large industrial park, and
- that the functions and facilities should be selected considering the needs in the region.

Therefore, classification by the size of the LMS Centers caused by the size of the cities should not be taken.

c) Purpose of action plan

The purpose of the action plan is to study on establishing the LMS Centers that meet the needs from industries of each region.

d) Expected outcome

- To establish LMS Centers to be able to extend services for regional industries
- To establish centers to provide standards and services necessary to RVOs
- To develop a system including facilities and human resources necessary for HRD of the RVOs.

e) Framework for implementation

- To set-up a working group to conduct a survey for needs and services necessary for regional industries and RVOs
- To set up a working group to construct the LMS Centers

f) Activities of action plan

- To decide the locations of the sites of LMS Centers
- To develop work plan to establish the LMS Centers
- To decide facilities and equipment necessary for the activities of the LMS Centers
- To develop a program for services to regional industries and RVOs

g) Required facilities and equipment, human resources, etc. (in Implementation)

- The facilities to install equipment necessary for the activities of LMS Centers
- The working standards calibrated by DOM
- Human resources to provide services to RVOs and regional industries

h) Estimated budget: US$777,000 equipment for one LMS Center

i) Implementation schedule: immediately

2) Middle-term action plan

(1) Action plan B-2

a) Name of action plan: Providing services to RVOs and regional industries

b) Background of proposed action plan

It was recommended in the report submitted by the JICA study team in 1994 that the LMS centers should provide services to promote the regional industries. This idea comes from the fact that the verification itself is nothing more than a part of calibration, and calibration is a part of measurement technology (i.e., measuring a measuring instrument). The difference between verification and general calibration is that the former is mandatory by law while the latter is voluntary and conducted on request. The service program should be developed by the above mentioned point of view.

c) Purpose of action plan

The purpose of the action plan is to promote the ability of the services and to RVOs and the regional industries.

d) Expected outcome

- To enable the services that meet the needs from the regional industries
- To enhance the traceability of legal metrology
- To promote the HRD for RVOs and the regional industries

e) Framework for implementation

The number of staffs will depend on the contents of the services of each LMS Center.

f) Activities of action plan

- To provide services to the regional industries that are not possible by RVOs
- To provide standards necessary for the activities of RVOs
- To develop technical expertise to manage large scale machines and/or special equipment.
- To hold training courses on establishment of traceability for RVOs.
- To develop an instruction manual for management system.
- To enhance activities on public relations.
- To develop human resources with leadership to regional industries.

g) Required facilities and equipment, human resources, etc.

- Large scale facilities to provide services not possible by RVOs
- Facilities to meet the needs of the regional industries
- Human resources for conducting services to RVOs and regional industries

h) Estimated budget: See Action plan B-1.

i) Implementation schedule: 4 years after starting the project

6.6 Plan of Capacity Building of RVOs

6.6.1 Objective

It is obvious that the successful renovation of RVOs is vitally important in survival of legal metrology system in Indonesia, because RVOs are organizations to directly implement verification and re-verification of legally controlled measuring instruments. The relationship between DOM and RVOs becomes looser than before, as RVOs are administrated by local governments after the decentralization. Therefore, for development of legal metrology, plan for RVO's capacity building is very important before taking actions for improvement, including how to improve the setbacks of existing system. The vision, mission and strategy of RVO are shown in Table 6.6.1-1.

Table 6.6.1-1 Vision, Mission and Strategy of RVO

Vision	To implement a fair and proper legal metrology activities, and enhance consumer protection and increase profit for consumers
Mission	1. Implementation of fair and proper verification rapidly in wide area, and keep a system for providing accurate measuring instruments 2. Strengthening of market surveillance on measuring instruments and keeping implementation of fair and proper measurement system
Strategy	1.1 To establish traceability to DOM by implementing periodic calibration of standards maintained by RVOs, and make services of verification based on the proper measurement standards 1.2 To collect information on in-use measuring instruments and elevate the rate of re-verification by implementing verification taking customers convenience into account 1.3 To upgrade the skill of the inspectors by their reeducation and provide reliable services
	2.1. To collect information necessary for market surveillance on measuring instruments and exterminate illegal measuring instruments 2.2 To give proper instruction of measuring instruments to the users and obligate them to use correct measuring instruments and implement accurate measurements
	3. To promote legal metrology and enlightenment on it and enhance awareness of the public of legal metrology

6.6.2 Action plan

The action plans are designed to realize the vision, mission and strategy described in Table 6.6.1-1. The action plans are summarized in Table 6.6.2-1. The action plans are divided into three: short-term, mid-term and long-term plans according to the starting periods for implementation.

Table 6.6.2-1 Action plans

Action plan	Name of Action Plan
1) Short-term action plan	R-1: Business innovation of RVO
	R-2: Preparation of annual action plan
	R-3: Development of manuals
	R-4: Plan for Facility Development
	R-5: Implementation of verification of water meters by RVOs
	R-6: Improvement of recording and reporting system
	R-7: Collaboration of RVOs
2) Mid-term action plan	R-8: Improvement of facilities
	R-9: Interim evaluation of innovation of RVOs（Plan Do Check Action circle or PDCA circle）
3) Long-term action plan	R-10: Study on unification of RVO and BPSMB

1) Short-term action plan

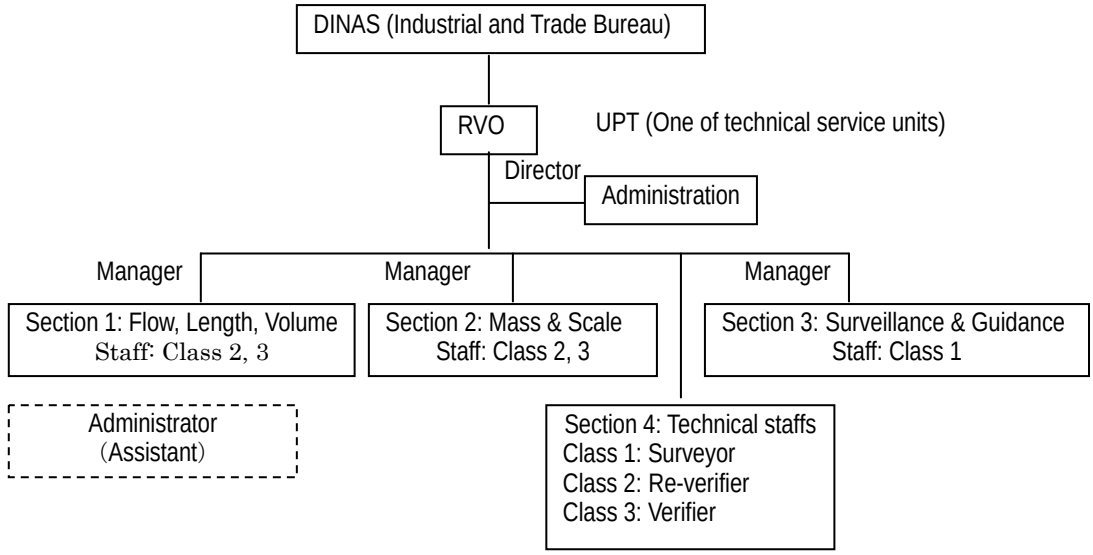
(1) Action plan R-1

a) Name of action plan: Business innovation of RVOs

b) Background of proposed action plan

- According to the result of questionnaire survey to RVOs, it is pointed out that updated technology, basic skills of electronics and maintenance as well as the basic knowledge of legal metrology is insufficient.
- The ratio of administration staffs to the whole staffs is very high.
- The implemented ratio of verification and re-verification has been remarkably reduced after the decentralization.
- It is difficult for RVOs to indict illegal conducts relating to legal metrology.
- The budget from local government is insufficient for most RVOs.
- The organization of RVO is based on the metrological law of local government, but when such a law does not exist, it follows organization that DOM had controlled before decentralization as shown in Figure 6.6.2-1. (Actually, this

organization seems to be the majority.)



Note: Flow includes electricity and flow meter

Figure 6.6.2-1 Organization of RVO

- Technical staffs are allocated in Section 4 and dispatched to Sections 1, 2 and 3 as required to conduct different jobs of each section. As a result, they can not accumulate sufficient expertise.
- Each section manager prepares work schedule by order from the director. They have the historical record of legally controlled measuring instruments of users. The schedule for re-verification is made based on the data. There is no section to control whole RVO such as business management section.
- Surveillance & Guidance Section designs the activities for dissemination and enlightenment of legal metrology and reports to the director for approval. The staffs in charge to promote dissemination are selected from the staffs in Technical Staffs Section.
- Surplus administrators of local government sometimes transferred to RVO.

c) Purpose of action plan:

To implement business innovation of RVO (including the target management) for fostering specialized staffs, improving technical level and increasing work efficiency

d) Expected outcome:

- The business system within RVO is developed.
- Staffs can work efficiently based on work schedule.
- Staffs as well as managers have better discipline and become more motivated

for their tasks.

- Staffs can get advanced technology.
- Awareness of consumers about legal metrology is enhanced.
- The above leads to the efficient verification work.

e) Framework for implementation

(a) The organization of RVO is re-organized by establishing the following sections for instance:

- Business Management Section
- Surveillance & Guidance Section
- Verification Section
- Inspection Section

Their job is defined by job description as follows:

- Business Management Section: Personnel affaires, salary, document control in RVO, total planning, adjustment and promotion related to legal metrology, dissemination and enlightenment of legal metrology, HRD, asset management, rules in RVO, etc.
- Surveillance & Guidance Section: Guidance to entities related to measurement, registration of manufacturers, repairers and traders of legally controlled measuring instruments, and surveillance and on-the-spot inspection
- Verification Section: Verification and re-verification of legally controlled measuring instruments for flow, length, volume, mass and scale
- Inspection Section: Periodical inspection of measuring instrument in RVO, issuing certification of measurement, and maintenance of measurement standards

f) Activities of action plan

(a) Business Management Section makes the following annual plans with cooperation of related sections according to the RVO's Business Rule at the beginning of a year:

- Comprehensive plan for execution of legal metrology policy in province
- Plan on dissemination and enlightenment of metrological concept
- Staff education plan about up-dated technology, electrical technology, etc.

(b) The Director announces the above plans to all staffs gathered in a place to get their consensus at the beginning of a year.

(c) Each manager makes a monthly plan in detail from the annual plan.

(d) All managers and heads have a monthly meeting to recognize the difference between the target and the achievement that are fed back to take necessary measures (target control).

(e) Managers make a weekly or daily plans based on the monthly plan which are put up on the board to let all staffs know. The work load of the plan should be assigned properly. A morning meeting should be customized to confirm the daily work.

(f) Work of the day should be assigned to surplus staffs. If there is no work for many days, they should be sent back to DINAS.

(g) Required facilities, equipment, human resources etc.

- Facilities and equipment: Not necessary
- Human resources: See (a) of e)
- Others: Not required

g) Estimated budget: No budget is needed.

h) Implementation schedule: From the first year

(2) Action plan R-2

a) Name of action plan: Preparation of annual plan

b) Background of proposed action plan:

According to the interview survey to 11 RVOs, most RVOs made only annual plan and did not make monthly and weekly plans with some exceptions. Among RVOs visited, only few of RVOs made a schedule table every day so that all staffs could recognize what they should do individually in a day. Their motivation for work seemed relatively high.

c) Purpose of action plan: To make annual plan which are reduced to monthly and daily plans for effective assignment of work

d) Expected outcome:

(a) The ratio of accomplishment of tasks to the target during the corresponding period becomes clear, and it can be reflected to monthly or daily action plans for adjustment.

(b) It can be used in adjusting delays of work as well as adjusting work load of staffs.

(c) Proper manning schedule can be made.

(d) The motivation of staffs to work is enhanced.

e) Framework for implementation:

(a) Create the work climate enabling not only top down but also bottom up for better communication by clarifying the line of command by functions/duties.

(b) Monthly meetings as well as morning gatherings are held regularly for better communication.

f) Activities of action plan:

The annual plan includes the following activities:

- Activities to enhance the ratio of verification and re-verification
- Activities to increase the number of periodical inspections
- Activities to increase on-the-spot inspections
- Activities to disseminate and enlighten legal metrology
- Activities to maintain traceability of secondly standards and working standards with periodical calibration and management
- Activities to control budget effectively
- Activities to conduct surveillance

g) Required facilities, equipment, human resources etc.:

- Equipment:
  - Personal computers to make and manage the annual and monthly schedules: 3 units/RVO
  - Several notice boards to indicate schedules
- A staff who can make schedules using Word and Excel
- Others: Computer software for preparation and management of annual plan

h) Estimated budget: US$500,000

i) Implementation schedule: From the first year

(3) Action plan R-3

a) Name of action plan: Development of manuals

b) Background of proposed action plan:

According to the questionnaire survey to RVOs, 82% RVOs have a manual for verification/re-verification, 12% RVOs have not, 6% RVOs have partially. According to the interview survey, all eleven RVOs use manuals (SSTK prepared by DOM). However, few RVOs develop their own working manuals for their specific tasks from SSTK and take in new technology. Some staffs do not rely on manuals, but rely on only experience and what they learned at MTC training.

c) Purpose of action plan：

To make technical manuals for verification/re-verification, maintenance manuals, etc. that are easily understood and practical (DOM and LMS Center provide technical support to RVOs).

d) Expected outcome：

- Easily understood and practical manuals are prepared.
- All staffs can conduct tasks with the same working procedure so that quality

work is maintained.

- Staffs can discuss revising manuals by themselves when those manuals do not meet the actual conditions. It creates a sense of participation as well, leading to enhance motivation of staffs to work.
- Manuals can be used OJT for new staffs.

e) Framework for implementation:

Manual study groups are organized by kind of work within RVOs to review existing manuals and revise them. DOM and LMS Center technically assist them in development of manuals. If required, MTC plans a short-term training course for RVOs how to prepare manuals.

f) Activities of action plan:

The following should be considered to develop manuals:

- A manual is a document describing work procedure that can be a basis for quality work and OJT. It should clearly specifies the basic policy of legal metrology and value of work as well as concrete work procedure, target level, key points and important skills.

  To achieve this purpose,

(a) Cover the fundamental work for new staffs.

(b) Cover daily routine work.

(c) Prepare manuals for skilled work and task for management as well.

(d) Include measures to enhance motivation.

- It is not the end of work when manuals are completed, but continuous maintainance of manuals is of importance. PDCA management circle is useful in revising manuals.
- Develop manuals with the words, “A persons brush up a manual and a manual develops a person.” in mind.
- Manuals should describe the most effective approach in sentence.
- A manual should seek efficiency, activiation and creativity of work.
- Understanding and recognition of RVO’s duties and tasks are promoted through preparation, revision and use of manuals.
- It is noted that the reference is made to OIML and ISO.
- Description of work contents and procedures using pictures, figures and charts is effective for easy understanding of manuals.

g) Required facilities, equipment, human resources etc.:

- Facilities and equipment: not necessary

- Human resourses: Inspectors from DOM and LMS Centers
- Others: Not required

h) Estimated budget：Not necessary

i) Implementation schedule: Two years from the first year

(4) Action plan R-4

a) Name of action plan: Plan for Facility Development

b) Background of proposed action plan:

According to the questionnaire survey of RVOs, only 9% of RVOs are satisfied their existing facilities and equipment, and as many as 76% of RVOs replied that their facilities and equipment are insufficient.

According to the interview with inspectors of RVOs, the insufficient subjects are facilities, budget and human resources in this order. Accordingly, it is an urgent matter to solve the problem of facilities and budget.

There are big differences in condition of facilities between RVOs. Some RVOs still maintain facilities installed at Dutch occupation period. Among RVOs, Jakarta RVO has comparatively good facilities and equipment including environment of buildings.

There are big differences in budget of RVOs. For instance, the budget of Jakarta RVO is Rp. 940 million and that of Padang RVO is Rp. 118 million.

c) Purpose of action plan:

To draw up the facility development plan to be required for verification and re-verification

d) Expected outcome: By supplement the required facilities, the ratio of verification and re-verification increase.

e) Framework for implementation:

After the decentralization, provincial governments allocate the budget; however, there is big difference of budget between some lucrative governments and not lucrative ones. Accordingly, many provincial governments can not allocate enough budgets to purchase the required facilities. Therefore, it is indispensable to structure the system that the central government (DOM) assists them in order to improve their facilities.

f) Activities of action plan:

(a) RVOs apply for necessary facilities to DOM (excluding real estate).

The contents of application include the following:

- Legally controlled measuring instrument
- Specifications and estimated cost

- Expected increase of number of measuring instruments to be verified and re-verified or calibrated; estimate of increase of revenue with growth rate
- Scrapping of unnecessary and/or unused facilities

(b) DOM summarizes the application by RVOs in a form of application list.

(c) DOM decides the priority of assistance for purchase of facilities considering higher growth rate, and prepare a purchase plan for specified years. DOM then applies the budget to MOT.

g) Required facilities and equipment, human resources, etc.:

(a) Facilities and equipment: Not necessary (under planning)

(b) Human resources: Not necessary

(c) Others: Not necessary

h) Estimated budget: Not necessary

i) Implementation schedule: Start from the first year for two years

(5) Action plan R-5

a) Name of action plan: Implementation of verification of water meters by RVOs

Remarks: The action plan R-5 focuses on actual verification work to be achieved by RVOs. While the action plan L-3 focuses on system development including amendment of regulations. In this report, total action plan is described in action plan L-3. Therefore, see action plan L-3 for detail.

(6) Action plan R-6

a) Name of action plan: Improvement of System for Record and Reporting

b) Background of proposed action plan:

After the decentralization, the relationship between DOM and RVOs become weaker and RVOs do not have obligation to report DOM about their activities. Accordingly, DOM can not grasp RVO's annual activities sufficiently. In addition, exchanges among RVOs become inactive. Under these circumstances, DOM can not plan based on the real situations what point should be strengthened and how to develop legal metrology toward future.

c) Purpose of action plan:

To develop a data base on actual distribution of legally controlled measuring instruments, to improve recording system of verification and re-verification and to structure reporting system to DOM

d) Expected outcome:

Data base on actual conditions of legal metrology in each province is structured.

- Network through internet is structured between DOM and RVOs.
- RVOs can use these data effectively to draw up their annual activity plans.
- DOM can obtain real data of RVOs, resulting in better management of RVOs.
- DOM can utilize the reported data in developing legal metrology policy as well as its implementation.

e) Framework for implementation:

DOM designs information system through internet for communication with DOM and RVOs.

f) Activities of action plan:

(a) DOM prepares formats for reporting of legal metrology performance records and sends them to RVOs. The formats include the following:

- Annual budget and cost
- Number of staffs by inspector and officer
- Number of verified measuring instruments and revenue of verification fee
- Number of legally controlled measuring instruments by kind
- Equipment list including newly purchased equipment
- Number of staffs who get training in a year at MTC

(b) RVOs allocate at least one computer operator to control operation and report to DOM using the above formats.

(c) DOM collects data from RVOs to report it to organizations concerned as well as to make it public. DOM uses the collected data to analyze RVO's activities. DOM dispatches personnel to RVOs whose performances are inferior for taking measures for improvement.

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: personal computers, computer server
- Human resources: IT engineers
- Others:

h) Estimated budget: US$30,000

i) Implementation schedule: Start from the first year

(7) Action plan R-7

a) Name of action plan: Collaboration of RVOs

b) Background of proposed action plan:

The JICA study team visited eleven RVOs and found that the following activities are

conducted as collaboration among RVOs:

- Indonesian Metrology Technical Meeting is held once a year as a liaison meeting.
- Within West Jawa Province, there is a liaison conference of RVOs once a month with subjects of metrological policy, technical issues, adjustment, budget, etc.
- Staff of Medan LMS Center visited thirteen RVOs in Sumatra by a truck with standard tanks on it to conduct inter-laboratory comparisons of volume standards for tank trucks that RVOs own. LMS Center requested RVOs with standards exceeding the limit of uncertainty not to conduct verification and re-verification.
- Metrological Communication Forum sponsored by DOM were held for whole RVOs at Bandung in November 2006.

c) Purpose of action plan:

To conduct inter-laboratory comparisons, technical competitions, etc. among RVOs by assistance of LMS Centers aiming at improvement of their technology

d) Expected outcome:

- Inter-laboratory comparisons promote the maintenance of traceability of RVOs
- RVOs know their calibration capabilities through inter-laboratory comparisons of measurement standards.
- RVOs know their verification capabilities through technical competition among RVOs.
- RVOs can develop skills for calibration as well as verification and re-verification by technical support of LMS Centers.
- Relationship between DOM/LMS Centers and RVOs improves.
- Information can be exchanged frequently among DOM/LMS Centers and RVOs.

e) Framework for implementation:

DOM, LMS Centers and RVOs

f) Activities of action plan:

- DOM continues to hold seminars that have been held annually, by reviewing the results for improvement of seminars.
- DOM/LMS Centers assist in holding “area meetings” of RVOs.
- LMS Centers conduct comparative testing of not only volume standard but also other standards.
- Presentation of results of comparative testing are made at seminars to share the information.
- DOM designs and conducts technical competition among RVOs.

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: trucks for LMS Centers, Measurement standards
- Human resources: experts of calibration, statistics engineer
- Others: Calculation by statistics method

h) Estimated budget: US$30,000/LMS Center

i) Implementation schedule: The first year and onward

2) Mid-term action plan

(1) Action plan R-8

a) Name of action plan: Improvement of facilities

b) Background of proposed action plan: Same as action plan R-4 (see action plan R-4)

c) Purpose of action plan:

To implement facility development based on the planning of action plan R-4

d) Expected outcome:

- The facilities of RVOs are well equipped.
- RVOs can implement re-verification of more measuring instruments.
- RVOs can travel to remote areas for re-verification, surveillance and dissemination.

e) Framework for implementation:

Project teams organized within RVOs and LMS Centers for assistance

f) Activities of action plan:

- DOM purchases facilities and equipment by DOM's budget and rents them to RVOs, either by DOM directly or through LMS Centers.
- RVOs have to report improvement of performance (increase of verification and re-verification rate etc.) to DOM who reviews it for further improvement of development plan.

g) Required facilities and equipment, human resources, etc.:

- Facilities and equipment: Trucks for verification, measurement standards, comparators, etc.
- Human resources: Not necessary except RVO staffs
- Others: Not necessary

h) Estimated budget: US$50,000/RVO

i) Implementation schedule:

Within three years from the beginning of mid-term action plan period

(2) Action plan R-9

a) Name of action plan: Interim evaluation of innovation of RVOs（PDCA）

b) Background of proposed action plan:

Same as action plan R-1 (see action plan R-1)

c) Purpose of action plan:

To evaluate the effects of innovation of RVOs by action plan R-1

d) Expected outcome:

The results and progress of innovation are evaluated using PDCA circle, which are fed back to the original plan to modify tasks or develop them.

e) Framework for implementation:

Organization established for the action plan R-1

f) Activities of action plan: Following items are evaluated:

- Was the business rule of RVO made?
- Did the Business Management Section make plans bellow?
  - i) Comprehensive plan for legal metrology administration in province
  - ii) A plan for dissemination and enlightenment of legal metrology
  - iii) Training plan of staffs about up-dated technology, electrical technology, etc.
- Did the director announce the above plans to all staffs gathered in a place at the beginning of a year?
- Did each manager break down the annual plan to the monthly plan in detail?
- Did managers etc. have a monthly meeting to discuss reasons of difference between target and actual performance and take action to remedy it?
- Did managers divide a monthly plan into weekly and/or daily plans to level the work load? Were morning gatherings held regularly to announce the daily work?

g) Required facilities and equipment, human resources, etc.:

- Required facilities and equipment: Not necessary
- Human resources: Not required
- Others: Not required

h) Implementation schedule: From the fourth year and onward

3) Long-term action plan

(1) Action plan R-10

a) Name of action plan: Study on unification of RVO and BPSMB

b) Background of proposed action plan:

- PPMB is under control of Directorate General of Foreign Trade of MOT to evaluate quality of products for export and import. BPSMB is an organization under control of provincial governments to get technical support from PPMB.
- BPSMB handles physical quantities such as temperature, mass, length, volume, pressure, work quantity, light, etc, some of which are duplicated with DOM.
- RVO and BPSMB, locating in the same city, keep the similar secondary standards or working standards separately and provide similar services to regional industries that seem to be inefficient and disperse of services.

c) Purpose of action plan:

To review feasibility of unification of RVO and BPSMB to avoid overlap of actual services to regional industries and provide more advanced ones

d) Expected outcome:

The number of officers and operation cost can be reduced by merging RVO and BPSMB, resulting in keeping measuring technology and equipment in common and providing unified services to the regional industries.

e) Framework for implementation:

"Committee for Study on Unification" consisting of DOM, PPMB, RVOs and BPMSBs

f) Activities of action plan:

- Getting consensus on unification
- Establishing "Committee for Study on Unification"
- Preparation of unification program
- Amendment of regulations

g) Required facilities and equipment, human resources, etc.:

- Required facilities and equipment: Not necessary
- Human resources: members of "Committee for Study on Unification"
- Others: Not required

h) Estimated budget: Not necessary

i) Implementation schedule: After sixth year

6.7 Plan for HRD for Legal Metrology in MTC

6.7.1 Framework of the Plan for HRD of Legal Metrology

1) Measures to cope with the changes

RVOs perform tasks for legal metrology countrywide. The tasks are re-verification of measuring instruments, surveillance, supervision and guidance, etc., that are regulated by the law. In order to provide quality services within the territory based on uniform regulations in the country, it is indispensable to allocate, makeup and reinforce personnel who have expertise to respond to the local economic and social needs.

- The social economy in regions asks for enforcement and improvement of measurement services as a whole upon the implementation of decentralization in 2001. Local measurement services are conducted by staffs of technical specialist, but many RVOs suffer from understaffed problems now.
- In addition, a large number of staffs will reach the retirement age within several years, caused by staff's age structure of individual RVO. If the situation is left without taking appropriate measures, it is anticipated that the local measurement service will be deteriorated further. And considering it as a whole country, it may lead to lose trust in legal metrology system not only domestically but also internationally.
- Understaffed problems caused by insufficiency of qualified staffs lead to the decrease of implementation ratio of re-/verification. Further, there are problems, which have been unsolved from the past, concerning insufficient monitoring and surveillance that secures legal metrology system and an absence of staffs that can manage new metrological fields such as establishment of measurement standards and supply of standards in regions.。
- Many RVOs point out that the contents of present training courses of MTC do not fully correspond to the needs for measurement in recent regional social economy. However, MTC remains unchanged by restriction of existing rules and customs that seem outdated.

The following summarizes the above understaffed problems and countermeasures of insufficient tasks for legal metrology:

(1) Make-up of personnel:

The number of RVO personnel is decreasing year by year, and it is anticipated that retired persons will increase significantly within the next six to seven years. If no effective measures are taken for making up the personnel, it is forecast that the number of inspectors engaged in measurement work will decrease to half within the next ten years.

(2) Reinforcement (short-term period):

As a decentralization policy, the transfer of personnel from other sections is performed in some provinces. As a result, some personnel who do not have experience in legal metrology are assigned to RVOs. Furthermore, the problem is that the ratio of implementation of re-verification (the number of actually re-verified measuring instruments in the term/ the number of measuring instruments subject to re-verification in the term) falls down to 60 - 70%.

And the numbers of measuring instruments subject to re-verification in the term are not well grasped. If the numbers of measuring instruments are not properly grasped, it is anticipated that not only the re-verification but also the initial verification is not carried out sufficiently.

(3) Reinforcement (mid-term period)

In case that the re-/verification is implemented properly in an area, the issue is how to realize accurate measurement uniformly in social economy in whole country that is the final purpose of legal metrology system. Measurement instruments are accurate, but surveillance and guidance how to use them and how to keep accurate contents to get proper measurement results are not well undertaken. And, in international trend, range of legal metrology system is expanding from the conventional trade system. In order to cope with this situation, human resources with updated special technology should be developed.

2) Scheme for HRD

According to the site survey of JICA study team, RVOs pointed out the lack of budget as well as the lack of personnel for achieving legal metrology tasks completely. Fostering human resources is not easy. To keep and increase the number of personnel that can perform legal metrology tasks are important issue in Indonesia. Especially, the requisite for supply of inspectors is to establish proper HRD system to deal with the current situation.

The JICA study team specifies the vision, mission and strategy for HRD as shown in Table 6.7.1-1, and draws up the “Plan for HRD for Legal Metrology” in MTC.

Table 6.7.1-1 Vision, Mission and Strategy for HRD

Vision	To foster human resources who can conduct proper and fair measurement with ability to cope with changes of circumstances and with competent expertise in implementation of measurement system
Mission	1. To foster human resources who can make proper judgment based on the law and regulations 2. To foster human resources who have expertise and knowledge concerning measurement 3. To foster human resources who can cope with changes of international circumstances and follow technology development
Strategy	1.1 To foster human resources who can make fair interpretation of regulations by intensive case studies
	2.1 To conduct separate trainings by classification of trainees into inspectors, surveillance officers and measurement standard laboratory officers 2.2 To incorporate OJT at RVOs into the whole training program in order to foster practical inspectors
	3.1 To conduct follow-up education for inspectors by short term training 3.2 To develop curriculum to cope with technology advancement and changes of requirement in measurement 3.3 To foster private measuring engineers by collaboration of industry and academy
	4. Common 4.1 To accelerate trainer's training for the above training 4.2 To effectively conduct above training with shorter period

6.7.2 Plan for HRD for Legal Metrology

1) Scope of the training

In accordance with the Decree of Minister of Trade （MOT Decree 34/M-DAG/PER/12/2005）, training is made for fostering human resources with technical capability to perform tasks properly that are specified in the Indonesian legal metrology system. Firstly, the training is targeted to foster inspectors (Penera) of RVOs and DOM, and to train to acquire capability of special measuring technology as the follow-up process. Secondly, in addition to fostering public inspectors, consideration should be made after the appropriate period for implementation of training for private measurement engineers. For example, training is given to foster measurement technology managers and supervisors from private entities that deal with legal metrology system.

(1) Contents for fostering metrology officer (refer to 435/MPP/KEP/6/2003 = HRD Decree/128/12/2002)

For the official personnel engaging in metrology work who conduct major legal metrology tasks in Indonesia or persons who wish to become public metrology officers,

the following classified training is offered, with consideration given to classification of inspectors (Penera) and job ranking:

(a) Re-/verification technology for legally controlled measurement instruments (UTTP)

(b) Technologies for metrology surveillance and metrology guidance (UTTP＝legally controlled measurement instrument, BDKT＝pre-packaged goods)

(c) Technologies for management and supply of measurement standards (Handling technology of high precision measuring standard and management technology of measurement calibration laboratory)

This new training system is designed to complete at shorter period by revising the contents as well as applying intensified training. The reasons are to relieve the burden of trainees and RVOs, considering actual situation of the field and preparation of measures for the future direction of Legal Metrology in Indonesia.

(2) Contents for fostering private measurement engineers

The training is carried out concerning basic knowledge of legal metrology system etc. depending on the fundamental duties and responsibilities to be taken, by dividing private measurement trainees into manufacturers and users.

2) Contents of training

Considering Indonesian actual situation, training contents is prepared as follows:

- Acquisition of implementation technology of re-/verification of measuring instrument (UTTP)
- Acquisition of high-level specialty knowledge and technology related to re-/verification of UTTP
- Acquisition of management methods and supply technology of measurement standards
- Acquisition of surveillance technology for UTTP and BDKT
- Acquisition of operation and management technology of Legal Metrology.

Considering an efficient lecture (proportion to academic background), a preparatory course (Course A) is designed prior to attending course (B).

3) Increase of number of trainees and capacity building of MTC

- MTC can accept 200 trainees per year for middle-term plan. Among them the target is to foster 100 standard inspectors. As this number exceeds the existing MTC training capability (about 50 persons), measures to increase the capacity should be taken

urgently. Furthermore, even if the training capacity of MTC becomes double, measures should be taken to enable RVOs to dispatch their trainees easily and enhance trainees' eagerness to study.

- It is estimated that Indonesia needs will require 1,200 inspectors in 2016 (considering the Indonesian legal metrology system, economy, land area, and population). Since the total number of inspectors is 849 (RVOs: 768, DOM: 81; source: DOM) as of June 2006, increase of inspectors are necessary to satisfy the above figures and manage necessary operations. Current issues include fostering new inspectors who replace retired inspectors of RVOs and developing human resources to strengthen post-decentralization legal metrology work.

4) Shortening training period

- The current training terms are about one-year long for two courses (1,820 hours and 1,540 hours). Trainees who have graduated from senior high schools or colleges must complete two courses. Trainees also need one year of on-the-job training (OJT) to receive acknowledged certification, depending on the courses. Trainees who have graduated from the engineering departments of universities must complete a 1,200 hour training (approximately eight months) followed by OJT before receiving a certification. The period required for the whole training seems too long, causing some problems in conducting RVO's work. Also, trainees find it inconvenient to attend training for such an extensive period of time.
- Considering all of the above, typical training terms are set for two to three months and do not exceed five months.

5) Location for training

Facilities and equipment at MTC in Bandung are used for training.

6) Sufficiency of training equipment

The specifications and quantity of existing equipment (including equipment in order now) are reviewed. If additional facilities and equipment are required for effective and efficient training, recommendation will be made.

7) Increase of trainers

Thirty-two trainers will be required for implementation of this plan.

Required number of trainers is calculated based on the course design and number of trainees.

6.7.3 Training Course and Trainees

1) Analysis of existing training course

In the existing training courses, trainees must attend all courses to complete all subjects, causing longer training term. From the trainee side, they are obliged to attend classes with no relation to their duties now and in future as well. In view of actual situation of RVO's work, not all the personnel are necessary to aim at acquiring "Inspector" certificate that can suffice all metrological activities.

In order to improve these situations, the training courses are divided into general courses and technical courses to classify inspectors so that specialties are enhanced in the master plan. Inspectors who possess aptitude and eagerness can obtain higher levels of inspector qualification.

Since the basic tasks of RVOs are re-/verification work, certificates for legal treatment except extremely technical or high precision matter are acquired first. All trainees can acquire knowledge of an entire range of legal metrology work and can understand the outline of basic work treatment of RVOs. Trainees can learn specified lessons of classified training courses according to requirements of RVOs and individuals. The period of each course is cut to less than half of the existing courses. OJT at RVOs then becomes more important.

2) Training course and qualification of trainees

Table 6.7.3-1 shows the training course and qualification of trainees. After completing the Basic Course over the specified level, trainees receive OJT at their RVOs for more than a specified period to obtain MOT's certification of Basic Course following evaluation of the total outcome of the training. The trainees studying by the former curriculums must complete additional subjects of new curriculum B through short-term training course if they proceed to new courses of C, D and E.

Table 6.7.3-1 Training Course and Qualification of Trainees

No	Training course	Aim of training	Qualification of trainees attending the course
A	Inspector Basic Course	Acquisition of basics knowledge for Course B	• Graduate of senior high school, college, or humanistic university.
B	Junior Inspector Course	To foster a Junior Inspector who can manage verification and calibration on junior lever	• Graduate of university of science and technology. • Graduate of Course B
C	Expert Inspector Course	To foster an Expert Inspector who has special knowledge and skill for measuring technology and instruments	• Junior inspector who has operational experience in RVO more than appointed duration after graduating from Course B. • Recommendation of RVO
D	Laboratory Specialist Course	To foster a Measurement Standard Laboratory Specialist who has specialty of handling and maintaining for measuring instruments and standards	
E	Surveillance Officer Course	To foster a Surveillance Officer who can accomplish the monitoring and guidance for legal measurement verification	
F	Senior Inspector Course	To foster a Senior Inspector who has ability of management and administration for legal metrological operations at his responsible territory	• Expert inspector • Measurement Standard Laboratory Officer • Surveillance Officer • More than 5 year operational experience in RVO after getting his certification • Recommendation of RVO

6.7.4 Plan for Training Curriculum

Tables 6.7.4-1 through 6.7.4-6 show the curriculum plans by course. Study of mathematics and physics corresponding to that of university engineering departments in Curriculum A is designed as the base course of study for understanding the technical subjects that follow. There is an entrance examination for this course. The Curriculum B is the compulsory for all courses. It includes legislation system, and measurement of mass, volume and electricity, which covers whole range of legal metrology (especially, outline of whole measuring instruments).

Features of planning concept for these training curriculums are to incorporate international metrological discussion results and case studies from advanced countries into the metrological

system, considering decentralization in Indonesia. For example, legal system for consumer protection and labor safety are incorporated into Course B. Environmental measurement and measurement certification systems are incorporated into Course F.

The above concept includes how to distribute training hours.

One year OJT is required before proceeding to Curriculums C or F from Curriculum B, considering the tradition and efficacy. The kinds and arrangements of subjects are based on the existing ones incorporating Japanese ones. OJT after Curriculum B is an obligation, and OJT and self-study supplement what could not be taught sufficiently in classroom lessons. This process has an advantage that the trainees can judge by themselves during OJT which direction they should go and what is their suitability. Figure 6.7.4-1 shows the flowchart of inspector training.

Equipment and instruments to be used in classroom lessons and in practice to promote understandings of technical subjects are filled up significantly in comparison with the existing ones. Based on this condition, the curriculum can be cut to half of existing one. The subjects are adjusted according to the RVO's actual situation and future direction of metrology, and the distribution of time for each subject is made properly.

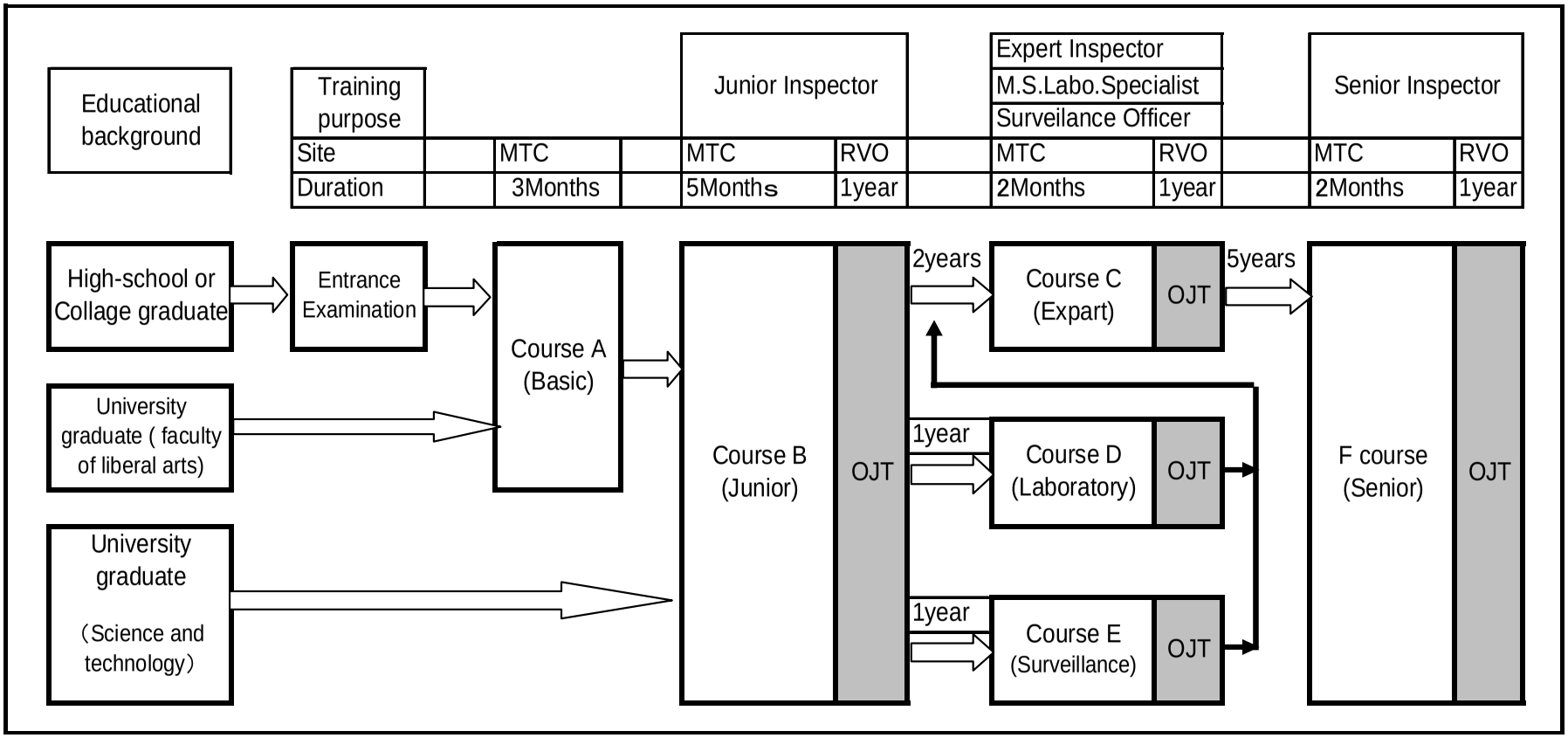


Figure 6.7.4-1 Flowchart of Inspector Training

Table 6.7.4-1 Curriculum Plan of Inspector Basic Course

A. Inspector Basic Course （A Dasar）			
No	Subject	Training Hours（H）	
		Lecture	Practice
	A. Basic		
1	Mathematics	100	
2	Basics physics	80	30
3	Outline of mechanical engineering	50	
4	Outline of electrical engineering	50	
5	Outline of stochastic outline	40	
6	Material science	20	
7	Outline of computers	40	40
8	Graphics engineering	20	
9	Outline of measurement system outline	10	
	Subtotal	410	70
Total		480	

Table 6.7.4-2 Curriculum Plan of Junior Inspector Course

B. Junior Inspector Course	B. Penera Pelaksana Lanjutan(Ahli） Penera Penyelia (Terampil）		
No	Subject	Training Hours（H）	
		Lecture	Practice
	A. Basic		
1	Outline of administration and law/ regulation	10	
2	Law of Legal Metrology (UUML)	40	
3	Legal system of consumer protection	10	
4	Outline of organization and administration for metrological management（Including an international & Indonesian system / standards）	20	
5	Quality control (Including ISO standards）	20	
6	Analytics of measuring error（Uncertainty studies）	20	20
7	Applied physics（Principle of measurement & measuring technology）	20	
8	Outline of electronic measurement	30	20
9	Verification system (Type approval / traceability）	10	
10	Labor safety system	10	10
	B. Ability		

11	Weight verification （Class M1,M2&M3）	20	30
12	Non-automatic weighting meter verification (Class I & IV）	40	70
13	Introduction of automatic weighting meter verification	10	10
14	Length meter verification	20	30
15	Volume meter verification	30	40
16	Flow meter verification	20	30
17	Pressure gauge verification	10	20
18	Thermometer verification	10	20
19	Outline of testing for hygrometer	10	10
20	Outline of testing of concentration meter (Buoyant type)	10	10
21	Outline of testing for watt-hour meter	20	30
22	Outline of testing for hour meter	10	10
23	Pre-packaged goods (BDKT) inspection	20	30
	Subtotal	420	380
Total		800	

Table 6.7.4-3 Curriculum Plan of Expert Inspector Course

C. Expert Inspector Course	C. Penera Muda （Ahli） Penera Pertama （Terampil）		
No	Subject	Training hours （H）	
		Lecture	Practice
	A. Basic		
1	Introduction to measurement certification / accreditation system	20	10
2	Introduction of quality control system (ISO/IEC) on verification office	20	
3	Automatic control	20	10
4	Application of legal metrological regulations (UUML)	20	
	B. Ability		
5	Weight verification / calibration (ClassF1 & F2)	20	20
6	Non-automatic weighting meter verification/calibration (ClassI, II&III）	10	20
7	Automatic weighting meter verification/calibration	10	20
8	Length meter (angle / area) verification/calibration	10	10
9	Volume meter verification/calibration	20	20
10	Flow meter verification/calibration	10	10
11	Pressure gauge verification/calibration	10	10
12	Thermometer verification/calibration	10	10
	Subtotal	180	140
Total		320	

Table 6.7.4-4 Curriculum Plan of Laboratory Specialist Course

D. Laboratory Specialist Course	V. Fungsional Laboran Standar Ukuran （Ahli/Terampil）		
No	Subject	Training hours （H）	
		Lecture	Practice
	B. Ability		
1	Standard equipment and administration of laboratory	10	
2	Quality control system (ISO 9000, ISO/IEC 17025)	30	
3	Management for using standard equipment	20	20
4	General idea of accreditation and certification	10	
5	System of accreditation and certification (International/ domestic)	20	20
6	Conformity assessment	20	20
7	Quality control of calibration laboratory (Maintenance and testing/calibration）	20	40
8	Procedure of accreditation for verification office and internal audit	30	20
9	Record safekeeping	20	20
	Subtotal	180	140
Total		320	

Table 6.7.4-5 Curriculum Plan of Surveillance Officer

E. Surveillance Officer Course	E. Fungsional Pengawas/Penyidik (Ahli/Terampil)		
No	Subject	Training Hours (H)	
		Lecture	Practice
	A. Basic		
1	Administration of law and regulations for legal metrology (UUML)	20	
2	Procedure of crackdown and communication/adjustment method with the police	20	
3	Procedure of visit investigation (on the spot inspection)	10	
4	Procedure on handling of cases （Document-making and reporting）	10	10
5	Administration and management of verification approval seal	10	10
6	Publicity / public hearing	10	10
	B. Ability		
7	The crackdown of unjust use of legally-controlled measuring instruments (UTTP)	40	30
8	Measurement surveillance system (BDKT）	20	20
9	Knowledge of treatment for complaint / consultation	20	
10	Summary of the Law of Detective Procedures (KUHAP)	40	
11	Summary of Criminal Law (KUHP)	40	
	Subtotal	240	80

Total	320

Table 6.7.4-6 Curriculum Plan of Senior Inspector Course

F. Senior Inspector Course			
No	Subject	Training Hour （H）	
		Lecture	Practice
	A. Basic		
1	Operation and management of legal metrology	10	
2	System of legal metrology and industrial metrology	20	
3	Basic study of environmental measurement and measurement certification business	30	
4	Unit of measurement	20	
5	International measurement system	20	
6	Metrological Sociology	20	
7	Measurement certification / accreditation system	20	
8	Metrological English	10	30
	B. Ability		
9	Law and regulations on legal metrology (UUML)	10	30
10	Dealing with affairs	10	20
11	Testing and verification for high precise measuring instrument.	10	30
12	Quality control of calibration laboratory	10	20
13	Subtotal	190	130
Total		320	

Table 6.7.4-7 summarizes the list of training hours. The required time for training is reduced substantially by reviewing the contents of present curriculum.

Table 6.7.4-7 List of Training Hours

No	Training Course	Training Hours （H）			Months
		Lecture	Practice	Total	
A	Inspector Basic course	410	70	480	3
B	Junior Inspector course	420	380	800	5
C	Expert Inspector course	180	140	320	2
D	Laboratory specialist course	180	140	320	2
E	Surveillance Officer course	240	80	320	2
F	Senior Inspector course	190	130	320	2

6.7.5 Plan for Training Equipment

Table 6.7.5-1 summarizes the recommended training equipment to be used for proposed curriculums. Since MTC already has plans to purchase equipment using budget of 2006-2007, the JICA study team reviewed their plan and recommended the following equipment plan.

Table 6.7.5-1 Recommendation of Training Equipment (For UUML use)

No	Name of Equipment		Quantity	Specifications
1	Mass measuring instrument and balance (non-automatic)	Mechanical balance	10 set	Manual control with indicator : Capacity 200g,1kg, 5kg, 30kg,150kg （ClassⅢ& Ⅳ）
		Electric type balance	10set	
		Balance	5 set	Electronic balance type: Capacity (1) 10g, 200g, 1kg, 5kg, 30kg （ClassⅡ） (2) Balance combined use of inspection weight calibration : 5g, 200g, 1kg （Class Ⅰ&Ⅱ）
		Standard weight	3 set	Class F1: 1mg~5kg Kit
		Inspection weight	10 set	Class M1: 1mg~20kg Kit ClassF2: 1mg~20kg Kit + Standard weight (Class1） 3Kits
		Surface table	1 set	Surface table:Made of cast iron and marble (Mechanical type, capacity-wise, Combined use of inclination inspection) Size: 1mx6m
*	Truck Scale (non-automatic/ Mechanical type) Actual or Scale model		2 set	Manual control with indicator: 10t (ClassⅢ) Stacker (Capacity 500kg) :1 unit. Inspection weight: Class M2 (20 kg) × 250
*	Mass measuring instrument (automatic)－Actual or scale model		1 set	indicated items(Grader, Hopper S, Crane S and conveyer S) Chain for tests Hoist crane (2t)
2	Vertical cylindrical tank measuring instrument (TUTSIT)		2 set	Capacity: 10, 30, 100 liters Standard burette
3	Water meter testing equipment		2 set	For less than 40 mm bore (20 units/ test) with flow meter Standard tank for 100mm bore (5,000 & 20,000 liters) Facilities for water supply and drain/ pressure test equipment
4	Basic physical measuring instruments		10 set	

5	Measuring instruments with PC	10 set	
6	PC and internet	10 set	
7	Watt hour meter testing equipments	2 set	For single-phase alternating current 2 line / three phases 4 line use： 1) Standard instruments (voltage / an electric current / electric volume) 2) Testing equipment for Watt-hour meter (10units/test) 3) Testing equipment for transformer based on iInternational standards 4) Power source units for testing equipment
8	Taxi meter with PC	1 set	Fixed type / Portable type/ head test device
9	Horizontal tank measuring instrument (TUM)	1 set	Standard tank: 100/ 500/ 1,000 litters Water supply and drainage mechanism
10	Gas meter with PC	2 set	City gas meter testing equipment (1-5 units/test, wet type / dry type
11	Telephone pulse meter	0	No recommendation by JICA study team
12	Equipment for calibration and Verification	2 set	Measuring tape / Caliper gauge / Linear scale / Angle measuring instruments for angle comparison test / Projector / Various standard scales, block gauges
13	Fuel dispenser testing instruments	2 set	Standard oil tank ： 5, 20, 50,100 litters
＊	LPG dispenser testing instruments	1 set	Standard density buoyant Non-automatic weighing meter (1kg class Ⅱ) A volume gage pipe and equipment: (capacity of 50 litters)
14	Measuring instruments for length and volume	5 set	Thermometer / Hygrometer/ Volume meter for chemistry/ Pure water making device Others are same as length and volume measuring instruments.
15	Testing equipment for metal Corrosion	1 set	
16	Electronic measuring instrument	2 set	Testing device for electric current / voltage / resistance and power source device
17	Height testing equipment	2 set	（same as length group）
18	Measuring instruments for temperature (and pressure)	1 set	Standard temperature gauge Warm tank (air/water/ oil and refrigerant) Measuring tank for ice-making machine Draft chamber device
*	Measuring instruments for pressure	1 set	Dead weight standard pressure gauge Liquid column manometer
＊	Measuring instruments for moisture contest	1 set	Room temperature tank Balance: class Ⅲ
＊	Measuring instruments for Density meter	1 set	Standard density buoyant (various) Standard liquid (light liquid / heavy solution)

			Waste liquid depurator
19	Testing equipment for pre-packaged goods	1 set	Refrigeration case / volume meter for chemistry/ balance / height gauge / Surface plate/ thermometer / length meter
*	Testing equipment for pre-packaged goods (Potable type)	1 set	Trucks / testing device / office equipment
20	Simulation equipment for verification and re-verification	1set	Truck for verification and re-verification Standard burette Standard linear scale and length gage
21	Machine tools	1 set	Testing device of various material hardness / strength / impact fatigue Machine tools such as lathe / drilling machine Welding units
*	Instrument and materials for lecture use (lecture room / training room / a lecture hall) Auto-visual aid	10 set	Auto-visual aid (OHC / OHP for lecture hall / lecture room) Electrical White Board for every classroom / training room

Note: Equipment marked with an asterisk [*] in the No. column represents additional equipment recommended by the JICA study team.

6.7.6 Relationship with Certification System

Indonesian public employee for metrology has its own system for duties and job classification. Trainee's qualification to receive MTC curriculums has relationship with the above job classification. Table 6.7.6-1 shows the trainee's qualification to receive MTC curriculums.

For example, to acquire the certification of Expert Inspector, trainees must possess operational experience in RVOs for longer than two years after the completion of Course B. In addition, the ranks of position shall be higher than "Ⅲ/b".

Table 6.7.6-1 Trainee's Qualification to Receive MTC Curriculums

Classification	Study term to acquire the qualification			Trainee's qualification to receive MTC curriculums
	MTC		OJT period at RVOs	
	Course	period		
1. Inspector Basic (Preparative study for Course B) (Dasar)	A	3months (480H)	-	• Graduate from senior high school or junior college (mechanical or electrical department) • Pass the entrance examination to MTC • RVO recommendation
				• Graduate from university (liberal arts faculty)

				• RVO recommendation • No entrance examination is required.
2. Junior Inspector（Penera）	B	5months（800H）	More than one year after graduating from Course B	• Graduate from senior high school, or junior college (physical science), or university (a faculty of liberal arts) • Graduating from Course A
				• Graduate from university (science and engineering) • RVO recommendation • No entrance examination is required
3. Expert Inspector	C	2 months（320H）	More than one year after graduating from Course C	• Engaging in RVO more than two years after graduating from Course B • Duties rank: above class Ⅲ /b
4. Measurement Standard Laboratory Specialist	D	2 months（320H）	More than one year after graduating from Course D	• Engaging in RVO more than one year after graduating trom Course B • Duties rank: above class Ⅲ /b
5.Surveillance Officer	E	2 months（320H）	More than one year after graduating from Course E	• Engaging in RVO more than one year after graduating from Ccourse B • Duties rank: above class Ⅲ /b
6. Senior Inspector	F	2 months（320H）	More than one year after graduating from Course F	• Engaging in RVO more than two years after graduating from Course C • Duties rank: above class Ⅲ /d

6.7.7 Annual Schedule of Training Course

The annual schedule of training program is prepared based on required training hours by course as follows:

- Course A (three months/course): Three times a year.
- Course B (five months/course): Four times a year following the completion of Course A
- Course C (two months/course): Three times a year because there are trainees trained by the former curriculums; applicable for the first five years.
- Number of trainees per a class is planned max. 30 trainees.

Based on the above premises, the training schedule is simulated as shown in Table 6.7.7-1.

- The capacities for accepting trainees are 90, 120, 90, 30, 30 trainees/year, for Courses A, B, C, D and F, respectively. Total capacity is 360 trainees /year.
- The number of trainees is 120 trainees at maximum. Comfortable canteen and accommodations are necessary.

- The number of necessary classrooms is four rooms (or one large lecture hall and two classrooms).

Table 6.7.7-1 Scheduling of Training Course

Unit: Persons

Course/Month	Mo 1	2	3	4	5	6	7	8	9	10	11	Mo 12	No. of Trainees
A. Inspector Basic Course	30	30	30		30	30	30			30	30	30	90
B. Junior Inspector Course	30	30	30	30	30			30	30	30	30	30	120
	30	30	30	30	30			30	30	30	30	30	
C. Expert Inspector Course													
	30	30		30	30	30	30						90
D. Laboratory Specialist Course			30	30									30
E. Surveillance Officer Course						30	30						30
F. Senior Inspector Course								30	30				30
No. of Trainees/year													390
No. of Trainees/month	120	120	120	120	120	90	90	90	90	90	90	90	
No. of classrooms	4	4	4	4	4	3	3	3	3	3	3	3	

6.7.8 Plan for Training Facilities

1) Estimation of necessary area for training facilities

Table 6.7.8-1 shows the estimated area required for training facilities as calculated with consideration of the use of existing buildings.

Table 6.7.8-1 Estimated Area Required for Training Facilities

Buildings	Training facilities	Quantity	Area (m^2)	Remarks
Office building	General Manager's room	1		• Use existing office building
	Office room	1		
	Meeting room	1		
	Storage room	1		
	Bathroom/galley	1		
	Subtotal		800	
Lecture building	Lecture hall (for 60 trainees)	1		• Use existing facilities • Install A/C
	Lecture room (for 30 trainees)	2		
	Trainer's room	2		
	Meeting room	1		
	Library	1		

	Storage room		1		
	Bathroom/galley		1		
		Subtotal		800	
Laboratory(1)	Mass measuring instrument		1set		
		Test room(1)		56	
		Test room(2)		48	
		Precision measuring room		100	Basement
	Gas, LPG, Gasoline tank		1set	300	
	Watt-hour meter		1set	32	
	Water meter		1set	48	
	Electronic device		1set	24	
	Length measuring instrument		1set	100	Partly use Precision measuring room (30m^2)
	Temperature/Moisture/density meter, etc.		1set	120	
	Testing equipment for pre-packaged goods		1set	48	
	Simulation equipment for verification		1set	24	
	Machine tools		1set	100	
	Other space (hall, staircase, entrance, etc.)			300	
		Subtotal		1300	
Laboratory(2)	Taxi meter with PC		1set	32	Garage-type
	Tank truck		1set	100	Garage-type
		Subtotal		132	
Canteen	(Use Catering service from outside)				
Dormitory	(Use private hotel)				

Canteen and dormitory should be comfortable environment so that trainees can study comfortably for a long time.

6.7.9 Plan for Number of Staffs

1) Estimation of number of trainers

The required number of trainers (lecturer and practical skill instructors) is estimated by course. First, number of trainers required for each course is estimated based on the curriculum plan. Second, the number of trainers required for two courses held simultaneously is estimated by referring to scheduling table for training courses (see Table 6.7.7-1). The estimation result is shown in Table 6.7.9-1.

32 trainers with 16 lecturers and 16 practical skill instructors are necessary. The number of trainers increases with inclusion of new subjects in addition to the compulsory subjects in existing courses.

Table 6.7.9-1 Estimation of Number of Trainers

No	Training course	No. of trainers (exclusively)			Course overlapping	No. of trainers (overlapping)		
		Lecture	Practice	Total		Lecture	Practice	Total
A	Inspector basic course	4	2	7	no	4	2	7
B	Junior Inspector course	4	6	10	2 times	4	6	10
C	Expert Inspector course	3	5	8	no	2	2	4
D	Laboratory Specialist course	3	3	6	no	2	2	4
E	Surveillance Officer course	3	3	6	no	2	2	4
F	Senior Inspector course	5	5	10	no	2	2	4
	Total (Persons)					16	16	32

2) Plan for organization and number of staffs

MTC organization and the number of staffs are planned to carry out the efficient training courses. To make organization simple as much as possible, MTC is divided into two sections (Section s of Administration and Training). Marketing group is newly established in Administration Section to perform the recruitment of 200 trainees /year smoothly and surely. The staffing schedule provides for one general manager, two managers, eleven staffs, 32 trainers, and 15 secretaries, assistants, etc. The total number of employees is 61 persons. Table 6.7.9-2 shows the estimation of number of staffs.

Table 6.7.9-2 Estimation of Number of Staffs

MTC	Section	Group	No. of staff				
			G.M.	Manager	Staff	Trainer	Janitor
General Manager			1		1		
	Administration			1			
		General Affairs			1		3
		Finance			1		
		Planning & Management			2		
		Marketing			1		
		Welfare			1		5
	Training			1			
		Trainer				32	5
		Training Support			4		2
	Subtotal		1	2	11	32	15
	Total					61	

6.7.10 Plan for Trainer's Training

1) Qualification for Trainers

Capable trainers are indispensable to carry out the training successfully. In recruitment, trainer applicants with basic knowledge, technology and experience in legal metrology should be carefully evaluated. After employment of trainers, they receive intensive training to become facilitators of the metrological training course.

The requirements and positioning of trainers are specified in the decree of Minister of Trade. In order to recruit and keep capable trainers, it is necessary and important to treat trainers well and ensure good salaries for them.

Following are the requirements for trainers:

(1) Those who are RVO inspectors and have experience as facilitators of training courses and/or as instructors of OJT (including inspectors of retirement age); or

(2) Those who have experience as lecturers for "metrology" and/or under research of "metrology" at universities, institutes, etc. (including persons of retirement age); or

(3) Those who have experience in measurement management at private enterprises (including persons of retirement age).

- Public announcement is made for wider recruitment of applicants and the carrying-out of a recruitment examination.
- Recruitment examination consists of a primary test (paper test about legal metrology and technology), a secondary test (paper test for special knowledge on metrology) and an oral interview.
- During the oral interview, qualification is evaluated based on the applicant's leadership qualities, abilities of expression, and personal and professional motivation/discipline.

  The applicable age of a trainer called as Widyaiswara (Senior Professor who has reliability and prestige) in the existing system has been reduced to 45 years old from 50 years old, offering opportunities for better treatments for younger trainers.

  To widen the category of the recruitment, part-time trainers can be accepted instead of those who cannot work full time due to other employment, etc.
- To secure human resources, capable persons are registered in MOT's name list. The list is reviewed every five years for renewal.
- Legal metrology develops year by year. In order to catch up with development and invite trainers with advanced knowledge and technology, the requirements for trainers are reviewed every five years.

2) Training program for trainers.

MOT conduct the following trainer's training:

(1) Training at DOM and several main RVOs

To grasp metrology related work in detail.

(2) Plant tour of related entities.

- Field trip to PNL and PDAM to grasp what they undertake for supply of electricity and tap water
- Plant tour of meter manufacturer to grasp the structure of meters, manufacturing process and procedure of verification

(3) Classroom lecture training

To carry out the following training by inviting outside lecturers from ITB, universities or consulting firms:

- Training of metrology management（legislation, international standards and traceability, quality management, etc.）
- Training of measurement technology（principle of measurement and instrumentation, structure of measuring instruments, applicable conditions, etc.）
- Training of fundamental engineering（mathematics, physics and chemistry）

(4) Practical skill training

To carry out the following training by inviting outside lecturers from DOM, RVOs, etc.:

- Practical skill training about verification of measuring instruments
- Practical skill training for handling of calibration and standard instruments
- Training for ITC (PC and Internet).

In addition, special trainers who can train trainers in the field of advanced metrology are required. Special trainer's training by JICA scheme can be planned for trainers with excellent experience in Japan.

6.7.11 Revenue and Expenditure Plan

The operational cost for training is estimated based on the current price. Table 6.7.11-1 shows the estimated operational cost of MTC.

Since development of legal metrology is an important national project, it is recommended that the all training costs, including traveling and living expenses, be supported in the national budget.

Table 6.7.11-1 Estimate of Operation Cost of MTC

Unit: Million Rp/year

No.	Cost Items	Operation Cost
1	Wage for personnel	1,970
2	Welfare cost	590
3	General and administrative expenses	1,013
4	Electricity/Utilities/Telephone/Internet	197
5	Maintenance cost	59
6	Marketing &publicity	20
7	Training material cost	30
8	Visiting lecturer charges	64
Total		3,943

6.7.12 Project Schedule

1) Short-term action plan

Short-term action plan is shown in Table 6.7.12-1.

Table 6.7.12 -1 Short-term Action Plan

Activities	2007	2008
1. Preparations of Training (Long-term / Short-term training course)		
・Planning and decision of master schedule for training course		
・Text making according to curriculum plan		
・Collection of training equipments		
・Maintenance of training facilities		
・Personnel selection of trainers		
・Trainer's training		
・PR of training course and the recruitment of trainees		
2. Enforcement of training		
3. Periodical evaluation and feedback (PDCA circle)		

2) Middle-term action plan

(1) Review and revision of training curriculum

After the third year of training has been completed, MTC will accept opinions from RVOs to evaluate the results of the new training system and determine whether MTC achieved its target. MTC will note problems and issues to be solved, then immediately correct the problems as much as possible. If necessary, MTC will revise the training system.

(2) Review and replacement of training equipment

New training courses include subjects which RVOs require for the field work. The training equipment is planned for the above training courses. Training equipment for existing training courses are also recommended to enhance effects and improve efficiency. MTC will review the equipment to determine whether was helpful in achieving the target after five years of commencement.

In addition, more effective equipment for training may appear in the near future.

Therefore, MTC takes action for disposal of equipment or arrangement of budget for replacement and purchase of necessary additional equipment based on investigation results.

(3) Study on cooperation with Bandung Technical Institute (ITB)

MTC has kept in good relationship with ITB since long time ago. It is desirable that MTC requests assistance of ITB in HRD by extending this relationship. In promoting it, MTC should discuss DOM as well as ITB how to proceed HRD, who is to be trained (trainers and/or junior inspectors), what subjects are to be learned and so forth.

(4) Study on cooperation of metrological training among ASEAN countries

While watching results of domestic training, MTC will study the possibility of cooperation between metrological training and ASEAN countries.

6.8 Guideline for Establishment of RVOs

6.8.1 Objective

This guideline is to provide the basic requirements to be followed by the applicant who plans to establish an RVO in its area.

6.8.2 Use of Guideline

The applicant should refer to the guidelines for preparation of a feasibility study report, drawing up the application documents, planning the building and facilities of RVO, and planning of operation of RVO.

6.8.3 Applicable Law and Regulations

The following is the law and regulations to be referred to relating to establishment of RVO:

1) Law of Legal Metrology
2) Ministerial Decree: No. 251/MPP/Kep/6/1999
3) Ministerial Decree: No. 731/MPP/Kep/10/2002
4) Ministerial Decree: No. 633/MPP/Kep/10/2004
5) Ministerial Decree: No. 634/MPP/Kep/10/2004
6) Law No.32/2004 concerning Regional Autonomy (UU Nomor 32 Tahun 2004)

6.8.4 Proposed Guideline

1) Necessity of feasibility study report:

The applicant shall investigate the feasibility of RVO establishment whose result shall be summarized in the feasibility study report. The contents of the report should include the following:

(1) Justification for RVO establishment
(2) Covering area with map
(3) Population in the area
(4) Trade and industry in the area
(5) Existence of needs (market survey)
(6) Selection of legally controlled measuring instruments to be verified/re-verified
(7) Facility plan
(8) Outline of planned RVO (location, building, facility, organization, function, number of staffs, etc.)
(9) How to recruit staffs and their training plan
(10) Operation plan
(11) Budgeting/financing for investment and operation
(12) Schedule
(13) Expected support from the local government
(14) Evaluation for the feasibility

2) Application procedure:

The following is the application procedure for RVO establishment:

(1) Applicant prepares a feasibility study report.

(2) Applicant draws up application documents based on the feasibility study report.

(3) Applicant applies the RVO establishment with the application documents to the local government.

(4) The local government sends the application documents to DOM with its comments after reviewing the documents.

(5) DOM examines the documents and decides whether proposed RVO should be established or not.

3) Purpose of RVO establishment:

The purpose of RVO establishment is to implement the legal metrology in the area aiming at consumer protection and promotion of industry as specified in the Law of Legal Metrology Law.

4) Selection of measuring instruments to be verified/re-verified:

According to the regulation (633/MPP/Kep/10/2004), the RVO shall select one category out of the following three categories for its service:

(1) Type A: mass, length, volume, temperature, electricity

(2) Type B: mass, length, volume, electricity

(3) Type C: mass, length, volume

5) Scope of service and activities:

The RVO shall conduct the following service and activities:

(1) Verification/re-verification of legally controlled measuring instruments

(2) Market surveillance including on-the-spot inspection of pre-packaged goods

(3) Dissemination and PR of legal metrology including using SI units

(4) Maintenance of measuring instruments, equipment, standards and facilities

(5) Periodical calibration of standards to keep traceability

(6) Record keeping and making statistics

(7) Reporting to DOM and local government

6) Technical manual, operation manual and maintenance manual:

The RVO shall prepare technical, operation and maintenance manuals by getting assistance from DOM and equipment suppliers.

7) Recommended plan for building and facilities

(1) Access
(2) Required area
(3) Foundation of buildings
(4) Air conditioning
(5) Utilities
(6) Equipment and measuring instruments
(7) Standards

8) Secondary standards and working standards

The RVO shall prepare necessary standards specified in related regulations.

9) Traceability and calibration of measuring instruments and standards

The RVO shall send its standards for periodical calibration to either DOM or LMS Centers.

10) Required skills and technology

The RVO shall acquire necessary skills and technology through training at MTC, etc.

11) Required HRD and training

The RVO shall dispatch trainees for training to MTC to fulfill requirements for certified inspectors, etc.

12) Recommended organization within RVO and job description

See e) of (1) Action Plan R-1 in 6.6.2.

13) Maintenance of facilities

The RVO shall try to keep its facilities in top condition.

14) Record keeping and making statistics

The RVO shall keep records of verification and re-verification, performance, etc. and make necessary statistics.

15) Reporting to DOM and local government

The RVO shall report annually its performances etc. to DOM and local governments using standard reporting formats.

16) Securing budget/financing for investment and operation:

The RVO shall secure necessary budget/financing to establish and operate the RVO. Without appropriate funds, the sustainable operation of RVO would not be expected.

17) Technical support from DOM and LMS Centers:

The RVO can request technical support to DOM and LMS Centers, as required, to develop its capabilities and so forth.

18) Observance of the Legal Metrology Law and related Orders/Decrees:

The RVO shall follow the law and regulations relating to legal metrology.

6.9 Summary of Action Plans

Table 6.9-1 summarizes the action plan of each section. The periods for the action plan are classified as follows:

- Short-term: First-Third years
- Middle-term: Fourth-Fifth years
- Long-term: Sixth year and onward

Table 6.9-1 Summary of Action Plans

No.	Name	Budget (US$1000)	Short-term	Middle-term	Long-term
	<Legislation System>				
L-1	Development of legislation system	-	x		
L-2	Development of verification system of W-H meters	1,000	x		
L-3	Development of verification system of water meters	300	x		
L-4	Establishment & implementation of “Month of Measurement”	200	x		
L-5	Discussion on amendment of the Law of Legal Metrology	-		x	
L-6	Study of use of private vitalities	-		x	
L-7	Amendment of Law of Legal Metrology	-			x
L-8	Realization of study results of use of private vitality	-			x
	<DOM>				
D-1	Setting-up planning section		x		
D-2	Enhancing international activities		x		
D-3	Enhancing HRD program and bringing-up experts	30	x		
D-4	Transformation of staff assignment			x	
D-5	Upgrading Technical Infrastructure and Metrological Services	6,940		x	
D-6	Implementation of type approval testing and calibration of testing equipment	16,000			x
	<LMS Center>				
B-1	Establishment of Legal Metrology Standardization Centers	777/LMS	x		
B-2	Providing services to RVOs and regional industries	(ditto)		x	
	<RVO>				
R-1	Business innovation of RVO	-	x		
R-2	Preparation of annual action plan	-	x		
R-3	Consolidation of manuals	-	x		
R-4	Improvement plan of equipment	-	x		
R-5	Implementation plan of re-verification for water meters	-	x		
R-6	Improvement of recording and reporting system	30	x		
R-7	Cooperation between RVOs	30/RVO	x		
R-8	Implementation for improvement of equipment	50/RVO		x	
R-9	Interim evaluation for Business innovation of RVO （PDCA）	-		x	
R-10	Study to unite RVO and BPSMB	-			x

6.10 Investment Plan for DOM

DOM has difficulties in implementing whole scopes of type approval testing recommended by OIML because of lack of proper facilities and equipment. The facilities and equipment in DOM are mixed with the old and new. As a result, it is hard for DOM to provide the proper services in terms of accuracy and stability, even calibration services to RVOs. Leaving these problems not solved may undermine the foundation of legal metrology system in the country. Therefore, the first priority should be placed on improving service quality and performance through renovating both facilities and equipment. Based on this concept, the investment plan for DOM is drawn up in this section.

6.10.1 Objective and scope of the plan

It is clear that the buildings of DOM will need large-scale renovation when instruments for type approval testing are newly introduced. Also, air-condititioning is not sufficient for controlling temperature and humidity in the laboratory which keeps the national standard. Further, vibrations from the expressway that runs in front of the DOM building might influence the accuracy of sensitive instruments and calibration. Therefore, the draft construction plan has been drawn to improve the quality of services provided by DOM without sticking to the present location of DOM and its site area. The discussion regarding the future plan of DOM (new construction or renovation) is a crucial matter at the next stage of detail design.

6.10.2 Plan for building and auxiliary facilities

The construction design has been drafted based on the size of instruments for type approval test and calibration, their layout, work space of engineers, and so forth. The design also includes public spaces and facilities such as conference rooms, administration offices, toilets and entrance hall.

The floor height of the building is planned at four meters and ceiling height is at three meters with consideration of the dimensions of instruments and plumbing and wiring space in between. The floor load shall be around 500kg/m^2 on average.

The layout of the building includes laboratories for keeping the primary standards or National Standard, such as 1kg prototype, which require strict temperature and humidity control and prevent vibration; laboratories for ordinal calibration and type approval test under the moderate

control of temperature and humidity; laboratories for flow meters, the building of administration offices; and so forth. The building for the primary standards consists of the first basement and ground floor. The other buildings are planned as a two-story or single-story high.
The general conditions of site area and buildings are summarized as follows:

1) Site Area/Building Site

(1) The site should avoid the location near the road/expressway of heavy traffic, the source of vibration/shock, the industrial zone, the high-voltage cables, the powerful radio transmitters.

(2) The site should have a low ground water level in order to construct the basement.

2) General Requirements for Construction

(1) The laboratories which require the strict control of temperature should avoid direct sunlight or should be located in the basement.

(2) The width of the corridor should be three (3) meters or more so that the instruments can be moved easily.

(3) The width of doors should be large enough so that the measuring instruments and furniture can be moved in and out easily.

(4) Flooring materials should be load and wear resistant, hard, not subject to dust retention nor abrasion, not produce static electricity, not slippery when wet, easy to clean, and fire resistant.

(5) All illuminating lamps should be fluorescent tubes and ensure adequate brightness in the laboratories.

(6) The entrance doors to access to the air-conditioned laboratories, especially the laboratories for standards, should be doubled with the preparation rooms in the middle to prevent sudden rise in temperature and humidity.

3) Air-conditioning System

(1) The temperature and humidity control in the laboratories of mass and length should follow “Lampiran Keputusan Menteri Perindustrian dan Perdagangan Nomor: 634/MPP/Kep/10/2004.” The range of temperature should be between 18 and 23 deg.C according to this regulation and DOM should decide the certain degree of temperature. Then the temperature should be controlled within +/-0.5 deg.C differential.

(2) Air-conditioning system of the laboratories of mass standard and length standard should be an independent system to ensure the high accuracy with 24-hour control. Moreover, to avoid the influence of air convection against the measuring instruments, the outlet/intake of air should be covered with the iron plate or ceiling with extremely-small holes.

(3) The conditions of the temperature and humidity controls of other laboratories should be conformed to “Lampiran Keputusan Menteri Perindustria dan Perdangangan Nomor: 634/MPP/Kep/10/2004” (temperature: 27 deg.C +/-5 deg.C, humidity: 65%+/-20%).

(4) The temperature in laboratories which do not require accurate control and/or administration offices should be decided based on the experiments in accordance with the provision of ISO and/or domestic regulations.

4) Vibration and Sound Control

(1) Measures should taken in laboratories which generate vibrations and shocks to prevent negative influence on other laboratories. These laboratories should be in different buildings located away from the laboratories for standards.

(2) Laboratories which require stable circumstances should be located in the basement principally. To prevent influences of wind and sound vibrations, building foundations and floors should be separated then measuring instruments should be placed on vibration isolated tables.

5) Water Supply and Drainage

(1) The capacity of water supply and drainage should be a sufficient volume to prevent water outage and overflow in the buildings. It is also crucial for DOM to have clean water for the type approval test and calibration of water meters, etc.

(2) The facility which renders contaminated drainage water harmless shall be constructed if drained water is contaminated.

(3) DOM should install a proper drainage system to prevent water overflow in case of heavy rain and/or flood.

(4) A water storage tank and pump should be installed in case of water outage.

5) Electricity

(1) The instruments for type approval test and calibration require electricity in principal. Therefore, DOM should calculate the total demand of power with extras for the further operation and modification of the equipment and facilities.

(2) DOM needs to manage and control the power supply to all buildings/laboratories because some laboratories, such as mass standard laboratory, require 24-hour control of air-condition and/or continuously running electricity for the endurance tests.

(3) Automatic Voltage Stabilizers (AVR) will be installed to secure the stable power supply to the instruments. If DOM provides the type approval test for WH Meter, the installation of AVR is crucial. In this case, DOM shall need to consider the quantity, capacity, coverage and location.

(4) Each laboratory should be supplied with both single- and three-phase sockets. Some sockets may be kept in reserve.

(5) The type approval tests include the electrical impulse noise test and static discharge test. These fluctuated electric currents or noises may travel through the wires and affect the operations of other equipment and facilities. To prevent these disturbances, rooms must be wired separately, illuminated, and air-conditioned.

(6) For safety reasons, each laboratory must be provided with an individual earth line (earth resistance: less than 1 ohm) and automatic circuit breakers for earth leakage current for chemical and wet laboratories.

(7) The installation of a stand-by generator may be necessary for the provision for the power failure. Before installation, however, it is necessary to decide the coverage area and equipment, then, choose the proper generator. In addition, DOM will need to calculate operation and maintenance costs, including fuel, personnel, and so forth.

6) Safety Measures

(1) Draft Chamber

A draft chamber and ancillary facilities to render the flammable and harmful gases harmless should be installed in the laboratories if there is a possibility of exhausting harmful gases.

(2) Fire Protection Facilities

The fire protection facilities (hydrants, sprinklers, fire protecting walls and doors) must be installed in the buildings and fire alarm system in each room in compliance with the fire regulation.

(3) Others

A part of the machine hall will have to allow entry of trucks and cars especially equipped for field verifications. The calibration of heavy weights and unloading of heavy goods may require the installation of a hoist or a traveling crane. The carts and small crane with casters will be a helpful to carry heavy goods in DOM.

6.10.3 Layout Plan

The layout of laboratories are determined based on the conditions of storage of measuring instruments, the instruments and contents of type approval tests, the weight and dimensions of the instruments and so forth. The main preconditions of layout are summarized below:

1） The standard laboratories of mass and the length should be isolated from other buildings and located in the basement.

2） The mass and length standard laboratories should be placed in consideration of the vibrations and shocks from outside of DOM.

3） The laboratories which deal with the heavy goods and/or the heavy measuring instruments should be principally located on the ground floor in view of their circulations.

4） The laboratories of type approval and calibration of flow meters should be isolated from other buildings and single-story as they can be operated at ambient temperature and high humidity.

Floor Space of Laboratories

The floor space of each laboratory shall be determined in consideration of their services, number of staff, quantity of tests, dimensions of the instrument, etc. Although those details should be decided at the stage of detailed design, the belief estimation of spaces is calculated and shown in Table 6.10.3-1.

Table 6.10.3-1 Floor Space of Laboratories and Offices

Name of laboratory and office		Estimated area (m^2)
Laboratory		
1.	Mass	400
2.	WH Meter	220
3.	Taxi Meter	160
4.	Fuel Dispenser	100
5.	Water Meter	600
6.	Gas Meter	720
7.	Oil Meter	600
8.	Pressure	160
9.	Force	160
10.	Volume	150
11.	Length	240
12.	Temperature	110
13.	Time	54
14.	Electricity	220
15.	Others	200
Total		4,094
Administration Office		
16.	Director Offcie	72
17.	Administration office	700
18.	Meeting Room ($100m^2$ x 2、$170m^2$ x 1）	370
19.	Library	180
20.	Canteen	220
21.	Storage	200
22.	Mosque	80
23.	Common Space (Toilet, corridor, elevator, etc.)	1,800
Total		3,622
Ground Total		7,716

6.10.4 Procurement Plan

The instruments owned by DOM are mixed with both old equipment which cannot keep proper traceability and new ones that were recently procured, causing unbalanced performances. DOM plans and is expected to conduct proper type approval tests. So, it is crucial for DOM to replace the obsolete equipment and facilities for type approval tests and calibration of measuring instruments to play a major role as a national laboratory regarding legal metrology.

1) Instruments for Type Approval Test

The apparatus for type approval tests held by DOM is limited to the area of instrument error of the measuring instrument, which does not fulfill the requirements recommended by OIML. As was pointed out in the Chapter 6.4, the following seven measuring instruments shall be tested steadily by DOM as type approval following OIML recommendations. These seven areas are: NAWI, WH Meter, taxi meter, fuel dispenser, water meter, gas meter and oil meter. The facilities and equipment for type approval test will be planned to fulfill the OIML requirements recommended. The specifications of these facilities and equipment should be determined by DOM in accordance with the future direction as well as OIML recommendations and SSTK.

The major facilities and equipment newly introduced to DOM are summarized as follows:

(1) Non-Automatic Weighing Instruments

1. Tilting table
2. Constant temperature and humidity chamber
3. Endurance test device
4. Device for power voltage variations and short time power reductions
5. Electrical burst test device
6. Electrostatic discharge device
7. Electromagnetic susceptibility test device

(2) WH Meter

1. Device for type approval test (endurance test, power voltage, frequency variation test, etc.)
2. Device for mechanical performance test (vibration testing unit, external shock test, etc.)

3. Impulse noise test device
4. Electromagnetic susceptibility test device
5. Environmental endurance test devices (constant temperature and humidity, salt water spray, gas corrosion by sulfuric acid, etc.)

(3) Taxi Meter

1. Performance test device with constant temperature and humidity room
2. Electromagnetic susceptibility test device
3. Electrical impulse noise test device
4. Electrostatic discharge device
5. Vibration endurance testing unit

(4) Fuel Dispenser

1. Device for power voltage variations and short time power reductions
2. Electrical burst test device
3. Electrostatic discharge device
4. Electromagnetic susceptibility test device

(5) Water Meter, Gas Meter, Oil Meter

1. Constant temperature and humidity chamber
2. Electromagnetic susceptibility test device
3. Electrical impulse noise test device
4. Electrostatic discharge device

2) Facilities and Equipment for Calibration

DOM has been providing the calibration service of the measuring instruments brought from RVOs. The facilities and equipment owned by DOM, however, are intermingled with old and new. Therefore, the quality of service varies depending on their conditions and ages. It is important for DOM to renew the obsolete equipment and to provide stable and high quality of service.

The major necessary facilities and equipment required are summarized in Table 6.10.4-1.

Table 6.10.4-1 Major Equipment for Calibration

Equipment Name		Equipment Name	
Mass		**Temperature**	
	Standard weights		Oil Bath
	Mass comparator		Water Bath
	Vacuum Mass comparator		Sand bath
	Hardness Tester		Glass thermometer
	Laptop	**Time**	
	Weights manupulator (crane)		Rubidium Frequency Standard
	Balance Table		Frequency Comparator
Pressure			Standard Frequency Counter
	Calibration Apparatus for Vacuum Meter	**Specific Standard Gas Measurement Devices**	
	Dead Weight Piston Gauge		Gas Chromatograph
	Pressure Transducer	**Specific Standard Liquid Measurement Devices**	
	Strain Meter		Viscometer
	Digital Pressure Calibrator	**Electrical**	
Force			Power Source
	Force Standard Machine		Stabilized Source
	Standard Proving Ring		Power Amplifier
	Load Cell		Oil Bath
	Torque Transducer		Standard Register
Volume			Portable standard kWh meter class 0.05
	Weighing Machine (balance)	**Mobile Facility**	
	Water Distillation Apparatus		4WD + equipment
	Standard Tank		4 automobile + equipment
	Standard Flask		Motorbike
	Small Volume Prover	**Other Equipment**	
Length			Computer
	Line gauge comparator		LCD projector
	Gauge block comparator		Printer Laser
	Comparator 50 m		3D-coordinate measuring instrument
	Iodine stabilised He-Ne Laser		Dial Gauge

6.10.5 Cost Estimation

The initial cost estimation of the project is calculated as shown in Table 6.10.5-1. The estimation is included building construction and procurement of the equipment of type approval and calibration.

Table 6.10.5-1 Cost Estimation of Construction and Facilities/Equipment for DOM

1. Construction of DOM	¥1,000,000,000	Rp800,000,000,000
2. Facility/Equipment for DOM	¥2,602,750,000	Rp208,220,000,000
Type Approval	¥1,805,000,000	Rp144,400,000,000
a. Taxi Meter	*¥20,000,000*	*Rp1,600,000,000*
b. NAWI	*¥60,000,000*	*Rp4,800,000,000*
c. WH Meter	*¥160,000,000*	*Rp12,800,000,000*
d. Fuel Dispenser	*¥15,000,000*	*Rp1,200,000,000*
*e. Water Meter**	*¥600,000,000*	*Rp48,000,000,000*
*f. Gas Meter**	*¥250,000,000*	*Rp20,000,000,000*
*g. Oil Meter**	*¥700,000,000*	*Rp56,000,000,000*
Calibration	¥797,750,000	Rp63,820,000,000
a. Mass	*¥96,325,000*	*Rp7,706,000,000*
b. Pressure	*¥66,875,000*	*Rp5,350,000,000*
c. Force	*¥115,250,000*	*Rp9,220,000,000*
d. Volume	*¥41,050,000*	*Rp3,284,000,000*
e. Length	*¥141,062,500*	*Rp11,285,000,000*
f. Temperature	*¥37,375,000*	*Rp2,990,000,000*
g. Time	*¥13,750,000*	*Rp1,100,000,000*
h. Specific Standard Gas Measurement Devices	*¥15,000,000*	*Rp1,200,000,000*
i. Specific Standard Liquid Measurement Devices	*¥1,250,000*	*Rp100,000,000*
j. Electrical	*¥103,500,000*	*Rp8,280,000,000*
k. Mobile Facility	*¥105,000,000*	*Rp8,400,000,000*
l. Other Equipment	*¥61,312,500*	*Rp4,905,000,000*
TOTAL	¥3,602,750,000	Rp333,220,000,000

*: can be used for calibration

6.10.6 Operation and Maintenance

It is crucial for DOM to maintain the facilities and equipment day-to-day and keep them in good condition. The belief guidance of maintenance will be held by the supplier side and the maintenance manuals will be provided when equipment is installed. Maintenance should follow these instructions, but future mechanical failures are unavoidable. Manufacturers will repair their products within the guarantee period; however, DOM must pay repair costs once the guarantee period expires or someone other than the manufacturers opens the main unit to conduct maintenance or repairs. Therefore, DOM should secure the sufficient budgets for the repairs to prevent the serious situations that DOM cannot provide its services.

DOM also must calculate costs of the spare parts and consumables for smooth operations. It is necessary to confirm the kinds of spare pasts and consumables when procured as they may vary from product to product. In general, maintenance costs (including cost of spare parts and consumables) may be projected and calculated at one to two percent of each unit price.

Especially after the warranty period, DOM should estimate and secure enough budgets and, if necessary, DOM has to review these costs.

Moreover, the maintenance records shall be kept for the further maintenance activities. Records of causes of equipment breakdown as well as a report of maintenance and repairs must be distributed to all engineers and equipment users so that future failures can be avoided.

6.10.7 Schedule

The draft schedule of construction and procurement of the equipment is planned as shown in Table 6.10.7-1. The precondition is that DOM expropriates land.

Table 6.10.7-1 Implementation Schedule for DOM

Contents	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Foundation Construction																
Building Construction																
Completion of Construction																
Tender for Equipment																
Manufacturing																
Installation of Equipment																
Operational Training																
Completion of Installation																

6.11 Investment Plan for LMS Center

6.11.1 Objective and Scope of thePlan

LMS Centers are expected to support RVOs to calibrate their measuring instruments and subsequently encourage industrial development in the regions. For these reasons, LMS Centers should provide services accurately and quickly as a relay station based on the traceability from the standards which DOM possesses to the standards of RVOs and industrial measurements.

However, like DOM, the particularities regarding locations and detail specifications of facilities and equipment should be determined at the next stage of detailed design.

6.11.2 Plan for Building and Auxiliary Facilities

The varieties and dimensions of the equipment and instruments which may be necessary for the

calibration service and industrial development, and work-space of engineers were considered before making a facility plan. The design also includes the public spaces and facilities such as conference rooms, administration offices, toilets and entrance hall.

The floor height of the building is planned at four meters and ceiling height is at three meters with consideration of the dimensions of instruments and plumbing and wiring space. The floor load shall be around 500kg/m2 on average.

The preconditions regarding building construction is the same level as DOM.

6.11.3 Layout Plan

The layout of laboratories is determined based on the conditions of storage of measuring instruments. The laboratories for mass standard and length standard, which require proper temperature and humidity control, are planned to locate in the basement. The laboratories under the moderate temperature and humidity control were designed at the ground or first floor of the building. The laboratories of various flow-meters are planned to locate at the separated building from the main building.

6.11.4 Procurement Plan

LMS Centers are new institutions. The measuring instruments should be procured to satisfy the expected services. For that reason, the necessary facilities and equipment are designed and summarized as shown in Table 6.11.4-1.

Table 6.11.4-1 Equipment for LMS Centers

Equipment Name		Equipment Name	
Mass		**Temperature**	
	Standard weights 1 mg ~ 50 kg Class E1		Glass thermometer (0 ~ 250 ^{o}C)
	Standard weights 1 mg ~ 50 kg Class E2		Oil bath
	Standard weights		Thermocouple calibrator
	Mass comparator 60 kg	**Electric**	
	Mass comparator 30 kg		Portable standard kWh meter class 0.05
	Mass comparator 10 kg	**Mobile Facility**	
	Mass comparator 1 kg		4WD + equipment
Length			4 automobile + equipment
	Gauge Block Class A (0,5 mm ~ 100 mm)		Motorbike
	Comparator Van Becker (line gauge)	**Others**	
	Caliper		Note book
Volume			Computer
	Standard Tank 50 L		Stop Watch
	Standard Tank 20 L		LCD projector
	Standard Tank 10 L		Printer Laser
	Standard Tank 5 L		

6.11.5 Cost Estimation

The preliminary cost estimation for LMS Centers is summarized in Table 6.11.5-1. The cost estimation is included in the building construction and procurement of the equipment. However, the precondition is that the construction site of LMS Centers will be prepared by the Indonesian side.

Table 6.11.5-1 Cost Estimation of Construction and Facilities/Equipment for LMS Center

1. Construction of LMS Center	¥100,000,000	Rp8,000,000,000
2. Facility/Equipment for LMS Center	¥89,400,000	Rp7,152,000,000
a. Mass	*¥38,750,000*	*Rp.3,100,000,000*
b. Length	*¥ 3,250,000*	*Rp.260,000,000*
c. Volume	*¥1,375,000*	*Rp.110,000,000*
d. Temperature	*¥21,125,000*	*Rp.1,690,000,000*
e. Electrical	*¥6,250,000*	*Rp.500,000,000*
f. Mobile Facility	*¥9,937,500*	*Rp.795,000,000*
g. Other Equipment	*¥8,713,250*	*Rp.697,000,000*
TOTAL	¥189,400,000	Rp15,152,000,000

6.11.6 Operation and Maintenance

A proper maintenance system is also required to LMS Centers just as at DOM. LMS Centers should calculate the maintenance and operational cost of the equipment. The percentage of budgeting for maintenance is the same as DOM, that is from one to two percent of the unit price of the equipment. LMS Centers will play important roles to support the activities of RVOs and regional industries. So, the staffs of LMS Centers must be aware of their official and social responsibilities to prevent any interruption in service.

In addition, maintenance records shall be kept for the further maintenance activities. This information must be relayed back to the engineers and equipment users to be shared among the staffs, which will avoid repeating the same failures.

6.11.7 Schedule

The draft schedule of construction and procurement of the equipment is planned as shown in Table 6.11.7-1. The precondition is that each LMS Center expropriates the construction site.

Table 6.11.7-1 Implementation Schedule for LMS Centers

Contents	1	2	3	4	5	6	7	8	9	10	11	12
Foundation Construction												
Building Construction												
Completion of Construction												
Tender for Equipment												
Manufacturing												
Installation of Equipment												
Operational Training												
Completion of Installation												

6.12 Overall Investment Plan

It is essential and urgent for the improvement of the legal metrology system to reinforce the hard assets such as facilities and equipment. As prioritized the investment plan for DOM and LMS Center as discussed in the previous sections, 6.10 and 6.11, DOM should be placed as the first priority for project implementation rather than LMS Center. Of course, it is possible to implement it simultaneously; however, the rapid change may confuse the system, which is not recommended. Overall investment plan is summarized as shown in Table 6.12-1.

Before the construction and installation of the equipment, the future plan and direction of legal metrology system in Indonesia should be discussed carefully. The specifications regarding construction and equipment should be decided to satisfy the future needs of DOM and LMS Centers.

Table 6.12-1 Overall Investment Schedule

		1st year				2nd year				3rd year				4th year				5th year			
		i	ii	iii	vi	i	ii	iii	vi	i	ii	iii	vi	i	ii	iii	vi	i	ii	iii	vi
DOM		◄	·····	·····	·····	·····	·····	·····	►												
Construction	Detail Design	▬																			
	Estimation	▬																			
	Tender		☆																		
	Construction		◆	·····	·····	·····	◆														
Facility/Equipment	Detail Design	≈	≈																		
	Estimation		≈																		
	Tender			○																	
	Manufacturing			●	·····	·····	●														
	Installation/Training						▨	▨													
	Start Operation							●													
LMS Center												◄	·····	·····	·····	·····	►	◄	·····	·····	►
Construction	Detail Design																▬				
	Estimation																▬				
	Tender																	◆	·····	◆	
	Construction																				
Facility/Equipment	Detail Design																≈				
	Estimation																≈				
	Tender																	○			
	Manufacturing																	◆	·····	◆	
	Installation/Training																			▨	
	Start Operation																				◎

Chapter 7

Conclusion and Recommendation

Chapter 7 Conclusion and Recommendation

7.1 Conclusion

7.1.1 Common

- The JICA study team grasped present status of corresponding sectors and identified problems and issues to be solved through a wide range of site surveys.
- Indonesian organizations concerned cooperated with the study team for conducting detailed site survey.
- Accordingly, the Master Plan including action plan is considered to be a realistic one to reflect the present situations.

7.1.2 Legal Metrology Legislation

- The present situation of legislation on legal metrology was analyzed and problems to be solved were grasped.
- Indonesia has a long history in legal metrology, and its legislation system has been developed considerably. However, the legislation system has not been harmonized well since decentralization.
- Most local governments lack of a sense of consumer protection, which actually is the highest priority of legal metrology.

7.1.3 Legal Metrology System

To catch up international level of measurement standards and legal metrology, it is necessary:

- to establish a national metrology institute (NMI) by unification of existing ones,
- to develop a coherent traceability system, and
- to enhance research and development on metrology.

7.1.4 Enhancing DOM's Functions

For enhancing DOM's functions the following innovations will be necessary.

- To establish a system with accountability and transparency
- To improve environment for research and development
- To build-up researchers and technical experts

7.1.5 Establishing LMS Centers

It is necessary to establish a new scheme for providing RVOs and regional industries with testing and calibration services.

7.1.6 RVOs

- There are three major problems in RVOs which are equipment, budget and human resources as follows:.
  - Equipment and facilities are insufficient and old in many RVOs.
  - There are different budgetary systems employed among provincial governments and small budgetary support from DOM to RVOs.
  - The average age of inspectors is getting old and it is difficult to supplement retiring staffs.
- After the decentralization, the ratio of verification/re-verification is reduced substantially.

7.1.7 Measuring Technology

- Most facilities and equipment of DOM and RVOs are old and some equipment including air conditioning units are out of order.
- DOM has technical manuals of type approval testing and verification, called as SSTK (special technical standards). It is necessary that advanced technology be incorporated into SSTK and electric technology in SSTK be upgraded.
- Inspectors in DOM and RVOs rotate UTTP sections regularly for short time of period, which causes lack of accumulation of expertise.

7.1.8 HRD

- The number of legal metrology officers is estimated to be 1,200 at minimum in 2016 under the existing Law of Legal Metrology. It is always necessary to review HRD system so that the officers to manage national and regional requirements can be provided smoothly.
- MTC now faces two issues: increase in quantity of HRD and change of quality of HRD. The former is an issue of how to make-up the officers who reach retirement age. The latter is the discrepancy in quality of local officers after decentralization.
- Furthermore, the work for metrology is not well conducted because of lack of human resources. The legal metrology is characterized by both prior regulation and post regulation. The former is verification and re-verification of measuring instruments, and the latter is control and supervision. Both performances decrease (60% of verification rate and existence of RVOs who cannot perform surveillance).
- It is urgent that MTC be strengthened so it can foster 200 inspectors a year.

7.2 Recommendation

7.2.1 Common

- It is urgent to renovate DOM, MTC and RVOs.
- Action plans (projects) should be implemented when their conditions become ready. It is important to establish a project team, to secure human resources and funds, and to design a detailed plan which clearly shows "5W1H and How much."
- Planning of the action plan should be drawn up using an effective planning method. The country-wide project should first be implemented as a pilot project then extended to other locations after successful operation.
- A project team should be organized to make a detailed plan and implement the project. At least one full-time staff person should be assigned to the project team.
- Management of the action plan is evaluated by the PDCA circle concept.
- In promoting renovation, intensive discussion should be made among organizations concerned with obtaining the consensus.

7.2.2 Legal Metrology Legislation

- A "Metrology Legislation Study Committee" (project team) should be established to investigate the change and amendment of law and regulations.
- Change of law and regulations should be made based on the schedule for amendment.
- Interpretation of law and regulations should be adjusted between the central government and local governments. Responsibilities between both governments should be defined clearly, including RVO's responsibility for reporting to DOM.
- After successful implementation of action plan, transfer of some work for metrology is investigated for realization.
- Verification systems for WH meters and water meters that highly contribute to consumer protection should be developed and implemented.
- A "Month of Measurement" should be established for dissemination and enlightenment of legal metrology.

7.2.3 Legal Metrology System

- It is necessary to designate Indonesia's unique national standards for establishing coherent measurement traceability, traceable to Indonesia's national standards.
- Following the report by KSNSU, it is recommended that four existing NMIs be unified in future. The study on the unification should be facilitated. This recommendation will apply especially to DOM and KIM-LIPI.

- So far only one institute, KIM-LIPI, is designated as a participating NMI in CIPM MRA. In addition, Indonesia should designate the four existing NMIs including DOM.

7.2.4 Enhancing DOM's Functions

- Re-organization will be required to clarify and enhance the roles and functions of each section. Settlement of a planning section and international metrology section will be useful to establish an organization with accountability and transparency. It will also enhance DOM's ability to develop and implement its long-term strategies.
- In addition to the services to RVOs, functions of both DOM and LMS Centers should be extended so that are able to meet the needs of regional industries.
- It is necessary to bring-up experts to enhance technical activities in each metrological field.
- The current location of DOM is suitable neither for cooperation among the NMIs, nor for maintenance of the national standards. Another site convenient and suitable for establishing a new NMI should be sought.
- It is necessary to bring-up experts of type approval testing, verification, measurement technologies of each metrological field.
- It is recommended to enhance the following services.
  - To upgrade type approval testing in accordance with international recommendations
  - To extend technical services into calibration on request from private sector
  - To provide testing services on request

7.2.5 Establishment of LMS Centers

It is necessary to establish a new scheme to provide testing and calibration services for RVOs and provincial private sector. It will avoid overlapping investment necessary for calibration and testing in individual industries. The coverage of LMS Centers to be established should not overlap with that of RVOs and BPSMBs.

7.2.6 RVOs

- Up-dated technology and electrical technology should be strengthened in actual duties.
- Innovation of RVO is necessary to enhance the job efficiency.

7.2.8 Measuring Technology

- Facilities and equipment of DOM and RVOs should be replaced to new and precise ones.
- DOM and LMS Centers assist RVOs in development of measuring technology by various measures including inter-laboratory comparison and technical competition.

7.2.9 HRD

- Training is conducted according to specialty. Specialization classifications are: inspectors, surveillance officers and laboratory specialists. Compared to the existing system, training periods are reduced to half or below.
- The upgrading of MTC is achieved by strengthening the facilities and equipment for training as well as fostering capable trainers.
- MTC should bear all costs for training, including traveling and accommodation costs, so that many trainees can receive training. In addition, the living conditions of trainees should be improved to a standard of comfortable living.

7.2.10 Investment Plan

It is crucial for the improvement and comprehension of the legal metrology system in Indonesia to harmonize both soft and hard assets well. The improvement of soft sides may require more time than upgrading hard assets, such as facilities and equipment. Therefore, the timing of construction and equipping of DOM and LMS Centers should be considered in accordance with the progress of the legal metrology system.

The same can be said for relations between DOM and LMS Centers. It is possible to construct and equip DOM and LMS Centers at the same time, however the confusions could occur in the country's legal metrology system. Therefore, it is best to prioritize strengthening the function of DOM. The first stage is to construct DOM and procure the necessary facilities and equipment for type approval tests and calibration. Then, DOM should provide the sought-after services to the nation.

As the second stage, DOM shall consider the necessity of LMS Centers, including their function and services, their locations, contents and grade of equipment, relation between RVOs, etc. Those considerations are necessary steps for the improvement of the legal metrology and its system. If DOM finds the necessity of establishing LMS Centers, DOM should consider both the timing of construction as well as specification and grade of equipment.