No.

Directorate General of Domestic Trade
Ministry of Trade
Republic of Indonesia

# The Study on Development of Legal Metrology System in the Republic of Indonesia

Final Report

January 2007

JAPAN INTERNATIONAL COOPERATION AGENCY
UNICO INTERNATIONAL CORPORATION

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# Preface

In response to the request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct "the Study on Development of Legal Metrology System in the Republic of Indonesia" and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent a study team led by Mr. Kunio OTSUKA, UNICO International Corporation four times from February to December 2006.

The team held discussions with the officials concerned of the Government of Indonesia and conducted related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I hope that this report will contribute to the development of legal metrology system in Indonesia and to the enhancement of bilateral relations between our countries.

Finally, I wish to express my sincere appreciation to those who participated in and cooperated to the study.

January 2007

Tadashi IZAWA
Vice President
Japan International Cooperation Agency

January 2007

Mr. Tadashi IZAWA
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Izawa,

# Letter of Transmittal

We are pleased to submit herewith "the Final Report for the Study on the Development of Legal Metrology System in the Republic of Indonesia." The study was implemented for approximately one year from January 2006 with the objective to upgrade the existing metrology system into international level for enhancing the competitiveness of the Indonesian products and protecting consumers from unfair trade, taking into account impacts on domestic legal metrology implementation system caused by the de-centralization.

The JICA study team grasped present situation and problems/issues to be solved concerning legal metrology system by intensive investigation through the field survey of Directorate of Metrology (DOM) who is a main counter part for the study, eleven major regional verification offices (RVOs) who are under control of provincial governments and Metrology Training Center (MTC) who is responsible for training of legal metrology. In addition, the study team conducted questionnaire survey to fifty-four RVOs spreading over the whole country in order to supplement necessary information. These collected data and information were analyzed in detail, which were discussed with Indonesian counterparts to draw up a master plan including action plans.

It is expected that the development of legal metrology system in the country can be achieved by reviewing the master plan and individual action plan in this report to make a concrete implementation plan, followed by its implementation by corresponding organization(s).

Taking this opportunity, we would like to express our sincere gratitude for the implementation of the study to your Agency; the Ministry of Economy, Trade and Industry; National Institute of Advanced Industrial Science and Technology; Japan Electric Meters Inspection Corporation; and Japan Quality Assurance Organization. We especially wish to express our deep gratitude to

the Directorate General of Domestic Trade, Directorate of Metrology and Metrology Training Center of the Ministry of Trade, Regional Verification Offices and organizations concerned for the close cooperation and assistance extended to our study team.

Very truly yours,

Kunio OTSUKA
UNICO International Corporation
Team Leader
Study Team on Development of Legal Metrology System
in the Republic of Indonesia


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## Abbreviation List

| Abbreviation | English | Other Language |
|---|---|---|
| ACCSQ | ASEAN Consultative Committee on Standards and Quality | |
| ADB | Asian Development Bank | |
| AFTA | Asean Free Trade Area | |
| AIST | National Institute of Advanced Industrial Sciences and Technology, Japan | |
| APEC | Asia Pacific Economic Cooperation Conference | |
| APLAC | Asia Pacific Laboratory Accreditation Cooperation | |
| APLMF | Asia Pacific Legal Metrology Forum | |
| APMP | Asia Pacific Metrology Program | |
| ASEAN | Association of Southeast Asian Nations | |
| ASEM | Asia-Europe Meeting | |
| BAM | Federal Institute for Materials Research and Testing, Germany | Bundesanstalt fr Materialforschung und -prfung |
| BAPPENAS | National Development Planning Board, Indonesia | |
| BATAN | National Atomic Power Body, Indonesia | Badan Tenaga Atom Nasional |
| BDKT | Pre-packaged goods | Barang Dalam Keadaan Terbungkus |
| BIPM | International Bureau of Weights and Measures | Bureau Internationale des Poids et Mesures |
| BKPM | Investment Coordinating Board, Indonesia | Badan Koordinasi Penanaman Modal |
| BOE | Barrel Oil Equivalent | |
| BPLIP | Pulogadung Industry and Residence Environment Superintendence Body | Badan Pengelola Lingkungan Industri dan Pemukiman Pulogadung |
| BPMB, BPSMB | Product Quality Testing Office | Balai Pengujian Mutu Barang |
| BPS | Central Bureau of Statistics, Indonesia | Biro Pusat Statistik |
| BSN | The National Standardization Body, Indonesia | Badan Standarisasi Nasional |
| CBU | Completely Built Up | |
| CBWM | Central Bureau of Weight and Measures, Thailand | |
| CCQM | Consultative Committee on Amount of Substance | |
| CCRI | Consultative Committee for Ionizing Radiation | |

| Abbreviation | English | Other Language |
|---|---|---|
| CERLAB | | Centro de Recursos Laboratoriais, France |
| CGPM | The General Conference on Weights and Measures | Conference Generale des Poids et Mesures |
| CIF | Cost, Insurance, and Freight | |
| CIML | Committee of International Legal Metrology | |
| CIPM | | la Comite Internationale des Poids et Mesures |
| CIPM-MRA | | la Comite Internationale des Poids et Mesures - Mutual Recognition Arrangement |
| CMC | Calibration and Measurement Capabilities | |
| CPO | Crude Palm Oil | |
| CRM | Chemical Risk Management | |
| DF/R | Draft Final Report | |
| DGDT | Directorate General of Domestic Trade, Ministry of Trade, Indonesia | |
| DOM | Directorate of Metrology | |
| DOMA | Department of Manpower Affairs | |
| DoMC | Declaration of Mutual Confidence | |
| DSN | Standardization Council of Indonesia | Dewan Standarisasi Nasional |
| EOJ | Embassy of Japan | |
| F/R | Final Report | |
| FDI | Foreign Direct Investment | |
| FGD | Focus Group Discussion | |
| FOB | free on board | |
| FTA/ETA | Free Trade Agreement / Economic Trade Agreement | |
| FY | Fiscal Year | |
| GAIKINDO | the Assosiation of Indonesia Automotive Industries | |
| GBHN | Guidelines of State Policy | |
| GDP | Gross Domestic Product | |
| GDRP | Gross Domestic Regional Product | |
| GNP | Gross National Product | |
| GOI | Government of Indonesia | |
| GOJ | Government of Japan | |

| Abbreviation | English | Other Language |
|---|---|---|
| HRD | Human Resources Development | |
| IAEA | International Atomic Energy Agency | |
| IAF | International Accreditation Forum | |
| IC/R | Inception Report | |
| IEC | International Electrotechnical Commision | |
| ILAC | International Laboratory Accreditation Cooperation | |
| IMF | International Monetary Fund | |
| ISO | International Organization for Standardization | |
| ITB | Institute of Technology, Bandung | |
| ITU | International Telecommunication Union | |
| JBIC | Japan Bank for International Cooperation | |
| JCSS | Japan Calibration Service System | |
| JEMIC | Japan Electric Meters Inspection Corporation | |
| JETRO | Japan External Trade Organization | |
| JICA | Japan International Cooperation Agency | |
| JIEP | Jakarta Industrial Estate, Pulogadung | |
| JIS | Japan Industry Standard | |
| JQA | Japan Quality Assurance Organization | |
| KAN | National Accreditation Committee, Indonesia | Komite Akreditasi Nasional |
| Keppres | Presidential Decree | Keputusan presiden |
| KIMIA-LIPI (PUSLIT KIMIA-LIPI) | Research Center for Chemistry, LIPI, Indonesia | Pusat Penelitian Kimia LIPI |
| KIM-LIPI (PUSLIT KIM-LIPI) | Research Center for Calibration, Instrumentation and Metrology, LIPI, Indonesia | Pusat Penelitian KIM LIPI |
| KSNSU | Committee on National Measurement Standards, Indonesia | |
| LGC | Laboratory of the Government Chemist, UK | |
| LIPI | Indonesian Institute of Science | Lembaga Ilmu Pengetahuan Indonesia |
| LMK | Electric Related Institution | |
| LMS Center | Legal Metrology Standardization Center | Balai Standarisasi Metrologi Legal |
| LNE-CETIAT | | Centre Technique des Industries Aérauliques et Thermiques |

| Abbreviation | English | Other Language |
|---|---|---|
| LNE-ENSAM | | École nationale supérieure d'arts et métiers de Paris |
| LNE-FEMTO-ST | | Franche-Comté Electronique, Mécanique, Thermique et Optique - Sciences et Technologies |
| LNE-IRSN | | Institut de radioprotection et de sûreté nucléaire |
| LNE-LADG | | Laboratoire Associé de Débitmétrie Gazeuse |
| LNE-OB | | Observatoire de Besançon |
| LMA | Local Metrology Authority | |
| CMA | Central Metrology Authority | |
| LPG | Liquified Petroleum Gas | |
| M/P | Master Plan | |
| METI | Ministry of Economy, Trade and Industry, Japan | |
| MOFA | Ministry of Foreign Affairs, Japan | |
| MOI | Ministry of Industry | |
| MOSTE | The Ministry of Science, Technology and Environment, Thailand | |
| MOT | Ministry of Trade, Indonesia | |
| MPE | Maximum Permissible Error | |
| MPR | People's Consultative Assembly | Majelis Permusyawaratan Rakyat |
| MRA | Mutual Recognition Arrangement | |
| MTC | Metrology Training Center | |
| NATA | National Association of Testing Authorities | |
| NAWI | Non Automatic Weighing Instrument | |
| NEL | National Engineering Laboratory, UK | |
| NIMT | The National Institute of Metrology Thailand | |
| NITE | National Institute of Technology and Evaluation, Japan | |
| NMI | National Metrology Institute | |
| NMIA | National Metrology Institute of Australia | |
| NMIJ | National Metrology Institute of Japan | |
| NML | National Metrology Laboratory | |
| NPL | National Physical Laboratory, UK | |
| NWML | National Weights and Measures Laboratory, UK | |

| Abbreviation | English | Other Language |
|---|---|---|
| OIML | International Organization of Legal Metrology | la Organisation Internationale de Metrologie Legale |
| OIML-MAA | International Organization of Legal Metrology Mutual Acceptance Arrangement | |
| P3KRBiN BATAN | Research and Development Center for Radiation Safety and Biomedical Nuclear, BATAN | Puslitbang Keselamatan Radiasi dan Biomedika Nuklir BATAN |
| PAC/IAF | Pacific Accreditation Cooperation/International Accreditation Forum | |
| PDAM | Regional Corporation of Water Supply | Perusahaan Daerah Air Minum |
| Perda | Regional Regulation | Peraturan Daerah |
| Perpu | Government Regulation Substituting a Law | Peraturan Pemerintah pengganti Undang Undang |
| PG/R | Progress Report | |
| PLN | State Company of Electric Supply | Perusahaan Listrik Negara |
| PLTA | Hydro Power Electric Generator | Pembangkit Listrik Tenaga Air |
| PLTD | Diesel Powered Electric Generator | Pembangkit Listrik Tenaga Diesel |
| PLTG | Gas Fired Electric Generator | Pembangkit Listrik Tenaga Gas |
| PLTN | Nuclear Power Electric Generator | Pembangkit Listrik Tenaga Nuklir |
| PLTU | Steam Power Electric Generator | Pembangkit Listrik Tenaga Uap |
| PP | Government Regulation | Peraturan Pemerintah |
| PPMB | Product Quality Testing Center | Pusat Pengujian Mutu Barang |
| PR | Public Relations | |
| Propenas | National Development Program | Program Pembangunan Nasional |
| PTB | Federal Institute for Physical Technology, Germany | |
| R&D | Research and Development | |
| Repelita | Five Year Development Plan | Rencana Pembangunan Lima Tahun |
| RMO | Regional Metrology Organization | |
| RPJMN / NMTDP | National Medium Term Development Plan | |
| RVO | Regional Verification Office | |
| SI | the International System of Units | |
| SIRIM | Standards & Industrial Research of Malaysia | |
| SLI | Indonesian Electric Standards | Standar Listrik Indonesia |
| SME | Small and Medium Enterprises | Usaha Kecil dan Menengah |
| SNI | Indonesian National Standards | Standar Nasional Indonesia |

| Abbreviation | English | Other Language |
|---|---|---|
| SNSU | National Measurement Standards | Standar Nasional Satuan Ukuran |
| SSDL | Secondary Standard Dosimetry Laboratory | |
| SSTK | Technical Instruction Manual | Syarat-syarat Teknis Khusus |
| ST | Steering Committee | |
| TBT | Technical Barrier to Trade | |
| TUM | Tank Truck | Tangki Ukur Mobil |
| UBA | Federal Office for Environment, Germany | |
| UNIDO | United Nations Industrial Development Organization | |
| UTTP | Legally Controlled Measuring Instruments | Ukur, Takar, Timbang dan Perlengkapannya |
| UUD | Constitution | Undang-undang Dasar |
| UUML | Law of Legal Metrology | Undang-undang Metrologi Legal |
| WG | Working group | |
| WTO | World Trade Organization | |

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# Chapter 1 Framework of the Project

## 1.1 Background of the Study

The Study on Legal Metrology System in the Republic of Indonesia was once formulated by JICA in 1993/1994; however, due to the rapid change of the roles of both the central and regional governments in executing legal metrology activities caused by enactment of the Regional Autonomy Law No.22/1999, later revised No.32/2004, some of the Study is no longer valid and it must be revised to meet the present situation.

At the same time, it is recognized that the legal metrology system in Indonesia is necessary to meet international/global standards due to the recent enhancement of the worldwide trade and the development of science and technology. Especially, it is necessary for the legal metrology system in Indonesia to cope with the WTO/TBT (World Trade Organization/Technical Barriers to Trade).

Under such circumstances and in response to the request of the Government of the Republic of Indonesia (hereinafter referred to as "GOI"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct the Study on Development of Legal Metrology System in Indonesia. Accordingly, JICA, the official agency responsible for the implementation of the technical cooperation programs of GOJ, undertakes the Study in close cooperation with the relevant authorities concerned of the GOI.

## 1.2 Objectives of the Study

The objective of the Study is to investigate the present situation relating to legal metrology and to make a master plan, including a medium and long-term plans and an action program, to upgrade the existing metrology system to international level for enhancing the competitiveness of the Indonesian products and protecting consumers from unfair trade, taking into account impacts on domestic legal metrology implementation system caused by the de-centralization which has been executed since January 2001.

## 1.3 Scope of the Work for the Study

### 1.3.1 First Phase

1) Data Collection in Japan
2) Study on current situation of the legal metrology system in Indonesia
3) Survey on DOM and 11 regional verification offices (RVOs)
4) Study on facilities and equipment of DOM, designated 11 RVOs, MTC and LMS Centers

### 1.3.2 Second Phase

Based on the study results in the First Phase, the following master plan was formulated:

1) Develop the legal metrology system that meets the international standards
2) Make a plan for strengthening DOM's functions
3) Design a guideline for the establishment of new RVOs
4) Design the national human resources development plan for legal metrology including MTC
5) Plan the most effective legal metrology system in order to improve the relationship between DOM and RVOs under the current Autonomy Law
6) Develop a long-term investment plan to improve the facilities of DOM including LMS Centers.

# Chapter 2 Present Status and Development Plan of National Economy and Industry in Indonesia

## 2.1 Present Status of National Economy and Industry

### 2.1.1 History of Economic Policy

The government led by President Suharto deregulated the strategic economy by creating opportunities for foreign investment starting from 1969 by a series of five-year development plans. The government adopted the strategy for substitution of import to develop domestic industries, and implemented policies for liberalization of foreign investment and foreign capital ("open door" policy towards the West) to support it. This strategy is very important to get new capital from abroad. Foreign capital, especially foreign direct investment (FDI), and foreign governmental loans and aid started to flow substantially into the country.

Repelita, an acronym from "Rencana Pembangunan Lima Tahun" or Five Year Development Plan, is a plan firstly adopted by the government to coordinate Indonesia for accelerating its development. Five Repelita(s) were implemented during 1969-1994, constituting a 25 year-long development period, and the results were remarkable with achievements of annual growth rates of 8.5 %, 7.2 %, 6.1 %, 5.2 % and 6.9 %, respectively.

### 2.1.2 Major Economic Indicators

Table 2.1.2-1 summarizes the outlook of Indonesia. According to the National Mid-term Development Plan (2004-2009), the economic growth rate will increase from 5.5% in 2005 to 7.6 % in 2009 with an average annual growth rate of 6.6%. Main indicators in 2005 are below.

**Table 2.1.2-1 Outlook of Indonesia**

| Indicators | Description (in 2005) |
|---|---|
| Land areas | 1,922,570 km2 (5times over Japan) |
| Populations | 219.2 million |
| Annual growth rate of population | 1.34% |
| GDP at current market price | Rp 2,730 trillion (US$278 billion) |
| GDP per capita | US$ 1,268 |
| Inflation rate of consumer price at 45 cities | 17.1% |
| Rupiah exchange rate | 9,830 Rp/US$ |
| Current account | US$ 2,334 million |
| Foreign currency reserves | $32.9 billion (Equivalent to 6.2 months of import) |

Source: BPS Statistical Yearbook of Indonesia 2005

### 2.1.3 Foreign Trade

Since 1987, the Indonesian export which dominated by oil and gas has been changing due to some new deregulation and policies to promote export of non oil and gas products. These deregulation and policies have enabled the exporter and producer of non oil and gas commodities to improve in quality and increase their export production. It succeeded to give a significant impact on non oil export.

Due to economic crisis caused by the decline of Thai Bhatt, the import value was fall down between 1998 and 1999, however, it was recovered after 2000.

### 2.1.4 Investment

The main foreign investment projects by economic sector are manufacturing, transport, storage, communication, etc.

## 2.2 Industrial Analysis

### 2.2.1 Gross Domestic Product (GDP) by Sector

Table 2.2.1-1 shows the GDP at current market prices by sector.

**Table 2.2.1-1 GDP at Current Market Prices by Sector**

(Unit: billion Rupiah)

| Industrial origin | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|
| 1. Agriculture, Livestock, Forestry, Fishery | 263,328 | 298,877 | 325,654 | 354,435 |
| 2. Mining and Quarrying | 182,008 | 161,024 | 169,536 | 196,892 |
| *- Oil and gas* | *115,335* | *93,092* | *94,780* | *120,641* |
| *- Non oil and gas* | *66,673* | *67,932* | *74,756* | *76,251* |
| 3.Manufacturing Industry | 506,320 | 553,747 | 590,051 | 652,725 |
| *- Oil and gas manufacturing* | *63,345* | *69,660* | *78,641* | *86,982* |
| *- Non oil and gas manufacturing* | *442,975* | *484,087* | *511,410* | *565,743* |
| 4. Electricity, gas and water supply | 10,855 | 15,392 | 19,541 | 22,855 |
| 5. Construction | 89,299 | 101,574 | 112,571 | 134,388 |
| 6. Trade, hotel and restaurant | 267,656 | 314,647 | 337,841 | 372,340 |
| 7. Transport and communication | 77,188 | 97,970 | 118,267 | 140,604 |
| 8. Financial. Ownership and business services | 135,370 | 154,442 | 174,324 | 194,542 |
| 9. Services | 152,258 | 165,603 | 198,069 | 234,244 |
| ***Gross Domestic Products*** | 1,684,281 | 1,863,275 | 2,045,854 | 2,303,032 |
| ***Gross Domestics Products without Oil-gas*** | 1,505,601 | 1,700,523 | 1,872,433 | 2,095,409 |

Source: BPS Statistical year book 2004

## 2.3 Development Plan of National Economy and Industry

### 2.3.1 Mid-term National Development Plan (2004-2009)

Mid-term national development program (2004-2009) (Government Regulation No.7/2005) was formulated and enacted on January 26, 2005 based on the most upper stream of national planning.

**1) Direction of Mid-term National Development Plan 2004-2009**

The vision of mid-term national development plan is:

a) To realize a society, nation and country characterized by safety, unification, harmony and peace

b) To realize of a society, nation and country which respects law, equality and human rights

c) To realize an economy that provides job opportunities, increases quality of life and provides a strong foundation for continued development

The mission to realize the stated vision is:

a) To realize safety and peace in Indonesia

b) To realize fairness and democracy in Indonesia

c) To realize welfare in Indonesia

**2) Economic Prospects in 2004-2009**

The medium-term economic goal is centered on the improvement, the increase in economic production, and the expansion of purchase power of people. The program assumes that the goals can be achieved by building adequate infrastructures, reutilizing the local economy focusing on the agriculture and manufacturing sectors, strengthening small and medium enterprises, and securing legal certainty for business.

**3) Draft of Long-term national development plan 2005-2025**

The Indonesian government drafted a long-term national development plan for a period of 2005-2025 in March 18, 2005 by letter No: R-01/PU/II/2005 from President Susilo Bambang Yudoyono to parliament. By this plan, it is expected to guarantee: (i) implementing of plan coordination, (ii) creating integration, synchronization, and synergy plan between place, time, and function of government both centrally and regionally, (iii) consistency in planning, budgeting, implementing and monitoring, (iv) utilizing of

resources in efficiency, effectiveness, fairness and continuance, and (v) Social participation in the process of preparation, implementation and monitoring of plan implementation.

### 2.3.2 MOT Strategic Plan 2004-2009

This plan was drawn up as a guideline to execute the 2004-2009 national mid-term development program (RP JMN). In order to support the achievement of the commercial development target which government decides, this plan shall be a reference of the local autonomy, which would draw-up strategic planning in the district.

# Chapter 3 Industrial Analysis and Legal Metrology

## 3.1 Industrial Analysis by Region

The objective of the survey in this chapter is to grasp the situation of local industry and analyze the needs of legal metrology in the region.

### 3.1.1 Summary of Industrial Analysis by Region

Local industries including agriculture/fishery and related manufacturers, food industry, and mining and quarrying are considered active by using natural resources available locally. Table 3.1.1-1 shows the summary of industrial analysis by province based on the interview survey.

Provincial governments have projects to develop industrial parks, plantation areas, etc., and to improve airports, harbors and roads to support industrial development in the region. Types of promising industrial sub-sectors for the next five years include stores, taxi companies, filling stations, transportation companies and manufacturers which use various measuring instruments. Therefore, the development of legal metrology systems in regions is important not only for protecting consumers but also for providing quality services to consumers.

**Table 3.1.1-1 Summary of Industrial Analysis by Province**

| Name of Province and Capital City | Land area and Population of Province (1) Land area (2) Population | Main Industries in Province | GRDP (a) GRDP at current price (b) GRDP growth rate at constant 1993 (c) GRDP per person | Needs of legal metrology (Kind of users/manufactures, which will increase in the next 5 years.) |
|---|---|---|---|---|
| North Sulawesi, Manado | (1) 13,930 $Km^2$ (2) 2.2 million | Processing industry: oil plant, LNG Agricultural industry: food, farming, stockbreeding, foresting, fishery | (a) 15,690 billion Rp(2004) (b) - - (c) 6,958 million Rp/Person | Taxi companies, filling stations, transportation, stores |
| South Sulawesi, Makassar | (1) 46,116 $Km^2$ (2) 7.5 million | Agro industry: rice, cacao, shrimp, seaweed Mining: Nickel | (a) 40,094 billion Rp (2003) (b) 4.85% (constant 2000) (c) 5,625 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| Bali, Denpasar | (1) 5,632 $Km^2$ (2) 3.2 million | Agro & fishery industry: cocoa, coffee, vanilla, tuna, shark fin, seaweed. hand crafts, Tourism. | (a) 28,986 billion Rp (2004) (b) 3.65% (2003 to 1993) (c) 8,154 million Rp/Person | Taxi companies, filling stations, transportation, stores |
| Riau, Pekanbaru | (1) 56,813 $Km^2$ (2) 3.8 million | Oil industry Paper industry Palm oil industry | (a) 114,189 billion Rp (2004) (b) 4.7% (2003 to 1993) (c) 30,410 million Rp/Person | Taxi companies, filling stations, transportation, stores |
| West Sumatra, Padang | (1) 42,200 $Km^2$ (2) 4.5 million | Foods and drinks, woods, textile, rubber and its products. | (a) 37,161 billion Rp (2004) (b) 4.48% (2003 to 1993) (c) 8,097 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufactures |
| North Sumatra, Medan | (1) 71,680 $Km^2$ (2) 12.3 million | Petroleum, coal, plastic, rubber, Manufacturing industry: food, beverages, textile, wood, etc. | (a) 114,647 billion Rp (2004) (b) 4.42% (2003 to 1993) (c) 9,712 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| South Kalimantan, Banjarmasin | (1) 37,530 $Km^2$ (2) 3.2 million | Metal, coal, machinery, electronics, chemicals, agro and forest products | (a) 24,504 billion Rp (2004) (b) 4.85% (2003 to 1993) (c) 7,769 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| East Java, Surabaya | (1) 46,689 $Km^2$ (2) 34.5 million | Wholesales, retail trade, agriculture, financial, transportation, construction | (a) 292,322 billion Rp (2004) (b) 4.11% (2003 to 1993) (c) 8,013 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| D.I.Yogjakarta, Yogjakarta | (1) 3,186 $Km^2$ (2) 3 million | Plastics, wood, bamboo, rattan, metal, stone, silver, brass, copper, ceramics | (a) 21,849 billon Rp (2004) (b) 4.09% (2003 to 1993) (c) 6,634 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |

## 3.2 Sector Analysis related to Legal Metrology

### 3.2.1 Electricity for Watt-hour Meters

The number of households in Indonesia is 54.9 million in 2004, while the number of PLN household customers is 30.0 million. Assuming that PLN can cover all households as a service area, the difference of over 20 million of households has not yet received electric service. The electrification ratio is expected to increase to 76.7% and new customers will increase by 10 million in the next five years.

### 3.2.2 Water Supply through Water Meters

The average growth rate of water supply demand is about 10% per year. The number of households in Indonesia is 54.9 million in 2004, while the number of household customers is 6.4 million in 2003, remaining more than 48 million of households without treated water supply.

### 3.2.3 Refinery Fuels for Fuel Dispensers and Tank Trucks

The number of motor vehicles in the country is 6 million cars and 20 million motorbikes. The population of Indonesia is about 220 million. Favorable prospects are foreseen in this sector. Needs for fuel dispensers and tank trucks will be increased.

### 3.2.4 Taxi Sector

During the site survey, no statistical data was available concerning the number of taxis, however, the number of taxis with taxi meters is estimated at about 100,000. Once some taxi companies started providing meters, passengers began to use these taxis again. Since passengers tended to ignore taxis which did not have meters and to take taxis with meters, other taxi companies in Jakarta and other major cities rushed into installing the taxi meters. Therefore, the demand of taxi meters became strongly supported at the requests of passengers.

### 3.2.5 Agriculture/Fishery Sector for Weighing Instruments etc.

This sector produces various kinds of goods and needs many kinds of measuring instruments including weighing instruments, scales and volume instruments. Therefore, the demand for these meters is strongly supported by this sector.

## 3.3 Production and Trade of Legally Controlled Measuring Instruments

### 3.3.1 Trend of Production and Trade

Table 3.3.1-1 shows the estimated number of production and import of legally controlled

measuring instruments.

**Table 3.3.1-1 Estimated Number of Production and Trade of Legally Controlled Measuring Instruments**

| Measuring Instrument | 2005 | | |
|---|---|---|---|
| | Production | Import | Total |
| 1. Measures | | | |
| 1) Length measuring instrument | | | |
| 2) Taxi meter | | 4,000 | 4,000 |
| 3) Moisture meter | | | |
| 4) Watt-hour meter | 950,000 | 5,000 | 1,000,000 |
| 5) Water meter | 240,000 | 360,000 | 600,000 |
| 6) Gas meter | | | |
| 2. Volume measuring instruments | | | |
| 1) Wet can | 110,562 | | 110,562 |
| 2) Dry can | 2,003 | | 2,003 |
| 3) Tank Truck | n.a. | n.a. | 1,500 |
| 4) Fixed storage tank | 55 | | 55 |
| 5) Boat tank | | | |
| 6) Rail tank | | | |
| 7) Standard tank | 4 | | 4 |
| 8) Oil flow meter | | | |
| 9) Working meter | 17 | 376 | 393 |
| 10) Fuel dispenser | | 3,300 | 3,300 |
| 3. Weighing instrument | | | |
| 1) Non-electronic weighing | 250,000 | | 250,000 |
| 2) Electronic weighing | 708 | 6,154 | 6,862 |
| 3) Conveyor belt scale | | | |
| 4) Hopper scale | | | |
| 5) Truck scale | 45 | | 45 |
| 4. Accessories | | | |
| 1) Weight set: F1, F2 | 56,332 | | 56,332 |
| 2) Weight set: M1, M2, M3 | 5,575 | | 5,575 |

Source: DOM, RVOs, manufacturers, PLN, water suppliers, etc.

Note: Blank cells mean data not available.

# Chapter 4 Questionnaire Survey to RVOs and Needs Analysis

## 4.1 Questionnaire Survey to RVO

### 4.1.1 Major Findings from the Questionnaire Survey

DOM send the survey to 54 RVOs and 33 RVOs replied (ratio of responses: 60%). The following are the major findings as well as issues to be examined further:

1) Scale of RVOs
2) Changes of duties after decentralization
3) Implementation of verification/re-verification
4) Defective rates in re-verification in 2005
5) Reporting to DOM
6) Estimation of increase of measuring instruments
7) Technology of RVOs' staff
8) Provision of manuals
9) DOM's assistance in HRD to RVOs
10) Technical assistance by DOM
11) Sufficiency of obtained budget of RVOs
12) Existing equipment and instruments
13) LMS Centers

## 4.2 Demand Forecast for Verification/re-verification

Table 4.2-1 shows the results of the estimation.

**Table 4.2-1 Results of the Estimation**

(Unit: thousand)

| | | 2005 | 2010 |
|---|---|---|---|
| Weighing instruments | No. of instruments | 1,290 | 1,646 |
| | Demand for re-/verification | 1,477 | 1,960 |
| Taxi meters | No. of instruments | 89 | 113 |
| | Demand for re-/verification | 89 | 113 |
| Fuel dispensers | No. of instruments | 64 | 81 |
| | Demand for re-/verification | 64 | 81 |
| Watt-hour meters | No. of instruments | 34,110 | 39,542 |
| | Demand for re-/verification | 3,411 | 3,411 |
| Water meters | No. of instruments | 5,958 | 7,605 |
| | Demand for re-/verification | 1,549 | 1,648 |
| Tank trucks | No. of instruments | 31 | 40 |

| | | | |
|---|---|---|---|
| | Demand for re-/verification | 31 | 40 |
| Flow meters | No. of instruments | 3.2 | 4.0 |
| | Demand for re-/verification | 3.2 | 4.0 |

### 4.3 Demand for HRD for Metrological Engineers in RVOs

#### 4.3.1 Estimation of Number of Metrological Engineers for HRD

The numbers of metrological engineers in the whole of Indonesia are 829 persons as of May 2006. The increasing factors of engineers can be divided into the following three categories:

Age retirement

Transfer of engineers to another sections

Increase of measuring instruments subject to verification and re-verification

**1) Estimation of number of retiring engineers, 2006-2016**

Numbers of engineers, who are going to retire in 2006-2016, can be broken down as shown in Table 4.3.1-1.

**Table 4.3.1-1 Estimation of Number of Retiring Engineers**

| Age | No. of engineers | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 | `+10 |
| <41 | 169 | | | | | | | | | | | |
| 41-45 | 291 | | | | | | | | | | | |
| 46-50 | 204 | | | | | | | 41 | 41 | 41 | 41 | 40 |
| 51-55 | 147 | | 29 | 29 | 29 | 30 | 30 | | | | | |
| >55 | 18 | 18 | | | | | | | | | | |
| No. of retirements | | 18 | 29 | 29 | 29 | 30 | 30 | 41 | 41 | 41 | 41 | 40 |

(Source: DOM)

**2) Estimation of number of transferring engineers, 2006-2016**

Table 4.3.1-2 shows the estimation of number of transferring engineers.

**Table 4.3.1-2 Estimation of Number of Transferring Engineers**

| Estimations | 2006 | 2007 | 2008 | 2009 | 2010 | 2011-2016 |
|---|---|---|---|---|---|---|
| Estimated percentage of transferring | 2% | 2% | 2% | 2% | 2% | 2.5% |
| Number of transferring engineers, estimated | 16 | 16 | 16 | 16 | 16 | 20 |

### 3) Estimation of number of inspectors to deal with increasing measuring instruments subject to verification and re-verification

(1) Watt-hour meters and Water meters

Table 4.3.1-3 shows estimation of number of inspectors for Watt-hour meters and Water meters.

**Table 4.3.1-3 Estimation of Number of Inspectors for Watt-hour Meters and Water Meters**

| Instrument | Items | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| Watt-hour meters | (a) Capable number of re/verified instruments by one inspector per year. | 16,640 | 16,640 | 16,640 | 16,640 | 16,640 | 16,640 |
| | (b) No. of instruments to be re-/verified. | 1,002,256 | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 |
| | (c) No. of Inspector=(b)/(a) | 60 | 204 | 204 | 204 | 204 | 204 |
| Water meters | (a) Capable number of re-/verified instruments by one inspector per year. | 24,960 | 24,960 | 24,960 | 24,960 | 24,960 | 24,960 |
| | (b) No. of instruments to be re-/verified. | 260,087 | 1,567,061 | 1,585,830 | 1,605,538 | 1,626,231 | 1,647,958 |
| | (c) No. of Inspector=(b)/(a) | 10 | 63 | 63 | 64 | 65 | 66 |

(2) Other measuring instruments

The annual increasing ratio of inspectors for other measuring instruments is estimated 38% per year.

### 4.3.2 Summary of Demand of HRD for Metrological Engineers

According to the estimation, more than 200 additional engineers will be needed every year and should be trained as qualified inspectors.

# Chapter 5 Present Status of Legal Metrology and Problem Analysis in Indonesia

## 5.1 Legal Metrology System

### 5.1.1 Categories and Functions of Metrology

Concerning metrology, in general, its fields will be classified into (1) Measurement standard, (2) Legal metrology, (3) Industrial standard, and (4) Laboratory accreditation.

### 5.1.2 International Activities of Metrology

When the development of a metrology system of a country is to be discussed, recent international activities of metrology should be taken into account.

**1) Measurement standard**

Recently CIPM drafted an arrangement for a system to recognize the national measurement standards and to certify calibration and measurement capability among participating countries. (Mutual Recognition of National Measurement Standards and of Calibration and Measurement Certificates Issued by National Metrology Institutes: CIPM MRA). The progress of metrology based on modern universal technology and the conclusion of the CIPM MRA made it necessary for participating countries to uniquely designate the national standards and for the national metrology institutes to maintain them. Indonesia signed CIPM MRA in June 2004. Concerning the position of DOM in relation to the CIPM MRA, DOM is not yet designated by the government as one of the metrology institutes of Indonesia.

**2) Legal metrology**

A certification system for measuring instruments was established among OIML member countries in 1991, and after that a mutual acceptance arrangement for the data of type approval testing (OIML MAA) was approved.

### 5.1.3 Requirements for International Level of Metrology

International level of metrology should be considered from the following points of view.

- Legislation
- Technical infrastructure
- Social activities
- International cooperation

### 5.1.4 Outline of the Present Metrology System of Indonesia

#### 1) Measurement standard

(1) Legislation and organizations

Indonesia's system of measurement standards is supported predominantly by four national institutes: DOM, KIM-LIPI, KIMIA-LIPI and BATAN. In addition to legal metrology, DOM maintains the Indonesia's prototype of kilogram.

(2) Technical infrastructure

There are two institutes concerning mass standard of Indonesia. DOM maintains the Indonesia's prototype of kilogram (K-46) as the national standard. Every ten years, DOM's K-46 has concluded direct calibration of K-46 by the international prototype of kilogram that is the definition of kilogram maintained by BIPM.

(3) Social activities

Measurement standard is one of the social infrastructures, especially for natural science and industrial technology, and has responsibility to certify reliability on the results of measurements.

(4) International cooperation

When DOM wishes to participate in the activities of CIPM MRA on mass standard, which is common to both DOM and KIM-LIPI, DOM has to be designated for membership of APMP as one of the national metrology institutes, and to take procedures for participation of CIPM MRA.

#### 2) Legal metrology

(1) Legislation

The most influential innovation was enactment of law on comprehensive administrative decentralization in 1999 followed by enforcement in 2001. Along with this policy, administration on regional legal metrology was transferred to provincial governments.

Considering this situation DOM decided to settle two offices for preparing LMS Centers in Medan and Makassar.

(2) Technical infrastructure

Technical infrastructure of legal metrology will be classified into two categories (i.e., type approval testing and verification). Principle of type approval testing is based on

structural testing, of which technical standards are recommended by OIML.

(3) Social activities

One of the most important ideas of legal metrology is the protection of consumers. Consumer protection supported by traceability for legal metrology becomes increasingly important along with economic development.

### 5.1.5 Present Problems of Indonesia's Metrological System

**1) Designation of national standards**

The unique designation of the national standard would be necessary for participation in CIPM MRA, since CIPM MRA intends the international equivalence of the national standards. As for mass standard, it is natural to specify the Indonesia's national prototype of kilogram.

**2) Participation in CIPM MRA**

When a national metrology institute wishes to participate in CIPM MRA, it is necessary to be designated by the government. As for Indonesia, KIM-LIPI is the signatory of Indonesia, but DOM, KIMIA-LIPI and BATAN are not designated institutes and are not able to participate in CIPM key comparisons.

**3) Responsibilities of national metrology institutes**

The problem described above will cause various problems, for example, which institute should be responsible for supplying standards for mass-related physical quantities.

**4) Instrumentation for traceability**

Some of the national standards of Indonesia have been calibrated by oversea institutes and the traceability has not been completed due to lack of key instruments

### 5.1.6 Considerations

**1) Unique designation of the national standards**

So far Indonesia has not yet explicitly designated the national standard for each physical quantity and the organizations responsible for their maintenance. They should be designated by a presidential decree or a governmental decree.

**2) National metrology institute of Indonesia**

It is recommended to unify DOM, KIM-LIPI, KIMIA-LIPI and BATAN following the report presented by KSNSU in August 2005.

**3) Participation in CIPM MRA**

So far the only one institute, KIM-LIPI, is designated as a participating NMI in CIPM MRA. The government should designate DOM, KIMIA-LIPI and BATAN as participating institutes.

**4) Environment of the institute**

The location of DOM is not suitable for the cooperation among institutes and precision measurements. It is better for DOM to seek another site convenient and suitable for developing a new national metrology institute.

**5) Traceability**

It is necessary to define the national standards and the organizations for their maintenance and to introduce a hierarchical system and to establish a coherent traceability.

**6) Activities of private sector**

It is quite important to develop a hierarchical system of traceability involving private calibration laboratories so that they can provide calibration services to the users on behalf of government laboratories.

## 5.2 Law of Legal Metrology and Related Regulations

### 5.2.1 Legislation System in Indonesia

Modern Indonesian legislation system comes in a number of forms. In August 2000, the People's Consultative Assembly (MPR) issued the official hierarchy of legislation as follows: 1) 1945 Constitution (UUD: Undang-undang Dasar 1945), 2) MPR Resolution (Ketetapan MPR) Law (Undang-undang), 3) Government Regulation Substituting a Law (Perpu: Peraturan Pemerintah Pengganti Undang-undang), 4) Government Regulation (PP: Peraturan Pemerintah), 5) Presidential Decree (Keppres: Keputusan Presiden), and 5) Regional Regulation (Perda: Peraturan Daerah) in this order.

Applying the above hierarchy of legislation is not without problems. The ministerial decrees are regulations to implement the government regulations and presidential decrees. The hierarchy explained in Ministerial Letter of No. 06-27 states that the regional regulations should be consistent with the ministerial decrees; however, local governments seem to disregard it.

### 5.2.2 Legal Metrology Regulation System and Autonomy Law in Indonesia

**1) Framework of legal metrology laws and regulations**

The laws and regulations concerning legal metrology, which can be classified into the categories consisting of Basic law of legal metrology, Laws and regulations in common and general relating to legal metrology, Demarcation of roles between DOM and RVOs, DOM, SSTK (Special Technical Standards), WH meters, Tank trucks, Pre-packaged products, Human resources development/MTC and RVOs.

**2) Autonomy law and legal metrology**

The key features of Law No.22/1999 concerning Regional Autonomy are the devolution of a wide range of public service delivery functions to the regions, and the strengthening of the elected regional councils which received wide-ranging powers to supervise and control the regional administration. This law was amended to Law No.32 in October 2004.

### 5.2.3 Legal Metrology System in Japan

**1) Legislation**

The Measurement Law was fully amended in 1992 (the current Measurement Law) in order to correspond to new social needs, such as internationalization, technological advance and deregulation. The purpose of Measurement Law is to establish the standards of measurement and to secure administration of proper measurement and thereby to contribute toward the development of economy and uplifting of culture (Article 1). Major points of the Measurement Law are as follows:

a) Main regulation for measurement
b) Establishment of standards for measurement
c) Accurate measurement of commodity quantities
d) Registration of measurement certification business
e) To foster certified measurers and promote autonomous measurement administration in businesses

**2) Roles of central government and local governments in legal metrology**

In Japan, the roles between the central government and local governments are changing along with the promotion of decentralization. In legal metrology, its responsibility was almost transferred to the local governments. Before the transfer, the central government entrusted the local governments with the work for legal metrology under the

comprehensive control of the central government. The local governments only followed the work for legal metrology which the central government specified on country-wide basis.

After the transfer, the local governments have the autonomy of management for legal metrology. The local governments have the authority to achieve the work at their own discretion by their own budget. As a result, some local governments can achieve improvement of service, but some governments cut the budget related to legal metrology, resulting in not only deteriorating the service quality but also facing difficulty in keeping the technology level.

### 5.2.4 Problem Analysis on Legal Metrology System

**1) Problem 1**

In transition of authority from the central government to local governments, the local governments seem not to well understand the existing laws and regulations concerning legal metrology. In addition, the demarcation of some responsibilities remains not defined clearly. These facts lead to some confusion in implementing legal metrology.

**Recommendation 1**

A committee consisting of DOM, local governments, men of learning and experience, representatives from industries and consumers, and authorities concerned should be organized to review and discuss the existing ministerial decrees. If there is a problem, the committee recommends measures for solution including necessary legislation.

**2) Problem 2**

The hierarchy of ministerial decree and regional regulation is not clear, leading to discrepancy in understanding of the positioning of the ministerial decree and regional regulation between the central government and local governments.

**Recommendation 2**

As specified in the Ministerial Letter of 06-27, regional regulations must conform to ministerial decrees.

**3) Problem 3**

Regional regulations tend to ignore orders under ministerial decrees such as DG-DT's orders.

**Recommendation 3**

Ministerial decrees should refer the important DG-DT's order(s) and regional regulations should be consistent with the ministerial decrees.

**4) Problem 4**

Some RVOs conduct type approval testing of some kinds of legally controlled measuring instruments. DOM receives the test results for approval and issues the type approval certificate.

The JICA study team visited the RVO that conducts type approval testing. The study team concluded that it does not have sufficient facility and technology to properly conduct the type approval testing. This fact seems to lead to the sale of locally manufactured and/or imported inferior measuring instruments with type approval by improper test results, which might be a part of reasons that the inferior water meters, locally made and/or imported, are on the market.

**Recommendation 4**

Item "k" of Clause "4" of the Ministerial Decree of 731/MMP/Kep/10/2002 should be amended. DOM should administrate all procedures for type approval including type approval testing. DOM should manage outsourcing for some tests, even if required.

**5) Problem 5**

The contents of type approval testing specified in SSTK are insufficient and incomplete. SSTK does not specify the structural testing, durability testing, environmental testing, etc.

**Recommendation 5**

The contents of type approval testing in SSTK should be revised incorporating OIML's recommendations and considering Indonesian circumstances, which should be referred by the ministerial decree.

**6) Problem 6**

The regulation does not specify the lower and higher capacity limits of UTTP (legally controlled measuring instruments). At present DOM and RVO are obliged to deal with any capacity of UTTP from the largest to the smallest, which is not practical and sometimes impossible.

**Recommendation 6**

SSTK should specify the capacity of UTTP to be controlled by legal metrology.

**7) Problem 7**

The reduction of RVO staffs is anticipated due to age retirement, if local governments do not make up the retired staffs.

**Recommendation 7**

DOM should prepare the guideline for necessary human resources for RVOs.

**8) Problem 8**

RVOs are not responsible for reporting to DOM.

**Recommendation 8**

Ministerial decree, etc. should specify the responsibility of RVOs for reporting to DOM. In Japan, such information is made public and accessible by all persons. The data of Japan's organizations corresponding to DOM and RVOs, including facilities, activities, performance, budget, etc., can be obtained through their homepages.

## 5.3 Budgetary System

### 5.3.1 Present Situation of Budgetary System

**1) Fiscal decentralization**

Fiscal decentralization constitutes an integral part of government decentralization program launched in 1999 (based on Laws No. 22/1999, No.25/1999 and No. 34/2000). These laws provide regional governments with greater authority to plan and implement their own budgets that can be most effectively designed to incorporate the aspirations of local citizens. In October 2004, Laws No. 22/1999 and No.25/1999 were amended by Laws No. 32/2004 and No. 33/2004.

**2) Budgets of DOM and RVOs**

There are two streams for the budget flow: MOT allocates its budget to DOM and MTC, and provincial governments appropriate their budget to RVOs.

### 5.3.2 Problem Analysis on Budgetary System

**1) Problem 1**

Provincial governments count on verification/re-verification fees of RVOs as the revenue of the provinces, which some provincial governments specify in their provincial regulations. They set a target of revenue from the RVOs. If the RVOs do not achieve the target, the governments tend to reduce the budget of the next year, causing some problems in implementing legal metrology in the region. The problem is that the governments do not fully understand the importance of legal metrology that is a kind of social obligation and welfare to protect consumers and does not yield much revenue from the activities.

**Recommendation 1**

In the five-year plan of MOT, the importance of legal metrology is addressed. As one of its action plans, MOT should keep contact with provincial governments to let them know

the significance of legal metrology. For instance, MOT can provide information on successful examples in certain provinces as well as in ASEAN countries.

**2) Problem 2**

RVOs do not have sufficient budget to purchase new facility and equipment.

**Recommendation 2**

DOM should draw up a guideline concerning facility and equipment to be equipped for RVOs. DOM should examine how to provide equipment for minimal requirements to RVOs, if they cannot provide the equipment themselves. For example, PPMB within the Ministry of Trade supplied equipment to BPMBs under the provincial governments.

**3) Problem 3**

After decentralization, provincial governments can determine the verification fees of RVOs on their own. PLN and other companies whose activities span nationwide consider it not reasonable.

**Recommendation 3**

DOM should draw up a guideline to determine the verification fees, as mentioned in the Minister Decree.

## 5.4 DOM

### 5.4.1 Outline of DOM

DOM is now under the Directorate General of Domestic Trade, the Ministry of Trade. Indonesia joined OIML and APLMF in 1960 and in 1999, respectively. Along with the above history, DOM is in charge of enforcement of the law of legal metrology, and represents Indonesia in the field of legal metrology.

### 5.4.2 Organization and Functions of DOM

**1) Sections for policy making and administration**

(1) Organization and cooperation
(2) Policy making on measurement standards and calibration
(3) Administration on verification and re-verification
(4) Human resource development
(5) Market surveillance

**2) Sections for technical implementation**

(1) Verification of measuring instruments

(2) Maintenance of national standards

(3) LMS Centers

### 5.4.3 Planning and Policy Making

One function of DOM is planning and policy making for legal metrology. However, no division is in charge of planning and policy making. At present, the planners are appointed by the director as specific issue.

### 5.4.4 Administration of Legal Metrology System

The following points should be considered as the fundamental issues to be discussed:

- To define the coverage of legal metrology
- To define the coverage of the additional services besides the legal metrology
- To involve private and regional sectors to develop hierarchical system for tasks of legal metrology
- To hold onto the activities of regional administrations by improving information flow
- To develop policy of enhancing competitiveness of the products
- To promote fair competition

### 5.4.5 Technical Services

The following are the categories of technical services presently provided by DOM:

**1) Supply of standards and calibration**

DOM is responsible for providing RVOs with mass standard as a basic unit and quantities related to legal metrology such as volume. DOM should also provide mass-related standards such as pressure, density, force, etc. In addition, LMS Centers currently under settlement should provide regional industries with calibration services and inspection.

**2) Type approval testing**

OIML has been developing a lot of technical recommendations for standardizing the methods and specifications of type approval testing. Most of Indonesia's type approval testing does not seem to be conducted completely due to lack of facilities and knowledge of techniques.

**3) Initial verification and re-verification**

After decentralization, services of initial verification and re-verification were allocated only to RVOs as their major tasks. DOM should enforce the work on type approval testing. However, technical services to RVOs should be continued.

**4) Factors to be considered for technical services**

(1) Instruction manuals for testing

The present conditions on verification and type approval testing are written in SSTK as an instruction manual for all inspectors of DOM and RVOs. Therefore, every inspector can understand the meaning of the test, and have an instruction manual at hand or be able to access it easily.

(2) Coverage of type approval testing

Several types of measuring instruments are better categorized as those controlled by an industrial standardization system. Metrological control of measuring instruments should be harmonized with policies of industrial standardization.

(3) Purpose of the law and regulations

The regulations should be composed systematically under the basic policy such as consumer protection, services for accurate measurement in civil life, development of regional industries, etc.

(4) Stakeholders and sector in charge

Type approval testing and verification are essential to legal metrology and quite influential to safety and fair trade in civil life. Therefore, in principle, the sectors in charge of these services should be separated from the suppliers that use measuring instruments under legal control.

(5) Range and conditions of testing

The range and conditions of testing, the types of measuring instruments and their range of measurement should be defined clearly.

### 5.4.6 DOM's Human Resources Development (HRD) Program

Human resource development concerning metrology covers a broad area of education and training. Technically, the Metrological Training Center (MTC) at Bandung has been educating

inspectors working in DOM and RVOs. It will be necessary for the technical staffs to understand traceability and uncertainty of measurements.

### 5.4.7 Internationalization

Indonesia should take the following actions to establish a system which meets the international standards and to contribute to activities of the framework of the Metre Convention and OIML.

**1) To participate in the APMP**

This is the first step after specifying the national standards of Indonesia to access the framework of the Metre Convention and CIPM MRA.

**2) To participate in the technical committee of OIML and contribute to developing OIML recommendations**

DOM has been representing the authority of Indonesia's legal metrology, but it must become more active in OIML and APLMF in order to establish a system which meets international standards.

### 5.4.8 Problem Analysis on DOM

Upon analyzing DOM's present conditions from the following points of view, several problems clearly should be settled. Some of the problems below will require amendment of some legal regulations.

**1) Law and regulations**

The purpose and target of law and regulations should be clearly defined when drafted.

**2) Organization and functions**

(1) Definitions of functions of organization

Problems concerning DOM's organization and functions have been described before. Re-organization will be required to make the roles and functions of each section clear. It will be necessary to settle sections responsible exclusively for international cooperation and for planning.

(2) Extension of role of LMS Centers

The roles and functions to be attributed to these organizations should clearly be defined. In that case, functions of LMS Centers should be extended so that they meet the needs of regional industries as pointed out in the report issued in 1994.

(3) Definition of the range and conditions of type approval testing and verification

It will be necessary to define the ranges of measuring instruments subject to testing and conditions of type approval testing and verification.

**3) Responsibilities in relation to the other sectors**

(1) Definition of responsibilities of the national institutes

Maintenance and development of measurement standards are based on the Law on Legal Metrology, Article 8 to 11. Currently, these responsibilities are split into four national institutes, and there is some confusion about mass standard and length standard.

(2) Involvement of the private sector

It is difficult for developing countries to establish a system involving private sector into traceability. Therefore, at present the national institutes should accordingly play a leading role for establishing traceability system and still be required to perform technical services.

**4) International cooperation**

As described in the previous section, DOM and other institutes concerned should be designated in due course as the national metrology institutes responsible for maintaining the national standards and traceability of related physical quantities.

**5) Present laboratory conditions and facilities**

(1) Necessity of new national metrology institute

Location should be quiet and convenient. The site should be large enough for future expansion.

## 5.5 Decentralization and Regional Verification Offices (RVOs)

### 5.5.1 Outline of RVOs

- The study team visited eleven RVOs out of fifty-four existing regional verification offices, and received 33 replies to the questionnaire, which were delivered to every RVO beforehand. Eleven RVOs are; Jakarta, Bogor, Yogyakarta, Surabaya, Manado, Makassar, Denpasar, Medan, Padang, Pekanbaru and Banjarmasin.
- The results of the survey including questionnaire and interviews to three inspectors of each RVO are analyzed.

- Fifteen questions were asked to twenty-one inspectors, and the results are as follows:
  - Factors of insufficient for works are equipment (90%), Human resources (52%) and treatment (43%).
  - Scheduling for works is mainly annual (61%). Scheduling per month or week is very scarce.
  - Working procedure is due to SSTK from DOM (81%).

### 5.5.2 Services of RVOs

**1) Verification/re-verification**

(1) The ratio of re-verification decreased greatly after decentralization.

(2) Verifications of water meters and WH meters are actually implemented by water meter companies and PLN, respectively.

(3) Re-verification for water meters has been partially implemented, but it has not been done for WH meters.

(4) The inspection of pre-packaged goods is not implemented except by RVOs of Jakarta, Yogyakarta and Surabaya.

**2) On-the-spot inspection**

Genhberally, RVOs conduct on-the-spot-inspections by cars, but many RVOs do not have sufficient service cars because they lack budget to purchase new cars or to repair old ones.

### 5.5.3 Problem Analysis on Legal Metrology System under Decentralization

**1) Non-uniform service level caused by decentralization**

Regulations for enforcement of the law are left to the regional governments, causing several differences among actual regulations and activities made by each provincial government. Hence, this will also result in consumers not receiving uniform administrative services of legal metrology. Actually the verification fees of each province are different, and the budgetary system of each province is also different.

**2) Control of legal metrology**

It caused serious problems in enforcement of legal metrology system that regional government officers do not have authority to detect violation of legal metrology law.

### 5.5.4 Problem and Suggestion for RVOs

- The average age of inspectors is rising, making it difficult to supplement retiring staffs.
- Equipment and facilities are both insufficient and outdated in many RVOs.

- The funds for new equipment, education, dissemination, enlightenment, etc. are scarce.
- The targets of income from re/verification are allocated to RVOs.
- Regulations on legal metrology by regional governments have not been enacted.
- Since RVOs do not have obligation to report the statistical data to DOM, the national statistics on legal metrology is not always available.

**1) Suggestions**

(1) The Central government (DOM) should consider supplying or lending equipment to RVOs that cannot afford to purchase necessary equipment due to limited budgets.

(2) Provincial governments should not allocate the budget to RVO based on the results of income from re/verification in previous year. If the income is reduced, the activities of RVOs tend to be minimized.

(3) DOM should support RVOs in recruiting their staffs.

(4) MTC should improve the training program to be updated and more efficient. The training courses should be shortened.

## 5.6 Human Resources Development (HRD)

### 5.6.1 Training Program

At present, the curriculum is designed according to "the Implementation Guideline for Education and Training of Inspectors, Minister Decree 482/November 2000" to foster regional inspectors by the centralized system, not considering the effects from the decentralization. It includes detailed description of (1) purposes, (2) qualification of trainees, (3) trainers and textbooks, (4) five classifications of inspectors, (5) relationship between MOT and DOM (DOM is an organization to decide the duties of regional inspectors, management of their capability and their scope of inspection.), (6) training courses with required hours (1,200-1,820 hours by type of learning), and (7) evaluation of trainees.

**Table 5.6.1-1 Training Hours by Classification of Inspectors**

| Position Classification | 【course】 Total training hours |
|---|---|
| Inspector of Legal Metrology (first level) | 【A】 1820 hours |
| Inspector of Legal Metrology (second level) | 【B】 1540 hours |
| Inspector of Legal Metrology | 【C】 1260 hours |
| Inspector equivalent for Metrological Controller | 【D】 1200 hours |
| Inspector of Legal Metrology; equivalent for Re-Verification | 【E】 1200 hours |

### 5.6.2 Achievement of Training

The original inspector training program of MTC is to foster 100 inspectors annually (25 trainees/course x 4 courses/year). However, the actual number in 2005 is 19 inspectors by two courses. MTC sends the invitation letters for training course to RVOs. MTC selects trainees from the replied list by RVOs without entrance examination. The cost for textbooks and accommodation is free; however, other costs such as food, sundries, etc. are borne by RVOs (provincial governments) or, in rare cases, by trainees themselves. MOT provides the short-term training courses for DOM staff and private companies as well.

### 5.6.3 Preconditions and Concepts for Design of HRD System

**1) Training courses**

- Fostering of inspectors mainly for RVOs
- Measurement standards including calibration for DOM
- Short-term training: new technology, technology of electricity/electronics, maintenance technology, etc.
- Training courses for private companies and persons

**2) Concepts of training course for fostering inspectors**

- Number of inspectors to be fostered: 200 persons based on needs analysis
- Period for training: Possibility of a shorter period than at present
- Training courses
  a) Basic course for all students, including policy of consumer protection
  b) Verification/re-verification course
  c) Measurement standards
  d) Course for monitoring and control of legal metrology

## 5.7 Measuring Technology

### 5.7.1 DOM

**1) Technical manuals for calibration**

DOM prepared the technical manuals for quality system, operation of working standards and procedures of calibration when they were accredited in 1998. As technical manuals of type approval testing and verification in legal metrology, SSTK (special technical standards) are developed and delivered to the regional verification offices (RVOs).

**2) Calibration technology**

According to the property lists of DOM, there are 14 technical groups in DOM with the number of instruments maintained by each group. But the verification and calibration services are implemented by the section for calibration of measuring instruments, each of which consists of 3 persons. Every two weeks a group changes laboratory and kind of instruments on which they have to work.

**3) Skills for type approval testing**

Essentially, type approval testing is structural testing which consists of several mechanical, electrical and electronic tests. The tests include the surge test, EMC test, durability test, vibration test, etc. However, DOM has no equipment for these tests and conducts almost the same test as calibration for type approval testing.

Type approval testing will be one of DOM's most important duties and is controlled by the idea of product liability. It is indispensable to supply consumers with reliable measuring instruments for trade and for developing industries of measuring instruments as well.

DOM should develop testing procedures referring to OIML recommendations for type approval testing and install equipment necessary for them. The following measuring instruments should be subject to type approval testing since they are most influential instruments for consumers; Mass and balances, Taxi meters, WH meters, Water meters, Fuel dispensers, Gas meters and Oil meters

**4) Maintenance of facilities and equipment**

Maintenance of DOM's facilities is not enough as a national metrology institute. It is essential to reserve necessary budget and keep facilities in good condition. At present facilities are quite old and does not seem well maintained.

The following are some cases that the study team found in the flow meter laboratory:

- An electronic counter of a gas meter laboratory is not repaired whereas it is necessary for traceability.
- Due to leakage both of two facilities for calibration of domestic gas meters do not work.
- A broken pipe prover has been left in the fuel oil laboratory.

**5) Technical instruction to RVOs**

Seventy six percent of RVOs receive technical assistance from DOM for HRD. 19 RVOs out of 33 (58%) replied that major assistance is training for proficiency and technical guidance. Ninety-one percent of RVOs say "Yes" on receiving guidance and/or technical assistance from DOM. Sixty-two percent of inspectors of RVOs say they use SSTK as a technical instruction manual. The above results show that DOM's technical instruction to RVOs is fairly good.

### 5.7.2 Regional Verification Office (RVOs)

**1) Preparation of manuals**

Eighty-two percent (27/33) of RVOs retain manuals for verification and 6% of RVOs partly. SSTK is very important for RVOs and is generally kept by the head of office or manager. Since inspectors cannot easily reach it, according to the results of interview to inspectors, manuals for electronic instruments and up-dated technologies may not be enough for their work.

**2) Skills for verification/re-verification**

RVOs require updated technologies, basic skill on electricity, electronics and maintenance.

**3) Maintenance of facilities and equipment**

- Maintenance of facilities and equipment is quite different among RVOs. This is due to the difference among their budget.
- Generally air conditioning of the RVO laboratories is poor to perform precision measurement required by mass standard.
- The mass standard maintained by RVO has been generally calibrated at DOM every 5 years.
- According to the interviews to RVO inspectors they do not understand the importance of maintenance of facilities. Even when they understand its importance, lack of budget prevents them from conducting maintenance.

### 5.7.3 Private Calibration Laboratory

**1) Outline of private calibration laboratories**

(1) BARINDO (Surabaya)

Water meters and water valves are fabricated from basic parts machined by themselves using their own machines, some of which are manufactured by their own design. Water meters are produced at 150,000~200,000 units a year in the factory where all parts are

cast, molded, machined, pressed, assembled and calibrated. Engineers are skillful in using computers (Computer-Aided Design) to design molding and cutting machines. In two calibration rigs, a total of 120 units of water meters can be installed and calibrated at one time. Their own developed flow computers can automatically set the flow rate using magnetic flowmeters and output calibration data.

(2) PDAM (Drinking Water Supply Bureau) in Banjarmasin

There are two calibration facilities for water meters. In Banjarmasin, water is supplied to 85,000 houses, 83% of individual houses. Because water meters must be re-verified every five years, they are gathered by the union and calibrated using these facilities. About 1,300 to 1,600 units are calibrated a month. The amount of rejection reaches 200 to 300 units. Meters with nominal sizes of 20, 25 and 50 mm can be calibrated up to the flow rate of 10 m3/h.

(3) PDAM of Bandung

PDAM of Bandung is a public water supply corporation in Bandung. They settled about 140,000 water meters at individual houses, and perform re-verification of about 30,000 units a year. They have five lines of rigs for calibration of water meters from 13mm to 100mm nominal sizes. The standard tanks have been calibrated every two years by Bandung RVO. They are forced to conduct durability tests by themselves after purchasing water meters since RVO does not have testing facilities.

(4) PT. METBELOSA

PT. METBELOSA is a joint venture of WH meters including Osaki Electric Company (Japan). The capability of production is one million units for single-phase WH meters and 95,000 units for 3-phase per year. LMK (Lembaga Masaiah Kelistrikan) implements type approval testing and calibration for WH meters and Jakarta RVO implements verification and sealing for them. The staff of the company said that the initial verification expires in ten years, but many WH meters are not re-verified and continue to be used until broken.

(5) PLN in Banjarmasin

Presently 259,000 households use electric power in Banjarmasin, which represents only 50% of the demand. 6,000 units are increasing every year but still short. Three persons are allocated to verification of 60 to 100 units of single-phase WH meters and about 20 units of 3-phase a day.

(6) PLN in Bandung

PLN Bandung controls the supply of electric power in West Java and Bandung. In West Java, 2.5 million households and 2,600 industries use electricity. PLN primarily has been verifying WH meters but recently decided to purchase WH meters from 2005 which were already verified by manufacturers. PLN is planning to lend verification facilities to third parties who do not have their own facilities. In principle, RVOs is responsible for re-verification of WH meters, but they often use PLN facilities. Such use of PLN facilities is allowed under agreement between the Ministry of Industry and the Ministry of Trade in the form of an MoU.

**2) Technical services and technical level**

The water meter manufacturer, the WH meter manufacturer, and PLN have a good technical service network and have good techniques for verifying measuring instruments.

**3) Facilities and equipments**

The facilities and equipment of public/private calibration laboratories for water meters and WH meters are much better than those of RVOs.

**4) Possibility for participation in legal metrology service by private calibration laboratories**

The water meter company and the water supply corporations visited by the study team are capable of conducting verification of water meters. And verification facilities of WH meters should be lent to third parties.

**5) Problem and suggestion for measuring technology**

(1) Indonesia should establish a traceability system that does not depend on a specific country for a certain standard. It is necessary to discuss the unification of the national metrology institutes and its participation in relevant international organizations.

(2) Indonesia should discuss to unify the length standards of DOM and KIM-LIPI and establish a national standard based on the CIPM recommendation.

(3) Considerable improvement of laboratories and facilities is necessary for further precision measurement.

(4) DOM should obtain each technical skill for calibration and verification.

## 5.8 Existing Facility and Equipment

### 5.8.1 DOM

**1) Outline of facility**

DOM was built in 1928 and designed to meet the requirement for the National Metrology Institute. The buildings were renovated in 1970s. The sections, which have to avoid the influence from outside (vibration, temperature, humidity, etc.), are located at the basement; however, the vibration from the expressway, constructed in front of DOM, may influence the accuracy of measuring equipment. The utility of central air-conditioning system has been out of order for a long time. Because of this, many rooms use a common air-conditioner to control the temperature and humidity. Such air-conditioners are installed even in the weighing sections, including room of kilogram prototype, and the cold air from the air-conditioner directly blows the weighing equipment, which might influence the accuracy of measurement.

**2) Outline of equipment**

DOM has 14 laboratory units to play a central role in the field of legal metrology in Indonesia. There are 273 equipment in the laboratories. Most equipment and facilities in each laboratory are obsolete. DOM is facing with the necessity of improving their equipment and facilities.

### 5.8.2 Regional Verification Office

54 RVOs exist in Indonesia, and all have the equipment related to mass such as weight and balance. These offices provided the verification services of weight and balance, water meter, taxi meter, volume of tank, etc. Most of their equipment has been installed and used for over twenty years, which exceeds recommended lifetime of the equipment. After the autonomy law, each Provincial Government is responsible for equipping RVO to have capability of meeting community needs. However, most Provincial Governments cannot allocate enough budget to RVOs which makes it difficult for RVOs to maintain the quality of service.

The building size of RVOs varies according to scale of services, which is based on the community needs. The maintenance condition of the buildings is fairly good. Air conditioners are installed only in the laboratories, in which weight standard (E2 or F1 class), balance standard, and length standard are preserved. Air conditioners are general units that blow cold air,

therefore the temperature and humidity are difficult to control.

### 5.8.3 MTC

MTC is the only metrology training center of in Indonesia. MTC became independent from DOM in 1992 and moved to away from DOM to its present location with a total land area of approximately 10,000m2.

Most MTC-owned equipment is old-fashioned and unsuitable for the training. Therefore, MTC sends trainees to DOM for practice in using certain equipment such as electric balance. MTC made the necessary facility/equipment list to improve the level of training and submitted it to the Ministry (21 items are listed). According to MTC staff, the budget of Rp.9 billion would cover the cost of purchasing necessary equipment.

The crucial matter for MTC is a building condition. The study team found several cracks on the walls and pillars of all buildings. New MTC is located on the hillside and the ground has not been leveled sufficiently for construction. The foundation work of the building seemed to be the same method of general houses according to the drawings. As a result, the walls and pillars have to support the heavy weight of building on the soft land, which led to the distortion of the whole buildings. Although the study team did not check the building structure in detail, some of the buildings appeared inappropriate for use for the training center of metrology. Thus, before using them, it is recommended that the building conditions have to be carefully checked by experts for security reasons.

# Chapter 6 Master Plan

## 6.1 Basic Concept

### 6.1.1 Vision, Mission and Strategy for Legal Metrology Management

| | |
|---|---|
| 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<br>2. To develop comprehensive measurement standard system and to maintain measurement standards that can be acknowledged and accepted internationally<br>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<br>1.2 To clearly define the authorities of central government and local governments and specify them by regulations<br>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<br>2.2 To enhance the traceability of measurement standards by development of national measurement standard system<br>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<br>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<br>3.3 To implement proper measurement by conducting accurate measurement, use of proper measuring instruments, conducting surveillance, etc.<br>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<br>• To establish impartial and harmonious legislation system<br>• 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

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 the 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 W-H 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

### 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) "CHAPTER III ORGANIZATION OF THE AUTHORITIRS" in "Part 4 Guidelines for setting up the structures": (a) Control of RVO by DOM, (b) Interpretation of laws and regulations, and (c) Responsibility of RVOs to identify and prosecute contravention
2) "CHAPTER V LEGAL METROLOGY" in "Part 3 Proposed legal provisions": Measurement range of legally controlled measuring instruments

### 6.2.4 Action Plan

Development measures can be implemented as action plans summarized in Table 6.2.4-1.

**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: Development of legislation system

a) Purpose of action plan

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

b) Expected outcome

- 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.

c) Framework for implementation

- ”Legislation Development Study Committee” chaired by DOM Director is established.
- A full-time chief secretary is appointed within the secretariat.

d) 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.

(2) Action Plan L-2: Development of verification of WH meters

a) Purpose of action plan

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

b) Expected outcome

- WH meters that are properly verified are provided to electricity users
- Users can pay charges for electricity consumption measured by reliable WH meters.

c) 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.

d) Activities of action plan

- Amendment of related regulations
- Preparation of business plan of J/V
- Establishment of J/V
- Inauguration of operation (PLN conduct removal and installation of WH meters)

(3) Action Plan L-3: Development of verification of water meters

a) Purpose of action plan

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

effective verification system of water meters

b) Expected outcome

- Water meters that are properly verified are provided to tap water users
- Users can pay charges for water consumption measured by reliable water meters.

c) Framework for implementation

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

d) Activities of action plan

- Amendment of related regulations
- Preparation of business plan
- Installation of equipment and measuring instrument
- Instruction to RVOs by LMS Center
- Commencement of operation

(4) Action Plan L-4: Establishment and implementation of "Month of Measurement"

a) Purpose of action plan

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

b) 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.

c) Framework for implementation

"Project Team for Implementation of Month of Measurement" is organized within DOM

d) Activities of action plan

- National Convention for Commemoration Day of Metrology: Plan and implementation
- Official commending by Minister of Trade
- Special lecture on Commemoration Day of Metrology
- Undertakings for dissemination and enlightenment of legal metrology: Selection of events, plan, implementation, evaluation (PDCA)

**2) Mid-term action plan**

(1) Action Plan L-5: Discussion on amendment of the Law of Metrology

a) 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

b) 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.

c) Framework for implementation

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

d) 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.

(2) Action Plan L-6: Study of use of private vitalities

a) Purpose of action plan

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

b) 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.

c) Framework for implementation

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

d) 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
- Investigation of amendment of regulations concerning privatization
- Investigation of privatization
- Preparation of study report including above

**3) Long-term action plan**

(1) Action Plan L-7: Name of action plan: Amendment of Law of Legal Metrology

a) Purpose of action plan

The Law of Legal Metrology is amended (refer to Action Plan L-5).

b) 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.

c) Framework for implementation

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

d) Activities of action plan

- In response to the report from LDSC, CMA 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.

(2) Action Plan L-8: Name of action plan: Realization of study results of use of private vitality

a) Purpose of action plan: Privatization is implemented (refer to Action Plan L-6).

b) Expected outcome

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

c) Framework for implementation

"Promoting Committee for Privatization"

d) Activities of action plan

- Legislation of privatization
- Establishing standards and procedure for privatization; preparing application forms
- Dissemination and enlightenment of privatization including
- Legislation of certified measurer system and conducting certified tests

### 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, recent activities and conditions of the international metrology and the present metrology system of Indonesia.

#### 6.3.2 Consideration

**1) Basic idea of metrological system of Indonesia**

As KSNSU recommended, the government should promote unification of these four institutes (DOM, KIM-LIPI, KIMIA-LIPI and BATAN) in early possible stage.

**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

KIM-LIPI, as a leader of this matter, organizes an office (NMI office) to facilitate NMI development. NMI office is a representative office to deal with international matters. Other participating institutes including DOM send officer(s) to the NMI office for necessary coordination etc. When Indonesia is invited to an international meeting, the NMI office selects suitable person(s) from the participating institutes. If individual institute takes part in an international meeting by itself, it must report it 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, KIM-LIPI organizes a committee to investigate NMI establishment to forward further.

**3) Necessity of regional state administration for industry by LMS centers**

(1) Activation of regional private sectors

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. In principle the new laboratory should cover testing and calibration on request and supply of standards to RVOs, and should not conduct verification 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.

## 6.4 Plan for Enhancement of DOM's Function

### 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.<br>2. Establishment of a transparent and internationally harmonized metrological system.<br>3. Development of human resources with a broad view and expertise necessary for metrology.<br>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. |
| | 2.3 | To keep transparency of the work and make all staffs understand their obligations and accountability. |
| | 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. |
| | 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

#### 1) Short-term action plan

(1) Action plan D-1: Setting-up planning section

a) Purpose of action plan

To organize a section that has a responsibility for planning of the activities of the institute including budget

b) Expected outcome

- Developing a long-term strategy
- Setting up a permanent section to develop a long-term strategy with functions to manage activities

c) Framework for implementation

Setting-up for planning an over all organization of DOM including LMS centers

d) Activities of action plan

First phase:

- 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.

Second phases

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

(2) Action Plan D-2: Enhancing international activities

a) Purpose of action plan

To set up a section responsible for developing strategies and work plan of DOM's international activities

b) 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

c) 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.

d) Activities of action plan

First phase

- 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

(3) Action plan D-3: Enhancing HRD program and bringing-up experts

a) Purpose of action plan

To bring-up experts of the techniques necessary for type approval testing, verification, measurement technologies of each metrological field

b) 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

c) 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

d) 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

**2) Mid-term action plan**

(1) Action plan D-4: Transformation of staff assignment

a) Purpose of action plan

To enhance the current technical services and enable to extend services into calibration and testing

b) 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

c) 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.

d) 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

(2) Action plan D-5: Upgrading Technical Infrastructure and Metrological Services

a) Purpose of action plan

To upgrade technical services on legal metrology, measurement technology and testing based on the needs from the industries

b) 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.

c) 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 over all system

d) Activities of action plan

- To enhance HRD for mass and length standards
- To improve DOM's research environment by establishing a new building with a library, information system
- To enhance communication with the other institutes of Indonesia and overseas
- To 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.

**3) Long-term action plan**

(1) Action plan D-6: Implementation of type approval testing and calibration of testing equipment

a) Purpose of action plan

To develop fields necessary for DOM to bring out its ability after decentralization and catch up to the international standards

b) Expected outcome

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

c) 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

d) 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

## 6.5 Establishment of Legal Metrology Standardization Centers

### 6.5.1 Vision, Mission and Strategy

| | |
|---|---|
| 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.<br>2. To keep liaison functions and measurement traceability between central and regional organizations.<br>3. To make services of verification and calibration services for large scale and special measuring instruments unable by RVOs.<br>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.<br>1.2 To grade up skills of calibration by comparisons of measuring instruments among RVOs.<br>1.3 To make the missions of LMS Centers well-known to regional industries and RVOs.<br>1.4 To hold training courses matched with the needs from regional activities. |
| | 2.1 To prepare equipment and system necessary for traceability.<br>2.2 To provide standards to RVOs and technical assistance.<br>2.3 To collect data and information concerning RVOs, and report them to DOM. |
| | 3.1 To grasp needs from regional industries.<br>3.2 To implement verification, calibration and testing matching with regional needs but unable by RVOs.<br>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.<br>4.2 To accept testing on request.<br>4.3 To develop a system for proper distribution of the testing fee. |

### 6.5.2 Action Plan

**1) Short-term action plan**

(1) Action plan B-1: Establishment of Legal Metrology Standardization Centers

a) Purpose of action plan

To study on establishing the LMS Centers that meet the needs from industries of each region

b) 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

c) 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

d) 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

**2) Mid-term action plan**

(1) Action plan B-2: Providing services to RVOs and regional industries

a) Purpose of action plan

To promote the ability of the services and to RVOs and the regional industries

b) 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

c) Framework for implementation

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

d) 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

## 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<br>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<br>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<br>1.3 To upgrade the skill of the verifiers by their reeducation and provide reliable services |
| | 2.1 To collect information necessary for market surveillance on measuring instruments and exterminate illegal measuring instruments<br>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

#### 1) Short-term action plan

(1) Action Plan R-1: Business innovation of RVOs

a) 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

b) 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.

c) Framework for implementation

The organization of RVO is re-organized by establishing the following sections for instance; Business Management Section, Surveillance & Guidance Section, Verification Section and Inspection Section.

d) 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 staffs.

(2) Action Plan R-2: Preparation of annual plan

a) Purpose of action plan

To make annual plan which are subdivided to monthly and daily plans for effective assignment of work

b) Expected outcome

- 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.
- It can be used in adjusting delays of work as well as adjusting work load of staffs.
- Proper manning schedule can be made.
- The motivation of staffs to work is enhanced.

c) Framework for implementation

- 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.
- Monthly meetings as well as morning gatherings are held regularly for better communication.

d) Activities of action plan

- 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

(3) Action Plan R-3: Development of manuals

a) 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)

b) 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.

c) 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.

d) 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 maintenance of manuals is of importance. PDCA management circle is useful in revising manuals.
- Develp 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.

(4) Action Plan R-4: Plan for Facility Development

a) Purpose of action plan

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

b) Expected outcome

By supplement the required facilities, the ratio of verification and re-verification increase

c) 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.

d) Activities of action plan

- RVOs apply for necessary facilities to DOM (excluding real estate).
- DOM summarizes the application by RVOs in a form of application list.
- 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.

(5) Action Plan R-5: Implementation of verification of water meters by RVOs

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: Improvement of System for Record and Reporting

a) 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

b) Expected outcome

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

c) Framework for implementation

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

d) Activities of action plan

- DOM prepares formats for reporting of legal metrology performance records and sends them to RVOs.
- RVOs allocate at least one computer operator to control operation and report to DOM using the above formats.
- 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.

(7) Action Plan R-7: Cooperation between RVOs

a) 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

b) 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.

c) Framework for implementation

DOM, LMS Centers and RVOs

d) 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.

**2) Mid-term action plan**

(1) Action Plan R-8: Improvement of facilities

a) Purpose of action plan

To implement facility development based on the planning of Action Plan R-4

b) 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.

c) Framework for implementation

Project teams organized within RVOs and LMS Centers for assistance

d) 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.

(2) Action Plan R-9: Interim evaluation of innovation of RVOs

a) Purpose of action plan

To evaluate the effects of innovation of RVOs by Action Plan R-1

b) 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.

c) Framework for implementation

Organization established for the Action Plan R-1

d) 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?

**3) Long-term action plan**

(1) Action Plan R-10: Study on unification of RVO and BPSMB

a) Purpose of action plan

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

b) 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.

c) Framework for implementation

“Committee for Study on Unification” consisting of DOM, PPMB, RVOs and BPSMBs

d) Activities of action plan

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

## 6.7 Plan for HRD for Legal Metrology in MTC

### 6.7.1 Plan for HRD for Legal Metrology

**1) Contents of training**

- 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

**2) Increase of number of trainees and capacity building of MTC**

- MTC can accept 200 trainees per year for mid-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.

**3) Shortening training period**

- The current training terms are about one-year long for two courses (1,820 hours and 1,540 hours). The period required for the whole training seems too long, causing some problems in conducting RVO's work.
- Considering all of the above, typical training terms are set for two to three months and do not exceed five months.

**4) Location for training**

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

**5) 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.

**6) Increase of trainers**

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

### 6.7.2 Training Course and Trainees

Table 6.7.2-1 shows the training course and qualification of trainees.

**Table 6.7.2-1 Training Course and Qualification of Trainees**

| No | Training Course | Aim of the Training | Qualification of Trainees Attending the Course |
|---|---|---|---|
| A | Inspector Basic Course | The acquisition of basics knowledge of B course. | • 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.<br>• Graduate of B course. |
| 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 B course.<br>• 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 | Inspector Senior Course | To foster a Senior Inspector who has ability of management and administration for legal metrological operations at his responsible territory. | • Expert inspector<br>• Measurement Standard Laboratory Officer<br>• Surveillance Officer<br>• More than 5 years operational experience in RVO after getting his certification.<br>• Recommendation of RVO |

### 6.7.3 Plan for training curriculum

Figure 6.7.3-1 shows the flowchart of inspector training.

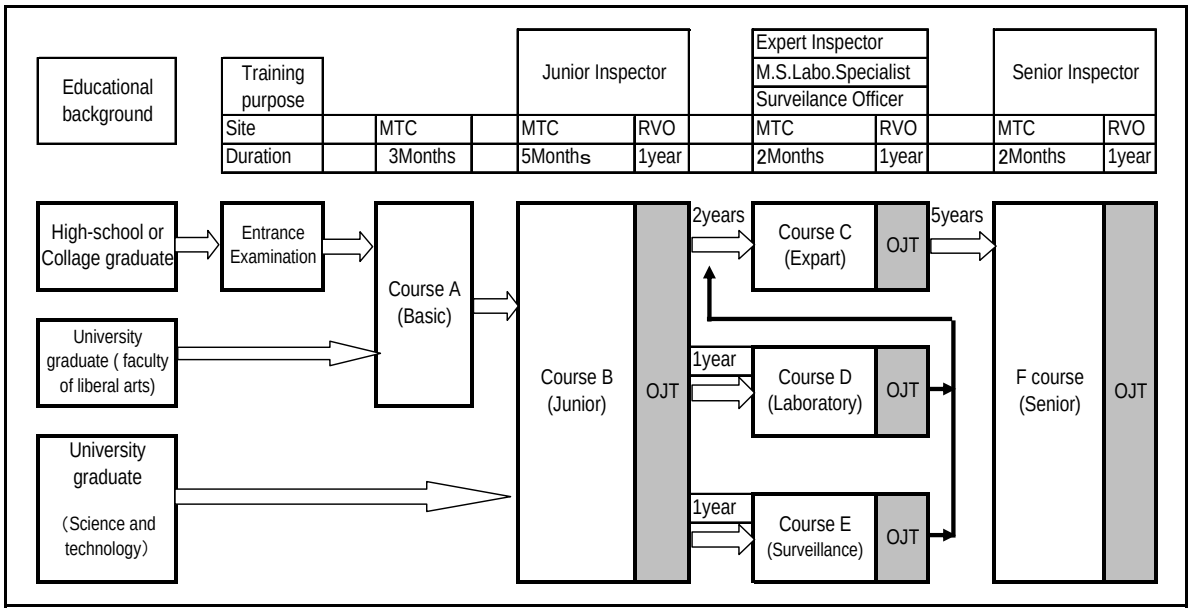



**Figure 6.7.3-1 Flowchart of Inspector Training**

Table 6.7.3-1 summarizes the list of training hours. The required time for training is reduced substantially by reviewing the contents of present curriculum.

**Table 6.7.3-1 List of Training Hours**

| No | Training course | Training Hours | | | 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 |

### 6.7.4 Plan for Training Equipment

Since MTC already has plans to purchase equipment using budget of 2006-2007, the JICA study team reviewed their plan and recommended the equipment plan (added 8 items).

### 6.7.5 Annual Schedule of Training Course

The schedule is simulated as shown in Table 6.7.5-1.

**Table 6.7.5-1 Schedule of Training Course**

| Course/Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 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 | |

### 6.7.6 Plan for Number of Staffs

Table 6.7.6-1 shows Estimation of Number of Staffs. The number of trainers increases because of inclusion of new subjects in addition to the compulsory subjects in existing courses.

**Table 6.7.6-1 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 | |

### 6.7.7 Training program for trainers

(1) Training at DOM and several main RVOs

(2) Plant tour of related entities

(3) Classroom lecture training

(4) Practical skill training

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.

### 6.7.8 Revenue and Expenditure Plan

The estimated operational cost of MTC is about Rp.3,943 million/year. Since development of legal metrology is an important national project, it is recommended that all training costs, including traveling and living expenses, be supported in the national budget.

### 6.7.9 Project Schedule

#### 1) Short-term action plan

Short-term action plan is shown in Table 6.7.9-1.

**Table 6.7.9 -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 recruitment of trainees. | | | | | | |
| 2. Enforcement of training | | | | | | |
| 3. Periodical evaluation and feedback. (PDCA circle) | | | | | | |

#### 2) Mid-term action plan

(1) Review and revision of training curriculum

(2) Review and replacement of training equipment.

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

(4) Study on cooperation with Bandung Institute of Technology (ITB).

## 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, 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 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.

**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
- Mid-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

### 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-conditioning 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 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.

### 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.

**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.

The total floor space for laboratories is approximately 4,000 m2 and that for other offices is approximately 3,600m2.

### 6.10.4 Procurement Plan

**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.

**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 necessary facilities and equipment are summarized in Table 6.10-2.

**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 stabilized He-Ne Laser | | Dial Gauge |

### 6.10.5 Cost Estimation

The preliminary cost estimation of the project is summarized in this section. The cost estimation is included building construction and procurement of the equipment both 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 | Rp.800,000,000,000 |
| 2. | Facilities/Equipment for DOM | ¥2,602,750,000 | Rp.208,220,000,000 |
| | Type Approval | ¥1,805,000,000 | Rp.144,400,000,000 |
| | Calibration | ¥797,750,000 | Rp.63,820,000,000 |
| | TOTAL | ¥3,602,750,000 | Rp.333,220,000,000 |

### 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 period of construction and procurement of the equipment is drafted. The duration of construction is 12 months and that of procuring equipment is 13 months including operational training.

### 6.11 Investment Plan for LMS Center

#### 6.11.1 Objective and scope of the plan

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 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. The subjected areas are, 1) mass, 2)length, 3) volume, 4) temperature, 5) electrical, 6) mobile facility, 7) others.

### 6.11.5 Cost Estimation

The preliminary cost estimation for LMS Centers is summarized in Table 6.11.5-1. The cost estimation is calculated by DOM, which includes 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 Centers**

| | | |
|---|---|---|
| 1. Construction of LMS Center | ¥100,000,000 | Rp.8,000,000,000 |
| 2. Facilities/Equipment for LMS Center | ¥89,400,000 | Rp.7,152,000,000 |
| *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 | Rp.15,152,000,000 |

### 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.

### 6.11.7 Schedule

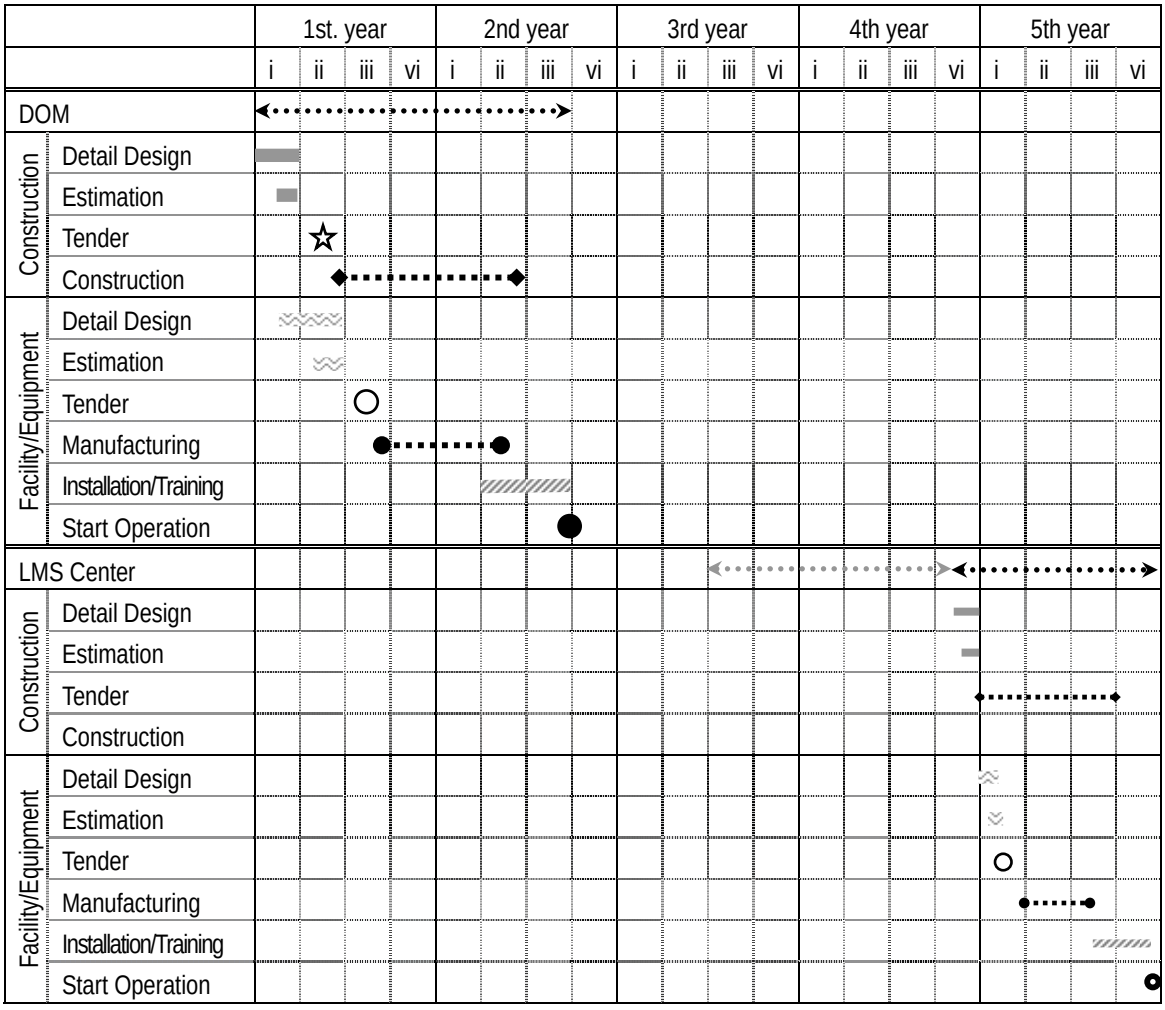
The period of construction and procurement of the equipment is drafted. The duration of construction is 10 months and that of procuring equipment is 9 months including operational training.

## 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**



# 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 W-H 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, four existing NMIs should be unified. 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.

### 7.2.7 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.

### 7.2.8 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.

### 7.2.9 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 should review 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.

# Chapter 1

# Framework of the Project

# Chapter 1 Framework of the Project

## 1.1 Background of the Study

The Study on Legal Metrology System in the Republic of Indonesia was once formulated by JICA in 1993/1994; however, due to the rapid change of the roles of both the central and regional governments in executing legal metrology activities caused by enactment of the Regional Autonomy Law No.22/1999, later revised No.32/2004, some of the Study is no longer valid and it must be revised to meet the present situation.

At the same time, it is recognized that the legal metrology system in Indonesia is necessary to meet international/global standards due to the recent enhancement of the worldwide trade and the development of science and technology. Especially, it is necessary for the legal metrology system in Indonesia to cope with the WTO/TBT (World Trade Organization/Technical Barriers to Trade).

Under such circumstances and in response to the request of the Government of the Republic of Indonesia (hereinafter referred to as "GOI"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct the Study on Development of Legal Metrology System in Indonesia. Accordingly, JICA, the official agency responsible for the implementation of the technical cooperation programs of GOJ, undertakes the Study in close cooperation with the relevant authorities concerned of the GOI.

## 1.2 Objectives of the Study

The objective of the Study is to investigate the present situation relating to legal metrology and to make a master plan, including medium and long-term plans and an action program, to upgrade the existing metrology system to international level for enhancing the competitiveness of Indonesian products and protecting consumers from unfair trade, taking into account impacts on domestic legal metrology implementation system caused by the de-centralization which has been executed since January 2001.

## 1.3 Scope of the Work for the Study

### 1.3.1 First Phase

The following activities were conducted to grasp the overall situation in legal metrology in Indonesia and extract problems to be solved and issues to be developed.

**1) Data Collection in Japan**

Data and information available in Japan were collected for analysis.

**2) Study on current situation of the legal metrology system in Indonesia**

a) Law of Legal Metrology
b) Budget flow for implementing legal metrology
c) Legal metrology system including organizations relating to legal metrology
d) Measurement technology
e) Human resources development
f) Industrial analysis

**3) Survey on DOM and 11 Regional Verification Offices (RVOs)**

a) Survey on organizations, functions, implementation of legal metrology, etc.
b) Survey on changes of relationships between Directorate of Metrology (DOM) and RVOs before and after the de-centralization

**4) Study on facility and equipment**

a) DOM
b) Designated 11 RVOs
c) Metrology Training Center (MTC)
d) Review of a plan concerning 7 Legal Metrology Standardization (LMS) Centers

### 1.3.2 Second Phase

Based on the study results in the First Phase, the following master plan was formulated:

1) Develop the legal metrology system that meets international standards
2) Make a plan for strengthening DOM functions
3) Design a guideline for the establishment of new RVOs

4) Design the national human resources development plan for legal metrology including MTC
5) Plan the most effective legal metrology system in order to improve the relationship between DOM and RVOs under the current Autonomy Law
6) Develop a long term investment plan to improve the facilities of DOM including LMS Centers

### 1.4 Study Areas for RVOs

1) Java: Jakarta, Surabaya, Yogyakarta, Bogor,
2) Sumatra: Medan, Pekanbaru, Padang
3) Sulawesi: Manado, Makassar
4) Kalimantan: Banjarmasin
5) Bali: Denpasar

### 1.5 Study Team Members

1) Kunio OTSUKA Leader/Metrology Administration
2) Issei AKAMATSU Legal Metrology System
3) Yutaka OGAWA Measurement Technology
4) Katsuhiko HATA Industrial Analysis 1
5) Insan FATHIR Industrial Analysis 2
6) Toshio YAMADA Human Resources Development
7) Takashi MORITA Metrological Facility and Equipment Analysis

### 1.6 Site Surveys

The JICA Study team conducted four site surveys as follows:

1) First site survey: 1 February – 2 March 2006
2) Second site survey 10 May – 27 July 2006
3) Third site survey 11 September – 20 September 2006
4) Fourth site survey 12 November – 9 December 2006

### 1.7 List of Persons for Interview

See Appendix A.1 for the list of persons for interview.

# Chapter 2

# Present Status and Development Plan of National Economy and Industry in Indonesia

# Chapter 2 Present Status and Development Plan of National Economy and Industry in Indonesia

## 2.1 Present Status of National Economy and Industry

### 2.1.1 History of Economic Policy

The government led by President Suharto deregulated the strategic economy by creating opportunities for foreign investment starting from 1969 by a series of five-year development plans. The government adopted the strategy for substitution of import to develop domestic industry, and implemented policies for liberalization of foreign investment and foreign capital ("open door" policy towards the West) to support it. This strategy is very important to get new capital from abroad. Foreign capital, especially foreign direct investment (FDI), as well as foreign governmental loans and aid started to flow substantially into the country.

Repelita, an acronym from "Rencana Pembangunan Lima Tahun" or Five Year Development Plan, is a plan first adopted by the government to accelerate Indonesia's development. Five Replita(s) were implemented during 1969-1994, constituting a 25 year-long development period, and the results were remarkable with achievements of annual growth rates of 8.5%, 7.2%, 6.1%, 5.2% and 6.9%, respectively. Indonesia succeeded in achieving self-sufficiency in rice production and was widely seen as a future economic giant. Appendix 2.1.1 explains the detail of Repelita Ⅰ to Repelita Ⅴ.

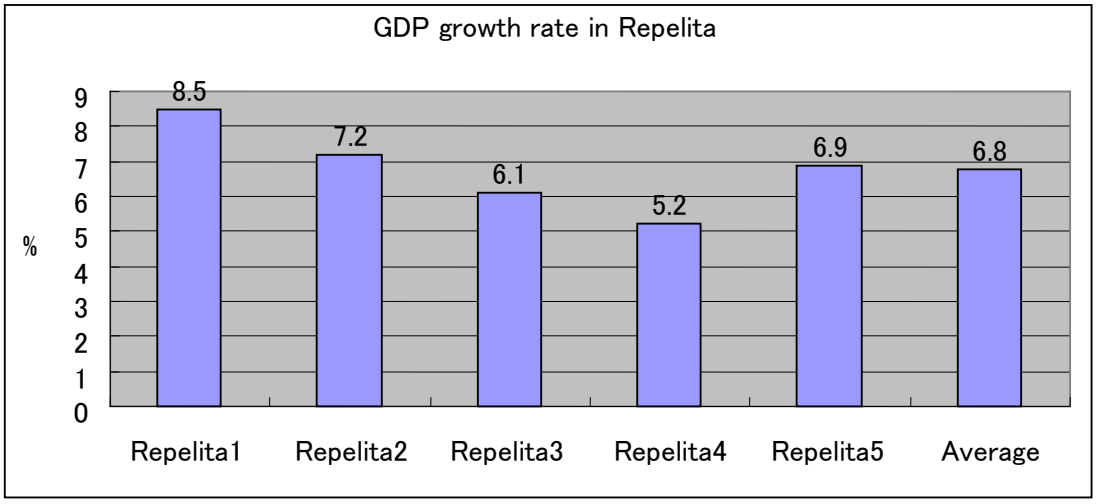
Table 2.1.1-1 shows the strategies for economic development of five Replita(s). Figure 2.1.1-1 presents the GDP growth rate in five Repelita(s).

**Table 2.1.1-1 Strategies for Economic Development of Five Replita(s)**

| | |
|---|---|
| Repelita I (1969–1974) | Focused on basic needs and providing a framework for growth by emphasizing agricultural and infrastructure development. Sixty-six percent of it is financed by foreign aid, mainly through the Inter-Governmental Group on Indonesia (IGGI). |
| Repelita II (1974–1979) | Continued emphasizing agriculture and infrastructure development but sought also to stimulate development outside the densely populated islands of Java, Bali, and Madura. Funded 35% by foreign aid, it heavily subsidized transmigration from these islands to other regions. |
| Repelita III (1979–1984) | Emphasized industrialization, especially the development of labor-intensive, export-oriented manufactures, as well as agricultural and forest products and non-oil-gas minerals. |
| Repelita IV (1984–1989) | Continued stressing new exports and emphasized the creation of employment along with the introduction of advanced industrial technology market. |

| | |
|---|---|
| Repelita V (1989–1994) | Emphasized infrastructure, especially transport, communications, electric power and education, but paid the greatest attention to manufacturing, which in 1991 surpassed agriculture as the largest economic sector. |
| Repelita VI (1994-1999) | Concentrated on manufacturing and initially appeared to be continuing the success of earlier plans, averaging 7.8 % of annual growth in its first three years. The plan ceased with the onset of the Asian economic crisis in 1997. |

Sources: Hill, Hal. (1996), The Indonesian Economy since 1966, Cambridge, U.K.




Sources: Data Consult, Indonesian Economic Trends 1968-2018

**Figure 2.1.1-1 GDP Growth Rate in Repelita I to Repelita V**

### 2.1.2 Major Economic Indicators

Table 2.1.2-1 summarizes the outlook of Indonesia. According to the National Mid-term Development Plan (2004-2009), the economic growth rate will increase from 5.5% in 2005 to 7.6% in 2009 with an average annual growth rate of 6.6%. Main indicators in 2005 are below.

- GDP at current market price was 2,730 trillion rupiah (US$29.7 billion)
- GDP growth rate at constant 2000 market price was 5.6%
- GDP per capita (nominal) was US$1,268
- Consumer price index at 45 cities was 125.1 (2002=100)
- Inflation rate of consumer price at 45 cities was 17.6%

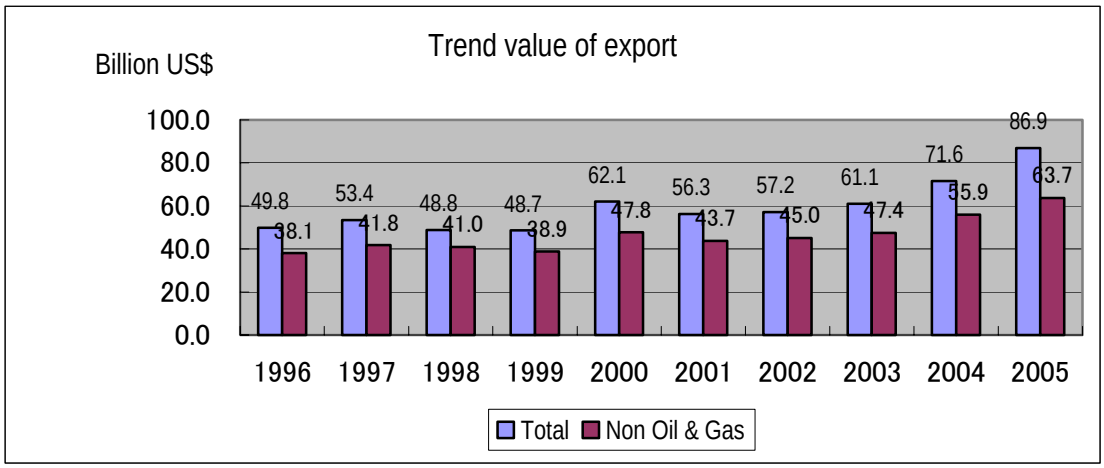
**Table 2.1.2-1 Outlook of Indonesia**

| Indicators | Description (in 2005) |
|---|---|
| Land areas | 1,922,570 km$^2$ (5times over Japan) |
| Populations | 219.2 million |
| Annual growth rate of population | 1.34% |
| GDP at current market price | Rp 2,730 trillion (US$278 billion) |
| GDP at constant 2000 market price | Rp 1,750 trillion (US$178 billion) |
| GDP growth rate at constant 2000 market price | 5.6% |
| GDP per capita | US$ 1,268 |
| Consumer price index at 45 cities | 125.1 (2002=100) |
| Inflation rate of consumer price at 45 cities | 17.1% |
| Rupiah exchange rate | 9,830 Rp/US$ |
| Current account | US$ 2,334 million |
| Balance of trade | US$ 23,172 million |
| • Export f.o.b. | US$ 86,906 million |
| Oil and Gas | US$ 23,161 million |
| Non Oil and Gas | US$ 63,745 million |
| • Import f.o.b. | US$ 63,734 million |
| Oil and Gas | US$ 16,437million |
| Non Oil and Gas | US$ 47,297 million |
| Foreign currency reserves | $32.9 billion (Equivalent to 6.2 months of import) |
| | |
| Main industry (The share of GDP by sector ) | |
| Manufacturing Industry | 29 % |
| Trade, Hotel and Restaurant | 16 % |
| Agriculture,Livestock, Forestry and Fishery | 13 % |
| Mining and Quarrying | 10 % |
| Financial, Ownership and Business Service | 8 % |
| Transportation and Communication | 7 % |
| Construction | 6 % |

Source: BPS Statistical Yearbook of Indonesia 2005

### 2.1.3 Foreign Trade

Since 1987, the Indonesian export which dominated by oil and gas has been changing due to new deregulation and policies which promote export of non oil and gas products. These deregulation policies have enabled the exporters and producers of non-oil and gas commodities to improve in quality and increase their export production. It succeeded to give a significant impact on non-oil export. Figure 2.1.3-1 shows the export of oil and gas and non-oil and gas products from 1996 to 2005.

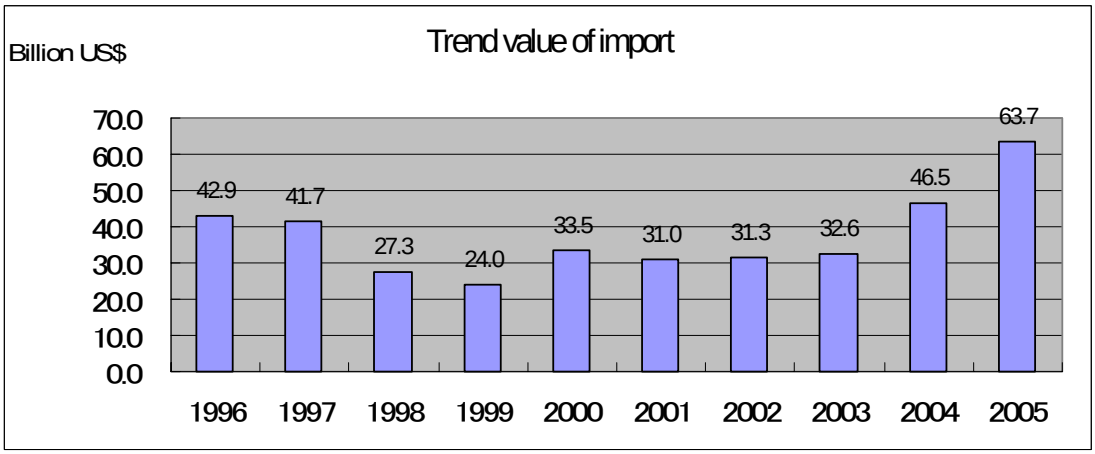



Source: BPS Statistical Year Book 2005

**Figure 2.1.3-1 Export of Oil & Gas and Non Oil & Gas Products (Unit: US$ Billion)**

Figure 2.1.3-2 shows the value of import from 1996 to 2005. Due to an economic crisis caused by the decline of Thai Bhatt, the import value fell between 1998 and 1999 before recovering after 2000.

Appendix 2.1.3 describes the detail of foreign trade, with analysis of export/import value and volume, major destination countries, major port, export and import items.




Source: BPS Statistical Year Book 2005

**Figure 2.1.3-2 Value of Import (Unit: US$ billion)**

### 2.1.4 Balance of Payments

Indonesia's balance of payments continued to show sound performance in 2004. The current account kept in surplus, reflecting improved performance of exports. After posting a deficit in 2003, the capital account shifted into surplus, largely due to rising private capital inflows. In line with these developments, official foreign exchange reserves increased substantially during the reporting year.

The favorable world economy improved performance of Indonesia's balance of payments in 2004. It was reflected in the current account which remained in surplus, but narrower than it did in 2003. Export increased strongly in line with rising world trade volumes and commodity prices, which were offset by significant increases in imports and net services.

Meanwhile, the capital account shifted to surplus in 2004 due to investors' positive prospects for the Indonesian economy and due to the benefit of increasing capital inflow to developing countries, particularly to Asia. The private capital account posted quite a large surplus, which was partly offset by a sizeable deficit in the official capital account due to increasing foreign debt payment after the end of the Paris Club rescheduling. With both the current and capital accounts in surplus, the overall balance of payments also recorded surplus, raising official foreign currency reserves to US$36.3 billion, equivalent to 5.6 months of imports and governmental foreign debt service. Table 2.1.4-1 shows Indonesia's balance of payments.

On the current account side, commodity price increases, high world trade volume and a stable Rupiah encouraged Indonesia's export. This was particularly the case for exports of oil and gas and some primary goods, such as mining commodities, whereas the agricultural goods (mostly raw materials) declined. At the same time, the acceleration in economic activity domestically caused a significant increase in import. Notably, raw materials and capital goods decreased. Expansion in economic activity led to a fuel consumption increase, triggering a pickup in the volume of oil imports. Accelerating imports and higher oil prices caused transportation costs to rise, thus widening the deficit on the services account. This was offset partly by a rise in receipt of service, originating from visits by foreign tourists and income repatriation from Indonesia workers abroad.

**Table 2.1.4-1 Indonesia's Balance of Payments**

Unit: US$ Million

| Items | 2002 | 2003 | 2004 |
|---|---|---|---|
| I. Current account | 7,822 | 8,106 | 2,878 |
| Goods account | 23,513 | 24,562 | 21,231 |
| Export fob | 59,165 | 64,109 | 71,785 |
| Import fob | -35,652 | -39,546 | -50,554 |
| Services | -15,691 | -16,456 | -18,353 |
| II. Capital account | -1,102 | -949 | 2,236 |
| Public sector | -190 | -833 | -1,911 |
| Private sector | -912 | -116 | 4,148 |
| Direct investment | 145 | -597 | 1,043 |
| Portfolio investment | 1,222 | 2,251 | 2,793 |
| Others investments | -2,279 | -1,770 | 311 |
| III. Total (I+II) | 6,720 | 7,157 | 5,114 |
| IV. Errors and Omissions (net) | -1,692 | -3,502 | -4,805 |
| V. Financing | -5,028 | -3,654 | -309 |
| Change in reserves assts | -4,023 | -4,257 | -24 |
| From Transaction | - | | 674 |
| IMF | -1,006 | 603 | -983 |
| Notes: Reserve assets (IRFCL) | 32,039 | 36,295 | 36,320 |
| In months of Imports and official | | | |
| Debt Repayment | 6.6 | 7.1 | 5.6 |
| 2. Current account/GDP (%) | 3.9 | 3.4 | 1.1 |

Source: Bank Indonesia, 2004 Economic Reports

### 2.1.5 Investment

In order to promote exports and foreign investment in Indonesia, the government has taken several initiative policies. In March 2004, the government issued a regulation concerning the acceleration of forest plantations to provide raw materials for the pulp and paper industry. This policy aims at entering downstream manufacturers into plantations, in order to develop value-added products. A similar policy also was applied to exports of raw and semi-processed rattan, to ensure availability of raw materials for rattan-based furniture.

Furthermore, in an effort to improve investment services, the government issued Presidential Decree No.29/2004 to simplify the bureaucratic process for awarding investment licenses. New investment in Indonesia requires more time compared to another ASEAN countries. In implementation, however, these policies still need greater support and understanding from local governments.

Investment activities, both private and government, are estimated to grow quite strongly in 2005. Overall, investment is projected to grow at 14-16%. Projected improvement in investment is supported by optimism in the business community regarding economic prospects. Increasing private investment by both domestic and foreign players is supported by the government's

commitment to create a more conducive investment climate. This is reflected in policy emphasis on infrastructure development, the enhancement of various regulations, and the preparation of new investment regulations.

Improved optimism in the business community is further supported by developments in other indicators, such as the continued narrowing of Indonesia's risk premium and the potential for more foreign direct investment into Indonesia. The survey of business activities also shows improved expectations of future business conditions.

Government investment would also increase strongly. One factor is the reallocation of spending from a fraction of the fuel subsidies to capital spending. Other government efforts to boost investment include: (i) the revision of eleven government regulations and three presidential regulations related to infrastructure; (ii) recommendation for a change from licensing to just registration, according to the draft law concerning capital investments; and (iii) preparation of a number of tax incentives for business players, covering acceleration of depreciation, compensation for losses, and a reduction in taxes on dividends. Meanwhile, to support investment in the oil and gas sector, the government is developing a fiscal incentive package for investors in this sector. To increase legal certainty for doing business in the oil and gas sector, the government has established a team for revising the draft law concerning oil and gas.

The government's commitment to accelerating infrastructure development is an important point in the new government's First 100-Day Program. The condition of infrastructure in Indonesia is no longer adequate and has become a constraint on other investment. One indicator in this regard is the ratio of infrastructure financing to GDP, which has been declining continuously since 1993/1994.

In addition to private financing, other keys to success of the infrastructure drive would include fair transparent tendering processes and clear legal rules, specifically in land acquisition. When these important points are realized, these many infrastructure projects would make a meaningful contribution to achieving – or exceeding – the projected range of investment. The foreign investment projects by economic sector are shown in Table 2.1.5-1. Compared to 2003, the investment in most sectors increased.

**Table 2.1.5-1 Foreign Investment Projects by Economic Sector**

Unit: US$ Million

| Economic sector | Investment | |
|---|---|---|
| | 2003 | 2004 |
| Agriculture, hunting, forestry and fishery | 178.9 | 329.7 |
| Mining and quarrying | 17.8 | 66.3 |
| Manufacturing | 6,457.4 | 6,336.4 |
| Electricity, gas and water supply | 362.9 | 275.5 |
| Construction | 787.7 | 954.0 |
| Wholesale, retail, restaurant, hotels | 952.3 | 1.179.0 |
| Transport, storage, communications | 4,160.2 | 5860.5 |
| Financial, insurance, real estate and business service | 10.3 | 339.6 |
| Community social and personal services | 279.7 | 212.8 |

Source: BPS Statistical Year Book 2004

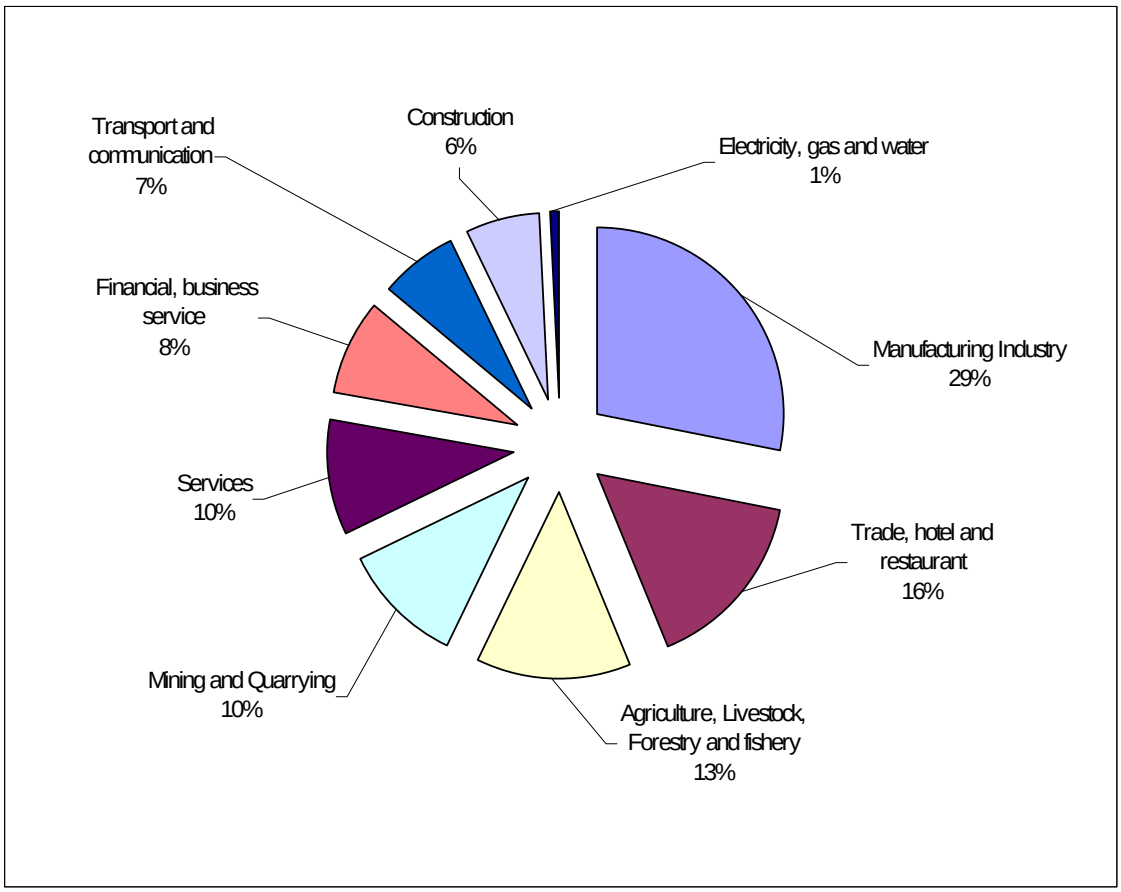
## 2.2 Industrial Analysis

### 2.2.1 Composition of industry

Indonesia was heavily damaged by the economic crisis in ASEAN countries. But, the macro economy of Indonesia is recovering step by step, and the industrial structure gradually changed after the crisis.

Concerning GDP of industrial sectors, when Indonesia experienced economic crisis in 1997, the primary industry shared 16%; the secondary industry, 43%; and the tertiary industry, 41%. In 1998, once the economic crisis had subsided, the shares of secondary and tertiary industries decreased. Manufacturing and related sectors fell drastically. An upward turn in the economy during 2001 combined with the recovery of the manufacturing sector caused the composition of industry to become as almost as before: the primary industry is 13% (slightly down), the secondary industry is 45% (slightly up) and the tertiary industry is 42% (slightly up) in 2005.

Figure 2.2.1-1 shows the GDP distribution by industrial origin in 2005. The largest sector is manufacturing industry (29%), followed by trade, hotel and restaurants (16%), and agriculture (13%).




Source: BPS Statistical Year Book of Indonesia 2005

**Figure 2.2.1-1 GDP Distribution by Industrial Origin in 2005**

Appendix 2.2.1 describes the trend of industry by industrial origin, with analysis of agriculture, manufacturing industry, oil, natural gas, iron and steel manufacturing, automotive industry.

### 2.2.2 Gross Domestic Product (GDP) by Sector

Tables 2.2.2-1 shows the GDP at current market prices by sector.

**Table 2.2.2-1 GDP at Current Market Prices by Sector**

Unit: billion Rupiah

| Industrial origin | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|
| 1. Agriculture, Livestock, Forestry, Fishery | 263,328 | 298,877 | 325,654 | 354,435 |
| 2. Mining and Quarrying | 182,008 | 161,024 | 169,536 | 196,892 |
| - Oil and gas | *115,335* | *93,092* | *94,780* | *120,641* |
| - Non oil and gas | *66,673* | *67,932* | *74,756* | *76,251* |
| 3.Manufacturing Industry | 506,320 | 553,747 | 590,051 | 652,729.5 |
| - Oil and gas manufacturing | *63,345* | *69,660* | *78,641* | *86,982* |
| - Non oil and gas manufacturing | *442,975* | *484,087* | *511,410* | *565,743* |

| | | | | |
|---|---|---|---|---|
| 4. Electricity, gas and water supply | 10,855 | 15,392 | 19,541 | 22,855 |
| 5. Construction | 89,299 | 101,574 | 112,571 | 134,388 |
| 6. Trade, hotel and restaurant | 267,656 | 314,647 | 337,841 | 372,340 |
| 7. Transport and communication | 77,188 | 97,970 | 118,267 | 140,604 |
| 8. Financial. Ownership and business services | 135,370 | 154,442 | 174,324 | 194,542 |
| 9. Services | 152,258 | 165,603 | 198,069 | 234,244 |
| ***Gross Domestic Products*** | 1,684,281 | 1,863,275 | 2,045,854 | 2,303,032 |
| ***Gross Domestics Products without Oil-gas*** | 1,505,601 | 1,700,523 | 1,872,433 | 2,095,409 |

Source: BPS Statistical Year Book 2004

## 2.3 Development Plan of National Economy and Industry

### 2.3.1 Mid-term National Development Plan (2004-2009)

Mid-term national development program (2004-2009) (Government Regulation No.7/2005) was formulated and enacted on January 26, 2005 based on the most upper stream of national planning. The program will be used as an official national development guideline for the next five years.

1) Problem and Agenda of Mid-term National Development Plan 2004-2009

   Economic crisis in 1997/1998 gave expensive but good lessons to Indonesia government. By this crisis, the Indonesian government made some improvement against weakness and mistakes in the past. The target and program for the next five years were determined based on the problems to overcome and challenges as follows:

   a) Low economic growth, resulting in decreasing and lowing level of welfare of society and rising social problems

      In 2000-2003, the economic growth rate with only 4.3%, and investment in sector of export goods and services with growth rate of only 3.5% and 2.1% per year, respectively

   b) Low quality in human resources

      In 2003, the student population more than 10 years old in middle schools shares only 36.2%. And the population, who still cannot read, shares 10.1%.

   c) Low quality of environment

      The quality of environment is deteriorated by pollution of water, air and atmosphere, and generally is affected by industry, household, mining and agriculture.

   d) Gap between center and regional, and regional to regional

      Example: Java island and others, West Indonesia region and East Indonesia region

e) Improvement of society welfare which is related to support of infrastructure development

Since 1998, the service condition and infrastructure of transportation, electricity, energy, post and telecommunication and information, water resources, property, etc. have deteriorated in quantity and quality.

f) Unfinished treatment of handling separatist action in some region
g) High level of conventional and transnational victims
h) Insufficiency of ability and number of personnel in military to handle broad regions with differences in society, economy and culture
i) Unfair regulations which do not respect human rights and remain overlapped between centrally and regionally.
j) Low public services, Low welfare of government officers, etc.
k) Weakness of governmental and public institutions as a political institution

2) Direction of Mid-term National Development Plan 2004-2009

The vision of mid-term national development plan is:

a) To realize a society, nation and country characterized by safety, unification, harmony and peace
b) To realize a society, nation and country which respects law, equality, and human rights
c) To realize an economy that provides job opportunities, increase quality of life, and provide a strong foundation for continued development

The mission to realize the stated vision is:

a) To realize safety and peace in Indonesia
b) To realize fairness and democracy in Indonesia
c) To realize welfare in Indonesia

3) Economic Prospects in 2004-2009

The medium-term economic goal is centered on the improvement, the increase in economic production, and the expansion of purchase power of people. The program assumes that the goals can be achieved by building adequate infrastructures, reutilizing the local economy focusing on the agriculture and manufacturing sectors, strengthening small and medium enterprises, and securing legal certainty for business.

The economic growth rate is expected to increase from 5.5% in 2005 to 7.6% in 2009 with an average growth rate of 6.6% per year. The growth rate of population will be 1.2% and real GDP income will reach Rp 9.9 million in 2009. The export goods, services, and consumption will grow 15.2%, 7.1% and 4.8%, respectively.

The targets in the five year development program are shown in Table 2.3.1-1.

**Table 2.3.1-1 Economic Structure and Quantitative Targets**

**National Mid-term Development Plan 2005-2009**

Unit: %

| | Actual | | | | Estimate | Target Value | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| GDP growth rate | 4.9 | 3.8 | 4.3 | 4.5 | 5.0 | 5.5 | 6.1 | 6.7 | 7.2 | 7.6 |
| Consumption | 2.0 | 3.9 | 4.7 | 4.5 | 5.5 | 4.7 | 6.0 | 5.7 | 6.1 | 6.3 |
| Private sector | 1.6 | 3.5 | 3.8 | 3.9 | 6.0 | 5.0 | 5.0 | 5.1 | 5.4 | 5.6 |
| Public sector | 6.5 | 7.6 | 13.0 | 10.0 | 6.7 | 2.6 | 13.9 | 9.9 | 11.2 | 10.9 |
| Investment | 16.7 | 6.5 | 2.2 | 1.9 | 11.7 | 13.6 | 14.8 | 9.9 | 11.2 | 10.9 |
| Export | 26.5 | 0.6 | -1.0 | 6.6 | 11.4 | 6.8 | 7.2 | 9.3 | 10.4 | 12.0 |
| Import | 25.9 | 4.2 | -4.0 | 2.8 | 24.2 | 11.8 | 10.2 | 11.8 | 12.1 | 12.4 |
| Agriculture | 1.9 | 4.1 | 2.8 | 3.1 | 3.1 | 3.2 | 3.4 | 3.6 | 3.6 | 3.8 |
| Manufacturing Industry | 6.0 | 3.3 | 5.9 | 5.0 | 5.5 | 5.9 | 6.9 | 7.8 | 8.6 | 9.5 |
| Non oil and gas Industry | 7.0 | 4.9 | 6.4 | 5.4 | 6.5 | 6.8 | 7.7 | 8.7 | 9.4 | 10.2 |
| Unemployment against total workforce | 6.1 | 8.1 | 9.1 | 9.5 | 9.7 | 9.5 | 8.9 | 7.9 | 6.6 | 5.1 |
| Population under poverty level | 19.1 | 18.4 | 18.2 | 17.4 | 16.6 | - | - | - | - | 8.2 |
| Inflation (CPI) | 9.4 | 12.5 | 10.0 | 5.1 | 6.0 | 7.0 | 5.5 | 5.0 | 4.0 | 3.0 |
| Exchange rate (Rp /US$) | 8,425 | 10,241 | 9,375 | 8,578 | 8,928 | 8,900 | 8,800 | 8,800 | 8,700 | 8,700 |
| Real exchange rate | 6.8 | 11.0 | -15.5 | -10.9 | 0.1 | -4.5 | -4.3 | -2.8 | -2.9 | -0.9 |
| | | | | | | | | | | |

Source: BAPPENAS, Rencana Pembangunan Jangka Menengah (RPJM) 2005-2009

4) Draft Long-term National Development Plan 2005-2025

The Indonesian government drafted a long-term national development plan for a period of 2005-2025 in March 18, 2005 by letter No: R-01/PU/II/2005 from President Susilo Bambang Yudoyono to parliament. By this plan, it is expected to guarantee: (i) implementing of plan coordination, (ii) creating integration, synchronization, and synergy plan between place, time, and function of government both centrally and regionally, (iii) consistency in planning, budgeting, implementing and monitoring, (iv) utilizing of resources in efficiency, effectiveness, fairness and continuance, and (v) Social participation in the process of preparation, implementation and monitoring of plan implementation.

The plan sets forth future visions and expectations, including a safe and peaceful country, a stable economy, and an environment-friendly society, summarized as follows:

A) The Vision: "Growing, Independent and Fair Indonesia"
B) The Seven missions to realize the stated vision

(1) "To realize national competitiveness" means to strengthen the national economy base on each regional advantage by building a nationwide production and distribution system/service linkage; by prioritizing the quality of human resource development to produce a competitive workforce; by increasing utilization and understanding; by creating science and technology; by developing a modern infrastructure; and by reforming the legal system and government organization, all with the ultimate purpose of establishing a comparative advantage.

(2) "To realize a democratic Indonesian society based on law" means to build a stronger and more mature democratic organization; by reinforcing the role of ordinary citizens; by improving quality of decentralization and regional autonomy; by developing the media to communicate information relating to public interest while guaranteeing freedom of press; by improving the legal structure; and by establishing a fair legal system that weigh citizen's interests consequently and not discriminatively.

(3) "To realize safe, peaceful and unified Indonesia" means to reinforce armed forces with minimum required power and presence that is recognized in the regional and international community; to improve the national police in terms of professionalism and ability of the intelligence organization to ensure national security; to secure defense-related parts; and to raise the local defense industry level of contribution to the national defense system.

(4) “To realize more uniform and equal development” means to improve rural development; to reduce social inequality by favoring population and regions in weak positions; to fight against poverty; to secure equal access to social services and the economic infrastructure; and to eliminate discrimination in various aspects, including gender.

(5) “To realize a green and beautiful Indonesia” means to promote the harmonization of space used for housing, social and economic activities as well as energy preservation; to utilize natural resources and the environment on sustainable basis; to manage natural resources and the environment required to support quality of life and provide aesthetics and comfort for daily life; to protect the functionality and support of the environment through the maintenance and utilization of biodiversity as the basic development capital; and to improve development management that balances the use and the maintenance of natural resources and the environment for comfortable life at present and in the future.

(6) “To realize a moral, ethical and cultural society” means to reinforce identity and character of population based on faith in but one god; to comply with laws; to maintain harmony between different religions; to develop social capital; to incorporate the original value; and to take great pride in spiritual, moral and ethical development.

(7) “To realize an Indonesia that assumes an affirmative role on the international stage” means to expand diplomacy in order to win national interest; to remain committed to international and regional integration and identity building; and to promote collaboration bilaterally and inter-regionally between people in different countries, and between organizations in various fields.

### 2.3.2 MOT Strategic Plan 2004-2009

This plan was drawn up as a guideline to execute the 2004-2009 National Mid-term Development Program (RP JMN). In order to support the achievement of the commercial development target which government decides, this plan shall be a reference of the local autonomy, which would draw-up strategic planning in the district.

This plan consists of various sections, such as the purpose of the plan, target items, operational strategy, etc. The quantitative part of commercial development target from 2005 to 2009 is shown Table 2.3.2-1.

**Table 2.3.2-1 Quantitative Part of Commercial Development Target from 2005 to 2009**

| No | Items | Target 2005－2009 |
|---|---|---|
| 1 | Ratio of the commercial field in GDP | 15% |
| 2 | Growth rate of commercial field | 7.5~8.9% |
| 3 | Growth rate of export | 5.7~10.1% |
| 4 | Growth rate of non oil and gas export | 5.5~8.7% |
| 5 | Growth rate of import | 8.6~11.0% |
| 6 | Growth rate of non oil and gas import | 8.2~11.9% |
| 7 | Inflation rate | 7~3% |

Source: MOT

To strengthen the consumer protective system, the legal metrology system, the wholesome competition system, and the other commercial systems, this plan indicates the following operational policies:

(a) Improving information service and defense activity for the consumer protective policy, especially in the medical and food fields, in order to raise consumer consciousness about the importance of the commodity's standard and its service
(b) Enlarging the effect of the commercial information network, both center and district
(c) Strengthening the supervision and the conducting in the commercial field with regard to the business, the system, and the merger
(d) Promoting the business cooperation between supermarket and small-scale enterprise (Supplier)
(e) Strengthening the small and medium-sized business by staff development, access to the market, and business cooperation
(f) Strengthening the supervision system of goods and services by improving the effect of consumer protection and appraisal disciplined execution
(g) Strengthening execution of the monitoring system for goods with regard to circulate safety and health, public order, environment (K31), and the service which has the possibility of swindling
(h) Promoting the technical instruction and dissemination for metrological standard, management of verification offices, supervision of length, weight, volume, pre-packing goods, and measuring instruments
(i) Strengthening the system of legal metrology in Indonesia
(j) Enacting the qualification standard of service professionalism in the commercial field

Appendix 2.3.2 presents the detailed explanation of MOT strategic plan 2004-2009.

# Chapter 3

# Industrial Analysis and Legal Metrology

# Chapter 3 Industrial Analysis and Legal Metrology

## 3.1 Industrial Analysis by Region

The objective of the survey in this chapter is to grasp the situation of local industry and analyze the needs of legal metrology in the region. The JICA study team carried out the interview survey with questionnaires to provincial governments for industrial analysis by region. The study team also collected published materials related to economic planning and statistical data for analysis.

### 3.1.1 Summary of Industrial Analysis by Region

Local industries including agriculture/fishery and related manufacturers, food industry, and mining and quarrying are considered active by using natural resources available locally. Table 3.1.1-1 shows the summary of industrial analysis by province based on the interview survey.

Provincial governments have projects to develop industrial parks, plantation areas, etc., and to improve airports, harbors and roads to support industrial development in the region. Types of promising industrial sub-sectors for the next five years include stores, taxi companies, filling stations, transportation companies and manufacturers which use various measuring instruments. Therefore, the development of legal metrology systems in regions is important not only for protecting consumers but also for providing quality services to consumers.

**1) Agriculture, food industry, etc.**

- Primary food products are rice, peanuts, soybeans, green beans, cassava, and corn.
- Primary plantation products are natural rubber, palm oil (CPO: crude palm oil), cocoa, coconut, cigars and coffee, most of which are for export to various countries.
- Recently, palm oil has attracted attention as a raw material for producing a fuel substitute used in diesel engines.
- Gardening products recently have become goods for exports

**Table 3.1.1-1 Summary of Industrial Analysis by Province**

| Name of Province and Capital City | Land area and Population of Province<br>(1) Land area<br>(2) Population | Main Industries in Province | GRDP i<br>(a) GRDP at current price<br>(b) GRDP growth rate at constant 1993<br>(c) GRDP per person | Needs of legal metrology (Kind of users/manufactures, which will increase in the next 5 years.) |
|---|---|---|---|---|
| North Sulawesi, Manado | (1) 13,930 $Km^2$<br>(2) 2.2 million | Processing industry: oil plant, LNG<br>Agricultural industry: food, farming, stockbreeding, foresting, fishery | (a) 15,690 billion Rp (2004)<br>(b)<br>(c) 6,958 million Rp/Person | Taxi companies, filling stations, transportation, stores |
| South Sulawesi, Makassar | (1) 46,116 $Km^2$<br>(2) 7,5 million | Agro industry: rice, cacao, shrimp, seaweed<br>Mining: Nickel | (a) 40,094billion Rp (2003)<br>(b) 4.85% (constant 2000)<br>(c) 5,625 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| Bali, Denpasar | (1) 5,632 $Km^2$<br>(2) 3.2 million | Agro & fishery industry: cocoa, coffee, vanilla, tuna, shark fin, seaweed. hand crafts, Tourism. | (a) 28,986 billion Rp (2004)<br>(b) 3.65% (2003 to 1993)<br>(c) 8,154 million Rp/Person | Taxi companies, filling stations, transportation, stores |
| Riau, Pekanbaru | (1) 56,813 $Km^2$<br>(2) 3.8 million | Oil industry<br>Paper industry<br>Palm oil industry | (a) 114,189 billion Rp (2004)<br>(b) 4.7% (2003 to 1993)<br>(c) 30,410 million Rp/Person | Taxi companies, filling stations, transportation, stores |
| West Sumatra, Padang | (1) 42,200 $Km^2$<br>(2) 4.5 million | Foods and drinks, woods, textile, rubber and its products. | (a) 37,161billion Rp (2004)<br>(b) 4.48% (2003 to 1993)<br>(c) 8,097 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufactures |
| North Sumatra, Medan | (1) 71,680 $Km^2$<br>(2) 12.3 million | Petroleum, coal, plastic, rubber,<br>Manufacturing industry: food, beverages, textile, wood, etc. | (a) 114,647 billion Rp (2004)<br>(b) 4.42% (2003 to 1993)<br>(c) 9,712 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| South Kalimantan, Banjarmasin | (1) 37,530 $Km^2$<br>(2) 3.2 million | Metal, coal, machinery, electronics, chemicals, agro and forest products | (a) 24,504 billion Rp (2004)<br>(b) 4.85% (2003 to 1993)<br>(c) 7,769 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| East Java, Surabaya | (1) 46,689 $Km^2$<br>(2) 34.5 million | Wholesales, retail trade, agriculture, financial, transportation, construction | (a) 292,322 billion Rp (2004)<br>(b) 4.11% (2003 to 1993)<br>(c) 8,013million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |
| D.I.Yogjakarta, Yogjakarta | (1) 3,186 $Km^2$<br>(2) 3 million | Plastics, wood, bamboo, rattan<br>metal, stone, silver, brass, copper, ceramics | (a) 21,849 billon Rp (2004)<br>(b) 4.09% (2003 to 1993)<br>(c) 6,634 million Rp/Person | Taxi companies, filling stations, transportation, stores, manufacturers |

**2) Fishery**

The fish farming industry is well-developed for exporting black tigers, etc. Natural fish and marine products, such as seaweeds, also show promise for export.

**3) Mining and quarrying**

There is a variety of mineral deposits, including coal, iron ore, gold, tin, zinc, copper, etc. Most of these resources have not been fully explored, therefore large potential exists in this sector.

**4) Industrial parks**

To activate local industry, most provincial governments develop industrial parks in which they try to establish manufacturing facilities, warehouses, etc. However, companies coming to the parks are too few to fill most of the parks. There are several reasons for it as follows:

- Most industrial parks are located far from the market. Long distance to the market tends to make transportation difficult.
- Infrastructures (electricity, water, sewage) as well as access to the parks are poor.
- There are no powerful supporting companies (subcontractors) around the parks. Manufacturers need many parts to be assembled and most parts usually are supplied by neighboring subcontractors.
- There is no attractive treatment to enter the industrial parks.
- It seems better to invite enterprises that process natural resources taken from neighborhoods, such as palm oil, corn margarine factories, and fish or fruit canneries.

**5) Airport and harbors**

- Provinces visited by the JICA study team have their own airports and harbors. The provincial governments maintain and try to level-up the facilities, however conditions do not meet international requirements except in some provinces.

**6) Tourism**

- Most provinces have a potential for tourism with beautiful beaches, rivers, lakes, mountains/hills, etc., where hotels and restaurants are developed.
- Moreover, tourism helps many small enterprises that make souvenirs such as handcrafts, batiks, and carvings.
- Both local and international tourists are projected optimistically.

**7) Shopping malls**

- Cities visited by the JICA study team either currently have shopping malls or are currently building them. Private consumption seems good in these cities.

**8) Supply of electricity**

- Most provincial governments replied that they have enough capacity to generate electricity for the current demand. However, the capacity seems insufficient, considering the projected increase in demand from future industrial development.

**9) Comparison of GRDP per province and GRDP per capita**

Table 3.1.1-2 shows the Gross Regional Domestic Product (GRDP) at current market price.

- Ten provinces in which the interview survey was carried out are rather rich provinces, as shown in the table.
- The GRDP in 2004 is Rp63,733 billion (US$6.93 billion) on average for 31 provinces, while the GRDP of ten provinces is Rp101,904 billion (US$11.1 billion) on average, which is 1.6 times larger than the total average value.
- Concerning GRDP/capita, the average of 31 provinces is 9.1 million Rp (US$989)/capita, while the ten province average is 11.8 million Rp (US$1,283)/capita, an amount 1.3 times larger than the total average value.
- Many provinces report GRDP/capita as small as Rp5,000,000 (US$543) or below. The alleviation of poverty is a real issue for the governments.

Appendix 3.1.1 describes the details of the industrial analysis for ten provinces.

**Table 3.1.1-2 Gross Regional Domestic Product at Current Market Price (2004) by Province**

| No | Province | Population | GRDP including Oil and Gas | | GRDP without Oil and Gas | |
|---|---|---|---|---|---|---|
| | | thousand | GRDP (2004) million Rupia | GRDP/capita 1,000 Rupia | GRDP (2004) million Rupia | GRDP/capita 1,000 Rupia |
| 1 | Nanggroe Aceh Darussalam | 4,089 | 41,901,536 | 10,247 | 24,488,735 | 5,989 |
| 2 | Sumatera Uttara (North) | 12,123 | 117,744,372 | 9,712 | 116,658,483 | 9,623 |
| 3 | Sumatera Barat (West) | 4,535 | 36,718,374 | 8,097 | 36,718,374 | 8,097 |
| 4 | Riau | 3,755 | 114,188,642 | 30,410 | 64,470,144 | 17,169 |
| 5 | Kepulauan Riau | 1,193 | 35,586,621 | 29,830 | 32,464,229 | 27,212 |
| 6 | Jambi | 2,625 | 17,939,862 | 6,834 | 15,394,626 | 5,865 |
| 7 | Sumatera Selatan (South) | 6,628 | 64,617,530 | 9,749 | 46,975,266 | 7,087 |
| 8 | Kep Bangka Belitung | 1,024 | 9,140,820 | 8,927 | 9,140,820 | 8,927 |
| 9 | Bengkulu | 1,549 | 7,638,363 | 4,931 | 7,638,363 | 4,931 |
| 10 | Lampung | 7,064 | 36,199,936 | 5,125 | 35,056,857 | 4,963 |
| | **Sumatera** | **44,585** | **481,676,056** | **10,804** | **389,005,897** | **8,725** |
| 11 | DKI Jakarta | 8,750 | 321,818,041 | 36,779 | 320,483,971 | 36,627 |
| 12 | Jawa Barat | 38,611 | 283,339,172 | 7,338 | 260,126,534 | 6,737 |
| 13 | Banten | 9,129 | 71,971,508 | 7,884 | 71,971,508 | 7,884 |
| 14 | Jawa Tengah | 32,543 | 186,530,238 | 5,732 | 163,889,258 | 5,036 |
| 15 | DI Yogyakarta | 3,223 | 21,382,187 | 6,634 | 21,382,187 | 6,634 |
| 16 | Jawa Timur | 36,482 | 292,322,590 | 8,013 | 291,941,402 | 8,002 |
| | **Java** | **128,738** | **1,177,363,736** | **9,145** | **1,129,794,860** | **8,776** |
| 17 | Bali | 3,397 | 27,697,767 | 8,154 | 27,697,767 | 8,154 |
| 18 | Nusa Tenggara Barat | 4,084 | 23,022,069 | 5,637 | 23,022,069 | 5,637 |
| 19 | Nusa Tenggara Timur | 4,156 | 10,884,788 | 2,619 | 10,884,788 | 2,619 |
| | **Bali,Nusa Tenggara** | **11,637** | **61,604,624** | **5,294** | **61,604,624** | **5,294** |
| 20 | Kalimantan Barat | 4,033 | 28,960,210 | 7,181 | 28,960,210 | 7,181 |
| 21 | Kalimantan Tegah | 1,870 | 18,708,249 | 10,004 | 18,708,249 | 10,004 |
| 22 | Kalimantan Selatan(South) | 3,227 | 25,071,114 | 7,769 | 24,505,937 | 7,594 |
| 23 | Kalimantan Timur(East) | 2,766 | 127,115,037 | 45,956 | 52,211,964 | 18,876 |
| | **Kalimantan** | **11,896** | **199,854,610** | **16,800** | **124,386,360** | **10,456** |
| 24 | Sulawesi Utara(North) | 2,159 | 15,022,723 | 6,958 | 14,961,647 | 6,930 |
| 25 | Gorontalo | 897 | 2,793,383 | 3,114 | 2,791,390 | 3,112 |
| 26 | Sulawesi Tengah(Center) | 2,253 | 14,019,955 | 6,223 | 14,019,955 | 6,223 |
| 27 | Sulawesi Selatan(South) | 8,369 | 47,073,097 | 5,625 | 46,916,539 | 5,606 |
| 28 | Sulawesi Tenggara | 1,923 | 10,231,273 | 5,320 | 10,231,273 | 5,320 |
| | **Sulawesi** | **15,601** | **89,140,431** | **5,714** | **88,920,804** | **5,700** |
| 29 | Maluku | 1,244 | 3,952,714 | 3,177 | 3,952,714 | 3,177 |
| 30 | Maluku Utara | 873 | 2,177,168 | 2,494 | 2,177,168 | 2,494 |
| 31 | Papua | 2,516 | 32,848,386 | 13,056 | 31,637,122 | 12,574 |
| | **Maluku & Papua** | **4,633** | **38,978,268** | **8,413** | **37,767,004** | **4,489** |
| | **Total** | **217,090** | **1,975,732,600** | **9,101** | **1,759,805,688** | **8,106** |

Source: BPS 2005

### 3.2 Sector Analysis related to Legal Metrology

The objective of the sector analysis is to grasp the business trend and prospects of the sectors related to legal metrology and investigate the needs of legal metrology in these sectors. Legal metrology is related to various sectors which use legally controlled measuring instruments. Sectors or sub-sectors for the analysis in this section are as follows:

- Electricity sector for watt-hour meters
- Water supply sub-sector for water meters
- City gas and LPG supply sub-sector for gas meters and LPG gas meters
- Gasoline supply sub-sector for fuel dispensers and tank trucks
- Taxi sub-sector for taxi meters
- Agriculture, fishery and food sector for weighing instruments, scales, volume instruments

#### 3.2.1 Electricity for Watt-hour Meters

**1) Electricity supply**

Table 3.2.1-1 shows the installed capacity and electricity production.

**Table 3.2.1-1 Installed Capacity and Electricity Production**

| Description | Unit | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|
| Installed capacity | MW | 20,850 | 21,052 | 21,113 | 21,206 | 21,722 |
| Electricity produced | 000MWh | 92,821 | 101,630 | 108,360 | 113,020 | 131,878 |
| Value of gross output | Million Rp | 22,476,512 | 28,601,782 | 40,246,040 | 50,151,894 | 62,495,900 |

Source: Statistik Indonesia 2004

- PLN (Perusahaan Listrik Negara) is the major power company in Indonesia. The supply area covers almost the whole country. PLN was established as a governmental enterprise in 1964 then later privatized in 1994.
- The total installed capacity was 21,722 MW in 2004.
- The total energy produced was 131.9 TWh in 2004, including electricity purchased from independent power producers (25 TWh). Some 33% of the energy is generated by coal-fired power plants, 18% by gas-fired power plants, 36% by oil-fired power plants, 10% by hydro power plants and 3% by geothermal power plants.

**2) Number of electricity customers (PLN customer)**

Table 3.2.1-2 shows the number of PLN customers by type of customers.

**Table 3.2.1-2 Number of PLN Customers by Type of Customers**

| Group | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| Household | 25,834,618 | 26,796,675 | 27,905,482 | 28,903,325 | 29,997,554 |
| Business | 985,620 | 1,062,955 | 1,177,012 | 1,245,709 | 1,310,651 |
| Industry | 42,514 | 44,337 | 46,021 | 46,824 | 46,818 |
| Social Institution | 559,950 | 582,811 | 608,993 | 633,114 | 659,034 |
| Public | 106,186 | 108,627 | 115,369 | 124,927 | 137,324 |
| Total | 27,528,888 | 28,595,405 | 29,852,877 | 30,953,899 | 32,151,381 |

Source: Statistik Listrik PLN 1999-2003

- The number of PLN customers during 1999-2003 steadily increased in line with the increase of demand. The total number of customers increased from 27.5 million in 1999 to 32.2 million in 2003, which shows an average annual increase of 4.0%. The household is the largest customer group, accounting for around 93% of total customers.
- All groups of customers increase every year. Household customers were 25.8 million and 29.9 million in 1999 and 2003, respectively, showing an annual increase of 3.8% on average. The business group customers show an average growth rate of 7.4% from 985 thousand customers in 1999 to 1.31 million customers in 2003. The industrial group customers increased from 42 thousand in 1999 to 47 thousand in 2003, showing 2.9% increase annually on average. The number of other customer group (public and social institution) increased from 666 thousand of customers in 1999 to 796 thousand in 2003 with annual increase rate of 4. 6%.

Table 3.2.1-3 shows the comparison of numbers of all households and PLN household customers.

**Table 3.2.1-3 Number of All Households and PLN Customers**

Unit: thousand

| Description | 2000 | 2003 | 2004 |
|---|---|---|---|
| Number of households in Indonesia | 52,008 | n.a. | 54,898 |
| Number of PLN household customers | 28,595 | 32,151 | n.a. |

Source: Statistik Listrik PLN 1999-2003, Statistik Indonesia 2004

- The number of households in Indonesia is 54.9 million in 2004, while the number of PLN household customers is 30.0 million. Assuming that PLN can cover all households as a service area, the difference of over 20 million of households has not yet received electric

service. There is huge number of customers waiting for the supply of electricity.

- The electrification ratio is expected to increase to 76.7 % and new customers will increase by 10 million in the next five years.

**3) Demand of electricity**

- The biggest electricity demand came from industrial use (40.4%), followed by residential use (38.7%).
- The average growth rate of electricity demand is about 10% per year. The growth rate of demand doesn't show a real growth rate. The electricity demand is restricted by the supply capability of electricity which relies on electric company's generating capacity. PLN cannot supply full demand of electricity in the country at present.

**4) Development plan against increasing of electricity demand**

- PLN planned to develop a Java-Sumatra interconnection submarine electric cable, expected to be completed by 2007. The development of two for 200 MW circuit each for 50 km submarine interconnection transmission line will cost US$170 million. With this line, it will solve the power crisis in Java-Bali by getting additional power supply from South Sumatra. The South Sumatra provincial government will have 3,400 MW installed power capacity by 2009 from PLTU Musi, PLTA Tarahan, PLTU Banjarsari and others.
- During the period 2004-2020, electricity demand will double, reaching 350.3 TWh which corresponds to 225 million BOE (barrel oil equivalent), 75% of which will be fueled by coal and natural gas.
- By the year of 2020, new power plants with 60,000 MW will be needed to support the economic growth and social needs. The projected cost is approximately US$35,000 million.

**5) Needs of watt-hour meters**

In order to cope with the increase in demand for electricity, PLN plans to expand its power generating capacity. It means the increase of PLN customers, leading to more demand for watt-hour meters.

### 3.2.2 Water Supply through Water Meters

**1) Water supply condition**

Table 3.2.2-1 shows the growth of water supply establishments.

**Table 3.2.2-1 Growth of Water Supply Establishments**

| Description | Unit | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|
| Number of establishments | | 457 | 454 | 469 | 477 | 485 |
| Quantity of tap water run to customers | 1,000 $m^3$ | 1,899 | 1,835 | 2,095 | 2,328 | 2,586 |
| Value of gross output | Million Rp | 1,891,604 | 2,323,006 | 3,900,975 | 5,660,192 | 6,653,980 |

Source: Statistik Indonesia 2004

- The number of water supply establishments in Indonesia was 485 in 2004.
- Quantity of tap water run to customers was 2,586,000 $m^3$ in 2004 while 1,899,000$m^3$ in 2000, which shows an increase of 36% over four years.

**2) Number of water supply customers**

Table 3.2.2-2 shows the number of customers by group.

- Customers have increased steadily in 1998-2002 in line with the desire of consumers to get clean tap water.
- Total number of customers was 4.6 million in 1998 and 6.4 million in 2002 with increase of 8.5% per year.
- Non-commercial (including household and institutions) customers are the largest group of customers. In 2002, the number of non commercial customer group increased to 5.9 million or 91.4% of the total. The other type of customers increased by 0.55 million or 8.5% of the total.

**Table 3.2.2-2 Number of Customers by Group**

| | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|
| Social group | 103,190 | 104,385 | 118,660 | 116,477 | 149,841 |
| Non commercial | 4,232,643 | 4,464,979 | 4,800,222 | 5,135,848 | 5,884,828 |
| Commercial and industries | 299,392 | 314,409 | 306,188 | 307,668 | 394,735 |
| Special group | 7,760 | 5,874 | 2,658 | 7,620 | 4,467 |
| Total | 4,642,985 | 4,889,647 | 5.227,728 | 5,567,613 | 6,433,871 |

Source: Statistik Air Bersili 1998-2002

**3) Demand of tap water**

Table 3.2.2-3 shows the comparison of numbers of households and water supply customers.

- The average growth rate of water supply demand is about 10% per year. There is still huge demand for tap water.
- The number of households in Indonesia is 54.9 million in 2004, while the number of

household customers is 6.4 million in 2003, remaining more than 48 million of households without tap water supply.

**Table 3.2.2-3 Comparison of Numbers of Households and Customers**

Unit: 1000

| Description | 2000 | 2003 | 2004 |
|---|---|---|---|
| Number of households | 52,008 | - | 54,898 |
| Number of customers | 5,228 | 6,434 | - |

Source: Statistik Air Bersili 1998-2002, Statistik Indonesia 2004

**4) Needs for water meters**

In order to cope with the increase of the demand for water supply, many water supply organizations plan the expansion of their supply capacities. It means the increase of customers, leading to more demand for water meters.

### 3.2.3 City Gas and LPG for Gas meter

**1) City Gas supply condition**

Table 3.2.3-1 shows the growth of the state gas company.

- The city gas and LPG suppliers consist of 7 establishments. The major supplier is PT. PGN (Persero: State owned gas company).
- The volume of gas distributed to customers through pipeline increased significantly.
- Gas produced increased from 1,986 million $m^3$ in 2000 to 3,859 million $m^3$ in 2004, with the increase of 94.2% for four years.

**Table 3.2.3-1 Growth of State Gas Company**

| Description | Unit | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|
| Number of establishments | | 7 | 7 | 7 | 7 | 7 |
| Gas produced | 000 $m^3$ | 1,986,257 | 2,116,524 | 2,458,017 | 3,372,739 | 3,858,851 |
| Value of gross output | Million Rp | 1,727,746 | 2,159,353 | 2,715,000 | 3,413,627 | 4,763,387 |

Source: Statistik Indonesia 2004

**2) City gas customers**

Table 3.2.3-2 shows the number of city gas customers by type.

- The number of city gas customers increased at an annual growth rate of 13.6% on average. The number of customers was 40,106 in 1999; and it increased to 66,869 in 2003.
- Among various types of customers, the household customers are outstanding in number, which share over 95%. In 1999, the household customers were 38,587 or 96 % of the

total. In 2003, they grew to 64,889 or 97 % of the total.

**Table 3.2.3-2 Number of City Gas Customers by Type**

| Group | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| Household | 38,587 | 42,991 | 48,401 | 51,943 | 64,889 |
| Industry | 565 | 594 | 626 | 646 | 675 |
| Hotel | 127 | 76 | 71 | 70 | 69 |
| Supermarket | 348 | 98 | 119 | 124 | 122 |
| Hospital | 111 | 83 | 97 | 88 | 86 |
| Offices | 248 | 213 | 205 | 212 | 208 |
| Dorm | - | 16 | 13 | 45 | 44 |
| Bakery | | 37 | | | |
| Dispensary | | 9 | | | |
| Restaurant | | 365 | 421 | 534 | 524 |
| Others | 120 | 156 | 231 | 257 | 252 |
| Total | 40,106 | 44,638 | 50,184 | 53,919 | 66,869 |

Source: Statistik Gas Kota 1999-2003

**3) LPG gas supply**

- PT. PGN (Persero) also sells LPG in cylinder. The quantity of LPG sold has continuously decreased since 1999-2000. LPG sold was 4,675 thousand kg in 1999, and it became 2,132 thousand kg in 2003, showing a decrease of 17.8 % per year on average.

**4) LPG gas customers**

Table 3.2.3-3 shows the number of LPG customers with cylinder supply.

- The number of customers of LPG has continuously decreased with an average rate of 13.3% per year.
- There were 14,297 customers in 1999, whereas they decreased to 8,069 in 1999.

**Table 3.2.3-3 Number of LPG Customers with Cylinder Supply**

| | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| Total | 14,297 | 14,283 | 14,276 | 13,431 | 8,069 |

Source: Statistik Gas Kota 1999-2003

**5) Needs of gas meters**

City gas supply is supported by the high demand of customers. Therefore, the needs of gas meters are prospective.

### 3.2.4 Refinery Fuels for Fuel Dispensers and Tank Trucks

**1) Production of oil fuels at oil refineries**

- Table 3.2.4-1 shows the installed capacity of oil refinery plants. At present, Indonesia has nine oil refineries, with a total installed capacity of 1.1 million barrel per day (bpd). The larger refineries are in Cilacap (Central Java) with capacity of 348,000 bpd; in Balikpapan (Kalimantan), 260,000 bpd; and in Balongan (Kalimantan), 125,000 bpd. However, since the growth of the installed capacity of the refineries is slower compared to the increasing domestic fuel consumption, the import of oil fuels has increased.
- Table 3.2.4-2 shows the import of oil fuels. The import figure in 2003 (up to August) was about 130 million barrel or US$3.3 billion, whereas the import volume in 2000 was smaller: 87 million barrel or US$2.9 billion.
- Table 3.2.4-3 shows the oil fuel products. The petroleum products produced were 279 million barrel in 2002 and 277 million barrel in 2000.

**Table 3.2.4-1 Installed Capacity of Oil Refinery Plants**

Unit: bpd

| Refinery plant | Location | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| Pangkalan Brandan | Sulawesi | 5,000 | 5,000 | 5,000 | 5,000 |
| Dumai | Sumatra | 120,000 | 120,000 | 120,000 | 120,000 |
| Sungal Pakning | Sumatra | 50,000 | 50,000 | 50,000 | 50,000 |
| Musl | Bali | 135,200 | 135,200 | 135,200 | 135,200 |
| Cllacap | Central Java | 348,000 | 348,000 | 348,000 | 348,000 |
| Balkpapan | Kalimantan | 260,000 | 260,000 | 260,000 | 260,000 |
| Cepu | Java | 3,800 | 3,800 | 3,800 | 3,800 |
| Exor-1 Balongan | East Java | 125,000 | 125,000 | 125,000 | 125,000 |
| Kasim | Sulawesi | 10,000 | 10,000 | 10,000 | 10,000 |
| Total | | 1,057,000 | 1,105,500 | 1,105,500 | 1,105,500 |

Source: Indonesia Energy Outlook and Statistics 2004

**Table 3.2.4-2 Import of Oil Fuels**

| Unit | 1999 | 2000 | 2001 | 2002 | 2003(JAN-AUG) |
|---|---|---|---|---|---|
| Thousand Barrel | 79,902 | 87,001 | 89,622 | 106,927 | 130,086 |
| Million US$ | 1,856 | 2,890 | 2,577 | n.a | 3,345 |

Source: Indonesia Energy Outlook and Statistics 2004

**Table 3.2.4-3 Oil Fuel Products**

Unit: Barrel

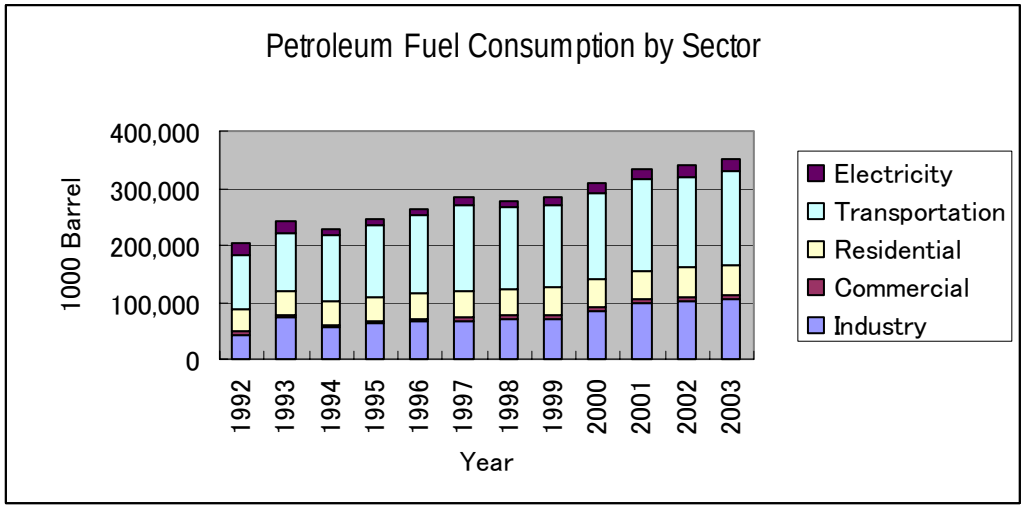
| Products | 1999 | 2000 | 2001 | 2002 | 2003(JAN-AUG) |
|---|---|---|---|---|---|
| JP-5 | 310,764 | 5,534 | 0 | 0 | 0 |
| Avgas | 71,609 | 7,218 | 51,818 | 32,813 | 18,111 |
| Avtur | 6,046,181 | 8,441,208 | 8,619,872 | 9,319,353 | 6,565,278 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Kerosene | | 58,491,500 | 57,896,547 | 58,011,890 | 56,300,795 | 39,099,860 |
| ADD/HSD | | 91,874,329 | 95,902,497 | 95,928,983 | 93,985,305 | 63,232,424 |
| Diesel/IDO/MDF | | 8,129 | 8,140,418 | 9,108,936 | 8,430,642 | 4,974,473 |
| Fuel/DCO/IFO/MFO | | 27,155,554 | 32,481,522 | 35,087,147 | 37,302,155 | 22,767,454 |
| Motor Gasoline | Premium | 70,976,484 | 70,664,737 | 73,149,813 | 70,708,340 | 46,700,831 |
| | Super TT | 236,682 | 331,861 | 522,113 | 480,958 | 335,098 |
| | Premix 94 | 2,443,624 | 2,252,408 | 2,491,224 | 2,098,492 | 1,677,543 |
| | premium2L | 701,009 | 618,090 | 437,558 | 0 | 0 |
| | Sub Total | 74,357,799 | 73,867,096 | 76,600,708 | 73,287,790 | 74,357,799 |
| Grand Total | | 166,437,731 | 276,696,536 | 283,409,354 | 278,658,853 | 185,371,072 |

Source: Indonesia Energy Outlook and Statistics 2004

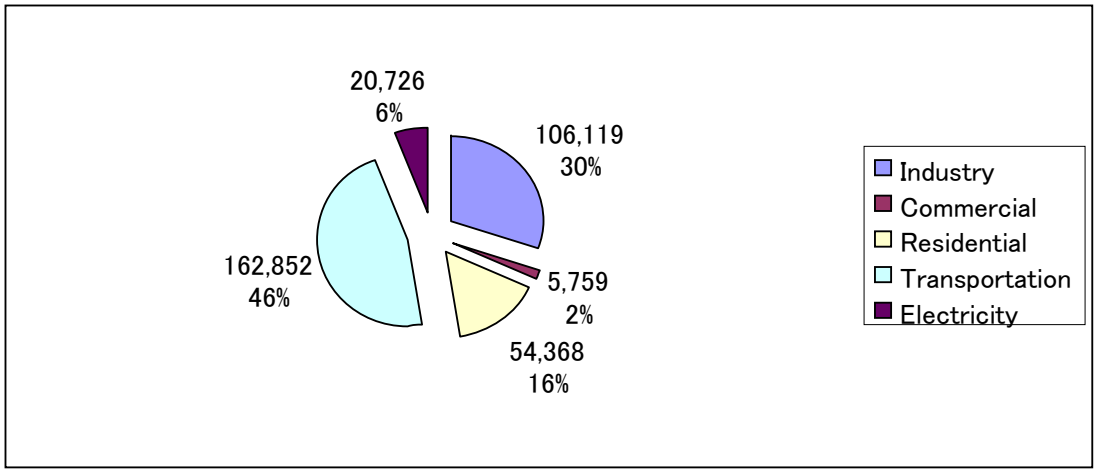
**2) Oil fuel consumption**

- Domestic oil fuel consumption increased to 349 million barrel in 2003 from 307 million barrel in 2000, which accounts for about 65% of total energy consumption.
- Figure 3.2.4-1 shows oil fuel consumption by sector.
- Most domestic fuel consumption is used in transportation (46%), industry (30%), and household (16%) sectors.
- Figure 3.2.4-2 shows the oil fuel consumption by sector in 2003.




Source: Indonesia Energy Outlook and Statistics 2004

**Figure 3.2.4-1 Oil Fuel Consumption by Sector**




Source: Indonesia Energy Outlook and Statistics 2004

**Figure 3.2.4-2 Oil Fuel Consumption by Sector in 2003 (Unit: 1000 Barrel)**

**3) Prospects for oil fuel consumption**

As is well known, the automotive industry is one that will grow rapidly, in line with rising demand of cars. The number of motor vehicles in the country is 6 million cars, and 20 million motorbikes. The population of Indonesia is about 220 million. Favorable prospects are foreseen in this sector.

**4) Needs for fuel dispensers and tank trucks**

Along with the development of automobile industry, the fuel consumption will increase significantly. Therefore, the capacity of filling stations will grow, leading to more needs for fuel dispensers and tank trucks.

### 3.2.5 Taxi Sector

**1) Number of taxis with taxi meters:**

During the site survey, no statistical data was available concerning the number of taxis, number of taxi manufacturers, etc. The results of questionnaire survey to RVOs showed that the number of taxis being verified/re-verified by 24 RVOs in 2005 was 47,375. Based on this figure and considering other big cities not visited by the study team, the number of taxis with taxi meters is estimated at about 100,000.

**2) Taxi fare payment system:**

Most taxi companies did not equip taxis with meters. Passengers must pay taxi fares on a negotiation basis. This payment system sometimes causes trouble between the taxi driver and passengers. As a result, passengers tend to avoid riding in taxis.

**3) Installation of taxi meters:**

Once some taxi companies started providing meters in taxis, passengers began to use taxis once again. Since passengers tended to ignore taxis which did not have meters and take taxis with meters, other taxi companies in Jakarta and other cities rushed into installing the taxi meters.

**4) Needs for taxi meters:**

Therefore, the demand of taxi meters became strongly supported at the requests of passengers.

### 3.2.6 Agriculture/Fishery Sector for Weighing Instruments, Scales and Volume Instruments

**1) Production of food crops:**

Food crops in Indonesia consist of rice, maize, cassava, sweet potatoes, peanuts and soybeans. The production of rice in 2004 was 52.1 million tons. It increased by 3.7% over the production in 2003. The production of corn in 2004 was 11.2 million tons; cassava, 19.4 million tons; sweet potatoes, 1.90 million tons; and soybeans, 0.70 million tons.

**2) Production of vegetables and fruits:**

The horticulture sub-sector includes production of vegetables and fruits. The production of bananas in 2004 was 4.4 million tons; mangoes, 1 million ton; and papaya, 0.6 million ton.

**3) Production of estate crops:**

Estate crops consist of palm (5.67 million ton in 2004), rubber (4.21 million ton), sugar (2.03 million ton), coffee (2.01 million ton), and cacao (1.35 million ton).

**4) GDP of agricultural sector:**

Table 3.2.5-1 shows the Gross Domestic Product by origin. This sector is one of the main sectors in Indonesia, always accounting for 15-16% of total GDP. Although there was not

quick development in this sector, the existing demand is large.

**Table 3.2.5-1 GDP by Origin at Constant 2000 Market Price**

Unit: Million Rp

| Industrial origin | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|
| (1) Farm food crops | 113,020 | 115,926 | 120,139 | 124,579 |
| (2) Non-food crops | 34,845 | 36,586 | 38,192 | 39,920 |
| (3) Livestock and its products | 27,770 | 29,394 | 30,727 | 32,158 |
| (4) Forestry | 17,610 | 17,987 | 18,118 | 18,396 |
| (5) Fishery | 32,441 | 33,082 | 35,900 | 37,900 |
| (7)=(1)+(2)+(3)+(4)+(5) Agriculture, Livestock, Forestry, Fishery | 225,686 | 232,975 | 243,076 | 252,953 |
| (8) Gross Domestic Product | 1,442,985 | 1,506,124 | 1,579,559 | 1,660,579 |
| (9) Ratio of GDP (7)/(8) | 16% | 15% | 15% | 15% |
| Growth rate of GDP at constant 2000 price | 4.08% | 3.23% | 4.34% | 4.06% |

Source; Statistik Indonesia 2004

**5) Needs of weighing instruments etc.:**

This sector produces various kinds of goods and needs many kinds of measuring instruments including weighing instruments, scales and volume instruments. Therefore, the demand for these meters is strongly supported by this sector.

## 3.3 Production and Trade of Legally Controlled Measuring Instruments

### 3.3.1 Trend of Production and Trade

No reliable official data on production and trade of measuring instruments is available in books or records, as no section of the government and/or organizations is responsible for dealing with statistics on legally-controlled measuring instruments, including the number of production and import as well as the number of legally controlled measuring instruments in use. Therefore, the best estimate was made for the production, trade and use of measuring instruments using the information obtained through the interview survey with DOM, RVOs, manufacturers, PLN, water suppliers, etc.

Table 3.3.1-1 shows the estimated number of production and import of legally controlled measuring instruments. Watt-hour meters and water meters are the biggest in number of production and import in total, followed by weighing measuring instrument. A part of water meters are exported.

**Table 3.3.1-1 Estimated Number of Production and Trade of Legally Controlled Measuring Instruments**

| Measuring Instrument | 2005 | | |
|---|---|---|---|
| | Production | Import | Total |
| 1. Measures | | | |
| 1) Length measuring instrument | | | |
| 2) Taxi meter | | 4,000 | 4,000 |
| 3) Moisture meter | | | |
| 4) Watt-hour meter | 950,000 | 5,000 | 1,000,000 |
| 5) Water meter | 240,000 | 360,000 | 600,000 |
| 6) Gas meter | | | |
| 2. Volume measuring instruments | | | |
| 1) Wet can | 110,562 | | 110,562 |
| 2) Dry can | 2,003 | | 2,003 |
| 3) Tank Truck | n.a. | n.a. | 1,500 |
| 4) Fixed storage tank | 55 | | 55 |
| 5) Boat tank | | | |
| 6) Rail tank | | | |
| 7) Standard tank | 4 | | 4 |
| 8) Oil flow meter | | | |
| 9) Working meter | 17 | 376 | 393 |
| 10) Fuel dispenser | | 3,300 | 3,300 |
| 3. Weighing instrument | | | |
| 1) Non-electronic weighing | 250,000 | | 250,000 |
| 2) Electronic weighing | 708 | 6,154 | 6,862 |
| 3) Conveyor belt scale | | | |
| 4) Hopper scale | | | |
| 5) Truck scale | 45 | | 45 |
| 4. Accessories | | | |
| 1) Weight set: F1, F2 | 56,332 | | 56,332 |
| 2) Weight set: M1, M2, M3 | 5,575 | | 5,575 |

Source: DOM, RVOs, manufacturers, PLN, water suppliers, etc.
Note: Blank cells mean data not available.

### 3.3.2 Suppliers and Market Demand

#### 1) Watt-hour meters

- The demand of watt-hour meters in Indonesia is one million units per year. There are six major manufacturers of watt-hour meters.
- PLN is the major customer. Therefore, the production of watt-hour meters depends on PLN's plan to develop electricity networks.
- Table 3.3.2-1 shows major Indonesian watt-hour meter manufacturers.

**Table 3.3.2-1 Major Indonesian Watt-hour Meter Manufacturers**

| Name | Established | Paid Up Capital | Shareholders | Estimated Share | Production Capacity (1000 units/year) |
|---|---|---|---|---|---|
| METBELOSA | 1982.2 | US$5 million | OSAKIDENKI 79.5%<br>PT.KRAKATAU 15.0%<br>KANEMATSU 5.5% | 40% | Single Phase: 1,000<br>3 Phase: 95 |
| FUJIDHARMA | 1982.8 | US$1.5 million | PT.DHARM 50%<br>FUJIDENKI 30%<br>SUMITOMO 20% | 20% | Single Phase: 800<br>3-Phase: 30 |
| MELCOINDA | 1982.6 | Rp10 billion | Mitsubishi 19%<br>Setsuyou 15%<br>PT.SAHABAT 66% | 20% | Single Phase: 1,000<br>3-Phase:<br>no production |
| MECOINDO | 1984.1 | US$4.8 million | AKTARIS 95%<br>PT BERCA 5% | Less than 20% | Single Phase: 3,000<br>3-Phase: 60 |
| ILATO METER(PADI) | 1994 | Rp4.5 billion | n.a | | Single Phase: 600 |
| LIMAPUTRA | 1994.6 | Rp6 billion | Eddy Daryanto 84%<br>Luisedy Ronal 8%<br>Sukamto 8% | | Single Phase: 1,000<br>3-Phase: 30 |

Source: Private watt-hour meter manufacturers

**2) Water meters**

- The demand of water meters in Indonesia is about 1 million units per year. About 60% of the demand is estimated to be supplied by importation, mainly from China.
- There are several domestic manufacturers, some of which assemble water meters using parts of their own make, and some only assemble water meters using Chinese parts.
- Conformity to international standards and improvement of durability are still subject to the domestic manufacturers.
- The outline of major Indonesian manufacturers are as follows:

(1)BARINDO (Surabaya)

- Established in 1974
- Capital US$5 million
- Main product: Water meters (Class A-C), Shut off valves
- Technical collaborations for water meter: France and Swiss companies
- Number of production: 150,000-200,000 unit per year, of which 25% is exported to Vietnam, Malaysia and Thailand

(2)LINK FLOW (Bandung)

- Established in 1991
- Main product: Water meters (0.5, 3/4, 1 inch)
- Technical collaborations: No (Own designing)
- Number of production: 124,000 Units per year

- Import of water meters are mainly through ports of Jakarta, Medan and Surabaya from China, Taiwan, South-Korea, Germany etc.
- It is said that the type approval testing and initial verification are not well conducted for some imported water meters, resulting in inferior water meters sold in the market.

**3) Taxi meters**

- Taxi-meters are imported mainly from Europe, Taiwan, and South Korea. At present, there is no domestic manufacturer.
- Traders supply taxi-meters to taxi companies with installation, taxi fare adjustment, etc. Traders also conduct after sales service of taxi-meters.
- There are eight traders, of which the following three companies are major traders:
    a) METRO-COM (Jakarta): Import agency of TRON (Spain)
    b) PARABA (Jakarta)
    c) MINITAX (Jakarta)

### 3.3.3 Necessity of Keeping Records and Reporting to Organizations Concerned

The JICA study team experienced difficulty in collecting necessary data and information on measuring instruments, including annual production and trade of measuring instruments and number of legally controlled measuring instruments in use, which should be collected periodically. In addition, DOM does not know the actual situation of RVOs in figure. RVOs do not know how many weighing instruments in use in their covering areas. Without these data, it is difficult to properly plan and manage the legal metrology in the country.

It is recommended to design and establish a system for keeping records and reporting to organizations concerned, including DOM and provincial governments.

# Chapter 4

# Questionnaire Survey to RVOs and Needs Analysis

# Chapter 4 Questionnaire Survey to RVOs and Needs Analysis

## 4.1 Questionnaire Survey to Regional Verification Offices

Fifty-four RVOs were surveyed about their legal metrology operations, etc. Survey replies were analyzed to give input into the master plan. The following are the major items to be asked:

- Outline of RVO
- Verification/re-verification
- Technology and manual
- Human resources development
- Budget
- Relationship with DOM
- Dissemination and PR
- LMS (Legal Metrology Standardization) Center
- Expansion of RVOs
- Land area of RVOs and building
- Equipment, measuring instruments and secondary standards
- Ambient conditions and utilities

### 4.1.1 Major Findings from the Questionnaire Survey

DOM sent the survey to 54 RVOs, and 33 RVOs replied (ratio of responses: 60%). The following are the major findings as well as issues to be examined further (Following description is not in the order of questions.):

**1) Scale of RVOs:**

RVOs cover relatively wide areas with limited staffs as follows:

- Average number of staffs: 32 persons
- Average service area: 51,000km$^2$
- Average population in service area: 5.1 million persons
- Average income: Rp 200 million (US$22,000)/year
- Average cost: Rp 648 million (US$70,000)/year excluding salary of staffs

**2) Change of duties after decentralization:**

RVOs stop monitoring the use of measuring instruments as follows:

- Major deleted functions are authority for monitoring.
- Major deleted responsibilities are closing of monitoring and guidance sections.

**3) Implementation of verification/re-verification:**

Twenty-seven percent of RVOs replied 'No' for conducting verification/re-verification. Meanwhile, the ratio of achievement of re-verification is 50-80%. Judging from this finding, the activities of RVOs are deteriorated after decentralization.

**4) Defective rates in re-verification in 2005:**

Defective rate of weighing instruments is 9.9%; taxi meters, 6%; fuel dispensers, 10.7%; and watt-hour meters, 14.3%. These highly defective rates show the necessity of re-verification at 100% for measuring instruments subject to re-verification.

**5) Reporting to DOM:**

Twenty-eight percent of RVOs replied 'No.' It is necessary to design a system for RVOs to report DOM for their activities etc. without exception. It is also necessary for DOM to prepare a format so that RVOs can report DOM easily and DOM can get the same kind of information from RVOs.

**6) Estimation of increase of measuring instruments:**

Increase rates of measuring instruments in 2010 (2005=100) is estimated 148; weight, 135; taxi meters, 138; fuel dispensers, 131; watt-hour meters, 164; gas meters, 143 and water meters, 253. These findings show that the measures how to properly implement verification/re-verification of water meter and watt-hour meter should be investigated urgently.

**7) Technology of RVO's staff:**

Twelve percent of RVOs do not satisfy technical level of their staffs. The required technology is 'up-dated technology', 'basic skills for electronics', and 'maintenance skills'.

**8) Provision of manuals:**

Twelve percent of RVOs do not have manuals for inspection. Since the manuals are

important to conduct quality work, DOM assists RVOs in preparing necessary manuals.

**9) DOM's assistance in HRD to RVOs:**

Twenty-four percent of RVOs do not get assistance in HRD from DOM. Among RVOs which get assistance from DOM, 70% of RVOs do not satisfy DOM's assistance and only 21% satisfy it. RVOs expect DOM's assistance in HRD of up-dated technology and electricity/electronics, followed by maintenance, machine, basic knowledge, computer related technology.

**10) Technical assistance by DOM:**

Ninety-one percent of RVOs get technical assistance by DOM (9%: 'No'). They expect DOM to give services including traveling instruction, provision of manuals, calibration of secondary standards, dispatch of information and frequent communication.

**11) Sufficiency of obtained budget of RVOs:**

Seventy-three percent of RVOs are not satisfied with their budgets.

**12) Existing equipment and instruments:**

- Seventy-six percent of RVOs do not satisfy the existing equipment and measuring instruments; only 9% of RVOs satisfy.
- Fifty-two percent of RVOs have air conditioning problems.
- Sixty percent of RVOs have electricity problems. Major problems are power failure, and fluctuation of power supply.
- Forty-four percent of RVOs have water supply problems. Major problems are supply volume, seasonal fluctuation, and dirty water.

**13) LMS Centers:**

Forty percent of RVOs consider LMS Centers are not necessary. Reason of 'Unnecessary' is increasing duplication of metrology service, which should do by DOM/MTC. It might stem from misunderstanding of RVOs. Major reasons of 'Necessary' (60%) are for calibration of standards, effective coordination and control of RVOs, support of RVOs with insufficient facilities, and covering regional service.

### 4.1.2 Analysis of Questionnaire Survey

The following are the analysis of questionnaire survey to each question. Details of the questionnaire survey are shown in Appendix 4.1.2.

Q1. *Year of establishment*

- 48%: Before 1981, 40%: during 1981- 2000, and the rest: after 2000

Q2. *Change of functions and responsibilities after the decentralization*

- 'Yes': 55%, 'No': 45%
- Major additional functions are administration, finance, and range of area service.
- Major deleted functions are authority for monitoring.
- Major additional responsibilities are administration, finance, and retribution of re/verification.
- Major deleted responsibilities are closing of monitoring and guidance sections.

Q3. *Service area and population covered*

- Average service area is 50,921km$^2$. 10,000-30,000 km$^2$: 41%, Less than 10,000 km$^2$: 33%, rest: More than 30,000 km$^2$
- Average population in service area is 5.1 million persons. Less than 5 million persons: 45%, 5-10 million: 18%, Rest: More than 10 million

Q4. *Major activities*

- Major replies are verification/re-verification, periodical inspection, on-the-spot inspection and PR of legal metrology.

Q5. *Number of staffs*

- Average number of staffs is 32.2 persons. 20-30 staffs: 39%, More than 30 staffs: 30%, Less than 20 staffs: 21%, No answer: 10%
- Numbers of staffs by job classification are 6.3 staffs for metrological engineer, 1.9 staffs for technical assistant, 7.9 staffs for inspector, 3.0 staffs for assistant to inspector, 9.1 staffs for administration and 4.3 staffs for others.

Q6. *Users and manufacturers*

- Main users are stores, taxi companies, filling stations, electric power companies, town gas suppliers, water suppliers and transportation companies.
- Main manufacturers are cement manufacturers, pre-packaged goods manufacturers, UTTP manufacturers, food and beverage manufacturers.

Q7. *Kind of measuring instruments*

- Major measuring instruments of RVOs are weight and weighing instruments, measuring instruments for taxi meters, fuel dispensers, watt-hour meters and water meters.

Q8. *Reporting to DOM*

- 72% of RVOs replied 'Yes', 28% of RVOs replied 'No'.
- The reason why they do not report to DOM is that they send the report only to their provincial government (There is no official form to DOM).

Q9. *Implementation of verification/re-verification*

- 67% of RVOs replied 'Yes', 27% of RVOs replied 'No', and 6% of RVOs did not reply.

Q10. *Implementation ratio*

- Among the RVOs which replied 'No', the largest replies of their implementation ratio are 50-80 %(56%), followed by more than 80% (22%) and less than 50% (22%).

Q11. *Number of measuring instruments for verification/re-verification*

- Major instruments for verification/re-verification are weighing instruments, weights, taxi meters, fuel dispensers, watt-hour meters, water meters and volumes.

Q12. *Defective rate of verification/re-verification*

- Defective rate (2005) of weighing instruments is 9.9%, taxi meters, 6%, fuel dispensers, 10.7%, and watt-hour meters, 14.3%.

Q13. *Number of pre-packed goods inspected on-the-spot*

- Major items inspected on the spot are drinks, sugar, rice, LPG, coffee and peanuts.

Q14. *Defective rate of pre-paced goods inspected on-the-spot*

- No valid replies are available.

Q15. *Methods to inform users about verification/re-verification*

- Major methods are notification by RVO through newspapers and radio.

Q16. *Estimation of increase/decrease rates of measuring instruments in 2010*

- Increase rates of weighing instruments in 2010 (2005=100) is estimated 148, weight, 135, taxi meters, 138, fuel dispensers, 131, watt-hour meters, 164, gas meters, 143 and water meters, 253.

Q17. *Satisfaction of staffs' technology and/or technical skills*

- 'Yes': 9%, 'Partly yes': 64% and 'No': 27%
- The RVOs that replied 'No' request their staffs to upgrade their technology or skills. The major requests are 'up-dated technology', 'basic skills for electronics', and 'maintenance skills'.

Q18. *Provision of manuals*

- 'Yes': 82%, 'No': 12%, 'Partly': 6%.

Q19. *Measure for HRD*

- The major measures for HRD are 'outside training', 'periodical internal training' and 'internal training as required'.

Q20. *Acquisition of assistance from DOM for HRD*

- 'Yes': 76%, 'No': 24%
- Major assistance given to RVOs is training for skill-up, technical guidance, instruction and consultation.
- However, 70% of RVOs do not satisfy DOM's assistance, only 21% of RVOs satisfy it, and 8% of RVOs did not reply.

Q21. *Expectation for further HRD*

- Major replies are updated technology and electricity/electronics. Maintenance, machine, basic knowledge, computer related technology follows.

Q22. *Number of trainees sent in 2005*

- The largest replies are 1-3 persons (52%), followed by 4-6 persons (42%), 7-9 persons (3%) and over 10 persons (3%).

Q23. *Number of trainees in future*

- For long-term courses, the largest replies are 1-3 persons (46%), followed by 4-6 persons (27%), and over 10 persons (15%).
- For short-term courses, the largest replies are 1-3 persons (41%), followed by 4-6 persons (37%), and over 10 persons (16%).

Q24. *Source of budget*

- Their source of budget is the provincial government.

Q25. *Sufficiency of obtained budget*

- 73% of RVOs replied 'No', 24% of RVOs replied 'Yes', and 3% of RVOs did not reply.

Q26. *Income and cost in 2005*

- Average income is 198,451,576 Rp/year (Reply: 28RVOs).
- Average cost is 648,303,148 Rp/year (Reply: 27RVOs).

Q27. *Technical assistance from DOM*

- 'Yes': 91%, 'No': 9%

Q28. *Expectation to DOM*

- Major expectations for DOM are traveling instruction, provision of manuals, calibration of secondary standards, dispatch of information and frequent communication.

Q29. *Measures of dissemination and PR*

- Major measures of dissemination and PR are pamphlets, demonstration, and exhibition, consumer's participation in monitoring, seminar, radio and TV.

Q30. *Needs of LMS center*

- 'Necessary': 60%, 'Not necessary': 40%
- Major reasons of 'Necessary' are for calibration of standards, effective coordination and control of RVOs, support of RVOs with insufficient facilities, and covering regional service.
- Reason of 'Unnecessary' is increasing duplication of metrology service, which should do by DOM/MTC.

Q31. *Expansion planning of RVO*

- 36% of RVOs replied 'Yes, they have expansion planning'; however, 52% of RVOs replied 'Not clear', 6% of RVOs replied 'No', and 6% of RVOs did not reply.
- Among the RVOs replied 'Yes', 42% of RVOs will realize it within one year, 25%, within 4-5 years and 8%, within 2-3 years, and 25 did not reply.

Q32. *Area*

- Land area

  2,000-5,000$m^2$: 48%, Less than 2,000$m^2$: 24%, Over 5,000$m^2$: 12%, No reply: 16%
- Floor area

  Less than 500$m^2$: 27%, Over 1,000$m^{2:}$ 24%, 500-1,000$m^2$: 22%, and No reply: 27%
- Underground floor

  75% of RVOs replied without underground floor, and 25% did not reply. No RVOs replied with underground floor.

Q33. *Satisfaction of existing equipment and measuring instruments*

- 76% of RVOs do not satisfy existing equipment and measuring instruments, only 9% of RVOs satisfy, and 15% of RVOs did not reply.

Q34. *Necessary equipment*

- Major requirement are all standards and optional, mass and volume, temperature and pressure, water meters, watt-hour meters and moisture meters.

Q35. *Maintenance*

- 91% of RVOs replied they maintain equipment by their own employees, and 9% of RVOs did not reply. No RVOs replied other maintenance methods.

Q36. *Ambient condition*

- 52% of RVOs have air conditioning problems.

- 60% of RVOs have electricity problems. Major problems are fluctuation of power supply (49%) and power failure (11%).
- 44% of RVOs have water supply problems. Major problems are seasonal fluctuation (23%), dirty water (12%) and supply volume (9%).

### 4.2 Demand Forecast for Verification/re-verification

#### 4.2.1 Estimation of Number of Measuring Instruments for Verification/re-verification

In this section, demand forecast for verification/re-verification is conducted by type of measuring instruments.

**1) Calculation formula on quantitative analysis:**

Since sufficient data is not available for the estimation, certain pre-conditions and correction factors are taken to supplement the actual information. The calculation formulas and its preconditions are as follows:

(1) Quantity of measuring instruments actually re-verified by RVOs:

Quantity of measuring instruments to be re-verified by kind of instrument in 2005 is obtained from the replies of the questionnaire survey. The replies of questionnaire are 24 (RVOs) out of 54 (RVOs). Since most RVOs are major RVOs and the RVOs not replied are mostly small RVOs, the sum of data obtained from 24 RVOs cannot check proportionally to the whole country (54 RVOs). In this estimation, the results of calculation extrapolated are corrected by multiplying the size coefficient (D).

Quantity of measuring instruments actually re-verified in 2005 = (Total number of measuring instruments actually re-verified by 24 RVOs) x [1+(54-24)/24 x (D)]

The size correction coefficient (D) is 50-80% depending on the measuring instruments.

(2) Quantity of production & import:

a) Actual quantity of production & import is required by kind of instrument.

b) In case that tthe quantity of production and import is not obtained, it is presumed by the following formula:

Quantity of Production and Import = Quantity of instruments in the field of previous year x [rate of demand based on new customers (5%) + rate of demand based on

replacement of old/broken instruments (5%)]

(3) Quantity of measuring instruments subject to verification:
The Quantity of measuring instruments subject to verification is the same as the quantity of production and import of measuring instruments.

(4) Quantity of measuring instruments in the field:
The Quantity of watt-hour meters and water meters in the field can be obtained based on BPS documents.
Other meters, whose statistical data is not available from the published documents, are estimated by the following formula:
Quantity of measuring instruments = Number of measuring instruments actually re-verified by RVOs(1) / Implementation ratio (B)
Definition of the implementation ratio (B) is Number of measuring instruments actually re-verified/Number of instruments subject to re-verification. Most replies of the implementation ratio survey are 50-80%.

(5) Quantity of measuring instruments subject to re-verification:
The formula for quantity of measuring instruments subject to re-verification is:
Number of instruments in the field (4) /Period of validity of verification (A)

(6) Number of instruments subject to verification and re-verification:
(6)=(3) +(5)

(7) Ratio of Estimated demand to actual for verification/re-verification in 2005:
(7) =(6)/(1)

**2) Summary of quantitative analysis on demand for verification and re-verification**

(1) Weighing instruments

(A) Period of validity of verification ＝1 year.

(B) Implementation ratio = 60%

(C) Number of instruments actually verified by 24 RVOs in 2005 = 443,321 units

(D) Size correction coefficient = 80%

(E) Number of instruments of production and imports in 2005 = 250,000 units

(F) Growth rate of number of production and import per year = 5%

(G) Rate of number of instruments of production and imports for new customer = 50%

＜2005＞

- Number of instruments actually verified by 54 RVOs in 2005 is presumed: 443,321 x (1+1.25 x 0.8) = 886,642 units.
- Number of instruments subject to verification/re-verification in 2005: is presumed 886,642/0.6 = 1,477,367 units.
- Number of instruments for verification in 2005 is presumed: 250,000 units.
- Number of instruments for re-verification in 2005 is: presumed 1,477,367-250,000=1,227,367 units.
- Number of instruments in the field=1,227,367+250,000x0.5=1,289,867 units.

<2006>

- Number of instruments subject to re-verification in 2006 is presumed: 1,289,867x1.05=1,354,360 units.
- Number of increased instruments in 2006 is presumed: 1,289,867x0.05=64,493 units.
- Number of instruments for verification in 2006 is presumed: 64,493x4=257,972 unit.
- Number of instruments for verification and re-verification in 2006 is presumed: 1,354,360+257,972=1,642,367 units.

(2) Watt-hour meters (for PLN customers)

(A) Period of validity of verification＝10 years.

(B) Number of customers in 2003=32,151,381 (Ref. to Table 3.2.1-2)

(C) Number of instruments of production and imports in 2005=1,000,000 units

(D) Growth rate of number of production and import per year=3%

<2005>

- Number of instruments in 2005 is presumed: 32,151,381x1.03x1.03=34,109,399 units.
- Number of instruments subject to re-verification in 2005 is presumed: 34,109,399/10=3,410,940 units.
- Number of instruments subject to verification is zero units, since watt-hour meters must be verified by manufacturers before their delivery.

<2006>

- Number of instruments subject to re-verification in 2006 is same as in 2005: 34,109,399/10=3,410,940 units, since re-verification of instruments produced after 2005

will be applied after 2016.

(3) Water meters

(A) Period of validity of verification＝5 years.

(B) Number of customers in 2002=6,433,871 (refer to Table 3.2.2-2)

(C) Meter installation rate per customer=80% (assuming that 20% is the flat-rate tariff customers)

(D) Growth rate of number of customers per year=3%

<2005>

- Number of instruments in 2005 is presumed: $6,433,871 \times 80\% \times 1.05^3 = 5,958,408$ units.
- Number of instruments subject to re-verification in 2005 is presumed: 5,958,408/5=1,191,682 units
- Number of production and import for domestic use is presumed: quantity of instruments in the field of previous year x [rate of demand based on new customers (5%)+rate of demand based on replacement of old/broken instruments (5%)] =5,958,408xo.10=595,841 units.
- Rate of import=60% ( According to the interview survey)
- Rate of export=(ignored)
- Number of imported instruments for verification =595,841x60%=357,505 units (at RVOs).
- Number of domestic-made instruments for verification =595,841x40%=238,336 units (at manufactures).
- Number of instruments subject to for re/verification=1,191,682+357,505=1,549,187 units.

<2006>

- Number of instruments in 2006 is presumed: 5,958,408x1.05=6,256,328 units.
- Number of production and import for domestic use is presumed: 6,256,328x0.10=625,633 units.
- Number of imported instruments for verification =6,256,328x60%=375,380 units (at RVOs).
- Number of instruments subject to for re-verification=1,191,682 units.
- Number of instruments subject to for re/verification in 2006 is same as in 2005,since re-verification of instruments produced after 2005 will be applied after 2011: 1,191,682 units
- Number of instruments subject to for re/verification=1,191,682+375,380=1,567,062

units.

(4) Fuel dispensers

(A) Period of validity of verification＝1 year.

(B) Implementation ratio=80%

(C) Number of instruments actually verified by 24 RVOs in 2005.=25,517 units

(D) Size correction coefficient= 80%

(E) Number of instruments of production and imports in 2005=250,000 units

(F) Growth rate of number of production and import per year=5%

(G) Rate of number of instruments of production and imports for new customer=50%

<2005>

- Number of instruments actually verified by 54RVOs in 2005 is presumed: 25,517x (1+1.25*0.8) =51,034 units.
- Number of instruments in the field (Number of instruments subject to verification/re-verification) in 2005 is presumed: 51,034/0.8=63,793 units.
- Number of import instruments for verification in 2005 is presumed: 63,793/1.05x5%=3,038 units.
- Number of instruments for re-verification in 2005 is presumed: 63,793-3,038=60,755 units.

<2006>

- Growth rate of number of import per year=5%
- Number of import instruments (number of instruments subject to re-verification) in 2006 is presumed 3,038x1.05=3,190 units.
- Number of instruments for verification in 2006 =63,793 unit.
- Number of instruments in the field in 2006 = 63,793+3,190=66,983 units.

(5) Taxi meters

(A) Period of validity of verification＝1 year.

(B) Implementation ratio=80%

(C) Number of instruments actually verified by 24 RVOs in 2005.=47,375 units

(D) Size correction coefficient= 40%

(E) Growth rate of number of production and import per year=5%

<2005>

- Number of instruments actually verified by 54RVOs in 2005 is presumed: 47,375x (1+1.25 x 0.4) =71,063units.
- Number of instruments in the field (Number of instruments subject to

verification/re-verification) in 2005 is presumed 71,063/0.8=88,828 units.

- Number of import instruments for verification in 2005 is presumed: 88,828/1.05x5%=4,230 units.
- Number of instruments for re-verification in 2005 is presumed: 88,828-4,230=84,598 units.

<2006>

- Growth rate of number of import instruments per year=5%
- Number of import instruments (number of instruments subject to verification) in 2006 is presumed 4,230x1.05=4,441units.
- Number of instruments subject to re-verification in 2006 =88,828 unit.
- Number of instruments subject to verification/re-verification in 2006 =88,828+4,441 = 93,269 unit.

(6) Tank trucks

(A) Period of validity of verification＝1 year.

(B) Implementation ratio=80%

(C) Number of instruments actually verified by 24 RVOs in 2005.=16,650 units

(D) Size correction coefficient= 40%

(E) Growth rate of number of instruments per year=5%

<2005>

- Number of instruments actually verified by 54RVOs in 2005 is presumed: 16,650x (1+1.25 x 0.4) =24,975 units.
- Number of instruments in the field (Number of instruments subject to verification/re-verification) in 2005 is presumed: 24,975/0.8=31,219 units.
- Number of import instruments for verification in 2005 is presumed :31,219/1.05x5%=1,487 units.
- Number of instruments for re-verification in 2005 is presumed: 31,219-1,487=29,732 units.

<2006>

- Growth rate of number of import instruments per year=5%
- Number of import instruments (number of instruments subject to verification) in 2006 is presumed: 1,487x1.05=1,561 units.
- Number of instruments subject to re-verification in 2006 =31,219 unit.
- Number of instruments subject to verification/re-verification in 2006 =31,219+1,561 =

32,780 unit.

(7) Flow meters

(A) Period of validity of verification＝1 year.

(B) Implementation ratio=80%

(C) Number of instruments actually verified by 24 RVOs in 2005=792 units

(D) Size correction coefficient= 50%

(E) Growth rate of number of production and import per year=5%

<2005>

- Number of instruments actually verified by 54RVOs in 2005 is presumed: 792x (1+1.25*0.8) =1,584 units.
- Number of instruments in the field (Number of instruments subject to verification/re-verification) in 2005 is presumed: 1,584/0.5=3,168 units.
- Number of import instruments for verification in 2005 is presumed: 3,168/1.05x5%=151 units.
- Number of instruments for re-verification in 2005 is presumed: 3,168-151=3,018 units.

<2006>

- Growth rate of number of import instruments per year=5%
- Number of import instruments (number of instruments subject to verification) in 2006 is presumed: 150x1.05=158 units.
- Number of instruments subject to re-verification in 2006 =3,168 unit.
- Number of instruments subject to verification/re-verification in 2006 =3,168+158 = 3,326 unit.

Table 4.2.1-1 shows the demand forecast for verification/re-verification.

**Table 4.2.1-1 Demand Forecast for Verification/Re-verification of Legal Measuring Instruments**

| Measuring instruments | Items | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| 1. Weighing instruments | (1) No. of instruments for the initial verification | 250,000 | 257,973 | 270,872 | 284,416 | 298,636 | 313,568 |
| | (2) No. of instruments for re-verification | 1,227,367 | 1,354,360 | 1,422,078 | 1,493,182 | 1,567,841 | 1,646,233 |
| | (3) No. of instruments for re-/verification =(1)+(2) | 1,477,367 | 1,612,334 | 1,692,950 | 1,777,598 | 1,866,478 | 1,959,802 |
| | (4) No. of instruments in the field | 1,289,867 | 1,354,360 | 1,422,078 | 1,493,182 | 1,567,841 | 1,646,233 |
| 2. Watt-hour meters | (1) No. of instruments for the initial verification | - | - | - | - | - | - |
| | (2) No. of instruments for re-verification | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 |
| | (3) No. of instruments for re-/verification =(1)+(2) | | | | | | |
| | (4) No. of instruments in the field | 34,109,399 | 35,132,681 | 36,186,661 | 37,272,261 | 38,390,429 | 39,542,142 |
| 3. Water meters | (1) No. of instruments for the initial verification | 357,505 | 375,380 | 394,149 | 413,856 | 434,549 | 456,276 |
| | (2) No. of instruments for re-verification | 1,191,682 | 1,191,682 | 1,191,682 | 1,191,682 | 1,191,682 | 1,191,682 |
| | (3) No. of instruments for re-/verification =(1)+(2) | 1,549,187 | 1,567,061 | 1,585,830 | 1,605,538 | 1,626,231 | 1,647,958 |
| | (4) No. of instruments in the field | 5,958,408 | 6,256,328 | 6,569,145 | 6,897,602 | 7,242,482 | 7,604,606 |
| 4. Fuel dispensers | (1) No. of instruments for the initial verification | 3,038 | 3,190 | 3,349 | 3,517 | 3,692 | 3,877 |
| | (2) No. of instruments for re-verification | 60,755 | 63,793 | 66,983 | 70,332 | 73,848 | 77,541 |
| | (3) No. of instruments for re-/verification =(1)+(2) | 63,793 | 66,983 | 70,332 | 73,848 | 77,541 | 81,418 |
| | (4) No. of instruments in the field | 63,793 | 66,983 | 70,332 | 73,848 | 77,541 | 81,418 |
| 5. Taxi meters | (1) No. of instruments for the initial verification | 4,230 | 4,441 | 4,663 | 4,897 | 5,141 | 5,399 |
| | (2) No. of instruments for re-verification | 84,598 | 88,828 | 93,269 | 97,933 | 102,830 | 107,971 |
| | (3) No. of instruments for re-/verification =(1)+(2) | 88,828 | 93,269 | 97,933 | 102,830 | 107,971 | 113,370 |
| | (4) No. of instruments in the field | 88,828 | 93,269 | 97,933 | 102,830 | 107,971 | 113,370 |
| 6. Tank trucks | (1) No. of instruments for the initial verification | 1,487 | 1,561 | 1,639 | 1,721 | 1,807 | 1,897 |
| | (2) No. of instruments for re-verification | 29,732 | 31,219 | 32,780 | 34,419 | 36,140 | 37,947 |
| | (3) No. of instruments for re-/verification =(1)+(2) | 31,219 | 32,780 | 34,419 | 36,140 | 37,947 | 39,844 |
| | (4) No. of instruments in the field | 31,219 | 32,780 | 34,419 | 36,140 | 37,947 | 39,844 |
| 7. Flow meters | (1) No. of instruments for the initial verification | 151 | 158 | 166 | 175 | 183 | 193 |
| | (2) No. of instruments for re-verification | 3,017 | 3,168 | 3,326 | 3,493 | 3,667 | 3,851 |
| | (3) No. of instruments for re-/verification =(1)+(2) | 3,168 | 3,326 | 3,493 | 3,667 | 3,851 | 4,043 |
| | (4) No. of instruments in the field | 3,168 | 3,326 | 3,493 | 3,667 | 3,851 | 4,043 |

### 4.2.2 Consideration

Table 4.2.2-1 summarizes the results of the estimation. According to the demand forecast of verification/re-verification, there is a strong demand for verification/re-verification in Indonesia. Although the forecast is based on some assumptions, the tendency for strong demand is evident. The current capacity of RVOs for verification/re-verification is not sufficient to support these demands. Both central and local governments should investigate measures to enhance the capabilities of verification/re-verification.

Among measuring instruments, there are big demands for watt-hour meters and water meters. The investigation to deal with verification/re-verification for the two measuring instruments should be undertaken carefully, including the participation of private sectors.

**Table 4.2.2-1 Results of the Estimation**

Unit: thousand

| | | 2005 | 2010 |
|---|---|---|---|
| 1. Weighing instruments | No. of instruments | 1,290 | 1,646 |
| | Demand for re-/verification | 1,477 | 1,960 |
| 2. Taxi meters | No. of instruments | 89 | 113 |
| | Demand for re-/verification | 89 | 113 |
| 3. Fuel dispensers | No. of instruments | 64 | 81 |
| | Demand for re-/verification | 64 | 81 |
| 4. Watt-hour meters | No. of instruments | 34,110 | 39,542 |
| | Demand for re-/verification | 3,411 | 3,411 |
| 5. Water meters | No. of instruments | 5,958 | 7,605 |
| | Demand for re-/verification | 1,549 | 1,648 |
| 6. Tank trucks | No. of instruments | 31 | 40 |
| | Demand for re-/verification | 31 | 40 |
| 7. Flow meters | No. of instruments | 3.2 | 4.0 |
| | Demand for re-/verification | 3.2 | 4.0 |

### 4.3 Demand for HRD for Metrological Engineers in RVOs

Metrological engineers in RVOs encounter problems of not only human resources development (HRD) but also reduction of inspectors as follows:

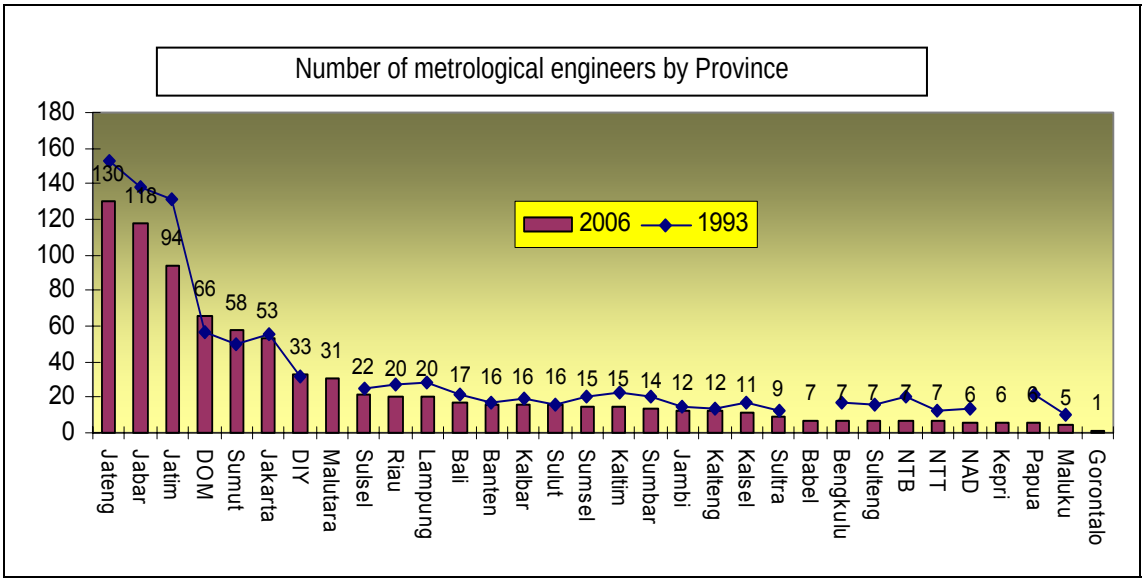
1) Inspectors become old and the number of inspectors will decrease to almost half within the next 5-10 years due to age retirement.
2) Some inspectors are transferred to another section of provincial government not related to legal metrology.
3) Some provincial governments are reluctant to make-up such reduction of inspectors, partly because they seem not to understand the importance of legal metrology and partly because they lack sufficient budgets to support legal metrology activities.
4) However, the measuring instruments required for verification and re-verification are increasing.

Under such circumstances, the urgent matter is to increase the number of inspectors by either recruiting new officers or shifting officers from other sections of provincial government to RVO. Inspectors must have necessary training to become qualified inspectors.

As pointed out through questionnaire surveying and interview surveying, the upgrading of existing inspectors is also important. Especially, education and training of new technology and electricity/electronics are necessary.

### 4.3.1 Number of Metrological Engineers

The numbers of metrological engineers in the whole of Indonesia are 829 persons as of May 2006. Figure 4.3.1-1 shows the numbers of metrological engineers by province in 1993 and 2006. Most RVOs reduce the number of metrological engineers from 1993 to 2006.




Source: DOM

**Figure 4.3.1-1 Number of Metrological Engineers by Province**

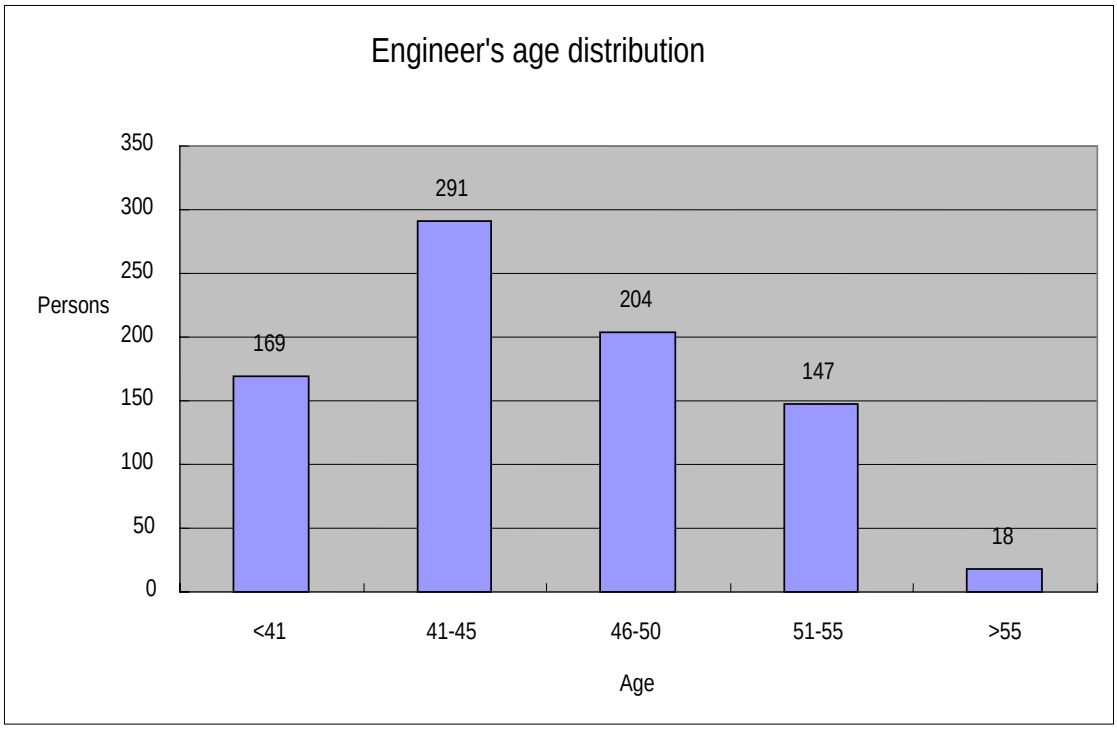
### 4.3.2 Analysis of Current Metrological Engineers

In this section, analyses are carried out concerning age, kind of job, type of inspectors and academic background of inspectors.

**1) Age**

Figure 4.3.2-1 shows age distribution of engineers. The ages of engineers (total: 829) are: 169 persons (20% of total) below 41 years old, 291 persons (35%) between 41-45 years old, 204 persons (25%) between 46-50 years, 147 persons (18%) between 51-55 years old, and 18 persons (2%) above 56 years old.

Most engineers become old and the number will decrease to half within the next 5-10 years.

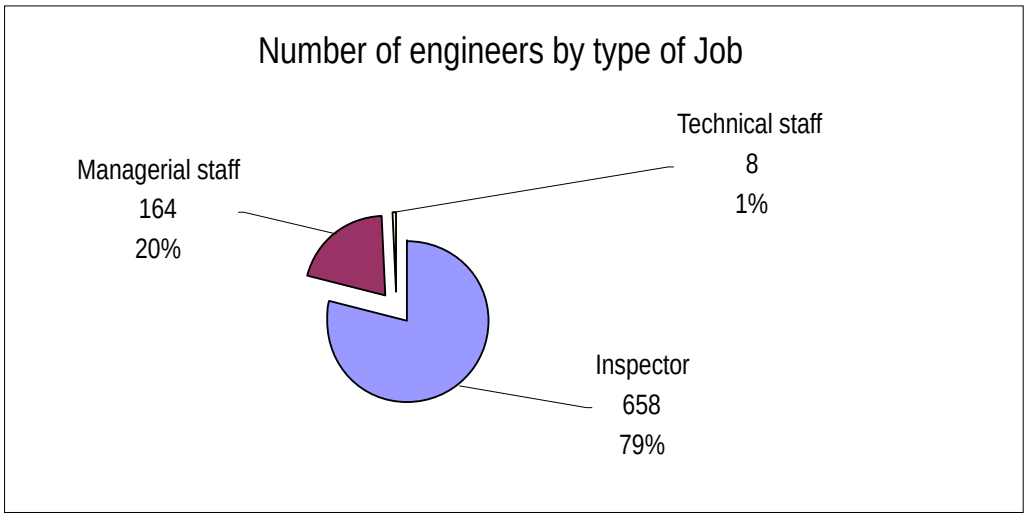



Source: DOM

**Figure 4.3.2-1 Engineer's Age Distribution**

**2) Type of job**

Figure 4.3.2-2 shows the numbers of engineers by Type of job. The number of inspectors is 658 persons (79%), managerial staffs, 164 persons (20%), and the rests, technical staffs (1%).




Source: DOM

**Figure 4.3.2-2 Numbers of Engineers by Type of Job**

### 3) Type of inspectors

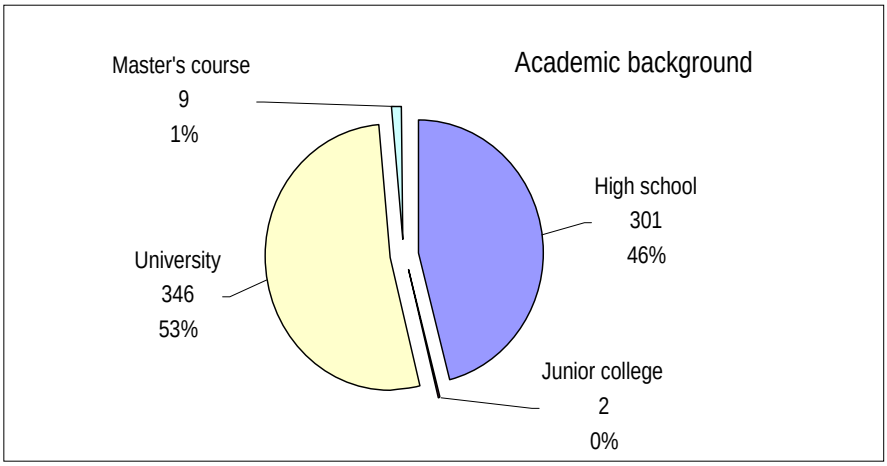
Figure 4.3.2-3 shows the number of inspector by type of inspector. Among 658 inspectors in total, the number of specialists is 350 persons (53% of total inspectors). The rest (308 persons) is skilled workers.


Source: DOM

**Figure 4.3.2-3 Number of Inspectors by Type**

### 4) Academic background

Figure 4.3.2-4 shows the number of inspector by academic background. Among 658 inspectors in total, university graduates shares the largest with 346 persons (53%), followed by high school graduates with 301 persons (46%).




Source: DOM

**Figure 4.3.2-4 Number of Inspector by Academic Background**

### 4.3.3 Issues to Be Examined

The following are issues to be examined:

1) **Reduction of metrological engineers due to age retirement and job transfer**

   Among 829 engineers total at present, 369 engineers (45%) will reach retirement age within the next 5-10 years. In addition, personnel transfers to other sections are carried out especially after decentralization. Unless effective recruitment of engineers is achieved, the number of engineers would become 460 persons or less after 10 years. If so, most RVOs will have trouble performing their duties. Since the inspectors have been decreasing every year after decentralization, this situation should be improved as soon as possible.

2) **Recruitment system for metrological engineers**

   Recruitment system for metrological engineers seems not to support the necessity of inspectors in RVOs. In the site survey, most RVOs pointed out the shortage of staffs and dissatisfaction of the support from their government. The major dissatisfaction is slow action, a long-term examination of application not only by the provincial government but also by the central government. So many offices of government are involved in the recruitment of staffs and engineers. A recruitment system for metrological engineers should be simplified by quick action.

### 4.3.4 Estimation of Number of Metrological Engineers for HRD

The increasing factors of engineers can be divided into the following three categories:

- Age retirement
- Transfer of engineers to another sections
- Increase of measuring instruments subject to verification and re-verification

1) **Estimation of number of retiring engineers, 2006-2016**

   Numbers of engineers, who are going to retire in 2006-2016, can be broken down as shown in Table 4.3.4-1 from the data in Figure 4.3.2-1. During the period of 2006-2011, about 30 engineers are going to retire every year, and about 40 engineers are going to leave RVOs every year during the period of 2012-2016. Accordingly, at least 30-40 engineers should be recruited and trained every year.

**Table 4.3.4-1 Estimation of Number of Retiring Engineers**

| Age | No. of engineers | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 | `+10 |
| <41 | 169 | | | | | | | | | | | |
| 41-45 | 291 | | | | | | | | | | | |
| 46-50 | 204 | | | | | | | 41 | 41 | 41 | 41 | 40 |
| 51-55 | 147 | | 29 | 29 | 29 | 30 | 30 | | | | | |
| >55 | 18 | 18 | | | | | | | | | | |
| No. of retirements | | 18 | 29 | 29 | 29 | 30 | 30 | 41 | 41 | 41 | 41 | 40 |

Source: DOM

**2) Estimation of number of transferring engineers, 2006-2016**

Table 4.3.4-2 shows the estimation of number of transferring engineers. Numbers of engineers who will be transferred to other sections not related to legal metrology are estimated at 2% of the total (829 persons) annually in 2006-2010, 2.5% in 2010-2016. Accordingly, additional 16-20 engineers shall be recruited and trained..

**Table 4.3.4-2 Estimation of Number of Transferring Engineers**

| Estimations | 2006 | 2007 | 2008 | 2009 | 2010 | 2011-2016 |
|---|---|---|---|---|---|---|
| Estimated percentage of transferring | 2% | 2% | 2% | 2% | 2% | 2.5% |
| Number of transferring engineers, estimated | 16 | 16 | 16 | 16 | 16 | 20 |

**3) Estimation of number of inspectors to deal with increasing measuring instruments subject to verification and re-verification**

According to the analysis of Section 4.2, the number of measuring instruments subject to verification and re-verification are projected to increase every year, demanding increase of inspectors. Since watt-hour meters and water meters are large in numbers at present as well as estimated, a lot of verification and re-verification work is necessary with many inspectors. If RVOs cope with this work by themselves, a lot of money and time would be necessary for provision of necessary equipment and technology in addition to increase of inspectors. Now other measures like privatization are considered for it.

(1) Watt-hour meters and Water meters

Table 4.3.4-3 shows estimation of number of inspectors for Watt-hour meters and Water meters. The estimation formula is as below;

(a) Capable number of re/verified instruments by one inspector per year

- Watt-hour meters=40unit x 2times/day x 260days x80%(ratio of actual working days)=16,640 units
- Water meters=40unit x 3times/day x 260days x80%=24,960

(b) No. of instruments to be re/verified

- Number of instruments derived from Table4.2.3-1, except the year of 2005.
- Number of instruments in 2005 shows actual re/verified numbers.

(c) No. of Inspector=(2)/(1)

- Number of inspectors for watt-hour meters is estimated 204 in 2010, as well as water meters is 66.
- Required number of inspectors for watt-hour meters per year = [Number of inspectors in 2010(204) - Number of inspectors in 2005(60)]/5years=29/year.
- Required number of inspectors for water meters per year = [Number of inspectors in 2010(66) - Number of inspectors in 2005(10)]/5years=11/year.
- Total required number of inspectors=29+11=40/year.

**Table 4.3.4-3 Estimation of Number of Inspectors for Watt-hour Meters and Water Meters**

| Instrument | Items | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| Watt-hour meters | (a) Capable number of re-/verified instruments by one inspector per year. | 16,640 | 16,640 | 16,640 | 16,640 | 16,640 | 16,640 |
| | (b) No. of instruments to be re-/verified. | 1,002,256 | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 | 3,410,940 |
| | (c) No. of Inspector=(b)/(a) | 60 | 204 | 204 | 204 | 204 | 204 |
| Water meters | (a) Capable number of re-/verified instruments by one inspector per year. | 24,960 | 24,960 | 24,960 | 24,960 | 24,960 | 24,960 |
| | (b) No. of instruments to be re-/verified. | 260,087 | 1,567,061 | 1,585,830 | 1,605,538 | 1,626,231 | 1,647,958 |
| | (c) No. of Inspector=(b)/(a) | 10 | 63 | 63 | 64 | 65 | 66 |

(2) Other measuring instruments

The number of inspectors for other measuring instruments is estimated by following steps.

Table 4.3.4-4 shows forecast of number of measuring instruments for re-/verification. From the table, the increasing ratios of working load by instruments are calculated. As a result, annual increasing ratio (2010-2006)/5 is estimated 38% per year.

**Table 4.3.4-4 Forecast of Number of Measuring Instruments for Verification/ Re-verification**

| | No. of measuring instruments | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| Weighting Instruments | (1) Actually verified by RVO | 886,642 (100%) | | | | | |
| | (2)Subject to re-/verification | 1,477,367 | 1,612,334 | 1,692,950 | 1,777,598 | 1,866,478 | 1,959,802 |
| | (3) Increasing ratio=(2)/(1) | | 182% | 191% | 200% | 211% | 221% |
| Fuel dispensers | (1) Actually verified by RVO | 51,034 (100%) | | | | | |
| | (2)Subject to re-/verification | 63,793 | 66,983 | 70,332 | 73,848 | 77,541 | 81,418 |
| | (3) Increasing ratio=(2)/(1) | | 131% | 138% | 145% | 152% | 160% |
| Taxi meters | (1) Actually verified by RVO | 71,062 (100%) | | | | | |
| | (2)Subject to re-/verification | 88,828 | 93,269 | 97,933 | 102,830 | 107,971 | 113,370 |
| | (3) Increasing ratio=(2)/(1) | | 131% | 138% | 145% | 152% | 160% |
| Tank lorries | (1) Actually verified by RVO | 24,975 (100%) | | | | | |
| | (2)Subject to re-/verification | 31,219 | 32,780 | 34,419 | 36,140 | 37,947 | 39,844 |
| | (3) Increasing ratio=(2)/(1) | | 131% | 138% | 145% | 152% | 160% |
| Flow meters | (1) Actually verified by RVO | 1,584 (100%) | | | | | |
| | (2)Subject to re-/verification | 3,168 | 3,326 | 3,493 | 3,667 | 3,851 | 4,043 |
| | (3) Increasing ratio=(2)/(1) | | 210% | 221% | 232% | 243% | 255% |
| Increasing ratio (Accumulative) | | | 157% | 165% | 173% | 182% | 191% |
| Annual increase ratio mean=(2010-2006)/5 | | - | 38% | 38% | 38% | 38% | 38% |

Work efficiency is taking into account in the estimation of number of inspectors. The estimation formula is defined:

{Total number of inspectors -(number of inspectors of watt-meter and water meter) in 2005}x{Increasing ratio of single year}/{Work efficiency coefficient (200%)}

Table 4.3.4-5 shows the estimation of number of inspectors.

**Table 4.3.4-5 Estimation of Number of Inspectors**

| Estimations | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Estimated percentage of work increase (%) | 38 | 38 | 38 | 38 | 38 |
| Current number of inspectors=658-70=588 | | | | | |
| Work efficiency coefficient (%) | 200 | 200 | 200 | 200 | 200 |
| Number of inspectors to be increased annually | 112 | 112 | 112 | 112 | 112 |
| Number of inspectors to be increased annually for watt-hour meter and water meter | 40 | 40 | 40 | 40 | 40 |
| Total | 152 | 152 | 152 | 152 | 152 |

### 4.3.5 Summary of Demand of HRD for Metrological Engineers

Table 4.3.5-1 summarizes the estimation of number of metrological engineers. The estimation shows that more than 200 additional engineers will be needed every year and should be trained

as qualified inspectors.

**Table 4.3.5-1 Estimation of Number of Metrological Engineers**

Unit: persons

| Requirements | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Retired engineers | 18 | 29 | 29 | 29 | 30 |
| Personnel transfer | 16 | 16 | 16 | 16 | 16 |
| Increase of work for re-/verification | 152 | 152 | 152 | 152 | 152 |
| Total | 186 | 197 | 197 | 197 | 197 |

# Chapter 5

# Present Status of Legal Metrology and Problem Analysis in Indonesia

# Chapter 5 Present Status of Legal Metrology and Problem Analysis in Indonesia

## 5.1 Legal Metrology System

### 5.1.1 Categories and Functions of Metrology

Before discussing the legal metrology system of Indonesia, it is helpful to review the categories of fields of standardization concerning metrology for clarifying the roles and responsibilities of metrological organizations. This will make the target of this report and recommendations easy to understand by comparing the results of the survey, described elsewhere, with this section.

Concerning metrology, in general, its fields and functions would be classified as follows:

**1) Measurement standard**

- Establishment and maintenance of national standards
- Development of technologies concerning measurement standards
- Development and maintenance of traceability for measurement system
- Establishment of world equivalent measurement standards
- Contribution to maintenance of quality of international measurement system

**2) Legal metrology**

- Legislation and enforcement of measurement law
- Implementation of type approval testing for measuring instruments
- Implementation of verification and inspection for measuring instruments
- Administration of metrological control

**3) Industrial standard**

- Maintenance of compatibility of system and industrial products
- Maintenance of quality of system and industrial products

**4) Laboratory accreditation**

- Maintenance of quality of testing and calibration laboratories

**5) Accreditation system**

- Establishment and maintenance of accreditation system

The above functions are listed only from the metrological point of view necessary for the latter discussions. It should be noted that it is not necessary to allocate a national institute to each field, since measurement standard and legal metrology are closely related and usually maintained by a common national institute.

Since the target of this study is to develop a master plan for advancing DOM to an international level of function, and DOM has responsibilities for maintaining Indonesia's mass standard and legal metrology, both measurement standard and legal metrology will be discussed somewhat in detail below.

### 5.1.2 International Activities of Metrology

When the development of a metrology system of a country is to be discussed, recent international activities of metrology should be taken into account. Described below is a brief description of recent international activities of measurement standard and legal metrology for further discussion.

**1) Measurement standards**

In 1875, the Metre Convention was concluded at Paris among seventeen countries aiming to define an international system of units (SI). Since the conclusion of the Metre Convention, BIPM was established for the management of the convention, and the SI was sisseminated.

As the SI has been recognized as a measurement system and been employed internationally, the activities in measurement standards have been focused on developing standards for wider areas and disseminating them to natural sciences, industries and legal metrology for further precise and accurate measurements.

Furthermore, along with the progress of modern science and technology, research has been promoted to realize measurement standards based on universal technologies instead of the international prototypes maintained by BIPM. Presently the unit quantities realized by these technologies are theoretically expressed by physical or atomic constants. Currently

seven units of physical quantities have been defined as the basic units of measurement. Those are units of length, mass, time, electric current, temperature, amount of substance, and luminous intensity. Among these seven basic units, only the unit of mass is realized by a specific object (i.e., the international prototype of kilogram maintained by BIPM). The others are defined with words of physics and realized by universal modern technologies.

The following are the present responsibilities of BIPM:

- To establish basic standards and their scales and maintain the international prototypes
- To make comparisons between national standards of member countries and the international standard
- To develop and maintain the measurement technologies concerning the above activities
- To perform the measurements of physical constants related to the above activities and make adjustment among them

CIPM, which consists of eighteen representatives out of signatories of the Metre Convention, plays a role of an administrative board and supervises BIPM.

As of 10 October 2005, there are fifty-one Member States of the Metre Convention and twenty Associate States and Economies of the General Conference. Since 1938, DOM has been maintaining Indonesia's prototype of kilogram as Indonesia's national standard of mass. Indonesia signed the Metre Convention in year of 1960.

As units of measurement have been expressed by physical and atomic constants, and precisely realized by universal technologies, it became necessary to keep equivalence of the national standards and measurement systems among member states of the Metre Convention.

For this purpose CIPM drafted an arrangement for a system to recognize the national measurement standards and to certify calibration and measurement capability among participating countries. This arrangement was signed by directors of national metrology institutes and concluded in October 1999 (Mutual Recognition of National Measurement Standards and of Calibration and Measurement Certificates Issued by National Metrology

Institutes: CIPM MRA).

The objectives of the CIPM MRA are as follows:

- To establish the degree of equivalence of national measurement standard maintained by NMIs
- To provide for the mutual recognition of calibration and measurement certificates issued by NMIs
- Thereby to provide governments and other parties with a secure technical foundation for wider agreements related to international trade, commerce and regulatory affairs

Therefore, as described above, the progress of metrology based on modern universal technology and the conclusion of the CIPM MRA made it necessary for participating countries to uniquely designate the national standards and for the national metrology institutes to maintain them.

The CIPM MRA has now been signed by the representatives of 67 institutes – from 45 Member States, 20 Associates of the CGPM, and 2 international organizations – and covers further 113 institutes designated by the signatory bodies.

Indonesia signed CIPM MRA in June 2004. Concerning the position of DOM in relation to the CIPM MRA, DOM is not yet designated by the government as one of the metrology institutes of Indonesia. This problem will be discussed in Section 5.1.4 and 5.1.5.

**2) Legal metrology**

Legal metrology is one of the fields of metrology which contributes to the improvement of peoples' lives through imposing legal controls on commonly used measurement instruments according to the conditions in which they are used. But, if each country imposes different legal controls on the rules and items of goods for trade, the result may be greater barriers against free trade and investment.

After concluding the Metre Convention, 37 countries had a meeting in 1937 to draft a convention for institution of an international organization of legal metrology (OIML). The purpose of the convention was to establish an international organization to settle the technical and administrative problems concerning measuring instruments that are not

intended by the Metre Convention but widely used for trade and industry. The draft was finalized in 1952, concluded in 1955, and enforced in 1958.

Since then OIML has been working as the international organization for legal metrology and been developing a lot of technical recommendations for standardization of type approval testing and international documents for metrological administration.

Indonesia joined OIML in 1960, making Indonesia the first OIML member among ASEAN countries.

Along with recent rapid growth of trade and investment, a legal control system on measuring instruments to be traded or to be used for domestic and/or international trade has been increasingly important to achieve so called one-stop testing for trade.

Considering the above conditions a certification system for type approval of measuring instruments was established among OIML member countries in 1991, and after that a mutual acceptance arrangement for the data of type approval testing (OIML MAA) was approved at the meeting of the Committee of International Legal Metrology (CIML) held in Kyoto in 2003. The purpose of the former arrangement is to eliminate multiple testing on measuring instruments and to establish a system of one-stop-testing by leveraging certificates issued by the authority, while the latter is to make it possible for a participating country to utilize the data of type approval testing taken by the other participating country. OIML MAA has been improved by incorporating a system for enforcing mutual confidence (DoMC: Declaration of Mutual Confidence) among participating countries.

**3) Accreditation of calibration laboratories**

As is seen in the system of DoMC of OIML MAA it is quite important to keep credibility of a laboratory participating in the certification system. At present the most common method for this problem is to leverage ISO/IEC-17025 “General requirements for the competence of testing and calibration laboratories”.

To obtain accreditation of ISO/IEC-17025 it is necessary for a laboratory (applicant):

- To be accredited by an accreditation body participating in ILAC-MRA, or
- To receive peer assessment by designated assessors.

As for Indonesia, KAN is participating in APLAC that is a member of ILAC, and many laboratories have so far been accredited by KAN for ISO/IEC-17025.

### 5.1.3 Requirements for International Level of Metrology

When considering the requirements for international level of metrology, it would be useful to point out firstly the components of metrology.

The following are the major components that comprise each category of metrology discussed in 5.1.1:

**1) Components of metrology**

- Legislation
- Technical infrastructure
- Social activities
- International cooperation

These are necessary for developing a metrology system with transparency and accountability which meets the requirements of modern social activities and the international standards, and these should be based on the people's law-abiding spirit especially for legal metrology.

In addition to the above, it should be taken into account that a system of legal metrology is different from that of measurement standard. The former strongly depends on the social activities and on legal system of the country, while the latter is one of the fields of science and rather common among most countries.

From the point of view of technical infrastructure and of international cooperation listed above, the requirements on international level of measurement standards and legal metrology are quite clear.

Concerning measurement standards, as discussed in 5.1.2, a national metrology institute will be requested to make a registration of its calibration capability to CMC of CIPM-MRA. This will require participation in international comparisons and a better quality system than that specified by ISO/IEC 17025. On the other hand, the legal

metrology authority will be requested to contribute to developing OIML recommendations and to participating both in the OIML certification system and in the OIML mutual acceptance arrangement (OIML MAA) on type approval testing of measuring instruments.

Furthermore, when developing a metrology system of a country the following factors should be considered for each item listed above:

**2) Factors for consideration on components of metrology**

- Present condition of each country
- Needs from present and future social activities
- Conformity with international standards and recommendations

The combination of the components of metrology and factors listed above will cover overall points to be discussed.

### 5.1.4 Outline of the Present Metrology System of Indonesia

The purpose of this section is to describe the outline of the metrology system of Indonesia especially in relation to the activities of DOM with the other organizations. Therefore, the other parts, that are irrelevant to or particular to DOM, are not described here. From the point of view of international activities, by comparing the results of this section with the discussion in the preceding sections, we will find the problems of the metrological system of Indonesia and how those problems should be settled. These are discussed in Section 5.1.5 and 5.1.6.

The outline, described below, is derived from the items list in 5.1.3, and arranged from the point of view discussed in 5.1.1-5.1.2. Since DOM is responsible for mass standard and legal metrology, the following discussions are focused on the issues concerning these fields.

**1) Measurement standard**

(1) Legislation and organizations

Indonesia's system of measurement standards is supported predominantly by four national institutes: DOM, KIM-LIPI, KIMIA-LIPI and BATAN. In addition to legal metrology, DOM maintains the Indonesia's prototype of kilogram and is responsible for mass standard, while KIM-LIPI is responsible for measurement standards other than mass standard. KIMIA-LIPI and BATAN are responsible for chemical and reference materials, and

radiation standards, respectively. DOM belongs to the Directorate General of Domestic Trade (DGDT), the Ministry of Trade (MOT), while the other institutes belong to LIPI, Ministry of Research and Technology. As far as we know, it is true that some institutes in the world that adopt a separate system of measurement standard and legal metrology. Among ASEAN countries, however, only Thailand has a system similar to the Indonesia's. The National Institute of Metrology Thailand (NIMT), which maintains all the measurement standards, belongs to the Ministry of Science, Technology and Environment (MOSTE), while the Bureau of Weights and Measures (CBWM), that is responsible for legal metrology, belongs to the Ministry of Commerce. Different from the case of Indonesia, however, all the physical measurement standards are maintained by NIMT.

(2) Technical infrastructure

As described above there are two institutes concerning mass standard of Indonesia. DOM maintains the Indonesia's prototype of kilogram (K-46) as the national standard, K-4, T-4 and two E0 weights as the secondary standards, and an E1 as the working standard, while KIM-LIPI maintains an E0 weight as its mass standard. Except described above, equipment of DOM and KIM-LIPI for mass standard are almost at the same level.

The above nomenclature, "E0", is not internationally defined, and quite confusing with that of OIML recommendation. Therefore, the nomenclature "E0" should not be used. Instead of this the following classification would be recommended.

- Group of the national standard
  - National standard

    The national standard should be uniquely designated.
  - Sub-national standards

    One of the sub-national standards will be used for transferring measurement standard to the group of secondary standard as a working standard, to which an $E_1$ class of weight may be allocated.
- Secondary standard

  This group may be maintained by the calibration laboratories other than the national metrology institute, such as calibration laboratories that are responsible for supplying standards for users. One of the secondary standards will be specified as a working standard.

- Laboratory standard (users of measurement standards)
  This group will be standards maintained in the laboratories of manufactures.

Every ten years, DOM's K-46 has concluded direct calibration of K-46 by the international prototype of kilogram that is the definition of kilogram maintained by BIPM. In this sense DOM that maintains that Indonesia's national standard of mass, is one of the national metrology institutes.

Concerning length standard, DOM maintains Indonesia's prototype of meter and uses it as the standard for calibration of line gauges. KIM-LIPI maintains an iodine stabilized He-Ne laser that is recommended by CIPM as one of the methods for realizing the definition of meter.

It is necessary for both DOM and KIM-LIPI to improve instruments for traceability of length. This problem will be discussed elsewhere in this report.

DOM is not responsible for maintenance of temperature standard but should keep a working standard of temperature for traceability of legal metrology, which will be necessary for the legal metrology standardization centers (LMS centers; Balai SML) and the regional verification offices (RVOs) in future.

(3) Social activities

Measurement standards are one of the social infrastructures, especially for natural science and industrial technology, and have responsibility to certify reliability on the results of measurements. In this sense DOM has been playing a role to supply mass standard through RVOs as discussed elsewhere in this report. Considering the role of measurement standard, it will be necessary for DOM to enforce development of traceability for promoting regional industries not only in the field of legal metrology but also of industrial measurements.

(4) International cooperation

The Asia-Pacific Metrology Program (APMP) is the regional metrology organization (RMO) in Asia-Pacific area. When a national metrology institute wishes to be a member of APMP it is necessary to be designated by the government or a principal national metrology institute.

When a national metrology institute is going to make registration to CMC (Calibration and Measurement Capability) of CIPM MRA for a physical quantity, it has to participate in an international comparisons (CIPM key comparisons or RMO key comparisons) to get accreditation of ISO/IEC 17025 and to receive a peer review for demonstration of its capability and competence. The data to CMC registration has to be reviewed by RMO and JCRB in due course.

These procedures have nothing to do with designation of the national measurement standards. But, theoretically the national standard of the corresponding quantity should be designated beforehand.

Indonesia participated in CIPM MRA in June 2004 by signing of the director of KIM-LIPI. KIM-LIPI participated in some APMP key comparisons and made registrations to CMC about some electromagnetic quantities.

When DOM wishes to participate in the activities of CIPM MRA on mass standard, which is common to both DOM and KIM-LIPI, DOM has to be designated for membership of APMP as one of the national metrology institutes, and to take procedures for participation of CIPM MRA.

Sources of international traceability of mass standard are different between DOM and KIM-LIPI. For example, K-46, the mass standard maintained by DOM, has been calibrated directly by BIPM, while the mass standard maintained by KIM-LIPI has been calibrated by Australia.

**2) Legal metrology**

(1) Legislation

After enacting Indonesia's Law of Legal Metrology (Undang-Undang Republik Indonesia Nomor 2 Tahun 1981 Tentang Metrologi Legal) in 1981, which intends introduction of SI based on metric system, the most influential innovation was enactment of law on comprehensive administrative decentralization in 1999 followed by enforcement in 2001. Along with this policy, administration on regional legal metrology was transferred to provincial governments.

Considering this situation DOM decided to settle 7 LMS centers in major regions. This idea was already presented in the JICA report compiled in 1994 (i.e., before decentralization) intending promotion and control of regional legal metrology by DOM. Two offices for preparing LMS centers already have been settled in Medan and Makassar.

(2) Technical infrastructure

Technical infrastructure of legal metrology will be classified into two categories (i.e., type approval testing and verification).

Principle of type approval testing is based on structural testing, of which technical standards are recommended by OIML. The details of Indonesia's type approval testing will be discussed in section 5.4. DOM has obligation to conduct type approval testing on 40 measuring instruments according to a ministerial order. But the testing facilities are quite old and in bad condition, and the technical instruction manual (SSTK; special technical standards) should be revised to specify the testing conditions in detail. Except the facilities for watt-hour meters for which testing has been conducted by LMK-PLN, the facilities for type approval testing and for verification in DOM are not so different from each other.

Watt-hour meters and water meters are mainly verified by regional PLN offices and by water suppliers, respectively. Except these measuring instruments, verification have been conducted mainly by RVOs. System, facilities and human resources remain in poor condition and demand improvements.

(3) Social activities

One of the most important ideas of legal metrology is the protection of consumers. In many developing countries, this idea is not so popular. This seems to come from the fact that consumers are not so sensitive to correctness of trade. Consumer protection supported by traceability for legal metrology will become increasingly important along with economic development. The authorities should enforce enlightenment on legal metrology.

(4) International cooperation

Indonesia is the first country that participated in OIML among ASEAN countries, and attending CIML and APLMF meeting every year. Furthermore, Indonesia hosted some

APLMF training courses and is playing a leading role on ACCSQ. But if Indonesia wishes to contribute more to OIML, it will be necessary to develop techniques on type approval testing. This will also promote domestic industries since techniques of type approval testing are directly related to import and export of measuring instruments.

### 5.1.5 Present Problems of Indonesia's Metrological System

After completing the first site survey the following have been identified as the specific problems of Indonesia's metrology to be investigated during the second site survey, and should be discussed among authorities concerned including the study team, since those will directly affect the results of the master plan and the role of DOM.

**1) Designation of national standards**

The SI defines the seven base units for measurement and BIPM recommends the methods of their realization. Usually an artifact that realizes a unit of physical quantity is uniquely designated as the national standard since, as described in 5.1.2, the artifact is made up by universal technologies except mass standard. Furthermore, the unique designation of the national standard would be necessary if a country wishes to participate in CIPM MRA. This is due to the fact that CIPM MRA intends the mutual recognition of the national standards and of certification of calibration and measurement capability among participating countries. This means that CIPM MRA assumes the unique designation of the national standard for each unit and domestic traceability to it.

It seems that, so far, Indonesia has not yet explicitly designated the national standards and the organizations responsible for their maintenance for each unit.

As for mass standard, it would be natural to specify Indonesia's national prototype of kilogram as the national standard of mass, since it has been periodically compared directly with the international prototype of kilogram maintained by BIPM, the definition of kilogram.

**2) Participation in CIPM MRA**

When a national metrology institute wishes to participate in CIPM MRA it is necessary to be designated by the government. This is also necessary to participate in the CIPM key comparisons. This procedure is already described in detail in 5.1.4 1) d). It is quite

common that a national metrology institute cannot cover all the standards for measurement, and several national institutes are designated for participants in CIPM MRA.

About this matter, reference should be made of the following paragraph in the text of CIPM MRA for the latter discussions.

> "1.4 Each signatory to this arrangement is the national metrology institute designated by the appropriate national governmental or other official authority of the Member State of the Metre Convention as being responsible for national measurement standards. For any state that has more than one such designated institute, the arrangement is signed by one institute on behalf of all, the names of the other institutes being attached to the document."

For instance France designated the director of National Metrology Institute and National Metrology Laboratory as the signatory, and LNE-LADG, LNE-CETIAT, LNE-ENSAM, LNE-IRSN, LNE-OB, LNE-FEMTO-ST, etc as the participating institutes.

United Kingdom designated NPL as the signatory, and LGC, NEL and NWML as the participating institutes.

Germany designated PTB as the signatory, and BAM and UBA as the participating institutes.

As for Indonesia, KIM-LIPI is the signatory of Indonesia, but DOM, KIMIA-LIPI and BATAN are not designated institutes and would not be able to participate in CIPM key comparisons.

**3) Responsibilities of National Metrology Institutes**

The problem described above will cause the following other problems.

- How should an efficient and effective traceability system be established for mass related physical quantities such as pressure, density, force, etc.?
- Since responsibility of a national metrology is separated into four national institutes and there seems to be no cooperation, it is quite difficult to share information among those institutes. Since three institutes other than KIM-LIPI are not participating in CIPM MRA, it will be difficult for them to receive detailed

technical information from the consultative committees of BIPM. This may cause stagnation of research concerning international comparisons.

- Resources for traceability will be separated and investment for that will overlap.
- Some of standards of these institutes depend on foreign countries due to lack of cooperation among them.
- The research policy on measurement standards is not clear. It is necessary for DOM to make investment on research activities for developing measurement standards. There seems to be no such activities.

**4) Instrumentation for traceability**

As described before there are two length standards in Indonesia, the Indonesia's prototype of meter (X-27), for line gauge and an iodine stabilized He-Ne laser for realization of meter. Those are maintained by DOM and KIM-LIPI, respectively. Both standards have been calibrated by Australia (NMIA) since they lack a comparator between two instruments. Furthermore, an interferometer maintained by KIM-LIPI for calibration of gauge blocks is mal-working. Therefore KIM-LIPI cannot provide length standards based on the definition of meter, nor provide standard for line-gauge, while DOM cannot provide standard for end-gauge. Both institutes depend on a foreign country for their traceability. This is not normal for length standards from the international point of view.

**5) Private sectors**

As the procedures for accreditation of testing laboratories are internationally standardized and private sectors have accordingly entered into business of calibration of measuring instruments, the participating sectors have been involved in a hierarchic system, so that the government institutes concentrate their resources on the development of measurement standards and their dissemination.

However, few such private laboratories in Indonesia can disseminate measurement standards for cutting-edge industries.

It is quite important for the authorities and national metrology institutes to promote such private laboratories in some industrial areas that will provide services to satisfy the request from modern industries. In this process, harmonization between demands from the industries and investment for calibration services should be taken into account.

Most of the provincial laboratories that the study team visited during the second site survey are mainly involved in inspection of agricultural products to be exported.

**6) Laws and regulations**

While developing the progress report and the interim report, we have to refer to various laws and regulations, and found that it is difficult to understand the relationship between the articles of regulations and the articles of the legal metrology law. This is due to the fact that there is no statement on which articles of the law the regulation is referring to.

### 5.1.6 Recommendations

Taking the above considerations into account the recommendations at present would be as follows:

**1) Unique designation of the National Standards**

So far Indonesia has not yet explicitly designated the national standard for each physical quantity and the organizations responsible for their maintenance. They should be designated by a presidential decree or a governmental decree.

**2) National Metrology Institute of Indonesia**

As described above in detail, most of the present difficulties of Indonesia's metrology system seem to come from separation of its tasks into four institutes, DOM, KIM-LIPI, KIMIA-LIPI and BATAN. Therefore, it should be recommended to unify these institutes for elimination of those difficulties. This recommendation will be applicable especially to DOM and KIM-LIPI since these institutes have close relationship concerning basic standards.

Actually the Indonesian government has already settled a consultative committee on national measurement standards (KSNSU) based on a presidential decree. This committee intends promotion of cooperation among the institutes that are responsible for national measurement standards. The committee started discussion aiming at the establishment of an Indonesia's national metrology institute, and concluded a recommendation in August 2005 to establish a national metrology institute of Indonesia. A proposed Indonesia's metrological system is shown in Figure 5.1-1. The discussion on this matter should be

accelerated.

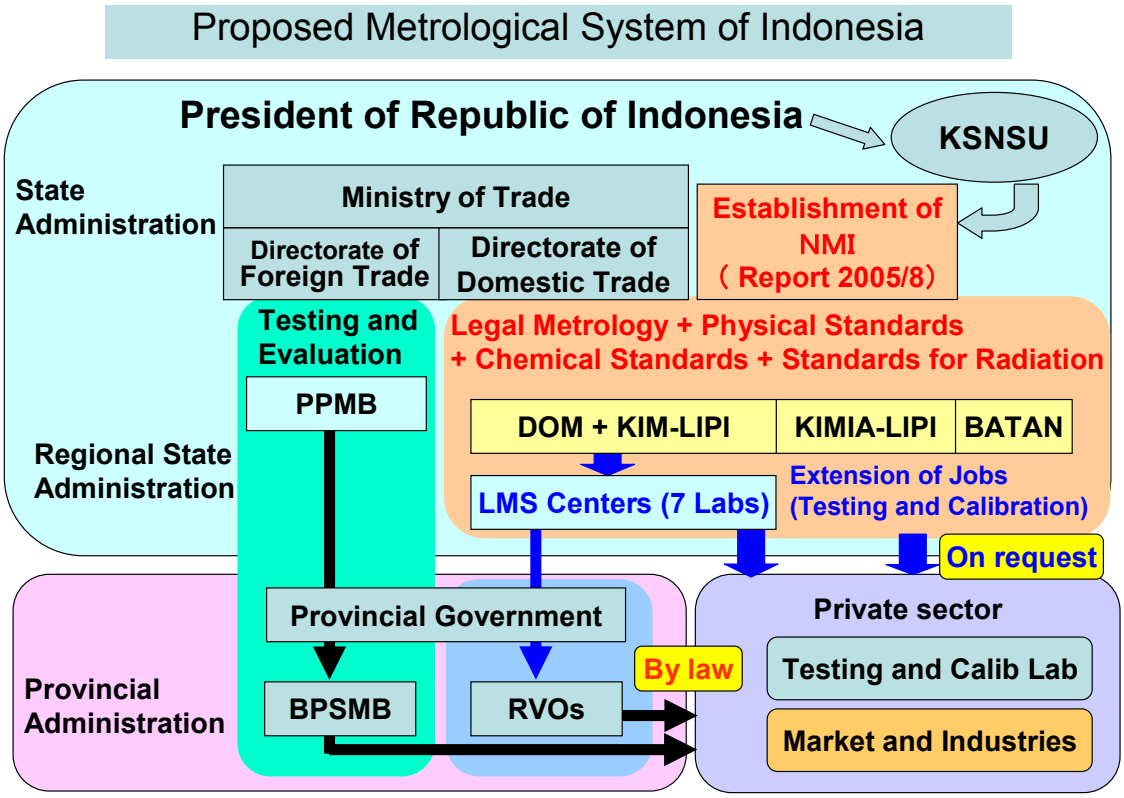



**Figure 5.1.6-1 Proposed Metrological System of Indonesia**

**3) Participation in CIPM MRA**

So far the only one institute, KIM-LIPI, is designated as a participating NMI in CIPM MRA. Indonesia should designate DOM, KIMIA-LIPI and BATAN as participating institutes following the procedures below:

a) Designate the national measurement standards
b) Designate these institutes for membership of APMP
c) These institutes be accredited based on ISO/IEC 17025.
d) Participate in APMP key comparisons
e) Designate these institute for participation in CIPM MRA
f) Perform registration to CMC/CIPM MRA through APMP review

**4) Environment of the national metrology institute**

The current location of DOM is suitable neither for cooperation among the NMIs responsible for national measurement standards, nor for maintenance of the Indonesia's

prototype of kilogram that requires precision measurement. Furthermore the total site area in Bandung is limited for future development. It would be better for DOM to seek another site convenient and suitable for developing a new national metrology institute.

**5) Traceability**

Concerning development of traceability system both in the field of industrial measurement and in legal metrology, it will be necessary to designate the national standards and the organizations for their maintenance and to introduce a hierarchical system, if possible, including private sectors. Updating of equipment and harmonization among the organizations will be requested for functioning of traceability.

**6) Activities of private sector**

As the Indonesian metrological system has been modernized, the private calibration laboratories will become increasingly important in the traceability system. KAN has already accredited about 90 laboratories, and more than half of them are private ones. It is quite important to develop a hierarchical system of traceability involving private calibration laboratories so that they can provide calibration services to the users instead of government laboratories. But a private inspection laboratory that the study team visited during the second site survey is working on inspection of agricultural products for export.

Authority should also encourage manufacturers to establish their associations for better communication and to clarify their needs for metrological control.

## 5.2 Law of Legal Metrology and Related Regulations

### 5.2.1 Legislation System in Indonesia

Modern Indonesian legislation system comes in a number of forms. In August 2000, the People's Consultative Assembly (MPR) issued the following official hierarchy of legislation:

- 1945 Constitution (UUD: Undang-undang Dasar 1945)
- MPR Resolution (Ketetapan MPR)
- Law (Undang-undang)
- Government Regulation Substituting a Law (Perpu: Peraturan Pemerintah Pengganti Undang-undang)
- Government Regulation (PP: Peraturan Pemerintah)

- Presidential Decree (Keppres: Keputusan Presiden)
- Regional Regulation (Perda: Peraturan Daerah)

Applying the above hierarchy of legislation is not without problems. For one thing, with the recent constitutional amendments and reduction in power of the MPR, the legislative force of past MPR resolutions is being reviewed. In addition, there are also other legislative instruments in current use that are not listed in the above hierarchy. They include Presidential Instruction (Instrukusi Presiden), Ministerial Decree (Keputusan Menteri) and Circular Letter (Surat Edaran). Moreover, inconsistencies currently exist between specific legislative instruments.

The ministerial decrees are regulations to implement the government regulations and presidential decrees. The hierarchy explained in Ministerial Letter of No. 06-27 states that the regional regulations should be consistent with the ministerial decrees; however, local governments seem to disregard it.

### 5.2.2 Legal Metrology Regulation System and Autonomy Law in Indonesia

**1) Framework of legal metrology laws and regulations**

Table 5.2.2-1 shows the laws and regulations concerning legal metrology, which can be classified into the following categories:

(1) Basic law of legal metrology
(2) Laws and regulations in common and general relating to legal metrology
(3) Demarcation of roles between DOM and RVOs
(4) DOM
(5) SSTK (Syarat-Syarat Teknis Khusus): Technical Standards
(6) W-H meters
(7) Tank trucks
(8) Pre-packaged goods
(9) Human resources development/MTC
(10) RVOs

**Table 5.2.2-1 Laws and Regulations concerning Legal Metrology**

| Number | Indonesian | English |
|---|---|---|
| **(1) Basic Law of Legal Metrology** | | |
| UU Nomor 2 Tahun 1981 | Tentang Metrologi Legal | Law No.2/1981 concerning Legal Metrology |
| **(2) Common/General** | | |
| UU Nomor 8 Tahun 1999 | Tentang Perlindungan Konsumen | Law No.8/1999 concerning Consumer Protection |
| PP Nomor 10 Tahun 1987 | Tentang Satuan Turunan, Satuan Tambahan, dan Satuan Lain yang Berlaku | Government Decree concerning Additional Units and Other Effective Units (1987) |
| PP Nomor 120 Tahun 2001 | | Government Decree concerning measuring units (2001) |
| 61/MPP/Kep/2/1998 | Tentang Penyelenggaraan Kemetrologian | Ministerial Decree concerning Implementation of Metrology (1988) |
| 251/MPP/Kep/6/99 | Tentang Perubahan Keputusan Menteri Perindustrian dan Perdagangan Nomor: 61/MPP/Kep/2/1998 Tentang Penyelenggaraan Kemetrologian | Ministerial Decree concerning Amendment of "Implementation of Metrology concerning Ministerial Decree of 61/MPP/Kep/2/1998" |
| 29/DJPDN/Kp/XII/98 | Tentang Rincian dan Syarat-Syarat Teknis Khusus UTTP Metrologi Legal | DG-DT's Order concerning Technical Particulars and Conditions of UTTP (Measuring Instruments of Legal Metrology) (1998) |
| 753/MPP/Kep/11/2002 | Tentang Standardisasi dan Pengawasan Standar Nasional Indonesia | Ministerial Decree concerning Standardization and Observation of Indonesian National Standards (2002) |
| 635/MPP/Kep/10/2004 | Tentang Tanda Tera | Ministerial Decree concerning Verification Mark (2004) |
| 636/MPP/Kep/10/2004 | Tentang Ketentuan Izin Perbaikan UTTP | Ministerial Decree concerning Decision for Permission of Repair of UTTP (Measuring instruments) (2004) |
| 637/MPP/Kep/10/2004 | Tentang Ketentuan UTTP Asal Import | Ministerial Decree concerning Imported UTTP (Measuring instruments) (2004) |
| 638/MPP/Kep/10/2004 | Tentang UTTP Yang Memerlukan Penanganan Khusus | Ministerial Decree concerning UTTP (Measuring instruments) Requiring Special Treatment (2004) |
| 640/MPP/Kep/10/2004 | Tentang Pegawai Yang Berhak Menera dan Menera Ulang UTTP | Ministerial Decree concerning Personnel Having Licenses of Verification and Re-verification of UTTP (Measuring instruments) (2004) |
| **(3) Demarcation of roles between DOM and RVOs** | | |
| 731/MPP/Kep/10/2002 | Tentang Pengelolaan Kemetrologian dan Pengeloaan Laboratorium Kemetrologian | Ministerial Decree concerning Management of Metrology and Management of Metrology Laboratory (2002) |
| 30/DJPDN/Kep/XI/99 | Tentang Pedoman Pengelolaan Standar dan Laboratorium Metrologi Legal | DG-DT's Order concerning Management Guidance for Standards and Legal Metrology Laboratory (1999) |
| 01/M-DAG/Per/3/2005 | Tentang Organisasi dan Tata Kerja Departemen Perdagangan | Ministerial Decree concerning Organization and Job Description of Ministry of Trade (2005) |

| | | |
|---|---|---|
| 27/M-DAG/Per/12/2005 | Tentang Organisasi dan Tata Kerja Balai Laboratorium Standar Nasional Satuan Ukuran | Ministerial Decree concerning Organization and Job Description of National Measurement Unit Standard Laboratory Center (2005) |
| 28/M-DAG/Per/12/2005 | Tentang Organisasi dan Tata Kerja Balai Pengujian UTTP | Ministerial Decree concerning Organization and Job Description of UTTP Test Center (2005) |
| 29/M-DAG/Per/12/2005 | Tentang Organisasi dan Tata Kerja Balai Standardisasi Metrologi Legal | Ministerial Decree concerning Organization and Job Description of LMS Center (2005) |
| B/2039/M.PAN/10/2005 | Perihal Organisasi dan Tata Kerja Unit Pelaksana Teknis di Lingkungan Direktorat Metrologi | Letter concerning Organization and Job Description of UTP (Technology Implementation Unit) relating to DOM (2005) |
| **(5) SSTK (Syarat-Syarat Teknis Khusus): Technical Standards** | | |
| 920/Dirmet-1/III/1997 | Tentang Syarat-Syarat Teknis Khusus (SSTK) Meter Air | Regulation by DOM Director: SSTK concerning Water Meter (1997) |
| | (SSTK) | Regulation by DOM Director: SSTK concerning Oil Flow Meter |
| | (SSTK) | Regulation by DOM Director: SSTK concerning Gas Flow Meter |
| | (SSTK) | Regulation by DOM Director: SSTK concerning Tank Truck |
| | (SSTK) | Regulation by DOM Director: SSTK concerning Tank Train |
| | (SSTK) | Regulation by DOM Director: SSTK concerning Fixed Storage Tank |
| | (SSTK) | Regulation by DOM Director: SSTK concerning LPG Flow Meter |
| **(6) W-H Meters** | | |
| 34A/KPB/II/1988 dan 0147 A.K/098/M.PE/1988 | Tentang Peneraan Alat-Alat Ukur Dan Perlengkapannya Yang Dipergunakan Pada Usaha Ketenagalistrikan | Joint Ministerial Decree of Ministry of Trade and Ministry of Energy concerning Verification of W-H Meter (1988) |
| **(7) Tank Trucks** | | |
| 639/MPP/Kep/10/2004 | Tentang KST Tangki Ukur Mobil | Ministerial Decree concerning Regulations of Tank Truck (2004) |
| **(8) Prepackaged Products** | | |
| UU Nomor 7 Tahun 1996 | Tentang Pangan | Law concerning Food (1996) |
| PP Nomor 69 Tahun 1999 | Tentang Label dan Iklan Pangan | Law No. 69/1999 Government Decree concerning Label and Advertisement of Food |
| 31/DJPDN/Kp/XI/99 | Tentang Pedoman Pengawasan Barang dalam Keadaan Terbungkus (BDKT) | DG-DT's Order concerning Guidance on Pre-packaged products (BDKT) (1999) |
| 634/MPP/Kep/9/2002 | Tentang Ketentuan dan Tata Cara Pengawasan Barang dan Atau Jasa Yang Beredar Di Pasar | Ministerial Decree concerning Observation and Method for Goods and/or Service in Marketplace (2002) |
| **(9) Human Resources Development/MTC** | | |
| 482/MPP/Kep/11/2000 | Pedoman Penyelenggaraan Pendidikan dan Pelatihan Fungsional Penera di Lingkungan Departemen Perindustrian dan Perdagangan | Ministerial Decree concerning Guidance with respect to Education/Training of Inspector's Skill in the Ministry of Trade and Industry (2000) |

| | | |
|---|---|---|
| 34/M-DAG/Per/12/2005 | Tentang Organisasi dan Tata Kerja Balai Pendidikan dan Pelatihan Metrologi | Ministerial Decree concerning Organization and Job Description of Metrology Training Center (2005) |
| B/2004/M.PAN/10/2005 | Perihal Organisasi dan Tata Kerja Unit Pelaksanan Teknis Departemen Perdagangan | Letter concerning Organization and Job Description of UTP (Technical Implementation Unit) of Ministry of Trade (2005) |
| **(10) RVOs** | | |
| 32/DJPDN/Kep/XI/99 | Tentang Pedoman Pembinaan Pos Ukur Ulang | DG-DT's Director Order concerning Guidance of Improvement of Re-verification Office (1999) |
| 633/MPP/Kep/10/2004 | Tentang Pedoman Pengeloaan Laboratorium Metrologi Legal | Ministerial Decree concerning Guidance for Assessment of Legal Metrology Laboratory (2004) |
| 634/MPP/Kep/10/2004 | Tentang Pedoman Pengelolaan Laboratorium Metrologi Legal | Ministerial Decree concerning Guidance for Management of Legal Metrology Laboratory (2004) |

Note: "Ministerial Decree" in the table means "Ministerial Decree of Ministry of Trade (and Industry)", if other ministry is not mentioned.

**2) Autonomy Law and legal metrology**

The key features of Law No.22/1999 concerning Regional Autonomy are the devolution of a wide range of public service delivery functions to the regions, and the strengthening of the elected regional councils which received wide-ranging powers to supervise and control the regional administration. This law was amended to Law No.32 in October 2004.

Law No.32/2004 concerning Regional Autonomy (UU Nomor 32 Tahun 2004) :

This new Autonomy Law transfers most authority of the central government to the regional governments except for policies in the judicial affaires, religion affairs, national defense and security, fiscal and monetary affaires, and international diplomatic relationship. The new Law also specifies the authority of local governments for three kinds: decentralization of authority (desentralisasi), deconcentration (dekonsentrasi) and provision of assistance of duty (tugas pembamtuan).

The legal metrology is defined as “decentralization” that the local governments have the authority to manage the tasks.

The tasks can be divided into two types: obligatory task and voluntary task. The former follows the laws of central government, and the latter, the regional regulations.

The tasks are also divided into thirty fields. The task of commerce is defined as a voluntary task. The metrology is a part of commerce, which means its task follows the regional regulation controlled by the local governments.

Table 5.2.2-2 shows the laws and regulations concerning decentralization.

**Table 5.2.2-2 Laws and Regulations concerning Decentralization**

| Number | Indonesian | English |
|---|---|---|
| <Positioning of Ministrial Decree> | | |
| Surat Menteri Kehakiman Dan Hak Asasi Manusia Nomor: 06-27 | Tentang Kedudukan Keputusan Menteri Dalam TAP MPR No. III/MPR/2000 | Ministerial Letter of 06-27 concerning Positioning of Ministerial Decree in MPR Resolution of III/MPR/2000 |
| <Law of Decentralization> | | |
| UU Nomor 32 Tahun 2004 | Tentang Pemerintahan Daerah | Law No.32/2004 concerning Regional Autonomy |
| UU Nomor 33 Tahun 2004 | Tentang Perimbangan Keuangan antara Pemerintah dan Pemerintah Daerah | Law No. 33/2004 concerning Fiscal Balance between the Center and the Regions |
| 80/MPP/Kep/3/2001 | Tentang Penghapusan Barang Milik/Kekayaan Negara Di Lingkungan Deperindag dengan Tindak Lanjut Dialihkan Kepada Pemerintah Daerah | Ministerial Decree concerning National Property Belonging to the Ministry of Trade and Industry to Be Transferred to Local Governments (2001) |
| 130-67 Tahun 2002 | Tentang Pengakuan Kewenangan Kabupaten dan Kota | Ministerial Decree concerning Authorities between Prefecture and City (2002) |

Note: “Ministerial Decree” in the table means “Ministerial Decree of Ministry of Trade (and Industry)”, if other ministry is not mentioned.

### 5.2.3 Legal Metrology System in Japan

**1) Legislation**

The legal Metrology system in Japan is administrated by the Measurement Law, related Cabinet order and Ministorial ordinance. The Law was established in 1951 and fully amended in 1992 (the current Measurement Law) in order to correspond to new social needs, such as internationalization, technological advance and deregulation.

The purpose of Measurement Law is to establish the standards of measurement and secure administration of proper measurement and thereby to contribute toward the development of economy and uplifting of culture (Article 1).

The features of the Measurement Law and legal metrology are as follows:

- The Law consists of three elements: “Units”, “Accurate Measuring”, and “Measurement standards”.
- The Law specifies all kinds of measuring activities related to transactions or certifications.
- Legal metrology has been historically enforced mainly by government organizations for a century.
- Self-inspection system is being promoted and is popular however, few private verification bodies can be found.
- The Law focuses on not only regulation for pre-market stage, such as verification or pre-packaging, but also on after- marketing stage.
- Provision System of Measurement Standards with certification (voluntary) has been set under the Law.

Major points of the Measurement Law are as follows:

a) Main regulation for measurement
   - Prohibition of use of non-legal measuring units for transaction and/or certification
   - Regulation of measuring instruments: Initial verification, re-verification, and periodical inspection

b) Establishment of standards for measurement
   - Unification of units (SI)

- Supply of measurement standards

c) Accurate measurement of commodity quantities

d) Registration of measurement certification business

e) To foster certified measurers and promote autonomous measurement administration in businesses

Appendix 5.2.3 shows the overview of Measurement Law by METI.

**2) Roles of central government and local governments in legal metrology**

In Japan, the roles between the central government and local governments are changing along with the promotion of decentralization. In legal metrology, its responsibility was almost transferred to the local governments. Before the transfer, the central government entrusted the local governments with the work for legal metrology under the comprehensive control of the central government. The local governments only followed the work for legal metrology which the central government specified on country-wide basis.

After the transfer, the local governments have the autonomy of management for legal metrology. The local governments have the authority to achieve the work at their own discretion by their own budget. As a result, some local governments can achieve improvement of service, but some governments cut the budget related to legal metrology, resulting in not only deteriorating the service quality but also facing difficulty in keeping the technology level.

For instance, the number of staffs in RVOs varies from 4 to 108 in 2003. It is considered to be a problem, even taking the difference in scale of local governments into account. In the past, local metrological officers had to get compulsory training; however, it is no longer necessary for them. If some local governments are reluctant to dispatch metrological officers to training courses, their technology level might be deteriorated.

The major roles and responsibilities by the central and local governments are described in the “Report by the Metrology Administration Council” issued in October 1998 as follows:

1. Major roles and responsibilities by the 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.:

- Design and maintenance of metrology system
- Unification of measuring units
- Development, maintenance and supply of national measurement standards
- Administration of national measurement standard supply system
- Designation of designated measuring instruments and implementation of type approval
- Establishment of unified technical standards (laws, government ordinances and ministerial ordinances) for passing requirements of verification/re-verification and inspection for measurement certificates.
- Assurance of compatibility of technical standards with international standards
- Administration of designated measuring equipment manufacturers
- Designation of designated goods and decision of allowance for weight and volume of pre-packaged goods in view of unification of standards nationwide
- Work related to Certified Metrological Engineers (conducting national test, registration, etc.)
- Dissemination of metrology concept nationwide
- Interpretation of laws and regulations

2. Major roles and responsibilities by local governments

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 on-the-spot inspection to check the weight and volume of pre-packaged goods for sale
- Execution of verification/re-verification and inspection for certificate for metrology
- Designation and guidance of Proper Metrological Management Business Office
- Execution of on-the-spot inspection, etc. to measuring instrument manufacturers, shops and

users of specified measuring instruments

- Guidance for promotion of voluntary metrology management
- Enhancing regional autonomy to execute the above tasks depending to the regional situation
- Keeping and enhancement of levels for execution of metrology administration work
- Supply of information to regional inhabitants and dissemination of metrology concepts

### 5.2.4 Present Situation of Legal Metrology System under Decentralization

**1) Demarcation of duties between DOM and RVO**

Ministerial Decree concerning Management of Metrology and Management of Metrology Laboratory (731/MMP/Kep/10/2002) specifies the demarcation of duties between DOM and RVOs as follows:

**CHAPTER 2**

**Implementation of Legal Metrology Activities**

**Clause 2**

The contents of implementation of legal metrology are as follows:

a. Management of Metrology
b. Management of Metrology Laboratory (RVO)

**Clause 3**

The Ministry of Trade and Industry shall perform the management of metrology as described above (Item "a" of Clause 2). The contents are to prepare proposals, make plans, decide policy for the whole country, implement metrology activities and make evaluation for the following subjects:

a. Measurement units, measurement standards and methods of UTTP measurement
b. Metrology observation and instruction in the whole country
c. Conducting human resources development for metrology and training in the whole country
d. Domestically made and imported UTTP
e. Control of verification marks

f. UTTP requiring special treatments
g. Verification fees
h. Cooperation of metrology domestically and internationally
i. Certification of metrology laboratory for implementation of the Law of Legal Metrology, and certification of training of skilled verification inspectors
j. Legal metrology system
k. Information and reporting

**Clause 4**

The Provincial governments shall perform the management of metrology laboratory as described above (Item "b" of Clause 2). Based on the regulations concerning legal metrology, the provincial governments shall perform practical technical work. The contents of the work are as follows:

a. Verification of standard instruments for measurement units
b. Maintenance of facility and equipment in the laboratory
c. Management of standard instruments for measurement units, laboratory rooms, and inspection equipment and materials
d. Fostering measurement human resources
e. Control and use of verification marks
f. Verification and re-verification of UTTP
g. Management of verification fees
h. Observation of prepackaged products (BDKT) and UTTP
i. Dissemination and education activities of metrology
j. Instructing UTTP repairers and manufacturers
k. Conducting UTTP testing for application of type approval of domestic products (Izin tanda pablik) and imported products (Izin tipe).

As mentioned before, the work specified in Item "k" of Clause 4 should be transferred to DOM.

### 5.2.5 Problem Analysis on Legal Metrology System

The following is problems in implementing legal metrology system with recommendations to solve the problem:

1) **Problem 1:**

In transition of authority from the central government to local governments, the local governments seem not to well understand the existing laws and regulations concerning legal metrology. In addition, the demarcation of some responsibilities remains not defined clearly. These facts lead to some confusion in implementing legal metrology.

**Recommendation 1:**

A committee consisting of DOM, local governments, men of learning and experience, representatives from industries and consumers, and authorities concerned should be organized to review and discuss the existing ministerial decrees. If there is a problem, the committee recommends measures for solution including necessary legislation.

2) **Problem 2:**

The hierarchy of ministerial decree and regional regulation is not clear, leading to discrepancy in understanding of the positioning of the ministerial decree and regional regulation between the central government and local governments.

**Recommendation 2:**

As specified in the Ministerial Letter of 06-27, regional regulations must conform to ministerial decrees.

3) **Problem 3:**

Regional regulations tend to ignore orders under ministerial decrees such as DG-DT's orders.

**Recommendation 3:**

Ministerial decrees should refer the important DG-DT's order(s) and regional regulations should be consistent with the ministerial decrees.

4) **Problem 4:**

Some RVOs conduct type approval testing of some kinds of legally controlled measuring instruments. DOM receives the test results for approval and issues the type approval certificate.

The JICA study team visited the RVO that conducts type approval testing. The study team concluded that it does not have sufficient facility and technology to properly conduct the type approval testing. This fact seems to lead to the sale of locally manufactured and/or

imported inferior measuring instruments with type approval by improper test results, which might be a part of reasons that the inferior water meters, locally made and/or imported, are on the market.

**Recommendation 4:**

Item "k" of Clause "4" of the Ministerial Decree of 731/MMP/Kep/10/2002 should be amended. DOM should administrate all procedures for type approval including type approval testing. DOM should manage outsourcing for some tests, even if required.

5) **Problem 5:**

The contents of type approval testing specified in SSTK are insufficient and incomplete. SSTK does not specify the structural testing, durability testing, environmental testing, etc.

**Recommendation 5:**

The contents of type approval testing in SSTK should be revised incorporating OIML's recommendations and considering Indonesian circumstances, which should be referred by the ministerial decree.

6) **Problem 6:**

The regulation does not specify the lower and higher capacity limits of UTTP (legally controlled measuring instruments). At present DOM and RVO are obliged to deal with any capacity of UTTP from the largest to the smallest, which is not practical and sometimes impossible.

**Recommendation 6:**

SSTK should specify the capacity of UTTP to be controlled by legal metrology.

7) **Problem 7:**

The reduction of RVO staffs is anticipated due to age retirement, if local governments do not make up the retired staffs.

**Recommendation 7**:

DOM should prepare the guideline for necessary human resources for RVOs.

8) **Problem 8:**

RVOs are not responsible for reporting to DOM.

**Recommendation 8:**

Ministerial decree, etc. should specify the responsibility of RVOs for reporting to DOM. In

Japan, such information is made public and accessible by all persons. The data of Japan's organizations corresponding to DOM and RVOs, including facilities, activities, performance, budget, etc., can be obtained through their homepages.

## 5.3 Budgetary System

### 5.3.1 Present Situation of Budgetary System

**1) Fiscal decentralization**

Fiscal decentralization constitutes an integral part of government decentralization program launched in 1999 (based on Laws No. 22/1999, No.25/1999 and No. 34/2000). These laws provide regional governments with greater authority to plan and implement their own budgets that can be most effectively designed to incorporate the aspirations of local citizens. In October 2004, Laws No. 22/1999 and No.25/1999 were amended by Laws No. 32/2004 and No. 33/2004.

Law No. 33/2004 concerning Fiscal Balance between the Center and the Regions (UU Nomor 31 Tahun 2004):

This law sets forth the legal framework for relations between the central and local governments, transfer mechanisms, local borrowing/floating of bonds, de-concentration and co-administrative funding schemes, regional financial management, management information system, and other issues related to fiscal decentralization.

**2) Budgets of DOM and RVOs**

There are two streams for the budget flow: MOT allocates its budget to DOM and MTC, and provincial governments appropriate their budget to RVOs.

(1) DOM

The budget for DOM operation comes from MOT.

(2) LMS Centers

The budget to establish the LMS Centers in Medan and Makassar is Rp700,000,000 in 2006 for planning and rent for project office. The budget for 2007 will be appropriated to build the LMS Centers. The budget will be used for the following:

- Securing land
- Construction of laboratory and office
- Purchase of necessary equipment (Class A equipment which is specified in the Ministerial Decree 633/634 in 2004)

(3) Regional Verification Offices (RVOs)

The budget for RVO operation comes from the provincial government. According to the hearing results of RVOs, the budget is sufficient to run RVOs although they can neither purchase new equipment nor substitute old ones. RVOs can get only limited funds from the central government based on their proposals.

According to the questionnaire survey (see Chapter 4), 73% of respondents replied that budget is insufficient. The average cost was Rp648,000,000 (US$70,000), while the revenue from the operation was Rp198,.000,000 (US$22,000) on average.

Following are the hearing results of RVO's budget during the first site survey:

a) Yogyakarta Verification Office

The following is the 2005 budget of the Yogyakarta Verification Office:

- Budget from the provincial government: Rp920,000,000 (US$100,000), in which Rp310,000,000 (US$34,000) is the budget excluding personnel cost
- Budget from the central government based on the proposal: Rp23,000,000 (US$2,500)
- Revenue from fee for verification/re-verification: Rp97,500,000(US$10,600)

b) East Java Provincial Government

The East Java provincial government provides the budget to 7 RVOs. The budget is sufficient to operate the offices, but it can not purchase new equipment. The budgets including all expenses and investment costs are Rp8 billion (US$870,000) and Rp5.5 billion (US$600,000) for 2005 and 2006, respectively. In 2005, the central government gave Rp300,000,000 (US$33,000) to the provincial government for RVOs.

Besides the budget for RVOs, the government plans to allocate the budget for

construction of metrology laboratory: Rp6 billion for building and Rp10 billion for equipment and facilities. In 2006, Rp2.8 billion (US$300,000) is allocated for the construction.

### 5.3.2 Problem Analysis on Budgetary System

The following are problems of the budgetary system with recommended solutions:

1) **Problem 1: Budget for RVOs**

Provincial governments count on verification/re-verification fees of RVOs as the revenue of the provinces, which some provincial governments specify in their provincial regulations. They set a target of revenue from the RVOs. If the RVOs do not achieve the target, the governments tend to reduce the budget of the next year, causing some problems in implementing legal metrology in the region. The problem is that the governments do not fully understand the importance of legal metrology that is a kind of social obligation and welfare to protect consumers and does not yield much revenue from the activities.

**Recommendation 1:**

In the five-year plan of MOT, the importance of legal metrology is addressed. As one of its action plans, MOT should keep contact with provincial governments to let them know the significance of legal metrology. For instance, MOT can provide information on successful examples in certain provinces as well as in ASEAN countries.

2) **Problem 2: Purchase of new equipment**

RVOs do not have sufficient budget to purchase new facility and equipment.

**Recommendation 2:**

DOM should draw up a guideline concerning facility and equipment to be equipped for RVOs. DOM should examine how to provide equipment for minimal requirements to RVOs, if they cannot provide the equipment themselves. For example, PPMB within the Ministry of Trade supplied equipment to BPMBs under the provincial governments.

3) **Problem 3: Verification fees:**

After the decentralization, provincial governments can determine verification fees of RVOs by themselves. PLN and other companies whose activities span nationwide consider it not reasonable.

**Recommendation 3:**

DOM should draw up a guideline to determine the verification fees, as mentioned in the Minister Decree.

## 5.4 DOM

The purpose of this section is to describe the particulars of DOM. Further information about DOM in relation to the other organizations is described in 5.1.

### 5.4.1 Outline of DOM

Indonesia's first metrological regulation, "Ordonansi Tera" (the Verification Ordinance), was enacted in 1923, by which management and enforcement were allocated to the Verification Office. From BIPM, Indonesia later received a copy of the international prototype of meter, X-27, in year of 1928, and a copy of the international prototype of kilogram, K-46, in year of 1938.

After receiving X-27, placing ten years grace from 1928, Indonesia introduced the metric system in the year of receiving K-46. In 1957, X-27 and K-46 were defined as the national standards by presidential decree No. 55. "Ordonansi Tera" was revised four times. Presently, the measurement law of Indonesia is the Law of the Republic of Indonesia No. 2, 1981 on Legal Metrology that intended introduction of SI based on metric system. Accordingly, the Verification Office was taken over by the Directorate of Metrology (DOM) under the Directorate General of Domestic Trade, the Ministry of Trade (MOT).

Metrological services were established in 27 provinces and in 28 out of the second regional governments (i.e., prefectures or cities) by the year 1955. In accordance with unification of the Ministry of Industry and the Ministry of Trade into the Ministry of Industry and Trade, metrological services are established in all the regional governments and municipalities.

Indonesia joined OIML and APLMF in 1960 and in 1999, respectively. DOM has hosted technical trainers training courses of APLMF and sixth APLMF Forum Meeting in Bali.

The following is the brief history of Indonesia's legal metrology:

| | |
|---|---|
| 2 Feb. 1923 | Enactment of the verification ordinance 1923 the Statute Book 57<br>Commencement of metric system |
| 1 Jan. 1928 | Enactment of the verification 1928 Statute Book 255<br>Amendment of period of grace to 15 years |
| 1 Jan. 1938 | Government decree 9 March 1933 No. 21 the Statute Book 1933<br>Prohibition of non-metric measuring instruments |
| 1 Jul. 1949 | Enactment of the verification ordinance 1949 the Statute Book 175<br>Substitution for completion of the preceding verification ordinance |
| 21 Dec. 1954 | Change of the name Verification Office to Metrology Office |
| 30 Oct. 1960 | Join the International Organization of Legal Metrology (OIML) |
| Nov. 1962 | Change of the name of Metrology Office to the Directorate of Metrology |
| 11 Sep. 1968 | Change of the name of the Directorate of Metrology to the Directorate of Metrology, Standardization and Normalization |
| 29 May. 1975 | Separation of the Directorate of Metrology, Standardization and Normalization into the Directorate of Metrology and the Directorate of Standardization under the Ministry of Trade |
| 1 Apr. 1981 | Enactment of the Law of Republic of Indonesia No. 2, 1981 on Legal Metrology (the Statute Book of the Republic of Indonesia 1981 No. 3193) in replacement of the Verification Ordinance 1949 |

Along with the above history DOM is in charge of enforcement of the law of legal metrology, and represents Indonesia in the field of legal metrology. The details of the present DOM are described below.

### 5.4.2 Organization and Functions of DOM

DOM, a technical institute belonging to the Directorate General of Domestic Trade, the Ministry of Trade, mainly consists of two section groups, except management level. One is a group for policy making and technical guidance; the other is a group for maintaining national standards and technical implementation of legal metrology. The activities of these groups are based on the Government Decree No.22/1999 and No.25/2000 followed by the ministerial decree of No.731/MPP/Kep/2002.

The following are the itemized functions of each section. The organization chart is shown in Figure 5.4.2-1.

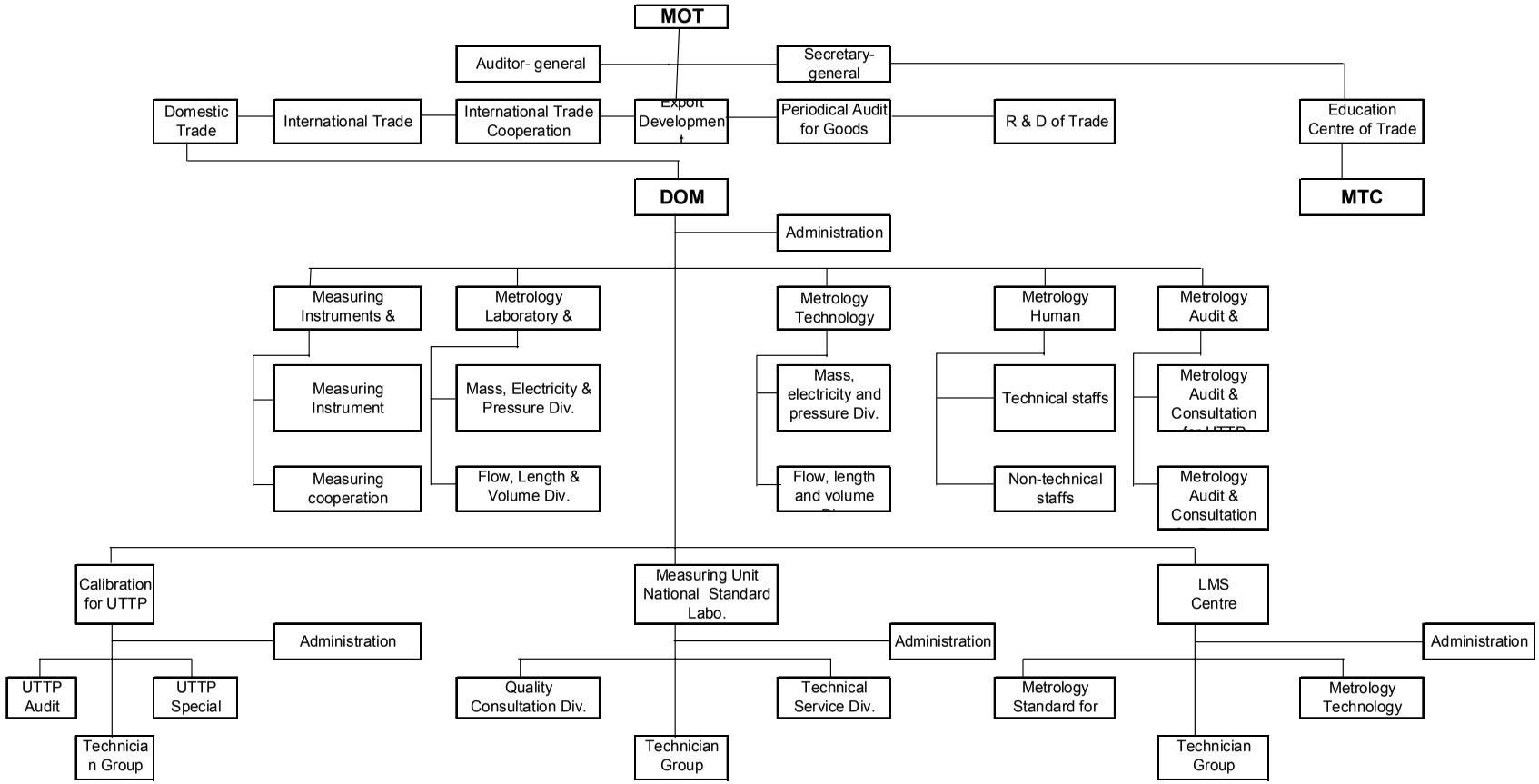



**Figure 5.4.2-1 Organization of Present DOM**



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**1) Sections for policy making and administration**

Sections for policy making and administration are the following five sections and has about 60 staffs altogether. All of these sections involve administrative activities on RVOs.

(1) Organization and cooperation

- Measurement instruments and cooperation with regional verification offices
- Information and reporting system on legal metrology
- Developing information and reporting system on legal metrology in the government

After decentralization, RVOs did not necessarily report their activities to DOM, which seriously prohibited DOM from obtaining statistical information on verification and re-verification conducted at RVOs.

(2) Policy making on measurement standards and calibration

- Standards and calibration technology related to mass, electricity, pressure, temperature, length and volume, as supplied to RVOs
- Policy making on developing and maintenance of traceability for mass and length
- Technical guidance and training to the officers of the regional verification offices
- Assistance to improve the functions of RVOs

(3) Administration on verification and re-verification

- Assistance and guidance to the RVOs for measuring technology, verification and re-verification
- Testing, survey and training on measuring instruments that require special technology

(4) Human resources development

- Human resource development for private sectors and RVOs
- Management of technical training on legal metrology in cooperation with APLMF
- Conduct training courses for staffs after participation in the APLMF training courses

(5) Market surveillance

- Market surveillance of measuring instruments and pre-packaged goods.

The staffs of this section are authorized to detect illegal activities. After decentralization, the present provincial officers lost authority to detect illegal activities.

**2) Sections for technical implementation**

There are mainly three sections for technical implementation and have eighty staffs in all. These sections concern implementation of technical services on measuring instruments such as re-verification, type approval testing, and maintenance of the national standards.

The LMS Centers, two of which preparation offices were settled recently in Medan and Makassar, are described in detail since they are established recently and important for functioning on RVOs. Extension of their services to the private sectors will be important for developing regional industries.

(1) Verification of measuring instruments

- Re-/verification and re-verification of measuring instruments that require special technology
- Type approval testing for legally controlled measuring instruments

DOM performs type approval testing on newly designed measuring instruments. However, several types of measuring instruments do not seem to need testing or verification. Testing and verification should be restricted to include only the types which really need it.

(2) Maintenance of national standards

- Maintenance of the national standards of mass
- Maintenance of the national standards of length for line gauge
- Realization of units of measurement standards and implementation of measurement technology.

DOM is now maintaining Indonesia's prototype of kilogram and the prototype of meter. The former is actually playing a role of Indonesia's national standard of mass, but the role of the latter is ambiguous since the definition of meter should be realized according to CIPM's recommendation.

(3) LMS Centers

a) Process of establishment

The establishment of seven LMS Centers by extending existing RVOs at major cities was already proposed in the former study conducted by JICA in 1993-1994. They proposed the establishment of seven key verification and calibration centers in Medan, Jakarta, Semarang, Surabaya, Banjarmasin, Denpasar and Palembang. Further, they proposed assigning functions of services for private sectors intending to satisfy the needs for higher calibration.

The law on comprehensive administrative decentralization enforced in 2001, however caused serious problems in Indonesia's legal metrology since regional legal metrology was categorized as voluntary rather than mandatory in provincial administration by the law No. 32 / 2004. According to this law, the provincial governments, prefectures and cities have a choice either to implement administration of legal metrology or not.

Hence, DOM lost the authority to control the RVOs responsible mainly for re-verification of measuring instruments in the market. This caused non-uniform administration of legal metrology among provinces. Another serious problem is that the officials of provincial governments do not have power to detect violation of law. Therefore, from the state administration point of view, it is necessary for the state government to establish regional state organizations for implementing legal metrology.

Taking into account these conditions, DOM decided to establish LMS Centers in seven major regions.

However, the functions of LMS Centers, proposed in the former study (i.e., key verification and calibration laboratories) are currently restricted by the ministerial order to technical assistance to the RVOs, and calibration of their reference instruments. Thus, the expected purpose was changed and the regional industries so far cannot have measures to use higher standards and advanced technology.

b) Present condition

The LMS Centers as a laboratory are not yet fully established. But offices for preparing LMS Centers have been settled at Medan and Makassar. The Medan office, which is already functional, organized, and has completed a proficiency test of volume measurement among the RVOs in Sumatera.

c) Role of LMS Centers

The interview with DOM revealed intentions to make LMS Centers take responsibility for only legal metrology, while RVOs will be responsible for both calibration and legal metrology. The role of the LMS Centers should be extended in earliest stage since the calibration capability of the regional private sectors and that of RVOs is quite limited and cannot satisfy the expectations of regional industries.

The activity of proficiency test described above is quite important for developing the capabilities of RVOs.

### 5.4.3 Planning and Policy Making

One function of DOM is planning and policy making for legal metrology. However, no division is in charge of planning and policy making. At present, it seems that planners are appointed by the director as specific issue.

On the questionnaire, the study team requested DOM's mid-term and long-term targets and held a meeting to clarify its meaning. However, most of the targets described were not clear. DOM should develop a quantitative plan with quantitative targets, and MOT should make a thorough effort to help them realize the targets.

In this sense it is quite important for DOM and MOT to provide/invest in human resources for planning and policy making.

As described above, no official division has responsibility for planning. Therefore, at present DOM is unable to develop a plan systematically.

### 5.4.4 Administration of Legal Metrology System

DOM is the governmental organization totally responsible for administration of legal metrology

and for enforcement of the measurement law. In this process, the following points should be considered as the fundamental issues to be discussed hereafter, and would be recommended to encourage and extend their activities.

**1) To define the coverage of legal metrology**

Concerning the issues to which extent the government and the private sectors should cover their roles, the government, in principle, should concentrate its resources on what the private sector could not achieve, such as providing measurement standards to RVOs and calibration laboratories, type approval testing for legal metrology, etc. This will lead to the development of a hierarchical arrangement of roles among participating sectors.

**2) To define the coverage of the additional services besides the legal metrology**

In addition to defining the coverage of legal metrology, DOM, as a headquarters, should define in detail the additional services (such as calibration and guidance) that will be provided. LMS Centers especially need such detail. The LMS Centers should provide regional industries with such services as advanced technologies and calibration so that the services can be accessed.

**3) To involve regional private sectors to develop hierarchical system for tasks of legal metrology**

**I**t is expected that the number of measuring instruments that should be subject to metrological control will increase rapidly. If the present structure to implement metrological control is not improved it would be almost impossible to satisfy the need from social activities and industries. Restructuring of DOM and of the RVOs and development of private sectors are indispensable to fulfill the responsibilities as an administrative organization.

In principle, the private sectors should play a role of manufacturers as well as participant in the traceability system. However, survey data seems to show that the competence of present private sectors is not adequate to bear such a task. So, the government should develop a plan and policy to encourage private sectors and incorporate potentiality into a hierarchical system.

**4) To grasp the activities of regional administrations by improving information flow**

Before decentralization, the RVOs belonged to DOM. After decentralization, however, they became a part of provincial administration, with no obligation to report their activities to DOM. The result is that DOM cannot record statistics on national legal metrology activities.

DOM should propose to amend related laws and regulations and to develop a reporting form to make them report their annual data.

**5) To develop policy of enhancing competitiveness of the products**

Some industries of measuring instruments seem to have competitiveness in international trade while some are behind the international level in quality. Standardization of the industrial products of the latter category should be promoted so that the quality and competitiveness of the products will be improved.

**6) To promote fair competition**

A system should be developed for fair competition between imported measuring instruments and domestically produced ones. If the imported ones are subject to type approval testing or verification, then they must be surely be controlled and subject to the measurement law as well as relevant domestic regulations.

### 5.4.5 Technical Services

Before decentralization, DOM consisted of the headquarters at Bandung and the RVOs in provinces. All of their staffs were national government officials. But after decentralization, RVOs were transferred to provincial governments and DOM at Bandung lost authority to supervise them as headquarters. But DOM still did maintain authority over tasks such as providing standards and consulting on technical services.

The following are the categories of technical services presently provided by DOM.

**1) Supply of standards and calibration**

So far it is recognized by the government that DOM is responsible for providing RVOs with standards of mass as a basic unit and of quantities related to legal metrology such as volume. Actually the study team confirmed that all the RVOs that it visited have been receiving their mass standard from DOM. But some RVOs receive the other standards such

as length from KIM-LIPI.

The sources of a measurement standards should be unified to one national metrology institute. To perform these tasks, the instruments and facilities of DOM must be improved considerably if DOM is to play the role of a national metrology institute capable of providing RVOs and private sectors with standards traceable to national standards. The standards that DOM should provide will include mass-related standards such as pressure, density, force, etc. Modern industries require their precision measurements for these basic quantities.

In addition, LMS Centers currently under settlement should provide regional industries with calibration services and inspection. There is not a laboratory which satisfies needs from regional industries, and private laboratories cannot perform such services since they are focusing their efforts on the inspection of agricultural products.

In addition to the type approval testing, DOM intends to perform services of calibration for the measuring instruments that are not regulated legally. Such items as physical quantities, specifications, etc. should also be clearly defined according to the demand from the customers. The testing instruments to be required for calibration should be prepared and installed based on the demand survey results.

The responsibility of DOM described above will overlap with that of KIM-LIPI. These issues should be resolved as soon as possible and discussion on unification of the national institutes should be accelerated. This would also be necessary for designing facilities of DOM and LMS Centers.

**2) Type approval testing**

One specific task that the national legal metrology organizations should be concerned with would be type approval testing. Therefore, most of the participants of OIML are principally government organizations, and OIML has issued a lot of technical recommendations for standardizing the methods and specifications of type approval testing.

Since the specifications in the OIML recommendations are the results of compromise among the participating countries, they often are not defined strictly. The conditions of

actual type approval testing should be supplemented and clearly defined by the authority to complete the conditions.

In ASEAN countries, as well as most of the world's developing countries, type approval testing recommended by OIML has not been conducted completely due to lack of facilities and knowledge of techniques. Most of Indonesia's type approval testing seems to be similar to just calibration or verification.

Indonesia should implement type approval testing (i.e. structural testing) in accordance with international standards in order to certify the quality of measuring instruments supplied to consumers.

**3) Initial verification and re-verification**

Before decentralization, initial verification and re-verification were conducted by DOM at Bandung and among the RVOs. DOM at Bandung provided technical services to RVOs as functions of headquarters, such as calibration of working standards maintained by RVOs and consulting about measurement technologies. RVOs that once were sub-organizations of DOM were transferred to provincial governments at the time of decentralization. Then services of initial verification and re-verification conducted by DOM, including RVOs, were allocated only to RVOs as their major tasks.

Thus, concerning verification, DOM functions as the headquarters with responsibilities only for verification of measuring instruments requiring special technologies. Extending capability of DOM to the work as a national institute, DOM should conduct the work on type approval testing.

**4) Factors to be considered for technical services**

The following are the factors to be considered during the design of the technical services described above.

(1) Instruction manuals for testing

The present conditions on verification and type approval testing are written in SSTK as an instruction manual for all inspectors of DOM and RVOs. Therefore, the following guidelines should apply:

- Every inspector can understand the meaning of the test.
- Every inspector can understand the contents and procedures of the test.
- The conditions of the testing should be specified clearly and in detail, as much as possible.
- Testing should be reproducible by following the instruction manual.
- A test report format should be prepared to record the procedures of the test and to be able to compare the repeated tests in a specific manner.
- Every inspector should have an instruction manual at hand or be able to access it easily.
- Every item written in the instruction manual should be practiceable at the environment of the inspector.

The study team found that: some inspectors of RVOs have not yet read the SSTK and have been using only a test report format; some RVOs store the SSTK where the inspectors cannot reach it easily; and in some RVOs relatively low- ranking officials cannot access the SSTK.

Furthermore, some items of testing may not be possible due to lack of necessary instrumentations in DOM.

(2) Coverage of type approval testing

The study team's findings showed that forty types of measuring instruments must be subjected to type approval testing in Indonesia. These include wood meters, steel measures, tape measures, etc., which are quite stable, unworkable for committing fraud, and do not need to be accurate. These types of measuring instruments may be better categorized as those controlled by an industrial standardization system since the quality of officially certified instruments does not decline quickly. Therefore, metrological control of measuring instruments should be harmonized with policies of industrial standardization.

(3) Purpose of the law and regulations

Another point to be considered is the purpose of the measurement law and its related regulations. Various regulations should be composed systematically under the basic policy such as consumer protection, services for accurate measurement in civil life, development of regional industries, etc. Thus, the services which do not meet the basic policy should be

excluded from governmental services.

(4) Stakeholders and sector in charge

Type approval testing and verification are essential to legal metrology and quite influential to safety and fair trade in civil life. Therefore, in principle, the sectors in charge of these services should be separated from the suppliers that use measuring instruments under legal control. In this sense, the most common idea is to allocate these services to the government. However, it would be possible to leave these services to a private sector, which is capable of managing them under a standard accreditation system. It would not be normal for PLN and water supplying companies to conduct type approval testing and verification of the measuring instruments that they use.

(4) Range and conditions of testing

The conditions and ranges of testing, the types of measuring instruments to be tested, and their range of measurement should be defined clearly. Surveys conducted by the study team show that most ranges and conditions of testing and range of the measuring instruments to be tested are not defined in type approval testing and verification by DOM. Therefore, it is often impossible for DOM to perform verification and type approval testing on measuring instruments that exceed the capacity of DOM's facilities. Upper and lower limits of specifications of the measuring instruments and of testing conditions should be defined in the regulations.

### 5.4.6 DOM's Human Resources Development (HRD) Program

Human resource development concerning metrology covers a broad area of education and training. Technically, Metrological Training Center (MTC) at Bandung has been educating inspectors working in DOM and RVOs.

In this section, we will discuss the human resource development for DOM as headquarters of administration of legal metrology.

As described above, sections of DOM have various responsibilities for managing legal metrology in Indonesia. The following are possible categories of workers in DOM classified by job positions.

a) Technicians for operating facilities
b) Technical assistant officers for metrology
c) Administrative/Technical officers for domestic metrology
d) Administrative/Technical officers for international metrology
e) Administrative/Technical planning officers for policy making
f) Management officers for general affairs and personnel affairs

Categories for e) and f) should be independently settled from the other sections, and human resource development and intensive training will be required in these fields. So far, there is not a section for these tasks.

The international standardization of management of testing and calibration laboratory has been making rapid progress. Not only the staffs of d) but also almost all staffs will be required to understand the system of laboratory management.

Furthermore, it will be necessary for the technical staffs to understand traceability and evaluation of measurement uncertainty.

### 5.4.7 Internationalization

Indonesia has been a member state of the Metre Convention and OIML since 1960. It is only Indonesia among ASEAN countries that is a full membership signatory of both the Metre Convention and OIML. These two organizations are the stages on which world metrology authorities communicate and cooperate with each other.

Furthermore DOM, as the representative of Indonesia, is a member of Asia-Pacific Legal Metrology Forum (APLMF), and of WG on Legal Metrology of the ASEAN Consultative Committee on Standards and Quality, in which DOM has played a leading role. It can be said that Indonesia has been already contributing to international activities of legal metrology.

Indonesia should take the following actions to establish a system which meets the international standards and to contribute to activities of the framework of the Metre Convention and OIML.

**1) To participate in the APMP**

This would be the first step after designating the national standards of Indonesia to access

CIPM MRA under the framework of the Metre Convention. The most preferable method to clarify the responsibilities among the national metrology institutes of Indonesia will be unification of the institutes involved.

**2) To participate in the technical committee of OIML and contribute to developing OIML recommendations**

DOM has been representing the authority of Indonesia's legal metrology, but it must become more active in OIML and APLMF in order to establish a system which meets international standards. It is difficult to establish such a system without taking part in the world technical activities.

### 5.4.8 Problem Analysis on DOM

Upon analyzation of DOM's present conditions from the following points of view, these problems clearly should be settled hereafter. Some of the problems below will require amendment of legal regulations.

**1) Law and regulations**

The purpose and target of law and regulations should be clearly defined when drafted.

**2) Organization and functions**

(1) Definitions of functions of organization

Problems concerning DOM's organization and functions have been described in the preceding section. Re-organization will be required to make the roles and functions of each section clear. It will be necessary to settle sections responsible exclusively for international cooperation and for planning.

(2) Extension of role of LMS Centers

DOM plans to establish the LMS Centers in major provinces in the near future for dissemination of legal metrology. From the point of view of efficiency, the roles and functions to be attributed to these organizations should clearly be defined since these are all central government organizations.

In that case, functions of LMS Centers should be extended so that they meet the needs of regional industries as pointed out in the report issued in 1994. A good example of the

activities of LMS Centers is coordination of proficiency test among RVOs.

(3) Definition of the range and conditions of type approval testing and verification

It will be necessary to define the ranges of measuring instruments subject to testing and conditions of type approval testing and verification in accordance with the purpose and target of the legal metrology. Otherwise limitless tasks which DOM cannot process will be imposed on DOM.

**3) Responsibilities in relation to the other sectors**

(1) Responsibilities of the national metrology institutes

Development and maintenance and development of measurement standards, one of the DOM's principal functions, is based on the Law on Legal Metrology, Articles 8 to 11. These articles state that the organization responsible for maintenance of the national standards should be defined by government decree. Currently, these responsibilities are split into four national institutes, and there is some confusion about mass standard and length standard.

(2) Involvement of the private sector

In some advanced countries, some roles in traceability are borne by private sectors. But it is difficult for developing countries to establish such a system since private sectors concerning metrology are inadequately developed to bear traceability. Therefore, at present the national institutes should accordingly play a leading role for establishing traceability system and still be required to perform technical services.

**4) International cooperation**

DOM and other national metrology institutes concerned should be designated in due course as the national metrology institutes responsible for maintaining the national standards and traceability of related physical quantities.

The steps necessary to participate in the CIPM MRA and to make registrations to CMC have been presented in previous section.

This seems to originate from the fact that DOM is not yet an Indonesia's member of APMP and as an Indonesia's national institute to participate in CIPM MRA.

From the point of view of international legal metrology, DOM should participate in technical committees of OIML recommendations. However, it will be necessary to upgrade facilities and related technologies to handle the rapid development of international legal metrology and to participate in OIML Certificate system and MAA (Mutual Acceptance Arrangement)

**5) Present laboratory conditions and facilities**

(1) Necessity of new national metrology institute

Environment of DOM, as a national metrology institute that maintains the national standard of mass, is not suitable for precision measurement since the DOM is located in downtown Bandung near a major expressway. The location should be quiet and convenient, and the area of the site should be large enough for future expansion.

Furthermore, unification of the four national institutes (i.e., DOM, KIM-LIPI, KIMIA-LIPI and BATAN) is essential for establishing a national metrology institute, making rapid progress in Indonesia's metrological activitities, and providing people with international level technical service.

## 5.5 Decentralization and Regional Verification Offices (RVOs)

### 5.5.1 Present Situation of Legal Metrology System under Decentralization

**1) Enforcement of Regional Autonomy Law**

The most influential innovation on legal metrology after enforcement of the law on legal metrology in 1981 would be the Regional Autonomy Law (No.22/1999, No.25/1999). It was enacted in 1999, enforced in 2001, and revised in 2004 (No.32/2004). This innovation was intended to decentralize several administrative services and leave implementation to the regional governments.

**2) Present problems and difficulties on regional verification offices (RVOs)**

Before enforcement of this law in 2001, all RVOs belonged to DOM, and DOM Bandung had functioned as the headquarters. After decentralization, RVOs were transferred to the provincial governments. Therefore, facilities and officers were not changed much in the procedures of this innovation. Decentralization did cause the following various problems and difficulties related to the enforcement of legal metrology.

- Non-uniform administrative services in legal metrology depending on policy of each province
- Different budgetary system among provincial governments
- No duties of RVOs to report their activities to DOM
- No budgetary support from DOM to RVOs, etc.

These aforementioned problems and difficulties are from the viewpoint of RVOs. In view of responsibilities of DOM, somewhat different issues are anticipated. These will be discussed in the latter section.

### 5.5.2 Outline of RVOs

The study team visited eleven RVOs out of fifty-four existing regional verification offices, and received 32 replies to the questionnaire, which were delivered to every RVO beforehand.

Following is a list of RVOs visited by the study team:

Jakarta, Bogor, Yogyakarta, Surabaya, Manado, Makassar, Denpassar, Medan, Padang,

Pekanbaru and Banjarmasin.

The results of the survey including questionnaire and interviews to three inspectors of each RVO are described below.

### 1) Survey on RVOs

#### (1) Jakarta RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・77 (including 57 technicians) |
| Verification/ Re-verification | ・Gas meter, Tank lorry, WH meter, Taxi meter, Water meter, weight, Volumetric tank |
| Main equipment for verification | ・For:; Scale, Weight, Water meter, Fuel dispenser, Taxi meter, Tank lorry, WH meter, Gas meter, Packaged products |
| Operational cost | ・9 billion Rp |
| Training | ・Almost staffs completed the training of MTC. |
| Others | ・Obtained the accreditation of ISO17025 and the accreditation of calibration laboratory from KAN. |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・No newcomer, but changes of personnel by Jakarta city government (with training of MTC) corresponded. |
| Education | ・Training of verification for taxi meter and up-to-date technologies is requested. |
| Equipment | ・Sufficient equipment seems to be provided. |
| Budget | ・No problem |
| Verification/ Re-verification | ・Increase of verification and re-verification for gas meters expected in future<br>・The ratio of examinees for scale is estimated as approx. 60%. |
| Others | ・Obtained the accreditation of KAN by requests from industries.<br>・The illegality for legal metrology can be punished by the investigator for legal metrology of police office in Jakarta. |

- Since year of 2000, calibrations in general have been implemented on request.
- Some inspectors are organized by police to detect violation of law and regulations on legal metrology.
- Jakarta RVO does not require a LMS center since they can mange legal metrology well after decentralization.

### (2) Bogor RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・32 (including 26 technicians) |
| Verification/ Re-verification | ・Mass, Volume, Length |
| Main equipment for verification | ・For: Scale, Weight, Fuel dispenser, Taxi meter (by borrowing equipment from Jakarta RVO), Tank lorry |
| Operational cost | ・2.5 billion Rp |
| Training | ・Lack of budget to dispatch staffs for training |
| Others | ・After decentralization to regional governments, the office moved to the place. |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・Lack of personnel. Difficulty of supplement for retiring staff |
| Education | ・Lack of budget to dispatch staffs for training<br>・Possible to participate in a short-term training (e.g. packaged products, K-w meter) |
| Equipment | ・No equipment for the verification/re-verification of water meter and WH meter |
| Budget | ・Not sufficient budget. No budget for the popularization, enlightenment of legal metrology |
| Verification/ Re-verification | ・Before decentralization to regional governments, the ratio of re-verification was about 90%, but 60% after it. |
| Others | ・Has a plan to built “Re-measurement site” in the city.<br>・Has a regular meeting per month with 5 RVOs in the east Jawa. |

- WH meters and water meters are verified by PLN and a water supply corporation, respectively.
- The provincial government has responsibility for re-verification of measuring instruments including weighing instruments. Bogor RVO conducts it on behalf of the provincial government. Verification has been conducted in the manner that weighing instruments are brought and verified at the RVO, or that inspectors travel carrying verification equipment to conduct on-site verification.

### (3) Yogyakarta RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・47 (including 31 technicians completing the training of MTC) |
| Verification/ Re-verification | ・Mass, Volume, Length, Electricity |
| Main equipment for verification | ・For: Scale, Weight, Water meter, Fuel dispenser, Taxi meter, Tank lorry, WH meter, Packaged products |
| Operational cost | ・0.31 billion Rp ( not including personnel expenses)<br>・0.92 billion Rp (Total budget ) |
| Training | ・31 staffs completed the training of MTC. |
| Others | ・2 verification offices existed , but the one for tank lorry and taxi meter was destroyed by the earthquake on 27 May 2006. |

b) Problems and considerations

| Personnel resources | |
|---|---|
| Education | ・Requests of DOM the training of 25 scale manufacturers<br>・Self-payment is sometimes necessary for training of MTC. |
| Equipment | ・Requested equipment: F1 class mass comparator ,Test equipment for thermometers below 0ºC, Test equipment for sphygmomanometers and standard tanks (for tank lorry, fuel dispenser) |
| Budget | ・Lack of capital for new equipment |
| Verification/ Re-verification | ・The verification for many scales are actively implemented. |
| Others | ・Expects DOM to apply the up-dated information. |

- The RVO covers four provinces and one city.
- The number of manufacturers of weighing instruments and repairers are twenty-five and two, respectively.
- There are five repairers of weighing instruments in Yogyakarta.
- Yogyakarta RVO makes market surveillance on legal metrology a few times a year over four provinces and one city.

**(4) Surabaya RVO**

a) Outline

| Numbers of staffs | ・37 (including 24 technicians) |
|---|---|
| Verification/ Re-verification | ・Mass, Volume, Length, Electricity |
| Main equipment for verification | ・For:; Scale, Weight, Water meter, Fuel dispenser, Taxi meter, Tank lorry, Packaged products |
| Total revenue | ・0.18 billion Rp |
| Training | ・Almost staffs completed the training of MTC. |
| Others | ・Obtained the accreditation of ISO17025, and accreditation of calibration laboratory from KAN<br>・A new legal metrological laboratory by Surabaya government is now going to be constructed.<br>・3 local verification offices exist. (For tank lorry, taxi meter and large water meter) |

b) Problems and considerations

| Personnel resources | ・Promotion of personnel resources is necessary in future. ( same as 6RVOs of prefecture) |
|---|---|
| Education | ・Has a plan for independent education program instead of MTC. |
| Equipment | ・Requests test equipment for high capacity and high grade metrological instruments and a mobile for verification. |
| Budget | ・No problem for operational budget but lack of budget to purchase new equipment |
| Verification/ Re-verification | ・Uses calibration system of Barindo Co. for verification of water meters with attendance of an inspector. |

| | |
|---|---|
| Others | ・Surabaya RVO is connected with 6 RVOs of prefecture level. |

- Calibration services excluding legal metrology services to seven RVOs, will be provided by a newly planned laboratory to avoid labor to bring instruments to DOM.
- According to a survey in year of 1994, 60% of measuring instruments in East Java are concentrated in Surabaya.

**(5) Manado RVO**

a) Outline

| | |
|---|---|
| Numbers of staffs | ・24 (including 13 technicians) |
| Verification/ Re-verification | ・Mass, Volume, length |
| Main equipment for verification | ・For: Scale, Weight, Fuel dispenser, Taxi meter, Tank lorry |
| Annual budget | ・0.168 billion Rp (not including personnel expenses, but including purchasing expenses for equipment) |
| Training | ・Staffs completed the training of MTC. |
| Others | ・Lack of weights for track scale and verification system for tank lorry with large content.<br>・No implementation of verification for WH meters and water meters |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・Fairly no problem of the supplement for retired staffs because of young average ages |
| Education | ・Not enough education expenses<br>・Requests the strengthen of consultation by DOM. |
| Equipment | ・No calibration equipment for tank lorry more than 8kL<br>・Lack of weights to verify track scales |
| Budget | ・60% from province, 20% from central government, 20% from enterprises (Pertamina, PLN) |
| Verification/ Re-verification | ・No implementation of Re-verification for water meters and WH meters |
| Others | ・The preparation of law on legal metrology is delayed.<br>・Cannot enough cover because of wide district of jurisdiction.<br>・Lack of the consciousness of civilian for legal metrology |

- It was suggested that LMS centers should give calibration services to RVOs of measurement standards and measuring instruments of industries.

**(6) Makassar RVO**

a) Outline

| | |
|---|---|
| Numbers of staffs | ・24 (including 16 technicians ) |
| Verification/ Re-verification | ・Mass, Volume, Length |
| Main equipment for verification | ・For: Scale, Weight, Water meter, Taxi meter, Tank lorry, WH meter, Packaged products |
| Operational cost | ・0.66 billion Rp |

| | |
|---|---|
| Training | ・Staffs completed the training of MTC. |
| Others | ・Must have the jurisdiction over east Sulawesi. (It will be separated in 2007.) |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・Lack of personnel resources |
| Education | ・Necessity of education is much higher. |
| Equipment | ・Lack of up-dated equipment |
| Budget | ・Not enough training expenses<br>・Not enough purchasing expenses of equipment |
| Verification/ Re-verification | ・Problem for the accuracies of fuel dispensers<br>(The reliabilities are different per manufacturers.)<br>・Has a plan to implement the Re-verification for water meters from 2007. |
| Others | ・Has a plan to obtain the accreditation of calibration laboratory from KAN.<br>・Has a plan to establish RVOs in east Sulawesi province. |

- The roles of LMS Center Makassar are: calibration of standards at RVOs, supply of equipment, personnel resources development, metrological consultation, enlightenment. The number of staffs will be increased from four to twenty-five by 2010.
- Water meters are verified by manufacturers, purchased by water supply corporations, and re-verified by the RVO. 300,000 pieces of water meters are installed and re-verified 60 units a day.

### (7) Denpassar RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・38 (including 17 technicians ) |
| Verification/ Re-verification | ・Mass, Volume, Length, Tank lorry, Taxi meter, K-w meter, Fuel dispenser, Water meter |
| Main equipment for verification | ・For: Scale, Weight, Taxi meter, Tank lorry |
| Operational cost | ・0.34 billion Rp |
| Training | ・DOM is expected. |
| Others | ・The office moved to Bali from Singaraja after decentralization.<br>・Traceability of electric is to LMK. |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・Staffs are not enough to serve 254 places in Bali.<br>・Expects that DOM supports human resources. |
| Education | ・Wants the support from DOM especially updated technology such as electric instruments. |
| Equipment | ・Expect that DOM supplies the standards based on international standard. |
| Budget | ・Require that the ratio between central and regional governments for budget is determined. |

| | |
|---|---|
| Verification/ Re-verification | ・Calibration facilities for water meters and WH meters have been requested to province government but rejected.<br>・Water meters are verified using the facilities of water meter companies.<br>・WH meters are verified using the facility of PLN. |
| Others | ・The certification of ISO 9000 and ISO 17025 are not obtained because of dissatisfied equipment.<br>・Before decentralization 2 RVOs existed but after decentralization RVO at Singaraja was closed.<br>(Singaraja RVO is strongly requested to be reconstructed.) |

- It is said that establishment of another RVO in Singarajaya would be possible by separating some staffs of the existing Denpasar RVO and by recruiting about ten additional staffs.

### (8) Medan RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・44 (including 17 technicians ) |
| Verification/ Re-verification | ・Mass, weight, Volume, Length, Water meter, WH meter, Taxi meter, Tank lorry, |
| Main equipment for verification | ・For Scale, Weight, Volume, Water meter, Taxi meter, Tank lorry, WH meter, Master flow meter, Moisture meter |
| Annual budget | ・0.65 billion Rp (Revenue of re-/verification fee) |
| Training | ・Educating 5 Staffs per year to be inspectors. |
| Others | ・Has a new truck with a standard tank of 5000L in order to compare the uncertainty of volume standards of RVOs. |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・Many inspectors will be retired near future. |
| Education | ・Makes a daily work program to elevate staff's consciousness. |
| Equipment | ・No equipment to calibrate thermometers and pressure gauges |
| Budget | ・Revenue from re-/verifications is much higher by inspecting 130,000~140,000 units /year. |
| Verification/ Re-verification | ・No problem, but PLN recently required calibrating a flow meter at 3,000 $m^3$/h with heavy oil. |
| Others | ・Interests that Japan transfers re-/verification to enterprises. |

- About 130,000 measuring instruments are verified per year. 700 units of tank lorries and track scales have been used, because of many tank lorries.

### (9) Padang RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・34 (including 18 technicians ) |
| Verification/ Re-verification | ・Mass, Volume, Length, WH meter, Taxi meter, Tank lorry |
| Main equipment for verification | ・For Scale, Weight, Taxi meter, Tank lorry, WH meter, Moisture meter |
| Operational cost | ・0.22 billion Rp (not including personnel expenses) |

| | |
|---|---|
| Training | ・Almost staffs completed the training of MTC. |
| Others | ・A plan to establish a new laboratory was rejected by provincial government. |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・4 inspectors will be retired for 5 years. (Average age: 45) |
| Education | ・Necessity of education is higher. |
| Equipment | ・Lack of up-dated equipment |
| Budget | ・If revenue from re-/verification is reduced, the budget is inevitably cut, then the activity has to be weak. |
| Verification/ Re-verification | ・The verification for water meter using the facility of water meter companies has been rejected, because they do not want to pay the re-/verification fee as well as lending the facility. |
| Others | ・Service car is out of order, and another one can be moved with difficulty, then numbers of re-/verifications are reduced. |

- Most equipment has been used since the Holland period.
- There are many palm oil fields in the West Sumatra provinces. The number of measuring instruments is increasing but RVO cannot give services due to lack of staffs, troublesome service cars, etc. The RVO is really in very critical condition.

**(10) Pekanbaru RVO**

a) Outline

| | |
|---|---|
| Numbers of staffs | ・35 (including 27 technicians ) |
| Verification/ Re-verification | ・Mass, Volume, Length, WH meter, Taxi meter, Oil flow, Tank lorry |
| Main equipment for verification | ・For Scale, Weight, Taxi meter, Tank lorry, WH meter, Oil flow, pressure |
| Annual budget | ・0.22 billion Rp (Revenue of Re-/verification fee) |
| Training | ・Applies 20 technicians to Provincial government because of many retirements and increase of regal metrological instruments. |
| Others | ・Has a plan to build new laboratory (15m x 10m x 3 stages). |

b) Others

| | |
|---|---|
| Personnel resources | ・Many inspectors will be retired near future. |
| Education | ・Necessity of education is much higher. |
| Equipments | ・No calibration facility for water meter |
| Budget | ・DOM has to cooperate with provisional governments in order to unit the verification fee. |
| Verification/ Re-verification | ・The re-/verification is to be implemented by the RVO after the meeting of DOM, PLN and the Pekanbaru RVO, as PLN do not want to re/verify WH meters. |
| Others | ・Regional Corporation of Water Supply charges constant fee to users without using water meters. |

- The calibration facility for WH meters is traceable to DOM and one is traceable to LMK.
- Quality of water itself and services of the water supply corporation are getting worse due to poor management.

### (11) Banjarmasin RVO

a) Outline

| | |
|---|---|
| Numbers of staffs | ・21 (including 11 technicians ) |
| Verification/ Re-verification | ・Mass, Volume, Length, Tank lorry, WH meter, Water meter, Flow meter |
| Main equipment for verification | ・For: Scale, Weight, Length, Water meter, Tank lorry, WH meter, Oil flow |
| Total revenue | ・0.11 billion Rp |
| Training | ・Depends on DOM. |
| Others | ・The land is leased. |

b) Problems and considerations

| | |
|---|---|
| Personnel resources | ・Very lack of human resources, as 4 inspectors will be retired in two years. |
| Education | ・Requests training of MTC around 1 year for a bachelor of technology, as the personnel completed from high school must be educated for 3 years. |
| Equipment | ・The support of provincial government for equipment is very higher this year. |
| Budget | ・Can not perfectly follow up the RVO, because equipment is expensive. |
| Verification/ Re-verification | ・Provincial government determined the re-/verification fee in law of No. 2002-13. |
| Others | ・As the land is leased, it can not be developed. |

- Taxi meters have been used since last year. The number of taxis is only 30.
- The provincial government has plans to relocate from Banjarmasin to Banjarbaru near the airport.

### 2) Interview to inspectors

The following items comprise the questionnaire information for inspectors:

1. Name and age
2. Academic background.
3. Years of working for the RVO
4. Reason for joining the RVO and c/v.

5. Technical level
6. Itemized impression of the training at DOM or MTC;
   a) Equipment, b) Teacher, c) Contents, d) Term, e) Daily allowance, etc.
7. Main duties
8. Feeling of satisfaction with duties
9. Reflection of technical level onto the duties
10. Itemized difficulties for work
    a) Budget, b) Equipment, c) Human resources d) Technique e) Operation manual
    f) Conditions (pay, position), g) Commutation h) teamwork etc.
11. Scheduling and planning for duties
12. Relationship with coworkers
13. Instruction manual for working procedures
14. Knowledge on traceability
15. Satisfaction in management and facilities

As mentioned before, a total of twenty-one inspectors replied to the questions.
The result is shown in Table 5.5.2-1.

**Table 5.5.2-1 Compilation of Survey Responses**

| No. | Question | Classification | Numbers |
|---|---|---|---|
| 1 | Numbers of staffs | Man | 20 |
| | | Woman | 1 |
| 2 | Final academic background | University | 3 |
| | | University while working | 11 |
| | | Courage (special school) | 3 |
| | | High school | 4 |
| 3 | Years worked for RVO | 1~5 | 1 |
| | | 6~10 | 3 |
| | | 11~15 | 3 |
| | | 16~20 | 4 |
| | | 21~25 | 8 |
| | | 26~30 | 1 |
| | | 30~31 | 1 |
| 4 | Organization belonged first | MOT | 7 |
| | | RVO | 8 |
| | | DOM | 1 |
| | | BPMB | 1 |
| | | By general test | 4 |
| 5 | Technical level | Class 1 | 0 |
| | | Class 2 | 2 |
| | | Class 3 | 3 |

| | | | |
|---|---|---|---|
| | | Class 3+ | 16 |
| 6 | Dissatisfaction for education in DOM or MTC | Facility | 1 |
| | | Materials | 9 |
| | | Teacher | 5 |
| | | Content | 6 |
| | | Term | 3 |
| | | Daily allowance | 10 |
| | | Others | 3 |
| 7 | Main duty | Verification | 11 |
| | | Re-verification | 13 |
| | | Consultation | 3 |
| | | Observation | 3 |
| | | Secretariat | 2 |
| | | Control | 3 |
| | | Programming | 1 |
| | | Others | 1 |
| 8 | Satisfaction for duties | Yes | 12 |
| | | Rather yes | 3 |
| | | Somewhat No | 1 |
| | | No | 4 |
| | | Unknown | 1 |
| 9 | Reflection of technical level to works | Yes | 14 |
| | | Not enough | 4 |
| | | No | 2 |
| | | Unknown | 1 |
| 10 | Insufficient for works | Budget | 12 |
| | | Equipment | 19 |
| | | Human resources | 11 |
| | | Technique | 7 |
| | | Education | 8 |
| | | Operation manual | 3 |
| | | Condition (pay, position) | 9 |
| | | Commutation | 1 |
| | | Teamwork | 2 |
| | | Others | 2 |
| 11 | Scheduling for works | Per year | 14 |
| | | Per month | 2 |
| | | Per week | 1 |
| | | No schedule | 1 |
| | | Unknown | 3 |
| | | Personal norm | 2 |
| 12 | Discussion & study | Periodical | 3 |
| | | Irregular | 7 |
| | | None | 0 |
| | | OJT bases | 6 |
| 13 | Working procedure | From DOM | 13 |
| | | By RVO | 3 |
| | | None | 0 |
| 14 | Traceability | DOM | 9 |
| | | LMK | 1 |

| | | | |
|---|---|---|---|
| 15 | Management of equipment | Enough | 5 |
| | | Rather not enough | 4 |
| | | Not enough | 3 |
| | | Unknown | 1 |

Tables 5.5.2-2 and 5.5.2-3 show the requested equipment from RVOs and the RVOs answered to questionnaire, respectively.

**Table 5.5.2-2 Requested Equipment from RVOs**

| No. | Island | Seat of RVO | Required Equipment |
|---|---|---|---|
| 1 | Sumatra | Banda Aceh | All equipment and Peripherals |
| 2 | | Bangka belitung | Mass, Length and volume standards, Standard tank, Test facilities of WH meter, Taxi meter and flow meter |
| 3 | | Bengkulu | Volume and mass standard facilities |
| 4 | | Tanjung pinang | Parama balance (A,B,C,D), Weight (F1 class), Test facilities of WH meter, Taxi meter and Watermeter Mass comparater |
| 5 | | Lampung | Humidity standard, Temperature test stand, mg class balance |
| 6 | | Jambi | |
| 7 | | Pekanbaru | Mass standard, Mass comparator, Test facilities of water meter F1 class Labo. |
| 8 | | Padang | All volume, Mass, Length standards |
| 9 | | Medan | Test facilities of water meter over 2", 3 phase WH meter, Pressure, Gas meter, Tank lorry, Flow meter and Taxi meter |
| 10 | Kalimantan | Samarinda | Facilities of Temperature and Pressure |
| 11 | | Pontianak | Electric tester, Facility of water meter |
| 12 | | Banjarmasin | |
| 13 | Sulawesi | Manado | 10, 200, 500 and 1000L volumetric standard, 10 and 20 kg mass comparator (class2) Water meter facility, Hydraulic pressure test stand, Class 0.2 thermometer |
| 14 | | Gorontalo | Facilities of tax meter, Vanbecker Comparator, Hydraulic pressure test stand |
| 15 | | Palu | Parama balance (C, D), Thermometers in standard works |
| 16 | | Kendari | Clean room adjustable of Temp., Humidity, air and blightness, Mass comparator, Test facilities of WH meter, flow meter, Gas meter and Weight Blood pressure, Standard oil manometer, Pressure calibrator, Pressure recorder, Viscosity standard, Area/Angle standard measuring instrument, Timer, Level gauge |
| 17 | | Makassar | |
| 18 | | Kupang | Mass, Length and volume standards |
| 19 | | Ambon | Reference water meter, Test facilities of flow meter |
| 20 | | Jayapura | Class B Labo |
| 21 | | Denpasar | Mass comparator, Block gauge, Test band, Test facilities of flow meter |
| 22 | West Java | Bogor | |
| 23 | | Bandung | |
| 24 | | Cirebon | Facility of water meter and oil meter |
| 25 | | Jakarta | Facility of gas meter, Telephone pulse counter, Parking meter |
| 26 | | Yogyakarta | |
| 27 | | Surabaya | Temperature, pressure test facilities |

| | | | |
|---|---|---|---|
| 28 | East Java | Jember | Test facilities of Mass, Volume, Humidity, Water meter and Oil flow meter |
| 29 | | Bojonegoro | Test facilities of water meter, WH meter, Pressure, Temp. Void ratio of air, Health meter |
| 30 | | Malang | Class B Labo. Facilities of WH meter, Taxi meter, Tank lorry and oil flow meter |
| 31 | | Pamekasan | Facilities of WH meter, oil flow meter, WH meter and Humidity |
| 32 | | Madiun | |
| 33 | | Kediri | Humidity standard, Mass comparator |

**Table 5.5.2-3 RVOs Answered to Questionnaire**

| No. | Island | The seat of RVO | Number of personnel | Population |
|---|---|---|---|---|
| 1 | Sumatra | Banda Aceh | 9 | 4,033,863 |
| 2 | | Bangka belitung | 8 | 1,000,000 |
| 3 | | Bengkulu | 21 | 1,500,000 |
| 4 | | Tanjung pinang | 8 | 1,198,526 |
| 5 | | Lampung | 31 | 7,500,000 |
| 6 | | Jambi | 20 | 3,156,125 |
| 7 | | Pekanbaru | 35 | 4,755,180 |
| 8 | | Padang | 34 | 4,800,000 |
| 9 | | Medan | 44 | 5,000,000 |
| 10 | Kalimantan | Samarinda | 24 | 562,463 |
| 11 | | Pontianak | 25 | 5,437,000 |
| 12 | | Banjarmasin | | 13,000,000 |
| 13 | Sulawesi | Manado | 24 | 2,154,240 |
| 14 | | Gorontalo | 8 | 900,000 |
| 15 | | Palu | 25 | 270,000 |
| 16 | | Kendari | 28 | 1,911,000 |
| 17 | | Makassar | 41 | *7,400,000 |
| 18 | Island | Kupang | 27 | 4,000,000 |
| 19 | | Ambon | | 275,888 |
| 20 | | Jayapura | 12 | 3,000,000 |
| 21 | | Denpasar | 38 | 3,179,918 |
| 22 | West Java | Bogor | 30 | 2,000,000 |
| 23 | | Bandung | 186 | 3,700,000 |
| 24 | | Cirebon | 29 | 223,776 |
| 25 | | Jakarta | 76 | 9,250,900 |
| 26 | | Yogyakarta | 47 | 3,200,000 |
| 27 | East Java | Surabaya | 30 | 3,000,000 |
| 28 | | Jember | 31 | 5,006,975 |
| 29 | | Bojonegoro | 16 | 3,691,256 |
| 30 | | Malang | 25 | 8,644,000 |
| 31 | | Pamekasan | 10 | 634,197 |
| 32 | | Madiun | 24 | 3,876,018 |
| 33 | | Kediri | | 8,000,000 |

* Population in Southern Sulawesi

The results of questionnaire are shown from Figure 5.5.2-1 to Figure 5.5.2–8.

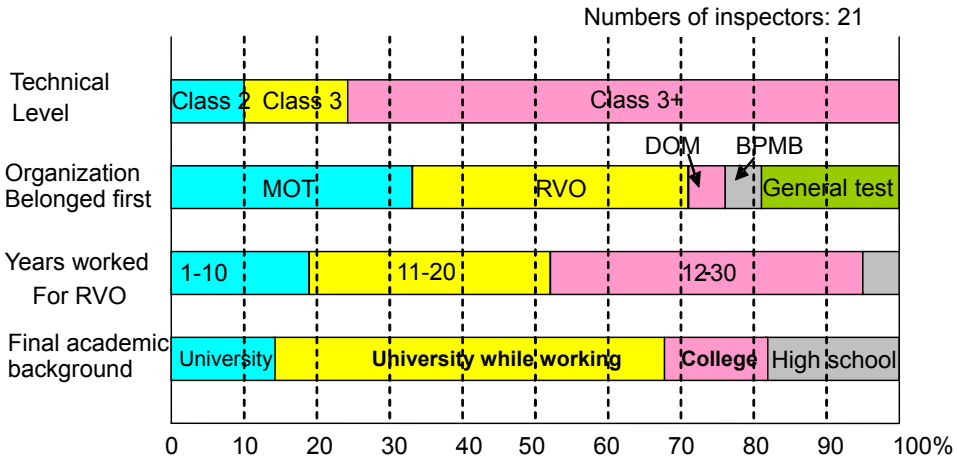



**Figure 5.5.2-1 Results of Questions 2 to 5**

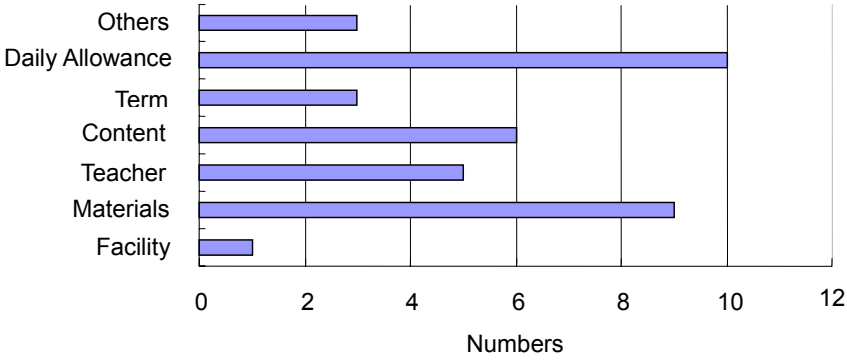
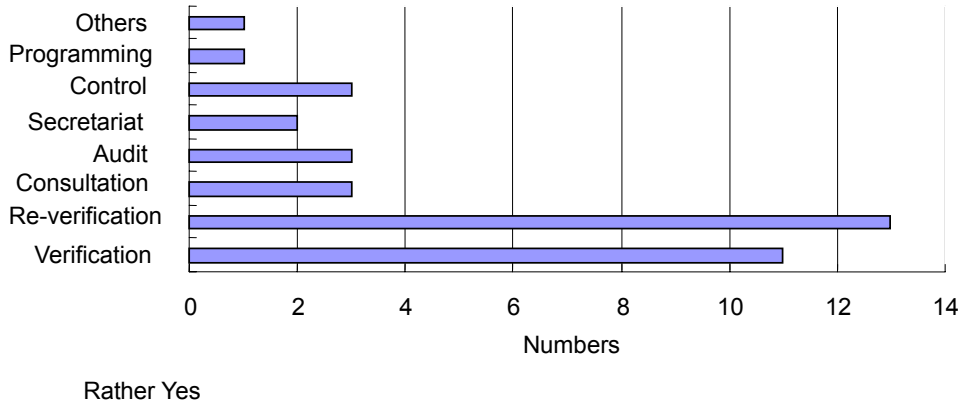



**Figure 5.5.2-2 Dissatisfaction for Training in DOM or MTC**




Rather Yes

**Figure 5.5.2-3 Staffs' Main Duties**

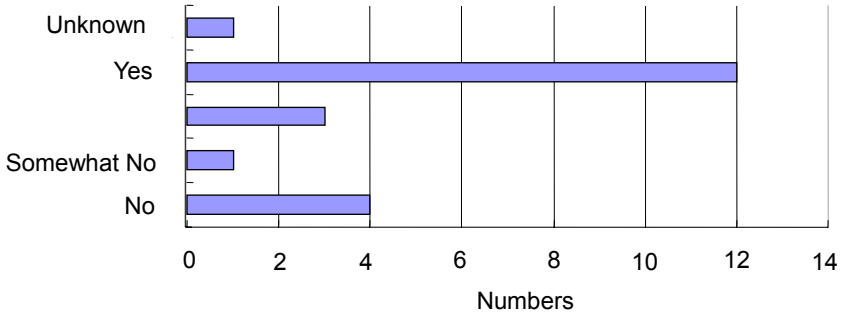



**Figure 5.5.2-4 Satisfaction for Duty**

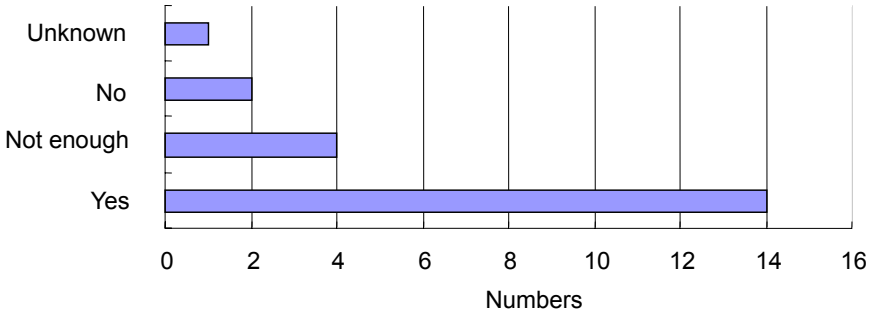



**Figure 5.5.2-5 Reflection of Technical Level to Work**

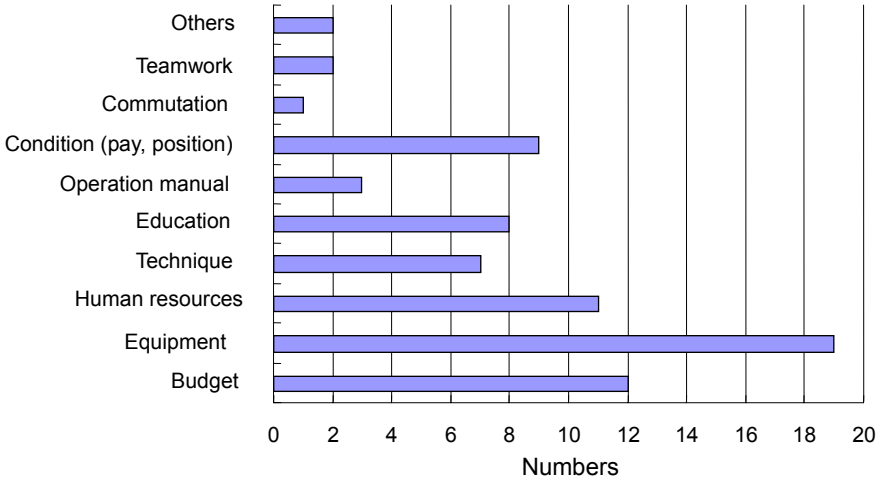



**Figure 5.5.2-6 Factors Insufficient for Work**

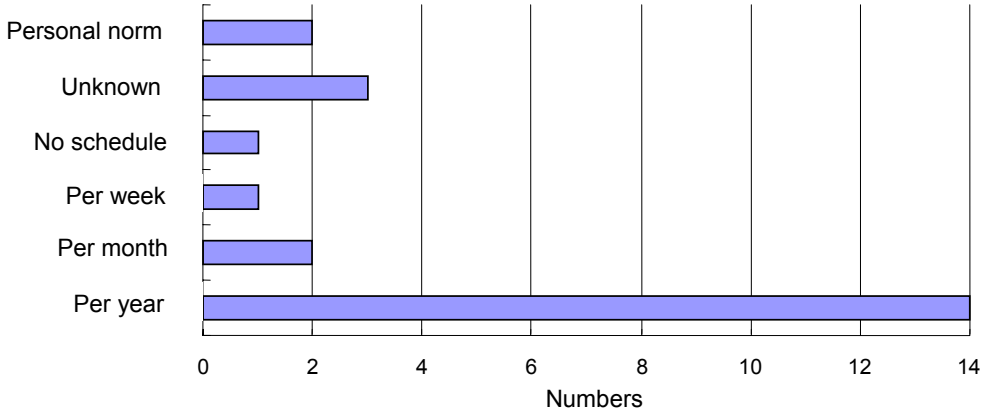



**Figure 5.5.2-7 Scheduling for Works**

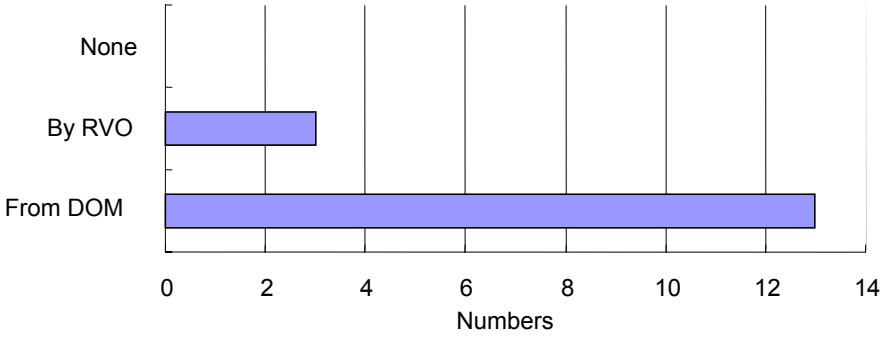



**Figure 5.5.2-8 Working Procedure**

### 5.5.3 Organization and Its Duty

According to the decentralization law, RVOs have been under the control of provincial governments since 1999. The duties of RVOs are as follows.

1) Verification and re-verification of legally controlled measuring instruments (UTTP)
2) Consultation on legal metrology
3) Market surveillance of legally controlled measuring instruments
4) Administrative control of legal measuring instruments
5) Implementation of type approval testing

- One difficulty in performing their duties is that they have no authority to detect either violations of law or regulations on legal metrology.
- Regarding 5), RVOs seem to conduct only testing similar to initial verification on simple measuring instruments, since they do not have facilities for structural testing.

### 5.5.4 Services of RVOs

**1) Verification/re-verification**

a) The ratio of re-verification decreased greatly after decentralization.
b) Verifications of water meters and WH meters are actually implemented by water meter companies and PLN, respectively.
c) Verification of imported water meters are not implemented except by Jakarta RVO.
d) Re-verification for water meters and WH meters has been implemented.
e) The inspection of pre-packaged products is not implemented except by RVOs of Jakarta, Yogyakarta and Surabaya.

**2) On-the-spot inspection**

Generally, RVOs conduct on-the-spot-inspections. Inspection equipment necessary is brought by car including standard volumes to inspect fuel dispensers, standard weights to inspect weighing instruments, etc. According to this survey, many RVOs do not have sufficient service cars because they lack budget to purchase new cars or to repair old ones. Service cars are essential for conducting inspections and verification in local areas due to the high ratio of inspections in these areas.

**3) Dissemination**

The questionnaire survey showed that nineteen RVOs (about 60% of RVOs) circulate pamphlets on dissemination of legal metrology, and twelve RVOs disseminate legal metrology by exhibition and demonstration.

**4) Maintenance of traceability**

Results of interviews showed that the mass standards of RVOs are traceable to DOM. In an RVO, it is calibrated once a year when a trainee goes to MTC with a mass standard. In other RVOs it is calibrated once every three years. After that, RVO calibrates all mass working standards using the mass standard step by step. The working standards of volume are also calibrated based on the gravimetric method.

The length standards are separated into two categories: end gauge and line gauge. The former has been supplied by KIM-LIPI, while the latter has been supplied by DOM in the field of legal metrology.

### 5.5.5 Problem Analysis on Legal Metrology System under Decentralization

**1) Non-uniform service level caused by decentralization**

According to the autonomy law discussed above, even though the fundamental administrations are controlled by the state government, regulations for enforcement of the law are left to the regional governments. This situation caused several differences among actual regulations and activities made by each provincial government. Hence, this will also result in consumers not receiving uniform administrative services of legal metrology. Actually the verification fees of each province are different, and the budgetary system of each province is also different.

**2) Position of legal metrology in regional administration**

Furthermore, the revised Regional Autonomy Law enforced in 2004 categorized administrative services in view of accountability, externality and efficiency to deregulate the implementation of administrative services. Legal metrology, which belongs to the activities of commerce, is categorized into voluntary services so that the regional governments can decide whether they settle the organization to implement legal metrology. This will make the position of legal metrology ambiguous in regional administration.

The development and purchasing of facilities are left to the provincial governments.

**3) Control of legal metrology**

After decentralization by the Regional Autonomy Law, all the officers at RVOs, who had been the national government officers, were transferred to the provincial governments. This caused serious problems in enforcement of legal metrology system, since regional government officers do not have authority to detect violation of legal metrology law.

**4) Extension of DOM's activities**

Since the RVOs have been transferred to the provincial governments, DOM does not have authority to control them. In principle, DOM's activities are naturally restricted to the state administration. DOM should not take this situation negatively rather view it as a chance to extend their activities and administrations onto the true state level administrations, such as research and development of measurement technologies, international affairs on legal metrology, type approval testing, development of traceability, its extension to regional industries, its expansion to new quantities, etc. The state government should support these activities.

### 5.5.6 Problem and Suggestion for RVOs

The following are the summary of Q & A and implementation of interview at RVOs.

**1) Problems**

**(1) Human resources**

a) Generally, the average age of inspectors is rising, making it difficult to supplement retiring staffs.
b) It is also difficult to respond to updated technologies.

**(2) Education**

a) It is difficult for provincial governments with inadequate budgets to make their staffs participate in the training courses held at MTC.
b) Training for new technologies is not sufficient.

**(3) Equipment**

a) Equipment and facilities are both outdated and insufficient in many RVOs.

Table 5.5.2-2 shows the required equipment of RVOs (from questionnaire for RVOs).

b) Service cars are not provided in many RVOs.

c) Air conditioners in standard laboratories are not so good.

**(4) Budget**

a) Generally speaking, the budget for ordinary activities of legal metrology is sufficient, although funds for new equipment, education, dissemination, enlightenment, etc. are scarce.

b) The targets of revenue from re-/verification are allocated to RVOs. Some provincial governments take the verification fee as the source of their revenue.

**(5) Others**

a) Regulations on legal metrology by regional governments have not yet been enacted.

b) Consumers do not have enough concern for legal metrology.

c) Education, dissemination and enlightenment are not sufficient.

d) Since RVOs do not have obligation to report the statistical data to DOM, the national statistics on legal metrology is not always available.

e) Many RVOs request accreditation of ISO17025.

**2) Suggestions**

(1) The Central government (DOM) should consider supplying or lending equipment to RVOs that cannot afford to purchase necessary equipment due to limited budgets.

(2) Provincial governments should not allocate the budget to RVO based on the results of revenue from re-/verification in previous year. If the revenue is reduced, the activities of RVOs tend to be minimized.

(3) DOM should support RVOs in recruiting their staffs.

(4) MTC should improve the training program to be updated and more efficient. The training courses should be shortened.

## 5.6 Human Resources Development (HRD)

### 5.6.1 Necessity for HRD

The RVO staffs, who are working for the end of consumers, should acquire measuring skills according to national minimum requirements. It is also advisable that they should possess

abilities to project future occurences and to deal with it. Now, the authority for the legal metrology has been shifted to the local government. If such skilled and talented staffs are fostered and accumulated in every province, they can take measures to prevent the level for suitable measurement from being deteriorated and discrepant, which might occur in the course of dissemination of legal metrology system nationwide. They can become key persons for the development of legal metrology system in the future as well.

The number of staffs of RVOs might be reduced depending on the situation of provincial governments under the decentralization. The immediate issues for HRD are to take measures to train staffs not only for making up the reduction of staffs but also for improvement of training courses to meet the current situation. The enhancement of giving incentives for staffs by HRD is also important.

### 5.6.2 Outline of MTC

Indonesia is the only country to have a long history of HRD for measuring experts among ASEAN countries. The training facility was built in 1923. To ensure the effectiveness of the training to measuring experts, MTC was established in 1981 when the Legal Metrology Law was enforced. MTC has become the one and the only training center of metrology in Indonesia. The major role of MTC is to foster inspectors working for the regional verification offices (RVOs). MTC became independent from DOM in 2004 and moved to the present location from the land area of DOM. The total land area of MTC is currently approximately 10,245 $m^2$. The buildings of administration, classrooms, multipurpose hall, accommodation and auditorium were constructed in 2002 and 2003 (total floor area is 2,718 $m^2$).

### 5.6.3 Organization of MTC and Its Duties

MTC has four sections including sections for making training plan and coordination. Four leaders are specified in “the Minister Decree of M-DAG/DER/No.34/2005”. The number proposed of instructors includes four full-time employees and eight part-time employees from DOM.

In December 2005, the Decree specified the MTC function, responsibility and so forth.

The major purposes of training provided by MTC are as follows:

1) Acquisition of skills for verification/re-verification of measuring instruments (UTTP)

2) Acquisition of technology to properly treat high-precision standards
3) Acquisition of management skills of calibration laboratories
4) Acquisition of inspection technology of pre-packaged goods (BDKT)

### 5.6.4 Training Program

The JICA study team received the actual records of curriculum in 2005 and the plan of curriculum in 2006. At present, the curriculum is designed according to "the Implementation Guideline for Education and Training of Inspectors, Minister Decree 482/November 2000" (see Appendix 5.6.4) to foster regional inspectors by the centralized system, not considering the effects from the decentralization. It includes detailed description of (1) purposes, (2) qualification of trainees, (3) trainers and textbooks, (4) five classifications of inspectors, (5) relationship between MOT and DOM (DOM is an organization to decide the duties of regional inspectors, management of their capability and their scope of inspection.), (6) training courses with required hours (1,200-1,820 hours by type of learning), and (7) evaluation of trainees.

According to the Minister Decree 482/November 2000, trainees who hold diplomas from high schools and two-year colleges must spend at least four years in training to become inspectors. Graduated of four-year universities need only to take the course titled "Inspector of Legal Metrology" (1,260 hours), to be considered for the certification (see Table 5.6.4-1).

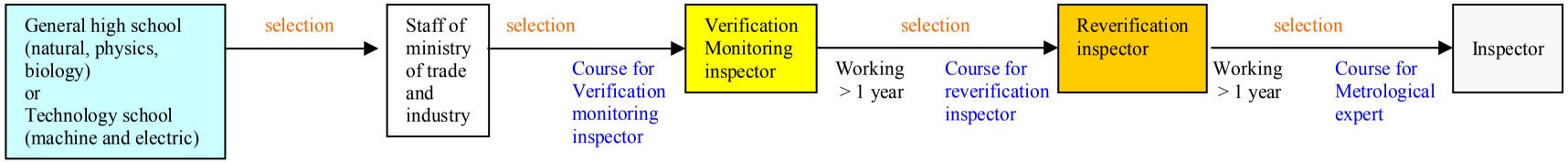
**Table 5.6.4-1 Position Classification and Total Training Hours**

| Position Classification | 【course】<br>Total training hours |
|---|---|
| Inspector of Legal Metrology (first level) | 【A】1820 hours |
| Inspector of Legal Metrology (second level) | 【B】1540 hours |
| Inspector of Legal Metrology | 【C】1260 hours |
| Inspector equivalent for Metrological Controller | 【D】1200 hours |
| Inspector of Legal Metrology equivalent for Re-Verification | 【E】1200 hours |

The process of becoming inspectors is different from the academic background of trainees (see Figure 5.6.4-1). The trainee graduated from either a high school or two-year college must enroll in the course titled "Inspector of Legal Metrology (first level)", which is (A) in Figure 5.6.4-1. The course consists of basic knowledge such as Mathematics, Physics, Statistics, introduction to Metrology, etc. After taking these courses, trainees must work at RVO for one year as intern inspectors. Then, they can take the course "Inspector of Legal Metrology (Second Level)".

Additionally, they must spend another year at RVO. As the final step, trainees can enroll in the course titled “Inspector of Legal Metrology.” Trainees with academic background can skip the preliminary courses and take only the course titled “Inspector of Legal Metrology,” which is (C) in Figure 5.6.4-1.

Base on Ministry decree No. 690/KP/XII/79




**Base on Ministry of Industry and Trade decree No. 482/MPP/kep/1/2000**

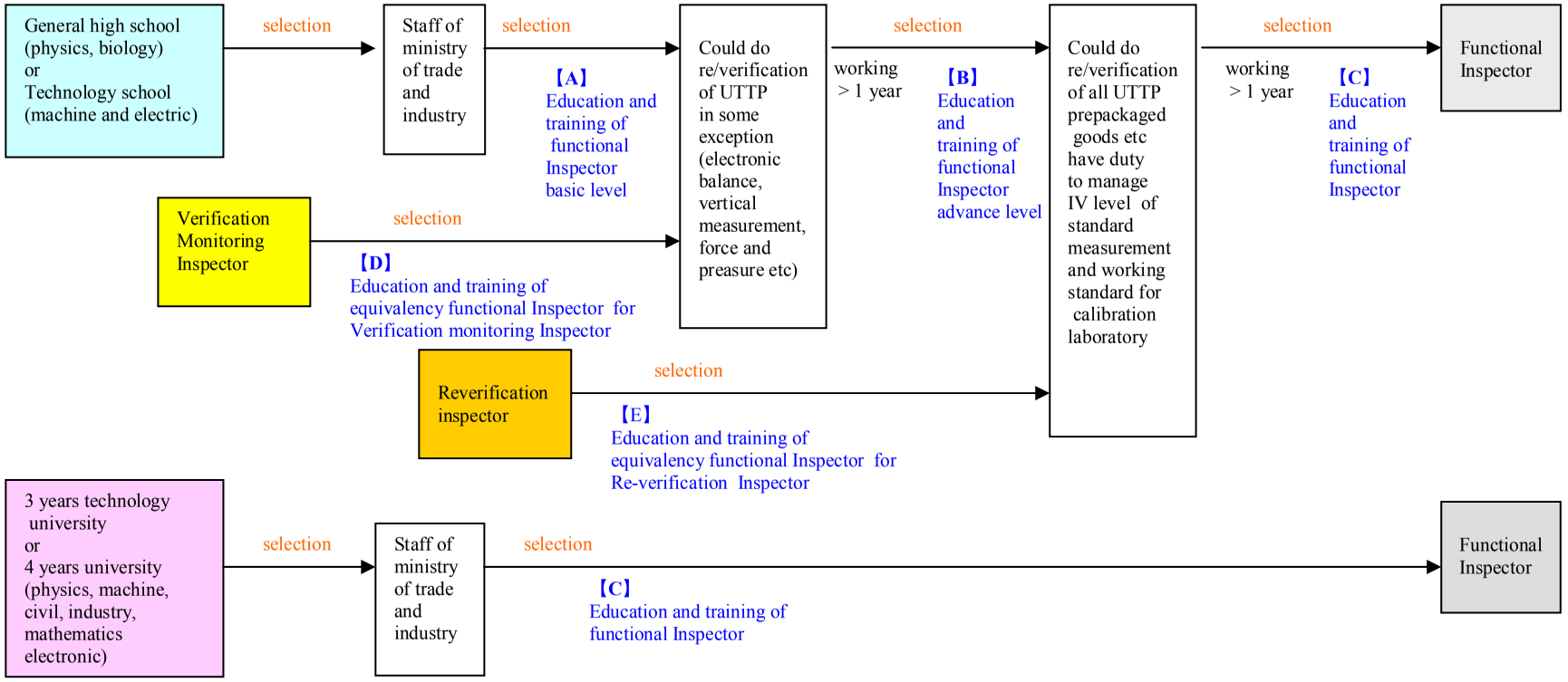



**Figure 5.6.4-1 Procedures of Becoming Inspectors**

### 5.6.5 Achievement of Training

The original inspector training program of MTC is to foster 100 inspectors annually (25 trainees/course x 4 courses/year). However, the actual number in 2005 is 19 inspectors by two courses. MTC sends the invitation letters for training course to RVOs. MTC selects trainees from the replied list by RVOs without entrance examination. The cost for textbooks and accommodation is free; however, other costs such as food, sundries, etc. are borne by RVOs (provincial governments) or, in rare cases by trainees themselves. MOT provides the short-term training courses for DOM staff and private companies as well.

**Table 5.6.5-1 Completion Number of Training Course**

| № | Training Course | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|---|
| | A. Functional Course | | | | | | | |
| 1 | Re-verification inspector | 31 | | | | | | 31 |
| 2 | Inspector equivalent for Metrological Controller | | 32 | 31 | 17 | | | 80 |
| 3 | Inspector of Legal Metrology | 28 | | | | | | 28 |
| 4 | Inspector of Legal Metrology equivalent for Re-Verification | | 30 | 61 | | | | 91 |
| 5 | Inspector of Legal Metrology (Second Level) | | | | 30 | 42 | 19 | 91 |
| | Total | 59 | 62 | 92 | 47 | 42 | 19 | 321 |
| | B. Technical Training Course | | | | | | | |
| 1 | Administration of measurement standard and laboratory | | | 60 | | 22 | | 82 |
| 2 | Application of information technology related to measurement | | | | 29 | | | 29 |
| 3 | Inspection of after-package | | | | 30 | | | 30 |
| 4 | Execution of official duty | | | | 22 | | | 22 |
| 5 | Inspection and application of large scale balance | | | | | 23 | 30 | 53 |
| 6 | Inspection and application of telephone pulse meter | 30 | | | | 30 | 90 | 150 |
| 7 | Inspection and application of Wh-meter | | | | | | 30 | 30 |
| 8 | Inspection and application of water meter | | | | | | 30 | 30 |
| | Total | 30 | 0 | 60 | 81 | 75 | 180 | 426 |
| | Grand Total | 89 | 62 | 152 | 128 | 117 | 199 | 747 |

### 5.6.6 Preconditions and concepts for Design of HRD System

**1) Training courses**

The following training courses will be necessary:

- Fostering of inspectors mainly for RVOs

- Measurement standards including calibration for DOM
- Short-term training: new technology, technology of electricity/electronics, maintenance technology, etc.
- Training courses for private companies and persons

**2) Concepts of training course for fostering inspectors**

The following is the concept of training courses for fostering inspectors:

- Number of inspectors to be fostered: 200 persons (one to three students from each RVO) from needs analysis
- Period for training: Possibility of a shorter period than at present
- Training courses
  a) Basic course for all students, including policy of consumer protection
  b) Verification/re-verification course
  c) Measurement standards
  d) Course for monitoring and control of legal metrology

## 5.7 Measuring Technology

### 5.7.1 General Description of Measuring Technology in Indonesia

Indonesia's industrial standards have been developed under the control of BSN (Badan Standardisasi Nasional; the National Standardization Body). Its former organization, DSN, was reorganized into BSN in 1997.

Indonesia has four national metrology institutes, which are: KIM-LIPI, DOM, KIMIA-LIPI and BATAN. KIM-LIPI is responsible for development and maintenance of the physical measurement standards except mass, while DOM is responsible for mass standard and legal metrology. KIMIA-LIPI and BATAN are responsible for chemical standards including reference materials and ionization radiation standards, respectively.

At present, only KIM-LIPI is designated as Indonesia's member of Asia-Pacific Metrology Program (APMP), of which membership is necessary to participate in the RMO (regional metrology organization) key comparisons.

The mass standard maintained by DOM has been compared periodically with the international prototype of kilogram at the Bureau of International Weights and Measures (BIPM). The other standards are calibrated by foreign national laboratories, PTB (Germany), NML (Australia), and CERLAB (France).

This is due to the fact that only KIM-LIPI is designated to APMP as Indonesia's national institute, so the other institutes cannot participate in the international comparisons. Instead, they make bilateral comparisons between their standards and those of other countries.

From a technical point of view, measurement technologies of DOM and KIM-LIPI are not enough for future needs from industries and social activities, nor are they consistent in instrumentation. Therefore, both institutes should develop a master plan for unification to rapidly progress the study on measurement technologies. They should also establish a system for efficient research and consistent measurement traceability.

### 5.7.2 DOM

The present conditions of DOM are described in detail as follows.

**1) Technical manuals for calibration**

DOM prepared the technical manuals for quality system, operation of working standards and procedures of calibration when they were accredited in 1998. As technical manuals of type approval testing and verification in legal metrology, SSTK (special technical standards) are developed and delivered to the regional verification offices (RVOs).

So far the following SSTKs have been updated and issued by DOM.

(1) SSTK AWI (Automatic Weighing Instrument)
(2) SSTK fixed storage tank
(3) SSTK force and pressure
(4) SSTK gas flow meter
(5) SSTK gas meter for industry
(6) SSTK length
(7) SSTK LPG dispenser
(8) SSTK WH meter

(9) SSTK Taxi meter

(10) SSTK mobile road tanker

(11) SSTK moisture meter

(12) SSTK NAWI (Non-automatic Weighing Instrument)

(13) SSTK rail tanker

(14) SSTK water meter

SSTK for weights and balances is now being developed.

**2) Calibration technology**

From the organizational point of view, there are two section groups in DOM besides general affairs and personnel affairs (i.e., the administrative section group and the technical section group). The technical section group consists of the following three sections.

- Section for Mass, Electricity and Pressure Measurement Technology
- Section for Flow, Length and Volume Measurement Technology
- LMS Centers

The former two sections are allocated to DOM, Bandung, and the preparatory offices of the last section are located in Medan and Makassar.

According to the property lists of DOM, there are 14 technical groups in DOM as shown in Table 5.7.2-1 with the number of instruments maintained by each group. But the verification and calibration services are implemented by the section for calibration of measuring instruments, each of which consists of 3 persons. Every two weeks a group changes laboratory and kind of instruments on which they have to work.

**Table 5.7.2-1 Technical Group and Measuring Instruments**

| No. | Technical group | Number of instruments |
|---|---|---|
| 1 | Gas meter | 11 (4) |
| 2 | Comparator & Level gauge | 7 (1) |
| 3 | Force & Pressure | 47 (3) |
| 4 | Temperature | 40 (6) |
| 5 | Density & Viscosity | 145 |
| 6 | Package | 39 |
| 7 | Mass | 73 (20) |
| 8 | Water meter | 12 |

| | | |
|---|---|---|
| 9 | Volume | 50 (1) |
| 10 | Length | 38 |
| 11 | Balance | 7 |
| 12 | Electricity | 28 (3) |
| 13 | Electric meter | 20 (1) |
| 14 | Fuel oil meter | 6 |

(1) Gas Meter Laboratory

**A. Gas meter facilities for high flow rate**

The calibration system of gas meters using air was constructed in 1978. It seems to have been introduced from Gasunie in Netherlands or produced by referring to it. The calibration system consists of one unit of bell prover, two units of wet gas meters, and seven units of master meters (CVM), of which composition is similar to the Gasunie system.

a) Specifications of major instruments

The specification of major measuring instruments used in the system is shown in Table 5.7.2-2.

**Table 5.7.2-2 Instruments in Gas Calibration Room**

| No. | Instrument | Capacity | Trademark | Quantity |
|---|---|---|---|---|
| 1 | Bell Prover | | George Wilson's<br>Graven Hague | 1 |
| 2 | Wet meter (1)<br>Wet meter (2) | 2,000L/h<br>16,000L/h | Dordrecht<br>Dordrecht | 1<br>1 |
| 3 | Master meter (MM1)<br>Master meter (MM2)<br>Master meter (MM3)<br>Master meter (MM4) | 200m³/h<br>400m³/h<br>1,200m³/h<br>4,000m³/h | IGA<br>IGA<br>IGA<br>IGA | 3<br>3<br>2<br>1 |
| 4 | Blower (1)<br>Blower (2) | Small<br>Large | Assel Bergs & Nachnis<br>Assel Bergs & Nachnis | 1<br>1 |

b) Traceability

The traceability is as follows:

Step 1: A master meter (MM1) is sent to NMi, Netherlands to be calibrated.

Step 2: 2 master meters (MM1) are calibrated using the above master meter after returning.

Step 3: Each MM2 is calibrated using two MM1s.

Step 4: Each MM3 is calibrated using three MM2s.

Step 5: MM4 is calibrated using two MM3s, three MM2s and two MM1.

Step 6: As shown in Photo.1, two MM1s, three MM2s and two MM3s are installed in the gas flow meter calibration rig.

- Flow range is 30 ~ 4,000$m^3$/h under the atmospheric pressure.
- The maximum pipe size to be attached to a flow meter is 300mm (12").
- The system is constructed using a step-up method developed by NMi, Netherlands.
- However, since the electronic counter necessary for step-up calibration is now out of order, the instrumental errors of master meters taken in 1978 have no choice but to be used.

**B. Gas meter facilities for low flow rate**

There are two systems (Meterfabriek-Dordrecht) that incorporate variable area flow meters and inclined manometers, which are used mainly for calibration of domestic gas meters.

- Ten domestic gas meters can be calibrated simultaneously by one system.
- Range of flow rate is 300 ~ 2000 L/min.

They are, however, too old to be used for calibration and serious leakage occurs. Therefore, a bell prover is temporally used when calibrating domestic gas meters.

(2) Comparator & Level Gauge Laboratory

Several calibration instruments are installed, such as a comparator, of which uncertainty is 0.01% for calibration of tape measures up to 20m, other length calibrators made by Mitutoyo and a level gauge of Sakura.

(3) Force & Pressure Laboratory

According to the property lists of DOM for force and pressure, this laboratory is equipped with eighteen pressure gauges (mostly made by Nagano), one vacuum gauge, six proving rings, five dead weight testers, two precision pressure calibrators, three hardness testers, one force comparator, etc.

A weighing type pressure gauge calibrated by SIRIM in Malaysia has been used as the

primary standard for calibration up to 2,000 bars with the accuracy of 0.025% F.S.

It should be made clear that which institute, DOM or KIM-LIPI, is responsible for the national standard of pressure and its traceability. Although KIM-LIPI has the national standard of pressure, the pressure standard maintained by DOM has been calibrated by SIRIM.

(4) Temperature Laboratory

This laboratory is equipped with twenty-one precision liquid-in-glass thermometers, six another type of glass thermometers, two digital thermometers, one temperature calibrator, one thermocouple calibrator, one psychrometer, one thermo hygrometer, three water bathes, etc. Thermometers are traceable to the standard of KIM-LIPI.

(5) Density & Viscosity Laboratory

This laboratory is equipped with thirty-one hydrometers (made by Frans Widder), forty-nine capillary viscometers (made by Czanon Fenske), many glass bottles, many standard liquid materials, and so on.

(6) Pre-packaged Goods Laboratory

- This laboratory seems to maintain many instruments to inspect pre-packaged goods, such as electrical balances, balances for medicine, counterbalance weights, thermometers, hydrometers, microscopes and glass bottles, etc.

(7) Mass Laboratory

- This laboratory was established around 1975~1978.
- DOM maintains Indonesia's prototype of kilogram (K-46) calibrated by BIPM on 30 August 2005 and K-4 and T-4 as sub-national standards. DOM also maintains three weights of class E1 (made by Mettler Toledo), seven weights of class E2 (made by Mettler Toledo and Vial Metrologie) and many weights of lower classes (F1, F2, M1, and M2). They recently purchased $E_0$(1) and $E_0$(2).

  Actually, as explained before, the nomenclature $E_0$ should not be used to avoid confusion with the nomenclature recommended by OIML (OIML R 111). As far as we know there is no international definition of weight "class $E_0$".

Three mass comparators made by Mettler and one by Sartorius are also used. A recently installed comparator (Mettler AX64004), which is announced as one of only four in the entire world, is planned to be used for dissemination up to 50kg.

- The measurement uncertainty is evaluated for calibration of secondary standards etc. using computer. The influence by human for repeatability is estimated 0.05mg/1kg. It is said that it should be reduced to 0.02~0.03 as a target.
- The range of calibration is 1mg to 50kg.
- The calibration is implemented for type approval testing, verification, re-verification and testing upon request.
- DOM has not yet participated in the international comparisons, since it is not yet designated as the national metrology institute responsible for mass standard and traceability.
- The following bilateral comparisons with oversea laboratories have already been performed.
  a) Indonesia's national standard of mass, K46, with BIPM
  b) A dead weight tester with SIRIM
  c) Indonesia's national standard for line gauge (X-27) with NML Australia
- Influence of vibration from the elevated expressway in front of DOM on mass measurement may be possible but is not yet confirmed.
- Indonesia's traceability of mass is shown in Figure 5.7–1.

Step 1: DOM calibrates the secondary standards (sub-national standards) K4, T4, $E_0(1)$ and $E_0(2)$ with the primary standard K-46 using mass comparators AT-1006 and KA30.

Step 2: A working standard of class E1 is calibrated with the secondary standards using comparators AT-1006.

Step 3: The transfer standards of class E2 for RVOs are calibrated using a comparator MC210P.

We proposed the other nomenclature for the names of class of weights.

Some RVOs do not have weights of class E2. The specifications of the comparators are shown in Table 5.7.2-3.

**Table 5.7.2-3 Specifications of Comparators**

| Type | Capacity | Uncertainty | Type | Capacity | Uncertainty |
|---|---|---|---|---|---|
| AT-1006 | 1000g | 0.00001g | AX64004 | 2~50kg | 0.1mg |
| KA30 | 30kg | 0.001g | MC210P | 0~60g<br>60~100g<br>100g~2kg | 0.01mg<br>0.02mg<br>0.05mg |
| AT-1005 | 1000g | 0.0001g | | | |

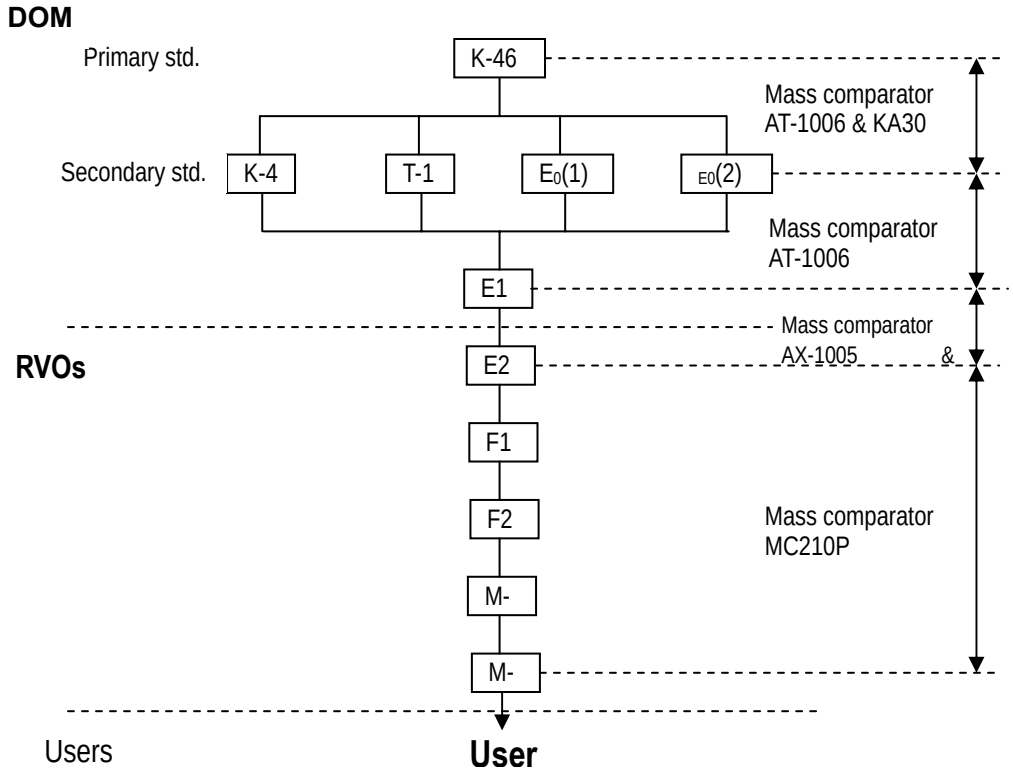



**Figure 5.7.2-1 Indonesia's Traceability of Mass**

(8) Water Meter Laboratory

- The test stand for water meters consists of two pipe lines which can accommodate water meters up to 13~40mm in diameter. Water meters are accommodated in series for calibration using a volumetric standard tank.
- Seven volumetric standard tanks of different capacities, 2,000L, 500L, 200L, 50L, 20L, 10L and 5L, are installed. Volumetric glasses of 2000mL, 100mL and 1mL are also used for small volume calibration.
- In another laboratory room, larger size pipe lines and a master meter with capacity of 1136L/min made by Avery Hardoll are installed for high flow rate calibration. A portable master meter with capacity of 500L/h made by Kinmon can also be used for low flow rate calibration. A pressure stabilizer and filter are installed in the line.

(9) Volume Laboratory

Volumetric glasses (measuring flasks, beakers, burettes, graduated pipettes, etc.) are calibrated with an electronic balance, after using a filling system to supply it with pure water. A mini-pump made by Sanyo is used in the filling system. Pure water is bought with a certificate of density because DOM does not have densitometer. They have many volumetric standard glasses. When the study team visited, the air conditioner was out of order.

(10) Length Laboratory

DOM has Indonesia's prototype of meter (X-27) which is made of platinum-iridium and traceable to NML Australia. Many length measurement instruments such as digital micrometers, gauge blocks, optical plates, etc. made by Mitutoyo Japan are used.

- KIM-LIPI and DOM have been supplying standards for end gauges and line gauges, respectively. Both standards of Indonesia are calibrated by NML Australia.

(11) Balance Laboratory

In this laboratory, old historical balances and weights are exhibited.

(12) Electricity Laboratory

Two electronic multi-meters made by Schlumberger (SM7050) are used as reference instruments about 60 times a year for type approval testing of watt-hour meters. They are calibrated at a private laboratory of France every two years. The main electronic instruments are shown in Table 5.7.2-4

**Table 5.7.2-4 Electronic Instruments Maintained by Electricity Laboratory**

| No. | Instrument | Bland name/Type | Quantity |
|---|---|---|---|
| 1 | Reference standard meter | Landis & Gyr/TVH2.32 | 1 |
| 2 | Universal meter test unit | Landis & Gyr | 1 |
| 3 | Portable meter test equipment | Landis & Gyr | 1 |
| 4 | Ampere meter | Siemens/ 500025 | 1 |
| 5 | Volt meter | Siemens /500029 | 1 |
| 6 | Digital power supply | Metrix/ AX-722 | 1 |
| 7 | Reference standard meter | Schlumberger/ SM7050 | 2 |
| 8 | Digital multi-meter | Fluke /45 | 1 |
| 9 | Insulation resistance | Laxtronics/DX-11-G, 10-G | 2 |
| 10 | Decade resistance box | Yokogawa/27930 etc. | 2 |

| | | | |
|---|---|---|---|
| 11 | Generator function | HAMEG/HM8131-2 | 1 |
| 12 | Illumination meter | Foot-Cmdle/DX-200 | 1 |
| 13 | Lux meter | Lutron/UVC-254, UVA-365 | 2 |
| 14 | Sound level meter | GRAS/42 RA | 1 |
| 15 | Generator | GRAS/14 AA | 1 |
| 16 | Volt mA calibrator | Fluke/715 | 1 |
| 17 | Multi-function Cal. | Scandura/B-20/DT | 1 |
| 18 | Oscilloscope | Metric/OX.735 | 1 |
| 19 | Signaling test set | Wiltron/9361B | 1 |

(13) Electronic Meter Laboratory

In this laboratory, use is made of many portable electronic measuring instruments for calibration of measuring instruments such as WH meters, watt meters, insulation testers, ammeters, and so on.

(14) Fuel Oil Meter Laboratory

Two systems are used for calibration of fuel oil meters, fuel dispensers and industrial oil meters. Both systems use kerosene. In the former system, the volume displaced from the fuel dispenser is calibrated with a standard tank (50L, 100L or 200L). The latter system consists of two standard tanks (5,000L and 1,000L) and two master meters. Capacities of pipe lines are 6" and 3". Maximum flow rate is around 230m3/h. The main equipment and instruments are shown in Table 5.7.2-5.

**Table 5.7.2-5 Equipment and Instruments in Fuel Oil Meter Laboratory**

| No. | Equipment, Instrument | Capacity | Bland name/Type | Quantity |
|---|---|---|---|---|
| 1 | Master meter | 3,750L/min | Smith/LG6.51 | 1 |
| 2 | Master meter | 1,136L/min | Avery Hardoll/BM252 | 2 |
| 3 | Centrifugal Pump | 55kW | MMA/R250M-2 | 1 |
| | | 18.5kW | MMA/R160L-2 | 1 |
| | | 5.5kW | NUG/DP1112 M-4 | 1 |
| | | 37kW | Guangzhou/C480M-2 | 1 |
| | | 4kW | MAA/R112M-2 | 2 |
| 4 | Pipe prover | | Mestrole/JP-330 | 1 |
| 5 | Standard tank | 5000L | | 1 |
| | | 1000L | | 1 |
| | | 500L | | 1 |
| | | 200L | | 1 |
| | | 100L | | 1 |
| | | 50L | | 1 |
| | | 20L | | 1 |
| 6 | Storage tank | 8000L | | 1 |
| | | 2000L | | 2 |

- These standard tanks of 5000L are traceable to Indonesia's proto type of kilogram (K-46) as follows.

  A standard tank, to be calibrated, of a capacity of 5000L is filled with water using a standard tank of a capacity of 200L, which is, beforehand, calibrated by gravimetric method. The weights used for gravimetric method are calibrated by step-up method of mass starting from the national standard of mass, i.e. K-46.
- Judgment for the result is made not by uncertainty but by MPE (maximum permissible error) shown in Table 5.7.2-6.

**Table 5.7.2-6 MPE for Standard Volumetric Tanks**

| Volumetric standard tank | MPE |
|---|---|
| 5000L | 2.5L |
| 1000L | 0.5L |
| 100L | 0.1L |

- The pipe prover has not been used because of a lack of spare parts.
- DOM does not make compensation on the effect of viscosity of the fluid, such as heavy oil, gasoline, LPG, etc. for the calibration of flow meters.
- The master meters seem too old to be maintained or to be enhanced with spare parts.

**3) Skills for type approval testing**

Essentially, type approval testing is structural testing which consists of several mechanical, electrical and electronic tests. The tests include the surge test, EMC test, durability test, vibration test, etc. However, DOM has no equipment for these tests and only conducts almost the same test as calibration for type approval testing. Therefore, some industries have to perform structural testing by themselves when they purchase measuring instruments for customers. For example, a water supply public corporation in Bandung says "Sometimes water meters are out of order after running for one month. Usage causes the shafts to wear-out. We have to calibrate them by ourselves even if they have been calibrated before. Imported water meters are not reliable. We request that RVO implement legally specified tests."

Type approval testing will be one of DOM's most important duties and is controlled by the idea of product liability. It is indispensable to supply consumers with reliable measuring

instruments for trade and for developing industries of measuring instruments as well.

DOM should develop testing procedures referring to OIML recommendations for type approval testing and install equipment necessary for them. The following measuring instruments should be subject to type approval testing since they are most influential instruments for consumers.

- Mass and balances
- Taxi meters
- WH meters
- Water meters
- Fuel dispensers
- Gas meters

**4) Skills for verification/re-verification**

Inspectors are divided into several groups. Each group consists of 3 persons, and changes laboratories (fuel oil meter, water meter, gas meter, mass and length) every 2 weeks. This system might be efficient for inspectors to obtain overall knowledge for making it through calibration of each measuring instrument. But it is difficult for them to deeply understand detailed techniques, and to obtain specialty of each instrument.

For example, it was found that the temperature compensation by the Boil-Charles' law, which is essential to accurate volume measurement, was not calculated in some calibration sheets for gas meters.

**5) Maintenance of facilities and equipment**

Maintenance of DOM's facilities is not enough as a national metrology institute. It is essential to reserve necessary budget and keep facilities in good condition. At present facilities are quite old and does not seem well maintained.

The following are some cases that the study team found in the flow meter laboratory.

- An electronic counter of a gas meter laboratory is not repaired whereas it is necessary for traceability.
- Due to leakage both of two facilities for calibration of domestic gas meters do not

work.

- A broken pipe prover has been left in the fuel oil laboratory.

**6) Technical instruction to RVOs**

- According to Item 9) of 4.1.1,. 76 % of RVOs receive technical assistance from DOM for HRD. 19 RVOs out of 33 (58%) replied that major assistance is training for proficiency and technical guidance.
- Ninety-one percent of RVOs say "Yes" on receiving guidance and/or technical assistance from DOM. [Item 10) of 4.1.1.]
- Sixty-two percent of inspectors of RVOs say they use SSTK as a technical instruction manual.

The above results show that DOM's technical instruction to RVOs is fairly good.

### 5.7.3 Regional Verification Offices (RVOs)

**1) Preparation of manuals**

- Eighty-two percent (27/33) of RVOs retain manuals for verification and 6% of RVOs partly. [Item 8) of 4.1.1.]
- SSTK is very important for RVOs and is generally kept by the head of office or manager. Since inspectors cannot easily reach it, they use the calibration sheets as shown in Figures 5.7.3-1 (for tank lorry) and 5.7.3-2 (for flow meter).
- According to the results of interview to inspectors, manuals for electronic instruments and up-dated technologies may not be enough for their work.

**2) Skills for verification/re-verification**

- Only 9% (3/33) of RVOs are satisfied with staff's skill and 64 % (21/33) are partly (Q17 in 4.1.2). They require updated technologies, basic skill on electricity, electronics and maintenance in this order.
- According to Table 5.5.2-1 (Nos. 5 and 8), the results of interview to 21 inspectors, it can be said that their technical levels are very high, and the application of their techniques to their work is also good at each level. However most of inspectors recognize the importance of training on up-dated technologies, electricity and electronics.

**3) Maintenance of facilities and equipment**

- Maintenance of facilities and equipment is quite different among RVOs. The facilities and equipment of Jakarta RVO are outstanding. Surabaya and Medan RVOs' are well maintained. The others are not good. This is due to the difference among their budget.
- Generally air conditioning of the RVO laboratories is poor to perform precision measurement required by mass standard.
- The mass standard maintained by RVO has been calibrated at DOM every 5 years.
- According to the interviews to RVO inspectors they do not understand the importance of maintenance of facilities. Even when they understand its importance, lack of budget prevents them from conducting maintenance.

### 5.7.4 Private Calibration Laboratory

**1) Outline of private calibration laboratories**

Described below is the outline of some private and public calibration laboratories the JICA study team visited.

(1) BARINDO (Surabaya)

Water meters and water valves are fabricated from basic parts machined by themselves using their own machines, some of which are manufactured by their own design.

SNI (Standard National Indonesia) based on ISO4064 for water meters has been prepared to test and use them properly. One of the objectives of issuing SNI is to expel inferior meters which mostly come from Asian countries. According to the SNI, all meters produced and imported are subject to verification before they are brought on the market. The SNI also specifies the design of water meters to prevent illegal changes that will cause malfunction of meters. The SNI is applied to WTO in November 2005 and will be approved in July 2006.

Water meters are produced at 150,000~200,000 units a year in the factory where all parts are cast, molded, machined, pressed, assembled and calibrated. Engineers are skillful in using computers (Computer-Aided Design) to design molding and cutting machines. In two calibration rigs, a total of 120 units of water meters can be installed and calibrated at one

time. Their own developed flow computers can automatically set the flow rate using magnetic flowmeters and output calibration data.

(2) PDAM (Regional Corporation of Water Supply) in Banjarmasin

There are two calibration facilities for water meters, one of which belongs to PDAM and the other to the Water Companies Union. In Banjarmasin, water is supplied to 85,000 houses, 83% of individual houses. This is a high ratio for this province. Because water meters must be re-verified every five years, they are gathered by the union and calibrated using these facilities. About 1,300 to 1,600 units are calibrated a month. The amount of rejection reaches 200 to 300 units and they are usually sold to manufacturers. Meters with nominal sizes of 20, 25 and 50 mm can be calibrated up to the flow rate of 10 m3/h. The capacity of water supply is now 3,780m3/h. A plan is in place now to elevate supply capacity with additional flow rate of 1,800 $m^3$/h.

(3) PDAM of Bandung

PDAM of Bandung is a public water supply corporation in Bandung. They settled about 140,000 water meters at individual houses, and perform re-verification of about 30,000 units a year following the SSTK issued by DOM. They have five lines of rigs for calibration of water meters from 13mm to 100mm nominal sizes. The standard tanks have been calibrated every two years by Bandung RVO.

At one time, PDAM experienced problems in that all water meters imported through Surabaya either did not work or were unreliable, despite the fact that the water meters had been already verified. Sometimes, the shafts of water meters wear out after one-month test runs. They are forced to conduct such tests by themselves after purchasing water meters since RVO does not have testing facilities.

The capacity of water supply of 2,500L/sec is not enough for the demand of 4,000L/sec.

(4) PT. METBELOSA

PT. METBELOSA is a joint venture of WH meters including Osaki Electric Company (Japan) of which capital ratio is 79.5 % (US$5,000,000). The number of employees is 216. The amount of production is one million units for single-phase WH meters and 95,000 units for 3-phase.

LMK (Lembaga Masaiah Kelistrikan) implements type approval testing and calibration for WH meters and Jakarta RVO implements verification and sealing for them.

If the number of units is informed to Jakarta RVO for sealing a few days before, inspectors visit the factory with sealing tools and perform the task. Verification is performed following the requirements from PLN. The maximum number of units for sealing is 1,000 per day.
The testing instruments and laboratory standards that belong to the manufacturer have to be calibrated once a year by Jakarta RVO.

The initial verification expires in ten years in Indonesia, but many WH meters are not re-verified and continue to be used until they run down.

(5) PLN in Banjarmasin

Presently 259,000 households use electric power in Banjarmasin, which represents only 50% of the demand. 6,000 units are increasing every year but still short. Three persons are allocated to verification of 60 to 100 units of single-phase WH meters and about 20 units of 3-phase a day. The number of WH meters that need to be installed is much greater than actually installed. This is due to the following reasons.

- No facilities for power supply in the area
- Lack of WH meters
- Overload of electric power in the area
- Lack of generated electric power

(6) PLN in Bandung

PLN Bandung controls the supply of electric power in West Java and Bandung. In West Java, 2.5 million households and 2,600 industries use electricity. WH meters were used recently for users of 20kV, and the ENR system also was provided. Until now, PLN primarily has been verifying WH meters but recently decided to purchase WH meters from 2005 which were already verified by manufacturers. PLN is planning to lend verification facilities to third parties who do not have their own facilities.

In principle, RVOs is responsible for re-verification of WH meters, but they often use PLN facilities. Such use of PLN facilities is allowed under agreement between the Ministry of

Industry and the Ministry of Trade in the form of an MoU.

**2) Technical services and technical level**

As stated previously, surveys and visits made by the study team revealed that the water supply corporation, the water meter manufacturer, the WH meter manufacturer, and PLN have a good technical service network and have good techniques for verifying measuring instruments.

**3) Facilities and equipments**

- The facilities and equipment of public/private calibration laboratories for water meters and WH meters are much better than those of RVOs.
- The facilities and equipment of calibration laboratory for taxi meters are not so good.

**4) Possibility for participation in legal metrology service by private calibration laboratories**

- The water meter company and the water supply corporations visited by the study team have are capable of conducting verification of water meters.
- So far, verification of WH meters has been conducted by manufacturers at their sites. It would be difficult to change the present scheme for verification since verification of WH meters requires considerable human resources and costly facilities. Fortunately, both the power supply company and WH meter manufacturers have good skills. The section for verification should be separated from their profit-earning group and/or the accreditation system should be applied to the private company.
- In view of the above, verification facilities of WH meters should be lent to third parties.

**5) Problem and suggestion for measuring technology**

(1) Indonesia should establish a traceability system that does not depend on a specific country for a certain standard. It will require unification of the national metrology institutes and its participation in relevant international organizations.

(2) Indonesia should unify the length standards of DOM and KIM-LIPI and establish a national standard based on the CIPM recommendation.

(3) Considerable improvement of laboratories and facilities is necessary for further precision measurement.

(4) DOM should obtain each technical skill for calibration and verification. For example, the following are some improvements of flow measurement. These techniques will improve measurement uncertainty.

- Standard volumetric tanks should have a glass scale for confirmation of zero point to avoid wet influence on the inside wall of a tank at each calibration.
- DOM should obtain the calibration technique with a small volume prover.
- Viscosity effect on flow meters should be taken into account for calibration.


Photo 5.7.2.1 Gas meter calibration stand


Photo 5.7.2.2 Comparator (Mettler AX64004)


Photo 5.7.2.3 Water meter calibration stand

Photo 5.7.2.4 Reference standard meter for kWh


Photo 5.7.2.5 Fuel oil calibration stand

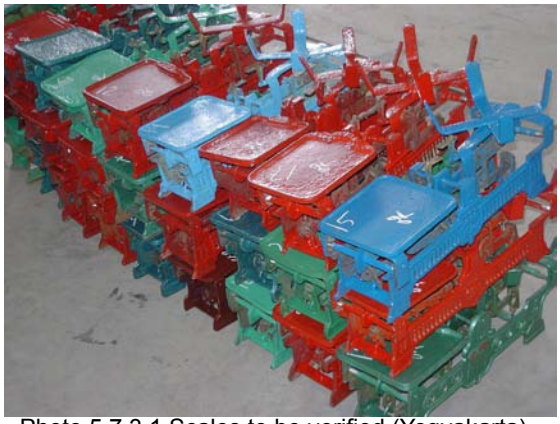


Photo 5.7.3.1 Scales to be verified (Yogyakarta)

Photo 5.7.3.2 Test stand for kWh meter (Surabaya)

Photo5.7.4.1 Flow computers for water meter cal.