

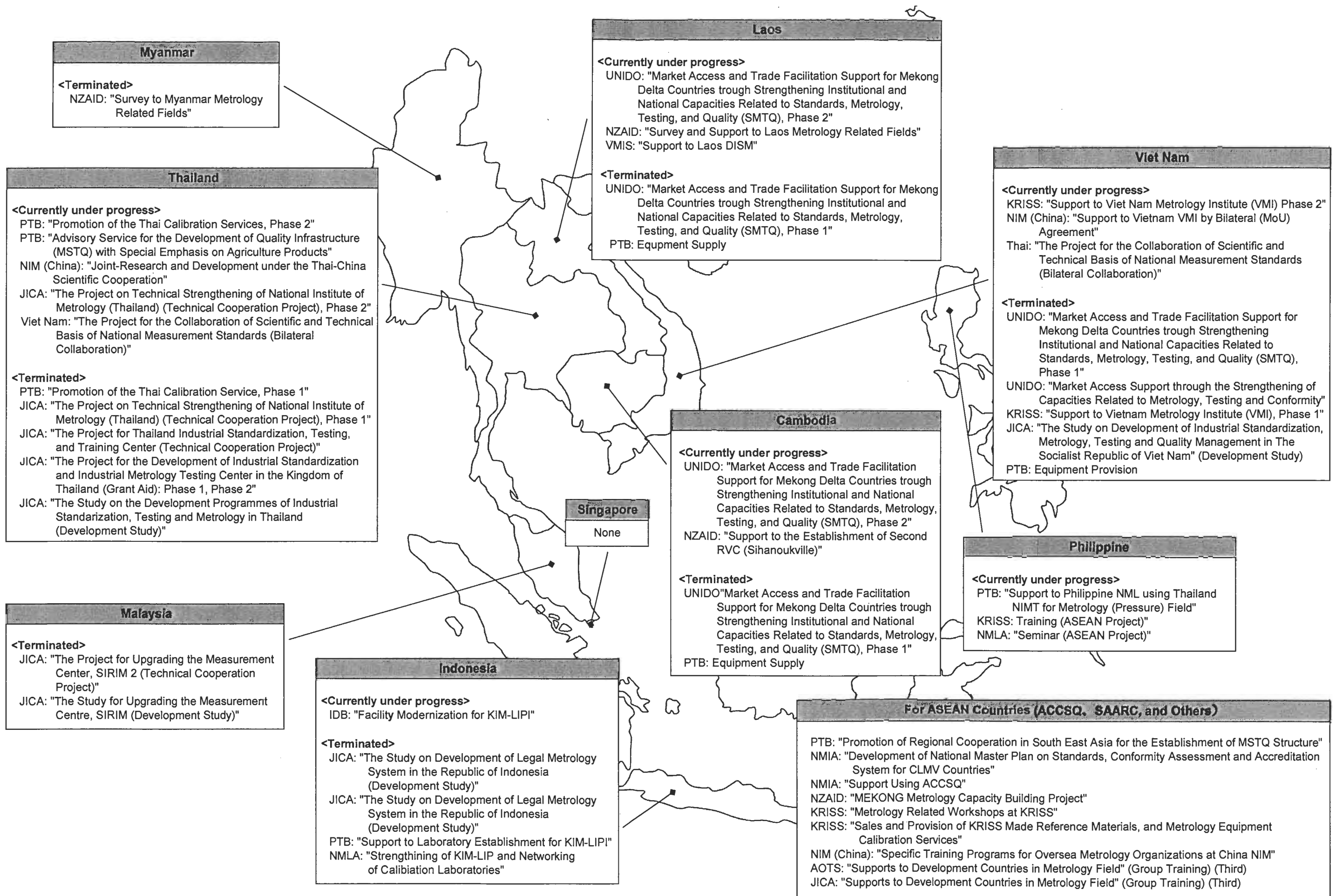
The Study on Present Situation of
Measurement Standard System and Effective
Technical Cooperation in ASEAN Region
(Project Study)

Final Report

March 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

UNICO INTERNATIONAL CORPORATION



Major Technical Supports by Donors

Abbreviation

Abbreviation	Full Description
<Common>	
AADCP	ASEAN Australia Development Cooperation Program
ACCSQ	ASEAN Consultative Committee on Standards and Quality
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
AUSAID	Australian Agency for International Development
BIPM	International Bureau of Weights and Measures
CGPM	General Conference of Weights and Meters
CIPM	International Committee for Weights and Measures
CLM	Cambodia, Laos, Myanmar
CLMV	Cambodia, Laos, Myanmar, Vietnam
EU	European Union
GTZ	Dentsche Gesellschaft for Technische Zusammenarbeit
HACCP	Hazard Analysis and Critical Control Point
IAI	Initiative for ASEAN Integration
KOICA	Korea International Cooperation Agency
KRISS	Korea Research Institute of Standards and Science
MLA	Multilateral Recognition Arrangement
MRA	Mutual Recognition Arrangement
NORAD	Norwegian Agency for Development
NZAID	New Zealand's International Aid & Development Agency
OJT	On the Job Training
OSHMS	Occupation Safety and Health Management System
PAC	Pacific Accreditation Cooperation
PT	Proficiency Testing
PTB	Physikalish-Technische Bundesanstalt
SECO	Swiss State Secretariat for Economic Affairs
SME	Small and Medium Enterprize
TBT	Technical Barriers to Trade

UNIDO	United Nations Industrial Development Organization
WG	Working Group
WTO	World Trade Organization
<Japan>	
AIST	National Institute of Advanced Industrial Science and Technology
AOTS	Association for Overseas Technical Scholarship
JEMIC	Japan Electric Meters Inspection Corporation
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JQA	Japan Quality Assurance Organization
METI	Ministry of Economy, Trade and Industry
NITE	National Institute of Technology and Evaluation
NMIJ	National Metrology Institute of Japan
<Cambodia>	
DOM	Department of Metrology
GDI	General Department of Industry
ILCC	Industrial Laboratory Center of Cambodia
MIME	Ministry of Industry, Mines and Energy
RVC	Regional Verification Center
<Lao>	
DISM	Department of Intellectual Property, Standardization & Metrology
DSQ	Division of Standards and Quality
MC	Metrology Center
MD	Metrology Division
STEA	Science, Technology & Environment Agency
<Myanmar>	
MIDC	Myanmar Industrial Development Committee
MOST	Ministry of Science and Technology
MSTRD	Myanmar Scientific and Technological Research Department

<Vietnam>	
BOA	Bureau of Accreditation
QUATEST	Quality Assurance and Testing Center
STAMEQ	Directorate for Standards and Quality
STEA	Science Technology and Environment Agency
VILAS	Vietnam Laboratory Accreditation System
VINAS	Vietnam Accreditation System
VMI	Vietnam Metrology Institute
<Philippines>	
DOST	Department of Science and Technology
ITDI	Industrial Technology Development Institute
NML	National Metrology Laboratory
PAC	Philippine Accreditation Office
<Indonesia>	
DOM	Directorate of Metrology
IDB	The Islamic Development Bank
KAN	National Accreditation Committee, Indonesia
KIM-LIPI	Research Center for Calibration, Instrumentation and Metrology
MOT	Ministry of Trade
PLN	State Company of Electric Supply
<Malaysia>	
DSM	Department of Standard Malaysia
MDTCA	Ministry of Domestic Trade and Consumer Affairs
NML	National Metrology Laboratory
SIRIM	Standards In Research Institute of Malaysia
<Thailand>	
CBWM	Central Bureau of Weights and Measures
DCR	Department of Commercial Registration
DIT	Department of Internal Trade, Ministry of Commerce
MOC	Ministry of Commerce
MOST	Ministry of Science and Technology

NIMT	National Institute of Metrology (Thailand)
ONAC	Office of the National Accreditation Council, TISI
PTT	Petroleum Authority of Thailand
TISI	Thai Industrial Standards Institute
TLAS	Thai Laboratory Accreditation Scheme
TPA	Technology Promotion Association (Thailand-Japan)
<Singapore>	
NMC	National Metrology Centre
SAC	Singapore Accreditation Council
SAC-SINGLAS	Singapore Laboratory Accreditation Scheme
SPRING	Standards, Productivity and Innovation Board
WMO	Weights and Measures Office

Table of Contents

Chapter 1 Present Situation of Industrial Technology Development and Measurement Standards, and Needs for Assistance

1.1	Cambodia.....	1 - 1
1.1.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 1
1.1.2	Metrology Law and Related Regulations	1 - 2
1.1.3	Organizations Related to National Metrology Organizations.....	1 - 3
1.1.4	Functions and Services of National Metrology Institute	1 - 5
1.1.5	Internationalization.....	1 - 5
1.1.6	Assistance by Donors	1 - 6
1.1.7	Issues in the Field of Measurement Standards	1 - 6
1.2	Lao PDR	1 - 8
1.2.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 8
1.2.2	Metrology Law and Related Regulations	1 - 9
1.2.3	Organization Related to National Metrology Organizations	1 - 10
1.2.4	Functions and Services of National Metrology Institute	1 - 12
1.2.5	Internationalization.....	1 - 13
1.2.6	Assistance by Donors	1 - 13
1.2.7	Issues in the Field of Measurement Standards	1 - 14
1.3	Myanmar	1 - 15
1.3.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 15
1.3.2	Metrology Law and Related Regulations	1 - 16
1.3.3	Organization Related to National Metrology Organizations	1 - 16
1.3.4	Functions and Services of National Metrology Institute	1 - 17
1.3.5	Internationalization.....	1 - 18
1.3.6	Assistance by Donors	1 - 18
1.3.7	Issues in the Field of Measurement Standards	1 - 18
1.3.8	Visits to Private Enterprises	1 - 19
1.4	Viet Nam.....	1 - 22
1.4.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 22
1.4.2	Metrology Law and Related Regulations	1 - 24
1.4.3	Organizations Related to National Metrology Organizations.....	1 - 24

1.4.4	Functions and Services of National Metrology Institute	1 - 26
1.4.5	Internationalization.....	1 - 29
1.4.6	Assistance by Donors	1 - 29
1.4.7	Issues in the Field of Measurement Standards	1 - 30
1.5	Indonesia.....	1 - 31
1.5.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 31
1.5.2	Metrology Law and Related Regulations	1 - 32
1.5.3	Organization Related to National Metrology Organizations	1 - 33
1.5.4	Functions and Services of National Metrology Institute	1 - 34
1.5.5	Internationalization.....	1 - 36
1.5.6	Assistance by Donors	1 - 36
1.5.7	Issues in the field of metrology standards	1 - 37
1.6	Philippines	1 - 38
1.6.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 38
1.6.2	Metrology Law and Related Regulations	1 - 39
1.6.3	Organization Related to National Metrology Organizations	1 - 40
1.6.4	Functions and Services of National Metrology Institute	1 - 42
1.6.5	Internationalization.....	1 - 44
1.6.6	Assistance by Donors	1 - 44
1.6.7	Issues in the Field of Measurement Standards	1 - 45
1.7	Malaysia.....	1 - 46
1.7.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 46
1.7.2	Metrology Law and Related Regulations	1 - 47
1.7.3	Organizations Related to National Metrology Organizations.....	1 - 47
1.7.4	Functions and Services of National Metrology Institute	1 - 49
1.7.5	Internationalization.....	1 - 50
1.7.6	Assistance by Donors	1 - 50
1.7.7	Assistance for Other ASEAN Countries	1 - 51
1.7.8	Issues in the Field of Measurement Standards	1 - 51
1.8	Thailand	1 - 52
1.8.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 52
1.8.2	Metrology Law and Related Regulations	1 - 53
1.8.3	Organizations Related to National Metrology Organizations.....	1 - 54

1.8.4	Functions and Services of National Metrology Institute	1 - 56
1.8.5	Internationalization.....	1 - 57
1.8.6	Assistance by Donors	1 - 58
1.8.7	Assistance for Other ASEAN Countries	1 - 59
1.8.8	Issues in the Field of Measurement Standards	1 - 60
1.9	Singapore	1 - 61
1.9.1	Present Situation of Industry and Its Priority Sectors in Future	1 - 61
1.9.2	Metrology Law and Related Regulations	1 - 62
1.9.3	Organizations Related to National Metrology Organizations.....	1 - 62
1.9.4	Functions and Services of National Metrology Institute	1 - 65
1.9.5	Internationalization.....	1 - 66
1.9.6	Assistance by Donors	1 - 66
1.9.7	Assistance for Other ASEAN Countries	1 - 67
1.9.8	Issues in the Field of Measurement Standards	1 - 67

Chapter 2 Situation on Linkage within the ASEAN Region Concerning Development of Measurement Standard System in the Region

2.1	Impact on Development of Measurement Standard System in the ASEAN Region Caused by the Change of International Situation through Globalization of Economy such as Economic Linkage	2 - 1
2.1.1	Changes of Roles of National Metrology Institutes after 1980s.....	2 - 1
2.1.2	Measures to Cope with International MRA in Each Country.....	2 - 3
2.2	Situation of Development of Measurement Standard System in the Whole ASEAN Region and Linkage between the ASEAN Nations	2 - 4
2.2.1	Functions and Activities of APMP (Asia Pacific Metrology Programme).....	2 - 4
2.2.2	ACCSQ: ASEAN Consultative Committee on Standards and Quality	2 - 6
2.2.3	IAI (Initiative for ASEAN Integration).....	2 - 9
2.2.4	Linkage between Two Countries.....	2 - 9

Chapter 3 JICA's Support on Metrology Standards at ASEAN Region

3.1	History of JICA's Support on Metrology.....	3 - 1
3.2	Current JICA Projects in ASEAN Countries	3 - 6
3.2.1	National Institute of Metrology (Thailand) Project.....	3 - 6

3.3	Comparison of JICA Cooperation in ASEAN Countries.....	3 - 8
3.3.1	JICA’s Metrology Projects in Thailand.....	3 - 8
3.3.2	JICA’s Metrology Projects in Malaysia	3 - 10
3.3.3	JICA’s Metrology Projects in Indonesia	3 - 11
3.3.4	JICA’s Metrology Project in Viet Nam.....	3 - 12

Chapter4 Technical Cooperation on Metrology Standards in ASEAN Region by Other Donors

4.1	United Nations Industrial Development Organization (UNIDO)	4 - 1
4.1.1	Laos, Cambodia and Viet Nam.....	4 - 1
4.1.2	Viet Nam	4 - 2
4.2	PTB and GTZ.....	4 - 2
4.2.1	Thailand.....	4 - 2
4.2.2	South-East Asia	4 - 4
4.2.3	Other Technical Support to ASEAN Countries Conducted by PTB	4 - 4
4.3	Australia: AusAID and NMIA.....	4 - 5
4.3.1	Support to ASEAN Countries	4 - 5
4.4	New Zealand: NZAID.....	4 - 6
4.4.1	Cambodia.....	4 - 6
4.4.2	Laos	4 - 7
4.4.3	Myanmar	4 - 7
4.5	Republic of Korea: Korea Research Institute of Standards and Science (KRISS).....	4 - 8
4.5.1	Viet Nam	4 - 8
4.5.2	Technical Support to ASEAN Regions	4 - 9
4.6	The People’s Republic of China: National Institute of Metrology (NIM)	4 - 9
4.6.1	Thailand.....	4 - 9
4.6.2	Viet Nam	4 - 10
4.6.3	ASEAN Countries	4 - 10
4.7	Viet Nam: Viet Nam Metrology Institute (VMI).....	4 - 11
4.7.1	Laos	4 - 11
4.8	Thailand: National Institute of Metrology (Thailand) (NIMT).....	4 - 11
4.8.1	Viet Nam	4 - 11
4.9	Others: Support form Private Sectors	4 - 12

Chapter 5 Issues of ASEAN Region and Subjects for Assistance Required in Metrology Standard

5.1	Features of Each Group Country	5 - 1
5.2	Issues with Respect to Design of Measurement Standards System for Legislation etc. Concerning Metrology	5 - 4
5.2.1	Group 1 countries	5 - 4
5.2.2	Group 2 countries	5 - 4
5.2.3	Group 3 countries	5 - 5
5.2.4	Group 4 country.....	5 - 6
5.3	Issues on Reliable Measuring Methods in Environmental Field in Whole ASEAN Region and Technological Issues on Development Methods of Reference Materials	5 - 6
5.3.1	General	5 - 6
5.3.2	Measuring Methods.....	5 - 7
5.3.3	Reference Materials.....	5 - 8
5.3.4	Necessity for Assistance.....	5 - 8
5.4	Assistance Suitable for Each Country in ASEAN Region and Its Possibilities.....	5 - 8
5.4.1	Supports through Regional Metrological Meetings and Conferences (Multilateral Cooperation: Use of ACCSQ).....	5 - 9
5.4.2	Cooperation by Bi-lateral Agreements among ASEAN countries	5 - 9
5.4.3	ASEAN Countries' Technical Levels in Metrology and Technical Cooperation Supporting Structure	5 - 10
5.5	Effects of Development of Measurement Standard System in Each Country and ASEAN Region.....	5 - 13
5.5.1	Value-added of Metrology and Measurement	5 - 13
5.5.2	Effects of Development of Measurement Standard System	5 - 14

Chapter 6 Roles Requested to Japan Concerning Development of Measurement Standards in the ASEAN Region

6.1	Roles Requested to Japan for Cooperation in System Design of Legislation etc. Concerning Metrology	6 - 3
6.1.1	Group 1: Cambodia, Laos and Myanmar	6 - 3

6.1.2	Group 2: Viet Nam, Indonesia and Philippines	6 - 3
6.1.3	Group 3: Malaysia and Thailand	6 - 3
6.1.4	Group 4: Singapore.....	6 - 3
6.2	Human Resources Development (HRD) for Metrology Technology	6 - 4
6.2.1	HRD Needs.....	6 - 4
6.3	Collaboration with Japan’s Accreditation Body	6 - 7
6.3.1	Group 1.....	6 - 7
6.3.2	Group 2.....	6 - 7
6.3.3	Group 3.....	6 - 7
6.3.4	Group 4.....	6 - 7
6.4	Consideration on Assistance by JICA’s Scheme	6 - 7

Appendix

Appendix A	Work Schedule of Field Survey.....	A - 1
Appendix B	List of Persons for Interviews.....	B - 1
Appendix C	Questionnaire.....	C - 1
Appendix D	Collection Data List.....	D - 1
Appendix E	Record of Seminars	E - 1

Introduction

1. Background History of the Study

The World Trade Organization (WTO) was established in 1995 to promote trade under free competition along with the extension of borderless market and economic globalization, and the WTO agreement was concluded. TBT agreement aims at realization of impartial and smooth international trade by harmonizing compulsory and/or voluntary standards with international ones and thus eliminating unnecessary barriers in international trade caused by the difference of regulations in each country. Therefore, it is an important issue for developing countries who promote international trade to harmonize their own system of standards and accreditation system including measurement standards with international standards.

In the light of such circumstances, the mutual recognition arrangement (MRA) on measurement standards was agreed at the 21st CGPM conference in 1999. The purposes of the MRA are as follows:

- To establish equality of national measurement standards maintained by national measurement institute (NMI) of each country
- To specify the mutual recognition of calibration certificates issued by NMIs
- To provide each government and related organizations with technical basis for broader agreements with respect to international trade, commerce and legislations

After that, each country develops domestic measurement standards system and seeks international equality of national standards by the National Metrology Institute (NMI) of each country as a leading part. In Asia Pacific region, the Asia Pacific Metrology Programme (APMP) was established in 1977 as a regional organization aiming at inter-collaboration of NMIs in the region.

Under these circumstances, JICA has conducted various assistances in the field of measurement standards in the ASEAN region. It assisted Malaysia in achievement of meter programs in 1980s, and provided Thailand with grant aid and technical assistances for construction of Thai Industrial Standard and Industrial Measurement Testing Center. The JICA's assistance in measurement standards in the country has continued since then. It now cooperates upgrading of national standards to international level by assisting in construction of the National Measurement Institute (Thailand) (NIMT).

In promoting Japan's assistance in establishment of measurement standards system in each country, it is necessary to consider not only development of measurement standards system of the country but also its harmonization with international framework. On the other hand, other donors such as UNIDO, Germany, Australia, Korea, etc. give assistance to NMIs in the ASEAN

region as well. Therefore, it is a time for Japan to investigate effective and efficient technical assistance methods in measurement standards that do not overlap with the assistance of other donors.

2. Objective of the Study

Based on the above background of the study, the objective of the study is to grasp and analyze the present situation of measurement standards supply system of each country as well as the assistance by other donors, and investigate the direction of technical assistance in development of measurement standards system in the ASEAN region by using comparative advantages of our country.

3. Countries for the Study

Countries for the study are the following nine countries in the ASEAN region: Cambodia, Lao PDR, Myanmar, Viet Nam, Philippines, Indonesia, Malaysia, Thailand and Singapore.

4. Viewpoint of the Study

Since the development of measurement standards in the above countries differs greatly, it is not efficient and effective to study them in the same manner. In this study, these countries are divided into the following four groups according to their development stages, and the study team investigates features of metrology standards belonging to the same group in addition to the common subjects in metrology standards for effective study. It is also important to investigate the needs of industry and testing and calibration laboratories for measurement standards to discuss appropriate services to be provided by the measurement standards organizations in countries in the same group.

The method for cooperation is investigated taking into account the limitation of resources in Japan.

(1) Cambodia, Laos and Myanmar (Group 1)

These group countries are less developed in measurement standards. There is little information available, and the industry and investment that require measurement standards stay at low level. Therefore, the issues include how to supply measurement standards, how to develop legal metrology, how to disseminate them, etc., and the study team investigates what kind of assistance is required in these countries.

(2) Indonesia, Philippines and Viet Nam (Group 2)

These group countries are classified as middle developed countries with relatively large

foreign investment and industry that requires measurement standards. The measurement standard institutes function fairly well at present. Indonesia and Viet Nam actively take part in international activities and understand importance of measurement standards system as social infrastructure. The issues include how to enhance domestic standards supply system and upgrade the quality, and foster private sectors. Furthermore, it is important to collaborate countries of Groups 2 and 3 for development each other.

(3) Malaysia and Thailand (Group 3)

Both countries have been provided assistance in measurement standards from Japan. In addition, Thailand has received assistance in metrology from Germany (PTB) and PTB continues assistance in measurement standards. Through these assistances, the development of facilities has been almost completed. It is necessary to upgrade the quantity as well as quality of standards and establish the standard supply system to industry. At the same time, it is important to create a system to support neighboring countries by collaboration with our country.

(4) Singapore (Group 4)

Singapore (SPRING) is the most developed country among ASEAN nations in measurement standards. It chaired the APMP after Japan and actively participates in international activities. It also supplies some measurement standards to other countries. Therefore, it is important to investigate the present situation of collaboration by Singapore within the ASEAN region and the possibility for assistance to other countries together with Japan.

5. Members of the Study Team

The members of the study team are as follows:

- Kunio OTSUKA Leader/Metrology System
- Issei AKAMATSU Mesurement Technology
- Tamon NAGAI HRD/Technical Cooperation

6. Itinerary of Site Surveys

The following two site surveys were carried out. The itinerary of the site surveys is shown in Appendix A.

- First site survey (Cambodia, Laos, Myanmar, Viet Nam and Indonesia): September 21, 2006-October 15, 2006
- Second site survey (Philippines, Malaysia, Thailand and Singapore): January 9, 2007-January 27, 2007

7. List of Interviewed persons

Attachment B shows the list of interviewed persons.

**Chapter 1 Present Situation of Industrial Technology
Development and Measurement Standards,
and Needs for Assistance**

Chapter 1 Present Situation of Industrial Technology Development and Measurement Standards, and Needs for Assistance

1.1 Cambodia

1.1.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Cambodia are 181 thousand km² and 13.8 million in 2005, respectively. Table 1.1.1-1 shows the main economic indicators of Cambodia. The country has developed steadily with the economic growth rates of more than 5% over the past five years. However, the GDP was US\$5.48 billion and the GDP per capita was as small as US\$393 in 2005.

Table 1.1.1-1 Main Economic Indicators (Cambodia)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)	3,787	4,079	4,355	4,888	5,477
Real GDP (% increase)	5.5	5.2	7.0	7.7	10.0
GDP per Capita (US\$)	293	310	325	357	393
Budget Revenue (% GDP)	10.5	11.0	10.2	10.8	11.7
Budget Expenditure (% GDP)	16.1	17.3	15.9	15.1	14.8
Current Public Deficit (% GDP)	1.1	1.0	0.9	1.7	2.1
Overall Public Deficit (% GDP)	-5.6	-6.3	-5.7	-4.3	-3.1
Export of Goods (% GDP)	42.1	42.1	47.4	48.3	50.7
Import of Goods (% GDP)	52.5	53.2	56.3	61.0	65.3
Trade Balance (% GDP)	-10.4	-11.2	-8.9	-12.8	-14.6

*: Projection

Source: Cambodia Economic Watch, April 2006

(2) Present situation of industry and its priority sector in future

Table 1.1.1-2 shows the GDP by industrial origin. Industrialization is not attained in the country with its GDP share of 26%. Among the industry, the garment sector is most developed with the share of more than half of the GDP of total industry, followed by the sector of food processing, beverage and tobacco with the share of about 9%. Most garment factories are operated by foreign enterprises and the domestic garment industry is not developed. The garment goods are mostly exported to the U.S.A. and the garment industry will be the priority industry in future as well.

Table 1.1.1-2 GDP by Industry Origin at Current Prices

Unit: US\$ million

	2001	2002	2003	2004	2005*
Agriculture	<u>1,302</u> <u>(34.4%)</u>	<u>1,333</u> <u>(32.7%)</u>	<u>1,475</u> <u>(33.9%)</u>	<u>1,548</u> <u>(31.7%)</u>	<u>1,749</u> <u>(31.9%)</u>
Paddy	313	285	350	321	400
Other Crops	267	272	348	388	405
Livestock	208	216	215	227	247
Fishery	384	434	433	479	559
Rubber & Forestry	130	126	128	133	138
Industry	<u>876</u> <u>(23.1%)</u>	<u>1,003</u> <u>(24.6%)</u>	<u>1,120</u> <u>(25.7%)</u>	<u>1,315</u> <u>(26.9%)</u>	<u>1,423</u> <u>(26.0%)</u>
Garment	429	503	577	709	771
Food, Beverage & Tobacco	116	116	123	128	134
Other Manufacturing	107	116	118	124	133
Electricity, Gas & Water	18	22	26	30	33
Construction & Mining	207	246	276	324	352
Services	<u>1,609</u> <u>(42.5%)</u>	<u>1,743</u> <u>(42.7%)</u>	<u>1,761</u> <u>(40.4%)</u>	<u>2,025</u> <u>(41.4%)</u>	<u>2,305</u> <u>(42.1%)</u>
Total GDP	3,787 (100.0%))	4,079 (100.0%))	4,355 (100.0%))	4,888 (100.0%))	5,477 (100.0%))

*: Projection

Source: Cambodia Economic Watch, April 2006

1.1.2 Metrology Law and Related Regulations

(1) Metrology law and related regulations

The following laws and regulations exist; however, there is no metrology law in Cambodia.

- Ministerial Prakas of SI Units
- Ministerial Prakas of Management of Standards and Equipment of Liquid Volume

The Law of Metrology (draft) which has been prepared by the assistance of UNIDO is

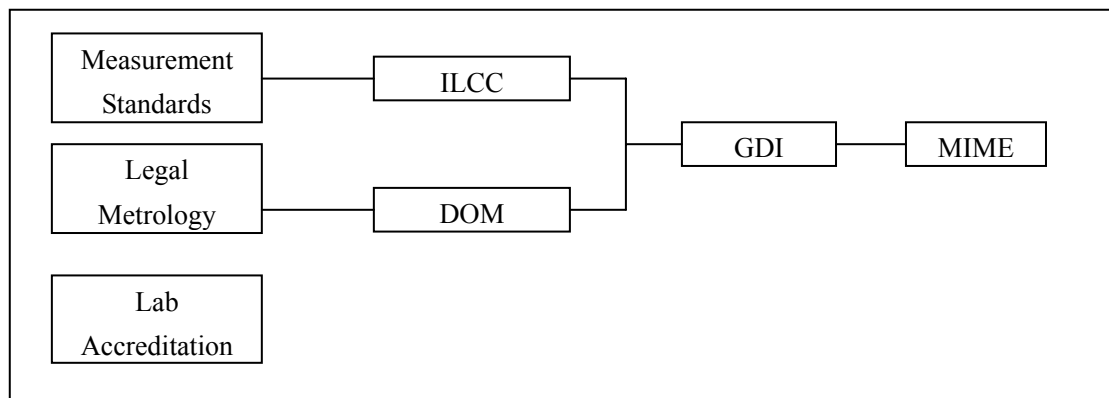
under review by the Cabinet meeting. After that, it will be sent to the Diet for approval; however, the detailed schedule is not known.

(2) Policy for metrology standards development

An action plan (2004-2008) has been drawn up including the establishment of RVC (Regional Verification Center) in order to promote metrology as well as to develop metrology infrastructure.

1.1.3 Organizations Related to National Metrology Organizations

(1) Administrative government organization



The GDI (General Department of Industry) under the MIME (Ministry of Industry, Mines and Energy) controls the metrology administration. Cambodia's metrology division is divided into two: the Department of Metrology (DOM) and the Industrial Laboratory Center of Cambodia (ILCC). The former is an organization for legal metrology and the metrology section of the latter organization was separated from the DOM in 2005 and deals with the industrial and scientific metrology. The both organizations belong to the GDI.

(2) National metrology institute

The ILCC has three laboratories other than the industrial and scientific metrology laboratory: laboratories of foodstuffs, microbiology and chemistry. The ILCC has several young staffs with little experience in measurement standards. It is necessary to train them concerning basics of metrology standards and basic technology.

The metrology laboratory of ILCC consists of laboratories of mass, volume, temperature, pressure and force, dimension and electricity. The ILCC maintains national measurement standards and conducts industrial and scientific metrology according to the DOM's request. The study team observed the measurement standards of mass, volume, length

(Mitsutoyo's instruments) and temperature, and some measuring instruments (weighing instruments, verification equipment for tank trucks, etc.).

UNIDO provided the ILC with the most of standards and equipment and also plans to provide standards of electricity and pressure. The ILC has a plan to participate in an international laboratory comparison of APMP supported by PTB. The building construction of ILCC was completed and the equipment was under installation when the study team visited there.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

There is no national laboratory accreditation body.

2) Testing and calibration laboratories

There is no testing and calibration laboratories certified based on ISO17025.

(4) Organization for legal metrology

1) DOM

The DOM was established on April 26, 1999. The number of staffs is 20. The DOM maintains mass standards, electric weighing instruments and volume standards. It inspects only limited kinds of measurement instruments (NAWI, weighing instruments of LPG filling station, electronic weighing instruments of lube oil filling station, oil dispensers, etc.) within a limited area (mainly Phnom Penh City). UNIDO plans to provide the DOM with verification facilities of watt-hour meters and water meters; however, it is questionable that the DOM can operate them properly at the present technology level.

- LPG filling station: It was established in 2003. It purchases LPG in tank trucks from the PTT of Thailand. LPG in tank is pumped to another tank at the border. The tank trucks are weighed by a truck scale and there has been no significant difference in weight between the two measurements. There is a plan to construct storage tanks at the border. Five platform scales for LPG filling are subject to verification once for every three months. A certificate seal is put on the passing instrument.
- Lube oil filling station: It is a semi-automatic filling station of lube oil. Weight checking is conducted by weighing sampled goods using an electronic weighing instrument. The DOM verifies the electronic weighing instruments once for every three months. A certificate seal is put on the passing instrument.

2) RVC (Regional Verification Center)

The following five RVCs are planned. The RVCs maintain working standards. The construction of No.2 RVC has already decided by the assistance of New Zealand (equipment supply). The Cambodian's government will purchase the land and construct the building. The other RVCs have no concrete construction plans.

- No.1 RVC (Phnom Penh)
- No.2 RVC (Sianouk Ville)
- No.3 RVC (Battambang)
- No.4 RVC (Kampong Cham)
- No.5 RVC (Ratanakiri)

There are 24 provincial metrology offices to inspect and verify measuring instruments. UNIDO provides the local governments with weights and volume standards.

1.1.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty

- ILCC: National standards (mass, length, volume and temperature)
- DOM: Secondary standards (mass, volume, etc.)
- RVC: Working standards

(2) Traceability and calibration service

1) Traceability

Traceability is not well established. It is expected that the traceability will be developed in accordance with the progress of ILCC's activities. To train ILCC's staffs will be helpful for development of traceability.

2) Calibration service

The calibration service for mass, weighing instruments and length is carried out; however, it is not actively achieved. Improvement of traceability service as well as the traceability is an issue to be solved. The study team observed the length related instruments that Mitsutoyo provided at US\$140,000; however, they are not used sufficiently.

1.1.5 Internationalization

Cambodia is members of the following international and regional organizations:

- Corresponding Member of OIML in 2000
- APLMF: participated in 2002
- WG3 member of ACCSQ

1.1.6 Assistance by Donors

(1) UNIDO:

UNIDO provides the following assistance to satisfy the requirements for WTO/TBT agreement. It is assistance to CLMV: Cambodia and Laos by NORAD's fund and Viet Nam by SECO's fund. For Myanmar, only preliminary survey was carried out and the further assistance did not provided because of the economic sanction to Myanmar.

- Capacity building project on metrology, testing and conformity assessment
- Assistance in drafting law on standards and metrology
- Assistance in establishment of ILCC with capacity building on metrology
- Supply of measuring instruments for volume, temperature, pressure, force, length, and electricity

(2) UNIDO/NORAD:

UNIDO prepared a master plan of "Market Access and Trade Facilitation Support for Mekong Delta Countries, Standards, Metrology, Testing and Quality (SMTQ)" using NORAD's fund (about US\$0.8 million; First phase: 2003-2005). The second phase (2006-2008) has already started with the similar amount of fund.

UNIDO mainly provided the ILCC with measurement standards and measuring instruments. It also provided DOM with mass standards.

(3) NZAID: Assistance in No.2 RVC construction

(4) PTB: Technical support and equipment supply

(5) EU: Capacity building in standards, testing, measurement, accreditation, and conformity assessment (in 2004, half million Euro)

(6) Thailand, Viet Nam and China: No assistance

1.1.7 Issues in the Field of Measurement Standards

There are few industries that require measurement standards and it can not be considered that such a industry emerges rapidly in near future. Therefore, it is necessary to develop legal metrology to protect consumers first. The following are issues in a field of measurement standards:

- (1) Development of national standards system (development of ILCC)
Since the ILCC which maintains the national standards was just established, the national standards system is not well developed. The fundamental matters in this field should be developed.
- (2) Development of legislation
The regulations to implement the metrology law are important.
- (3) Development of legal metrology
It is necessary to draw up the system to disseminate legal metrology nation wide.
- (4) Establishment of accreditation body
It will become necessary to establish an accreditation body of calibration laboratories along with the development of industry.
- (5) Improvement of technology (including the ILCC)
Measures to be taken for national measurement standards and legal metrology are just started. The top priority should be placed on acquisition of basic technologies.
- (6) Human resources development (including the ILCC)
The staffs of ILCC are young and less experienced in this field. It is necessary to learn basic technology and standards.

1.2 Lao PDR

1.2.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Laos are 237 thousand km² and 5.6 million in 2005, respectively. Table 1.2.1-1 shows the main economic indicators of Laos. The country has developed steadily with the economic growth rates of more than 5% over the past five years. However, the GDP was US\$2.87 billion and the GDP per capita was as small as US\$511 in 2005.

Table 1.2.1-1 Main Economic Indicators (Laos)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)	1,700	1,930	2,130	2,500	2,870
Real GDP (% increase)	5.8	5.9	5.8	6.9	7.3
GDP per Capita (US\$)	329	365	394	452	511
Budget Revenue (% GDP)	12.6	12.7	10.3	12.5	
Budget Expenditure (% GDP)	20.2	17.1	12.7	19.5	
Overall Public Deficit (% GDP)	-7.6	-4.4	-2.4	-7.0	
Export of Goods (US\$ million)	320	301	336	363	553
Import of Goods (US\$ million)	510	447	462	713	882
Trade Balance (US\$ million)	-191	-146	-127	-349	-329

*: Projection

Source: Statistics 1975-2005, National Statistics Center; Statistical Yearbook 2005, National Statistics Center; World Bank

(2) Present situation of industry and its priority sector in future

Table 1.2.1-2 shows the GDP by industrial origin. Industrialization is not attained in the country with its GDP share of 29%. Among the industry, the manufacturing sector is most developed with the share of 70% of the GDP of total industry. The main sub-sectors in manufacturing sector are food (meat processing, beverage, beer, tobacco, etc.), textile goods and cement. Minerals such as tin are produced as well.

The government is promoting export development of agricultural produce, textile goods, wood products and handcraft products.

Table 1.2.1-2 GDP Structure by Industrial Origin

Unit: %

	2001	2002	2003	2004	2005*
Agriculture	<u>50.8</u>	<u>49.9</u>	<u>48.1</u>	<u>46.6</u>	<u>44.4</u>
Crops	30.3	29.6	27.2	27.1	25.9
Livestock & Fishery	17.4	17.2	17.0	16.4	15.5
Forestry	3.2	3.1	3.2	3.1	3.0
Industry	<u>23.5</u>	<u>24.4</u>	<u>25.7</u>	<u>27.0</u>	<u>29.2</u>
Mining & Quarrying	0.5	0.5	1.7	1.5	3.1
Manufacturing	17.7	18.9	19.0	20.2	20.5
Construction	2.4	2.1	2.3	2.6	2.9
Electricity	2.9	2.9	2.8	2.7	2.7
Services	<u>24.8</u>	<u>24.7</u>	<u>25.3</u>	<u>25.5</u>	<u>25.5</u>
Total GDP	100.0	100.0	100.0	100.0	100.0

*: Projection

Source: Statistics 1975-2005, National Statistics Center

1.2.2 Metrology Law and Related Regulations

(1) Metrology law and related regulations

The following laws and regulations exist; however, there is no metrology law in Laos.

- Prime Minister's Decree on Metrology Management (October 26, 1993)
- Regulation of Registration of Measurement Instrument (No.233/STEA, March 10,1994)
- Prime Minister's Decree on Standards and Product Quality Management (February 1995)
- Guideline on Registration and Inspection of Fuel Dispensers (No. 808/STEA, August 6, 2001)
- Regulation on Fuel Storage Tank Inspection

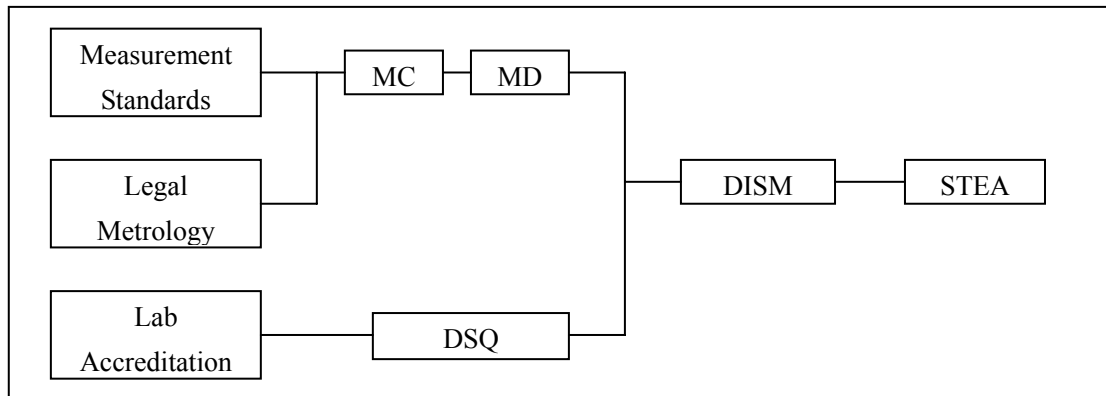
The Law of Metrology (draft) which has been prepared by assistance of UNIDO is under review. There is a plan to prepare a law concerning laboratory accreditation.

(2) Policy for metrology standards development

The government acknowledged the short (2001-2005), middle (2006-2010) and long (2011-2020) term strategies for metrology development.

1.2.3 Organization Related to National Metrology Organizations

(1) Administrative government organization



The STEA (Science, Technology and Environment Agency), a responsible agency for metrology administration, consists of the following seven divisions. One of the divisions is the DISM (Department of Intellectual Property, Standardization & Metrology) who administrate national measurement standards. The annual budget of STEA is as small as US\$100,000.

- CABINET
- DISM: Department of Intellectual Property, Standardization and Metrology
- DOE: Department of Environment
- DST: Department of Science and Technology
- SRI: Scientific Research Institute
- TRI: Technology Research Institute
- ERI: Environmental Research Institute

The DISM has four divisions: Division of Intellectual Property, Division of Standards & Quality (DSQ), Metrology Division (MD) and Div. of Dissemination & General Affaires. The MD with the Metrology Center (MC) is responsible for metrology and the DSQ is responsible for industrial standards and quality management.

(2) National metrology institute

The MD, a metrology division of DISM, administrates the measurement standards and legal metrology. The MD, administrating it by assistance of UNIDO, consists of several staffs whose capability are not so high.

1) Vision of the MD

To provide a nationally recognized metrology service by providing services in scientific

and legal metrology fields

2) Mission of the MD

To maintain national measurement standards, provide industrial calibration services and implement the Metrology Development Plan and its regulations

3) Functions and responsibility of MD

- Being a custodian of national measurement standards
- Establishment and maintenance of international traceability of national measurement standards
- Verification of measuring equipment used in trade and commerce
- Supervision, inspection and registration of measuring instruments
- Provision of calibration and traceability services to industrial and commercial establishments
- Co-operation with regional and international organizations in the field of metrology
- Provision of training and improvement of the technical level of its employees
- Drafting of legal instruments in the field of metrology, e.g. Metrology Law, Decree, and regulations

4) Metrology Center (MC)

There is the Metrology Center (MC) with a floor area of 900m² (first story building) in the suburbs of Vientiane, that will be used in verification and calibration of mass standards, volume standards and water meters. The construction of the Center was just completed and equipment provided by Viet Nam was brought in.

It is planned to conduct verification and calibration of electricity and temperature after the success of activities at the initial stage; however, MC has no fund and is waiting for donor's assistance.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

There is no national lab accreditation body. The establishment of accreditation body is under planning, which would be realized within 3-5 years. The DSQ is in the process of accrediting testing laboratories for food inspection. Activities concerning calibration laboratory are not conducted.

2) Vision of the DSQ

To be a regionally and internationally recognized national standards body for providing services on standards, conformity assessment and total quality management

3) Mission of the DSQ

To formulate and implement national standards, carry out product and system certification activities, quality inspections and provide training, consultancy, library and documentation services for enhancing the quality and competitiveness of products and services of Lao PDR

4) Function of DSQ and its responsibilities

- Formulation of National Standards
- Provision and implementation of product and systems certification scheme
- Provision of library and information services and maintenance of WTO/TBT enquiry point
- Supervision and inspection of goods and products for quality
- Conducting studies on standardization, testing and quality
- Co-operation with regional and international organizations in the fields of standardization and quality

2) Testing and calibration laboratories

There is no testing and calibration laboratories accredited based on ISO17025.

(4) Organization for legal metrology

The MD of DISM is responsible for legal metrology. Seventeen branch offices (STEO : Science, Technology and Environment Office) of the STEA implement the legal metrology in their territories (1-2 staffs). Refer to Item (2) above for the vision, mission, and the functions and responsibilities. The following is the activities of MD:

- Registration and certification of fuel dispensers, spring balances and digital balances (for precious metals in Vientiane Capital and provinces)
- Manufacture of 100 sets of weights of class M3 (range from 1kg to 10kg) and distribution to the districts of the provinces to use for registration and testing of spring balances and products in trade
- Annual inspection of 3% of used/installed measurement equipment such as water meters and electricity meters
- Annual inspection of spring balances used in trade

1.2.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty

There are following standards for mass and volume as national standards:

- Working standard weights: F1, F2 (1-20kg), M1, M3

- Volume vessels: 1-20 liters
- Block gauge

In addition, there are electronic weighing instruments provided by UNIDO, gauge blocks, optical projector, hardness testers, micro meters and calipers provided by Mitsutoyo, etc. that will be transferred to the MC.

(2) Traceability and calibration service

1) Traceability

Measurement standards made in Viet Nam that were provided by Viet Nam is considered to be calibrated in Viet Nam.

2) Calibration service

Calibration service is not actively conducted.

1.2.5 Internationalization

Laos is members of the following international/regional organizations. It is not a member of APMP.

- APLMF
- WG3 member of ACCSQ since 1998

1.2.6 Assistance by Donors

(1) UNIDO/NORAD

UNIDO prepared a master plan of “Market Access and Trade Facilitation Support for Mekong Delta Countries, Standards, Metrology, Testing and Quality (SMTQ)” using NORAD’s fund (about US\$0.8 million). The report was completed in 2005. This project includes the drafting of Law of Metrology, providing of measurement standards and equipment, short-term training, etc. (Phase 1). The Phase 2 project follows the Phase 1 project above.

(2) Assistance in metrology development by Viet Nam

The STAMEQ of Viet Nam provided the building of MC and equipment (US\$333,000 in total), and short-term training.

(3) PTB

PTB provided measurement standards (volume, burettes and pipettes, weights (F1/F2

classes, electronic weighing instruments, and digital thermometers). The total cost was 35,000 Euro. The DISM has participated in training courses, work shops and seminar under the ASEAN/PTB program since 1999.

(4) NZAID

NZAID has conducted a survey concerning legal metrology and provided motor cycles equipped with standards of mass, volume and length.

1.2.7 Issues in the Field of Measurement Standards

There are few industries that require measurement standards in Laos and it can not be considered that such an industry emerges rapidly in near future. Therefore, it is necessary to develop legal metrology to protect consumers first. The following are issues in the field of measurement standards:

(1) Development of national standards

It is necessary to improve measurement standards of MC and to learn technology for them.

(2) Development of legislation

The regulations to implement the metrology law are important.

(3) Development of metrology system

It is necessary to draw up the system to disseminate legal metrology nation wide.

(4) Improvement of technology

Improvement of verification technology of staffs of the MD/MC and local inspectors is necessary.

(5) Human resources development (MD/MC, local inspectors)

Basic knowledge on measurement standards and legal metrology should be acquired.

1.3 Myanmar

1.3.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

There is not sufficient information available on Myanmar as follows. GDP per capita is as small as US\$161 in 2003. The economic growth was less than 5%, resulting in less development.

- Population: 55.4 million as of 2005
- Land area: 678,330 km²
- GDP per capita: US\$161 in 2003
- GDP growth rates: 3.0% in 2004 and 5.0% in 2005
- Export: US\$3,648 million in 2005
- Import: US\$3,616 million

(2) Present situation of industry and its priority sector in future

Table 1.3.1-2 shows the GDP by industrial origin. Industrialization is not attained in the country. The share of manufacturing sector is as low as 10%. Among the manufacturing sector, the garment sector is most developed. There are several good enterprises that operate factories producing electric/electronics parts and equipment. Myanmar has energy resources of oil and gas.

Table 1.3.1-2 GDP Structure by Industry Origin

	2001	2002	2003	2004	2005
Agriculture	57.1	54.5	50.6		
Mining/Energy	0.5	0.4	0.4		
Manufacturing	7.8	9.2	9.8		
Electricity, gas and water	0.3	0.1	0.1		
Construction	2.2	3.3	3.9		
Trade	24.2	23.6	22.6		
Other Services	7.9	8.9	12.6		
Total GDP	100.0	100.0	100.0		

Source: World Bank

1.3.2 Metrology Law and Related Regulations

(1) Metrology law and related regulations

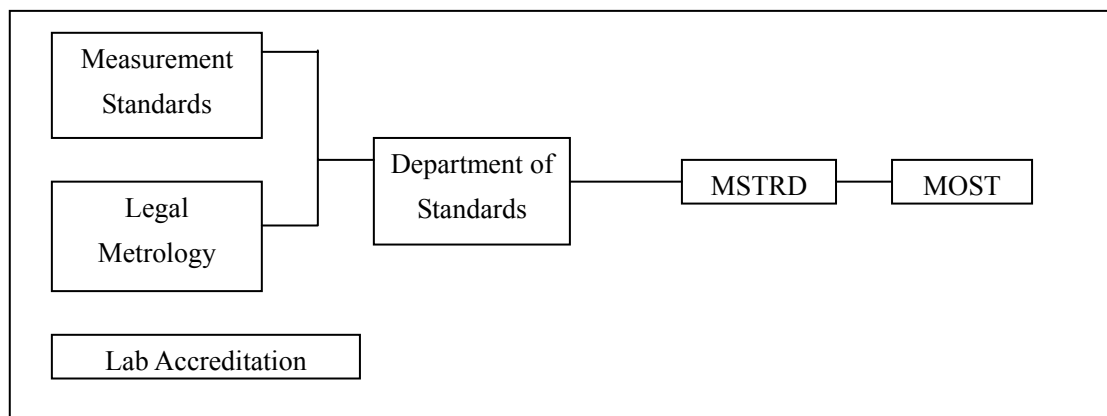
There is no metrology law. A draft of Standardization Law which includes metrology, measurement standards, accreditation, etc. is under review by the law department.

(2) Policy for metrology standards development

The existence of effective policy for standards development is not known, although the Director General of MSTRD (Myanmar Scientific and Technological Research Department) told that it is necessary to develop measurement standards.

1.3.3 Organization Related to National Metrology Organizations

(1) Organization related to national measurement organizations



The responsible ministry, the Ministry of Science and Technology (MOST), consists of the following organizations. The MSTRD controls the metrology administration.

- Myanmar Scientific and Technological Research Department (MSTRD)
- Department of Technical and Vocational Education
- Department of Advanced Science and Technology
- Department of Atomic Energy
- Department of Technology Promotion and Coordination

The MSTRD has ten research and development institutes and six technical service departments. The Department of Standards is classified into the latter.

(Remarks) There is Myanmar Industrial Development Committee (MIDC) chaired by the prime minister for facilitating industrial development. The measurement standards are dealt with in the MIDC.

(2) National metrology institute

The duties of the Department of Standards, staffed with 17 employees (five engineers), include metrology/measurement service (only physical measurement and measurement of electricity/health by other departments), measurement (issue of measurement analysis sheet), legal metrology (actually not conducted), and administration of industrial standards. Needs for JIS in English are large; however, it is very old covering only several fields. Up-dated English version of JIS can be purchased at about 300 thousand yen in Japan.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

There is no national accreditation body.

2) Testing and calibration laboratories

There is no testing and calibration laboratories accredited based on ISO 17025.

(4) Organization for legal metrology

The Department of Standards is responsible for legal metrology.

1.3.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty

There are few measurement standards. There are weighing balances, precision balances, pressure measuring instruments, volume standards, angle measuring instruments, micro meters, block gauges, height gauges (six units), hardness testers (Vickers), etc. Power failures happen occasionally and temperature control is difficult.

(2) Traceability and calibration service

1) Traceability

Traceability is not well established.

2) Calibration service

Little calibration service is conducted.

1.3.5 Internationalization

Myanmar is members of WG3 of ACCSQ and ISO (communication member). It wishes to participate in the APLMF and the APMP; however, there is no sufficient budget. The priority is an ISO membership. The related information can be collected from ISO for distribution to industry. The Myanmar standards can be prepared based on ISO (61 kinds existing at present and additional four standards (two standards for transformers and two standards for gas) under preparation).

1.3.6 Assistance by Donors

- (1) UNIDO: The preliminary survey was conducted; however, no further assistance is planned due to the influence of economic sanction.
- (2) NZAID: NZAID conducted a survey on legal metrology.
- (3) AusAID: A proposal for HRD assistance has been already prepared. The main focus is on industrial standards.
- (4) China: China sent an inquiry for potential fields of assistance.
- (5) ASEAN (IAI): ASEAN (IAI) drew up a capacity building plan for Myanmar, in which the standards are taken up. Necessity of HRD assistance in standards is in the fields of “standardization and measurement”, “harmonization of standards” and “MRA”. It is necessary to prepare a master plan concerning standardization and metrology implementation.

1.3.7 Issues in the Field of Measurement Standards

There are many issues to be solved as follows:

- (1) Development of all basic areas concerning measurement standards, calibration and surveillance
- (2) Most of the following national measurement standards do not equip: (i) length, (ii) mass, (iii) temperature, (iv) hardness, (v) pressure, (vi) luminous intensity and (vii) volume.
- (3) Fostering human resources who can implement the following:
 - a) Measurement methods, calibration methods, maintenance methods, etc.
 - b) Standardization

(4) Laboratory renovation

The existing building does not meet the specifications of metrology standard institute (layout, air conditioning, etc.). Intensive improvement of building is necessary before the introduction of measurement standards.

1.3.8 Visits to Private Enterprises

(1) Company A (Transformer manufacturer with sole Myanmar's capital)

1) Outline

- Employees: 250 (factory workers: 190, others: employees at head and liaison offices)
There is one Japanese adviser.
- Area: 2.6ha, Floor area: more than 10,000m²
- Certification based on ISO9001/2000 (8-9 Japanese companies certified based on ISO9000 in Myanmar Japanese Chamber of Commerce)
- Products: Transformers up to 33 kV (three domestic manufacturers, share of Company A: 60%)
- Production capacity: 1,000 units/year, actual production: 600 units (2005)
- Process: Stream line production from material processing to assembly
- Market: Only domestic market
- Inspection instruments: 25 kinds, mainly electric inspection instruments

2) Calibration of inspection equipment

- a) Electric inspection instruments made in China are calibrated based on GB standards at Shanghai Sen-pu Electric Research Institute. One kind of instrument is calibrated at China Aerospace Science & Industry Corporation (IEC standard). The MSTRD issues measurement analysis paper for four kinds of physical measuring instruments. The No.1 Ministry of Industry issues measurement analysis paper for two kinds of electric measuring instruments. Other new instruments have not yet calibrated
- b) Problems: Since there is no accredited calibration laboratory in Myanmar, the instruments must be calibrated overseas calibration laboratories. It takes time and cost. Accredited calibration laboratories should be established, because companies certified by ISO9000 will increase.

3) HRD is conducted. The company plans to introduce TQM system in the next 2-3 years.

4) Others

Company A is located in the South Dagon Industrial Zone. The types of companies in the zone are as follows:

- electricity/electronics
- Metal processing
- Casting
- Automobiles
- Plastics processing
- Sawing machine
- Food processing

5) Consideration

The factory has a wide space and well arranged. The office is located on the second floor so that it can observe the production line. According to the Japanese adviser, the inspection instruments are well equipped. In comparison with Japanese manufacturers, they are the same as or exceeds to Japanese ones in quality and kinds. The company put importance on quality very much and it is an excellent company in Myanmar.

(2) Company B (Manufacturer of small transformers with sole Myanmar's capital)

1) Outline

- Establishment: 1992, 1997 for industrial division
- Company B consists of five divisions: industry, IT, trading, civil engineering (including leasing) and transportation.
- Capital: US\$4 million
- Area: about 100,000 m² (South Dagon Industrial Zone (1), Yangon), Factory: 40.000 m²
- Employees: 1,500
- Certification based on ISO9002, assessor: SIRIM
- Safety standards by the JQA, UL, TUV, etc.
- Products: small transformers
- Process: Stream line production from material processing to wiring and assembly
- Inspection instruments: mainly electric inspection instruments (potentiometer, NCR tester, High voltage tester, insulation tester, etc.), metal analysis (required for ISO14000): outsourcing
- Others: relationship with Japanese companies (TAMURA and ANZENDENGU)

2) Calibration of inspection equipment

- Calibration is conducted once a year. TAMURA comes for calibration. Some instruments are sent to Malaysia for calibration.
- Problem: Overseas calibration needs time and costs. Instruments are lost in some cases.

3) Training for new workers: class room lessons: one week, OJT: 2.5 months

4) Consideration

Products are exported to Sony, MELCO, JVC, Canon, Toshiba, Kenwood, etc. The calibration of inspection instruments is important to keep quality of products. It is necessary to develop domestic calibration system.

(3) Company C (Electric parts manufacturer with Japanese capital)

1) Outline

- Employees: 93 (Japanese: 2)
- Plan to acquire certification of ISO14000
- Products: small electric parts such as sockets and connectors (made by plastics)
- Process: Stream line production from material processing (ABS plastics processing) to assembly
- Market: Delivery to a parent company, no sale to outsiders
- Inspection instruments: mainly for length measurement (micro meters, thickness gauges, etc.) and electricity measurement (voltage etc.)

2) Calibration of inspection equipment

- Number of instruments to be calibrated: about 40 units a year
- The company owns duplicated inspection instruments and sends one instrument to the parent company in Bangkok for calibration.
- Export and import procedures are necessary.
- Problems: It takes time and cost, because export and import procedures are required every time.

3) Consideration

Even if the products are small parts, the quality control should be kept strict to maintain interchangeability and to prevent from short circuit. Periodical calibration of inspection instruments is important. It is necessary to develop domestic calibration system.

1.4 Viet Nam

1.4.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic Information

The land area and the population in Viet Nam are 329 thousand km² and 83.1 million in 2005, respectively. Table 1.4.1-1 shows the main economic indicators of Viet Nam. The country has developed steadily with the economic growth rates of more than 7% over the past four years. The GDP was US\$52.4 billion and the GDP per capita was as small as US\$630 in 2005.

Table 1.4.1-1 Main Economic Indicators (Viet Nam)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)			39,552	45,445	52,832
Real GDP (% increase)	6.9	7.1	7.3	7.8	8.4
GDP per Capita (US\$)			489	553	618
Budget Revenue (% GDP)	21.6	23.1	24.8		
Budget Expenditure (% GDP)	27.0	27.7	29.5		
Overall Public Deficit (% GDP)	-5.4	-4.6	-4.7		
Export of Goods (% GDP)		56.8	59.3	65.7	69.0
Import of Goods (% GDP)		62.0	67.7	73.3	73.6
Trade Balance (% GDP)		-5.2	-8.4	-7.6	-4.6

*: Estimation

Source: Statistical Yearbook of Vietnam 2005, General Statistics Office; JETRO; World Bank

(2) Present situation of industry and its priority sector in future

Table 1.4.1-2 shows the GDP structure by industry origin. The share of the industry and construction was 41% in 2005, which shows the highest industrialization among LSMV countries.

Table 1.4.1-2 GDP Structure by Industry Origin at Current Prices

Unit: %

	2001	2002	2003	2004	2005*
Agriculture, Forestry & Fishing	23.2	23.0	22.5	21.8	20.9
Industry & Construction	38.1	38.5	39.5	40.2	41.0
Services	38.6	38.5	38.0	38.0	38.1
Total GDP	100.0	100.0	100.0	100.0	100.0

*: Estimation

Source: Statistical Yearbook of Vietnam 2005, General Statistics Office

Table 1.4.1-3 shows the structure of industrial output value by industrial activity in 2004. The manufacturing sector shares 81% of the industrial output. The share in manufacturing sector, the food products, beverage and tobacco are the largest (21%), followed by the textile, apparel and leather products (12%). The transportation machinery including cars is 8%; machinery and electricity, 5%; chemical and chemical products, 5%; and metal products, 4%. A wide range of manufacturing industry exists in the country.

Table 1.4.1-3 Structure of Industrial Output Value at Current Prices by Industrial Activity in 2004

Unit: %

Sector	Share	Sector	Share
Total	100.0	Chemicals and chemical products	5.4
Mining and Quarrying	12.8	Rubber & Plastic Products	4.0
Mining of Coal	1.5	Non-metallic Mineral Products	5.7
Extraction of Crude Oil and Gas	10.4	Basic Metal	3.8
Mining of Metal Ores	0.2	Fabricated Metal Products	4.3
Quarrying of Stones etc.	0.7	Machinery & Equipment	1.6
Manufacturing	81.2	OA Equipment	1.0
Food products and Beverages	19.3	Electric Machinery & Apparatus	3.0
Tobacco Products	1.7	Communication Equip. & Apparatus	2.2
Textiles	3.7	Medical, Precision Equipment, etc.	0.3
Wearing Apparel	4.0	Assembling & Repairing of Vehicles	3.3
Leather Products	4.1	Assembling/Repairing of Transport Equip.	4.8
Wood and Wooden products	1.8	Furniture	3.8
Paper and Paper Products	1.9	Recycling	0.1
Publishing, Printing, etc.	1.2	Electricity, Gas & Water Supply	5.9
Coke & Refined petroleum products	0.2		

Source: Statistical Yearbook of Vietnam 2005, General Statistics Office

1.4.2 Metrology Law and Related Regulations

(1) Metrology law and related regulations

The Ordinance of Metrology (October 6, 1999) was enacted in 1999. It will be amended with contents including internationalization and self-supporting system of related institutions in 2009. The VMI (Vietnam Metrology Institute) will draft it to submit the STAMEQ (Directorate for Standards and Quality). The final draft will be sent to MOST (Ministry of Science and Technology). At present there are regulations related to the Ordinance of Metrology and Orders by MOST.

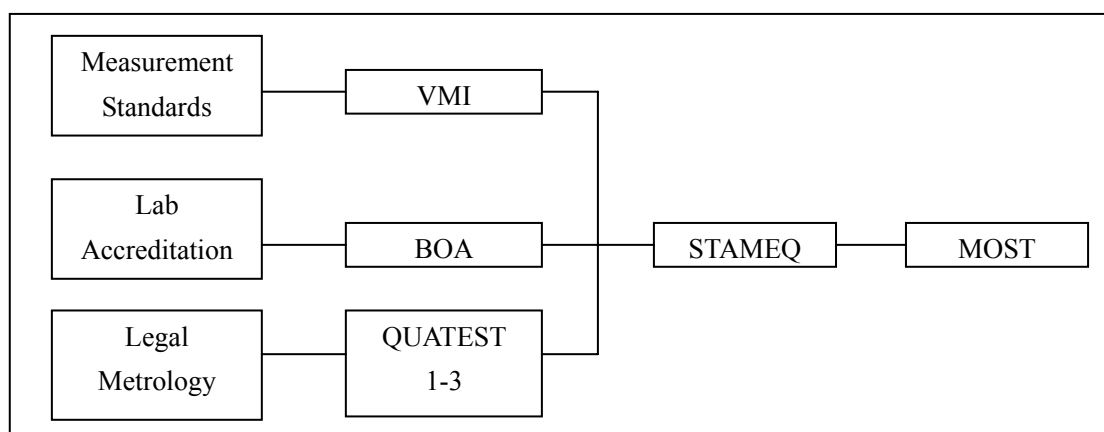
(2) Policy for metrology standards development

The National Standard Development Master Plan (Phase 2) during 2004-2010 was approved. It plans to increase the number of standards to 32 kinds from 10 kinds of standards which has been developed based on the Master Plan of Phase 1. However, the development of the whole standards seems difficult (VMI's opinion).

There is a plan to move VMI to Phoa Lack (total investment: US\$25 million, Phase 1: 12.5 million). The purpose of moving is to upgrade scientific metrology and to facilitate legal metrology and industrial metrology.

1.4.3 Organizations Related to National Metrology Organizations

(1) Administrative governmental organization



The STAMEQ (Directorate for Standards and Quality) under the MOST (Ministry of Science and Technology) administrates organizations dealing with measurement standards, lab accreditation and legal metrology. Other than metrology, it administrates standardization, QMS, productivity improvement, etc. The head office of STAMEQ is located in Hanoi with

branch offices in Danang and Ho Chi Minh. The employees of STAMEQ are about 1,000 in total.

(2) National Metrology Institute

The VMI (Vietnam Metrology Institute) under the STAMEQ is a responsible institution for the national measurement standards. The duties of VMI include establishment of national measurement standards, control and maintenance of standards, preparation of draft regulations for submission to the STAMEQ, facilitating industrial metrology activities and dealing with other subjects on metrology. The needs of VMI are as follows:

- Supply of services to scientific research fields, such as highly precise calibration, supply of calibration standards, research cooperation, and research and development of measuring instruments
- Supply of calibration standards and calibration services to high-tech fields
- Contribution to establishment of primary standards for overseas metrology institutes through international comparisons
- International technical cooperation with developing countries
- Supply of reference standards to testing and calibration laboratories
- Contribution to industrial standardization
- Supply of information concerning measurement standards and industrial standards

In addition, the VMI designs and manufactures measuring standards and instruments (standard tanks, standard weights, bell prover, verification equipment of meters (watt-hour meters, water meters, gas meters, and medical meters (electrocardiogram and brain waves))). The plan to move VMI to Phoa Lack is in progress.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

The BOA (Bureau of Accreditation) under the STAMEQ is a certification body of testing and calibration laboratories. The number of staffs is 18. The accreditation of laboratory is made by evaluation based on ISO17025 which is called as VILAS (Vietnam Laboratory Accreditation Scheme). The fields of laboratory accreditation are: mechanical, electricity, chemistry, construction material, measurement and calibration, pharmacy, NDT (non destructive testing), and biology.

2) Testing and calibration laboratories

There are about 230 accredited testing and calibration laboratories (not accredited by international organizations yet). Most of the laboratories are state-owned (private: 20%). The

calibration laboratories are 13%.

(4) Organization for legal metrology

1) QUATEST (Quality Assurance & Testing Center 1-3)

There are three QUATESTs to administrate regional legal metrology in Hanoi (QUATEST 1), Danan (QUATEST 2) and Ho Chi Ming (QUATEST 3). Among them, the most active one is QUATEST 3 whose outline is described below.

QUATEST 3

- Year of establishment: 1972 (US institution), 1983 (QUATEST 3)
- Location: Bien Hoa Industrial Park
- Land area: 24,000m², Floor area: 10,000m²
- Number of employee: about 350 (53%: engineers graduated from university or master course)
- Activities (sales ratio): metrology (23%), testing (43%), inspection (34%); 250 thousand samples/year in total
- Verification/calibration: dimension, mass, mechanical, volume/flow, electricity, temperature and physics/chemistry
- Customers: There are ten industrial parks. Enterprises in the parks are good customers. Customers from governmental institutions are about 10%.
- Annual sales amount: US\$4.4 million
- Plan for self-supporting system: Start from 2007 (2009 by government decision)

The location of QUATEST 3 is advantageous, because there are many potential customers near the QUATEST 3 and it can provide services to meet the needs of customers. The top management well understands the needs of customers, and makes necessary investment and keeps human resources. The work employed in it becomes a consistent flow from the measurement standards to the industrial metrology and product testing/inspection, which enables yielding profit through synergy operation.

2) DSMQC (Provincial Department for Standards, Metrology and Quality Control)

The DSMQC implements legal metrology in provinces.

1.4.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty

Table 1.4.4-1 shows the present status of national measurement standards at the VMI.

Table 1.4.4-1 Present Status of National Measurement Standards at VMI

Parameters	Units	Standards	Accuracy
1. Mechanical			
Length	m	Iodine Stabilized He-Ne Laser Vinter M100	1×10^{-11}
Angle	rad	24 Sided & 36 Sided Polygon	0.5 "
Mass	kg	Standard weight 1 kg	2×10^{-8}
Volume	m ³	Primary standard of Volume	6×10^{-5}
Flow	m ³ /h	Primary standard of water flow	5×10^{-4}
Density	kg/m ³	Glass Hydrometers (600 ~ 1300) kg/m ³	0.1×10^{-3}
		Density meter DMA 5000 (0 ~ 3000) kg/m ³	5×10^{-3}
Viscosity	m ² /s	Ubbelohde Viscosimeters	10^{-3}
Moisture	%	Vacuum Oven (5 ~ 47) %	0.1%
pH	pH	pHmet (2 ~ 9) pH	0.001
Force	N	Standard of Mass and Local Gravitational Acceleration	3×10^{-4}
Hardness	HR	Standard Harness Machine HNG-250	0.3 HRC
Pressure	Pa	Piston gauge RUSKA 2465 (14 mbar ~ 70 bar)	1×10^{-5}
		Piston gauge RUSKA 2485 (0.05 ~ 100) MPa	5×10^{-5}
		Piston gauge RUSKA 2492 (1 ~ 275) MPa	Up to 3.5×10^{-5}
2. Electrical			
DC Voltage	V	DC standard Fluke 732B	2×10^{-6}
AC Voltage	V	AC standard HP 3458A; Fluke 5720A ($f \leq 100$ kHz; $U = 0.1$ V ~ 1000 V)	5×10^{-5}
DC Resistance	Ω	Standard Resistors ($1 \sim 10^6$) Ω	3×10^{-6}
Power & Energy	W-Wh	1 phase power and energy standard C1-2 [5A; 240V; 3 x (3 ~ 480)V; 3 x (1 mA ~ 120 A)]	5×10^{-5}
		Power meter KOM. 200	1×10^{-4}
Capacitance	F	Standard Capacitors	2×10^{-4}
Inductance	H	Standard Inductors	5×10^{-4}
HF Voltage	V	* Complex Device ($f > 30$ MHz) - Digital Voltmeter D7075 - Power meter NRS BN 2414	5×10^{-3}
		* AC Standard Fluke 5790A ($f < 30$ MHz; $U = (0.1 \sim 3)$ V)	100 ppm
HF Power	W	Digital power meter HP – E4418B (10 MHz ~ 18 GHz; 100 pW ~ 100 mW)	5×10^{-3}
Level	dB	Level Meter	0.1 dB
Attenuation	dB	Standard Attenuators	0.5 dB
3. Time & Frequency			
Time Interval	s	Electronic Counter HP 53132A	1.5×10^{-10}

Parameters	Units	Standards	Accuracy
Frequency	Hz	Cesium Beam Frequency Standard HP 5071A	2×10^{-12}
4. Temperature			
		Fixed points and standard platinum resistance thermometer	
	K	Triple point of Mercury (-38.8344 degree)	0.5 mK
		Triple point of Water (0.01 degree)	0.5 mK
		Melting point of Gallium (29.7646 degree)	0.5 mK
		Freezing point of Tin (231.928 degree)	1 mK
		Freezing point of Zinc (419.527 degree)	2 mK

Based on the Master Plan (Phase 1, 2004-2006), the following ten standards have been developed:

- Mass: 1 kg standard
- Length: He-Ne laser
- Time/Frequency
- Temperature
- Pressure
- Hardness
- Capacitance
- Industrial electric energy
- Volume
- Flow of fluids

(2) Traceability and calibration service

1) Traceability system

a) Overseas

The national standards of Viet Nam are traceable to KRISS, since they are calibrated in KRISS. KRISS calibrates them at 10%-20% of actual cost.

b) Domestic

The following hierarchy of traceability in the country is established:

- VMI
- QUATEST 1-3
- Testing and calibration laboratories
- Private enterprises

2) Calibration service

The VMI calibrates measurement standards of QUATESTs etc. and QUATESTs calibrate working standards of enterprises. QUATEST 3, located in an industrial park in Ho

Chi Ming, satisfies the needs of neighboring enterprises.

1.4.5 Internationalization

Viet Nam is the members of the following international/regional organizations:

- CGPM (Associated member)
- OIML (Corresponding member)
- APMP
- APLMF
- ILAC
- APLAC
- PAC
- ACCSQ

1.4.6 Assistance by Donors

(1) UNIDO/NORAD

UNIDO completed a master plan report on "Market Access and trade Facilitation Support for Mekong Delta Countries, Standards, Metrology, Testing and Quality (SMTQ)" in 2005 using NORAD (Norway) fund.

(2) UNIDO/SECO

The study on "Market Access Support through the Strengthening of Capacities Related to Metrology, Testing and Conformity" supplements the above master plan and is under preparation (2004-2006) by the fund of SECO (Switzerland). The assistance mainly covers equipment supply.

(3) KRIS/KOICA

Viet Nam has made a bi-lateral agreement with Korea (First phase: 1999-2003, Second phase: 2003-2008). Korea accepts 2-3 trainees for three months every year. Key persons of VMI have already received training at KRIS. Korea dispatches experts and calibrates standards as well. The VMI is satisfied with the long-term assistance by Korea. KOICA provided QUATESTs 1 and 3 with high pressure voltage testing equipment with technical assistance.

(4) Thailand

Exchange of experts, comparison of standards and exchange of experience are implemented through bi-lateral agreement.

(5) PTB

Main focus is on seminar and training in Germany.

(6) China

A bi-lateral agreement is made in 2000; however, little cooperation has been conducted. Viet Nam asked for calibration of standards before, but it did not continue now.

1.4.7 Issues in the Field of Measurement Standards

(1) HRD for enabling to amend metrology law (scheduled in 2009) properly

(2) Expansion of standards based on the Master Plan (Phase 2, 2007-2010)

- Gas flow (primary standard equipment)
- Force (standard equipment up to 50 kN)
- Moment of force (standard equipment of 5 kNm)
- Hardness (standard equipment of Rockwell, Brinell and Vickers)
- Pressure (piston pressure gauge and mano-meter)
- Specific mass (standard equipment)
- Viscosity (standard equipment)
- pH (standard equipment)
- Humidity (standard equipment)
- Voltage (Josephson standard equipment)
- Resistance (Hall Register Meter)
- Capacitance (standard equipment)
- High frequency electricity efficiency (KOM200.3, C1-2)
- High frequency electric energy (KOM200.3, C1-2)
- High frequency voltage (Fluke 792A)
- High frequency capacity (HP-432A, HP-8447A)
- Attenuation (HP-1158XX)
- Frequency (standard equipment)
- Minus pressure (standard equipment)
- Radioactivity (standard equipment)
- Absorption quantity (Iodine room, standard sources of X-ray, B-ray and γ -ray)

(3) Development of reference material and acoustic/vibration standards

(4) HRD for enabling to plan the movement of VMI and implement the movement of VMI

1.5 Indonesia

1.5.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Indonesia are 1,923 thousand km² and 220 million in 2005, respectively. Table 1.5.1-1 shows the main economic indicators of Indonesia. The country has developed steadily with the economic growth rates of more than 4% over the past four years. The GDP was US\$281 billion and the GDP per capita was US\$1,283 in 2005.

Table 1.5.1-1 Main Economic Indicators (Indonesia)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)			243,293	245,527	281,276
Real GDP (% increase)	3.8	4.4	4.8	5.1	5.6
GDP per Capita (US\$)			1,099	1,176	1,283
Budget Revenue (% GDP)	17.8	16.1	16.7	15.4	
Budget Expenditure (% GDP)	20.3	17.6	18.4	16.5	
Overall Public Deficit (% GDP)	-2.5	-1.5	-1.7	-1.1	
Export of Goods (US\$ million)	56,318	57,154	61,013	71,550	92,909
Import of Goods (US\$ million)	30,962	31,289	32,649	46,524	64,377
Trade Balance (US\$ million)	25,356	25,865	28,364	25,026	28,532

*: Projection

Source: BPS Statistical Yearbook; JETRO; World Bank

(2) Present situation of industry and its priority sector in future

Table 1.5.1-2 shows the GDP by industry origin at current price. The GDP share of industry was as small as 28% in 2004. The industrial GDP increases year by year; however, the GDP growth of service sector exceeds the industrial one, resulting in decreasing the share of industry.

Indonesia produces oil, gas and coal. Recently, the government focuses on development of non-oil and gas manufacturing industry. Among non-oil and non-gas manufacturing industry, food processing/beverage/tobacco, transportation machinery and general machinery, and fertilizer, chemistry and rubber products share 28%, 22% and 17%, respectively.

Table 1.5.1-2 GDP by Industry Origin at Current Prices

Unit: billion Rupiah

	2001	2002	2003	2004	2005*
Agriculture, Livestock, Forestry & Fishery	263,328 (15.6%)	298,877 (16.0%)	325,654 (15.9%)	354,435 (15.4%)	
Mining & Quarrying	182,008 (10.8%)	161,024 (8.6%)	169,534 (8.3%)	196,892 (8.5%)	
Oil and Gas	115,335	93,092	94,780	120,641	
Non-oil and Gas	66,673	67,932	74,756	76,251	
Manufacturing Industry	506,320 (30.1%)	553,747 (29.7%)	590,051 (28.8%)	652,730 (28.3%)	
Oil & Gas Manufacturing	63,345	69,660	78,641	86,982	
Non-oil & Gas Manufacturing	442,975	484,087	511,410	565,743	
Electricity, Gas & Water Supply	10,855 (0.6%)	15,392 (0.8%)	19,541 (1.0%)	22,855 (1.0%)	
Construction	89,299 (5.3%)	101,574 (5.5%)	112,571 (5.5%)	134,388 (5.8%)	
Services	632,472 (37.6%)	732,662 (39.3%)	828,501 (40.5%)	941,730 (40.9%)	
Total GDP	1,684,281 (100.0%)	1,863,275 (100.0%)	2,045,854 (100.0%)	2,303,032 (100.0%)	

*: Projection

Source: BPS Statistical Yearbook

1.5.2 Metrology Law and Related Regulations

(1) Metrology law and related regulations

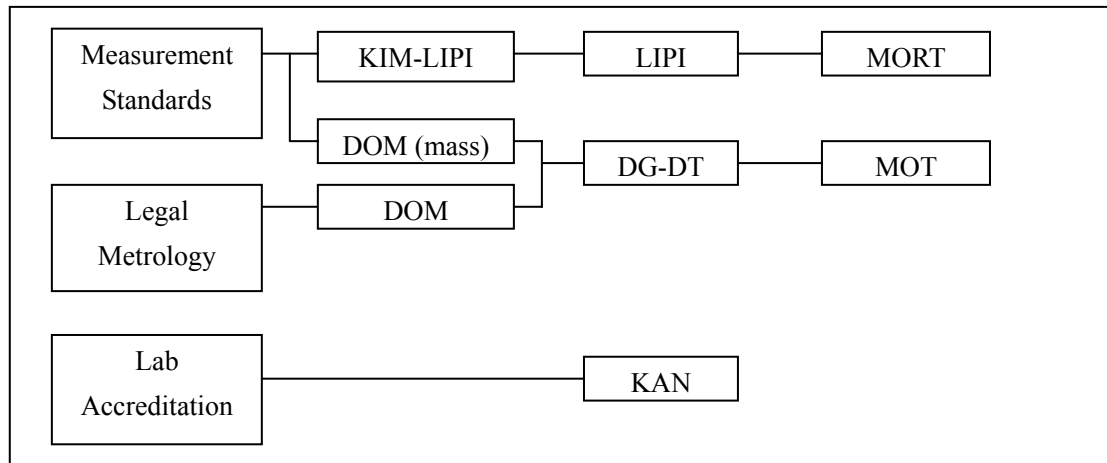
”Law No.2 concerning Legal Metrology, 1981” and related regulations

(2) Policy for metrology standards development

Establishment of NMI Indonesia is under study to facilitate internationalization of metrology.

1.5.3 Organization Related to National Metrology Organizations

(1) Organization related to national metrology organizations



Note:

- DG-DT: Directorate General of Domestic Trade, Ministry of Trade (MOT)
- LIPI: Indonesian Institute of Science, Ministry of Research and Technology (MORT)
- KAN: National Accreditation Body, Indonesia
- DOM: Directorate of Metrology

(2) National metrology institute

1) NMII (NMI of Indonesia)

Establishment of NMI Indonesia (NMII) is under study. The NMII will consist of KIM-LIPI as a leader, DOM, KIMIA-LIPI and BADANG.

2) KIM-LIPI (Research Center for Calibration, Instrumentation and Metrology)

KIM-LIPI maintains physical measurement standards other than mass standard. There is no liaison office of KIM-LIPI in the country. It calibrates working standards and measurement standards and issues 2,000 certificates a year. The demand is (i) mass (including pressure), (ii) length, (iii) temperature and electricity, (vi) acoustics, and (v) luminous intensity in this order.

3) DOM (Directorate of Metrology, DG-DT, MOT)

DOM maintains proto-type of kg (K-46) as a primary standard of mass and proto-type of meter (X – 27) as a primary standard of length.

4) KIMIA-LIPI (LIPI-Research Center for Chemistry)

KIMIA-LIPI under the LIPI administrates reference material.

5) BADANG

BADANG under the LIPI administrates radiation material.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body: KAN (National Accreditation Committee, Indonesia)

a) Outline of KAN

- Law for establishment: KAN was established based on the presidential decree. Therefore KAN reports to the president.
- Purpose of establishment: To promote trade and to protect consumers
- Organization: KAN was separated from the BSN (National Standardization Agency, Indonesia) to become association and includes members from industry and consumers. It is not influenced only by government. However, the most staffs belong to BSN.
- Function: KAN accredits certification, testing and calibration laboratories based on international standards such as ISO17025.

2) Testing and calibration laboratories

There are 84 accredited calibration laboratories. The laboratories can be classified into four types: (i) state-owned laboratories, (ii) private laboratories (50%), (iii) state-owned company (PERTAMINA, PLN, etc.) and (iv) RVOs (4 laboratories).

The fields for accreditation are mass, temperature, force, length, volume and electricity. The testing and calibration laboratories are required to observe regulations (environmental laboratories: about 100 and food laboratories (300-400). Proficiency tests were implemented for mass and volume.

(4) Legal metrology organization

1) DOM (Directorate of Metrology)

DOM, under DG-DT of MOT, is responsible for administration of policy of legal metrology policy, its planning and technical assistance to RVO.

2) RVO (Regional Verification Office)

Fifty-five RVOs under local governments implement verification and surveillance within their territories. Major legally controlled measuring instruments are weighing instruments, fuel dispensers, taxi meters, watt-hour meters and tank trucks. Re-verification rate is about 60% on average.

1.5.4 Functions and Services of National Metrology Institute

(1) Kinds of national measurement standards and uncertainty

DOM maintains proto-type of kg (K-46) as mass standard and proto-type of meter

(X-27). Table 1.5.4-1 shows the measurement standards and instruments that KIM-LIPI maintains.

Table 1.5.4-1 Measurement Standards and Instruments of KIM-LIPI

Measurement Field	Parameter
Acoustics, Ultrasonic & Vibration	Sound pressure level, voltage sensitivity
Mass & Related Quantities	Mass, absolute pressure, gauge pressure, force, fluid density
Electricity & Magnetism	DC voltage, DC resistance, DC current, capacitance, inductance, AC-DC transfer, AC voltage, AC current, AC high-voltage, AC high current
Length	Length, angle
Photometry & Radiometry	Luminous flux, luminous intensity, luminous responsivity, illuminance, luminance, spectral radiance power, optical density, coordinate chromaticity, wavelength, transmittance
Temperature	Temperature, humidity
Time & Frequency	Frequency, time interval

The equipment to be purchased by the IDB fund (see (7) of 1.5.6) is as follows:

- Mass & related quantities standard system
- Radiometry & photometry standard system
- Acoustics & vibration standard system
- Electricity standard system
- Length standard system
- Temperature standard system
- Electrical calibration equipment
- Pressure calibration equipment
- Force calibration equipment
- Mass calibration equipment
- Dimensional calibration equipment
- Temperature calibration equipment
- Optical calibration equipment
- Electromagnetic compatibility testing equipment
- Electro medical safety & performance testing equipment
- Electronic & Electrical testing equipment
- Hardware in-loop Simulation equipment
- Rapid Prototyping equipment
- Machine tools Testing equipment
- Environment testing equipment

(2) Traceability and calibration service

1) Traceability

- In principle, mass standards are traceable to DOM and the other physical standards are traceable to KIM-LIPI.
- Internationally, electricity is traceable to BNM (France), length maintained by KIM-LIPI to NMIA (Australia) and mass maintained by KIM-LIPI to NMIA.

2) Calibration service

KIM-LIPI calibrates measurement standards of calibration laboratory and laboratories within companies.

1.5.5 Internationalization

Indonesia is members of the following international/regional organizations:

- BIPM
- APMP
- OIML
- APLMF
- ILAC
- APLAC
- ACCSQ

1.5.6 Assistance by Donors

(1) JICA

”The Study on Development of Legal Metrology System” is completed and yen credit loan for the movement of DOM is under discussion within Indonesian government.

(2) PTB

There was cooperation agreement for 15 years (1981-1996). KIM-LIPI’s laboratory building and facilities were designed based on PTB’s concept. PTB provided equipment as well.

(3) DIST Australia

Technical assistance to KIM-LIPI (1994-1997)

(4) World Bank-NMLA

Strengthening of KIM-LIPI and structuring network of calibration laboratories (1997-2001)

- (5) NRLM Japan
APEC/ITIT project (1996-1998, 1997-2000)
- (6) KRISS
Calibration of measurement standards (2006)
- (7) IDB
IDB provides financing for modernization of KIM-LIPI's facilities (agreement in 2005). The contents of assistance are equipment procurement, consultation service for procurement and financial auditing. The total loan amount is US\$20 million, in which equipment is US\$18 million. The equipment is mainly measurement related ones (US\$12 million), followed by testing equipment (US\$4 million), calibration equipment (US\$2 million) and instrumentation (US\$1 million). Investment in length standards is the largest. Technical training will start from 2007.

1.5.7 Issues in the field of metrology standards

- (1) NMI Indonesia should be established as soon as possible to cope with internationalization of measurement standards.
- (2) It is necessary to develop traceability system on international standards (length and mass) which is divided into KIM-LIPI and DOM.
- (3) It is necessary to provide technical assistance after the IDB assistance on facility development as well as human resources development.

1.6 Philippines

1.6.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Philippines are 300 thousand km² and 85.2 million in 2005, respectively. Table 1.6.1-1 shows the main economic indicators of Philippines. The country has developed steadily with the economic growth rates of more than 4% over the past four years. The GDP was US\$98.4 billion and the GDP per capita was US\$1,168 in 2005.

Table 1.6.1-1 Main Economic Indicators (Philippines)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)			79,634	86,731	98,371
Real GDP (% increase)	1.8	4.3	4.9	6.2	5.0
GDP per Capita (US\$)			982	1,049	1,168
Budget Revenue (% GDP)	15.5	14.3	14.6	14.5	14.8
Budget Expenditure (% GDP)	19.5	19.6	19.1	18.3	17.5
Overall Public Deficit (% GDP)	-4.0	-5.3	-4.5	-3.8	-2.7
Export of Goods (US\$ million)	32,150	35,208	36,231	39,680	52,441
Import of Goods (US\$ million)	33,057	35,427	37,505	44,039	51,839
Trade Balance (US\$ million)	-907	-219	-1,274	-4,359	602

Source: JETRO, World Bank

(2) Present situation of industry and its priority sector in future

Table 1.6.1-2 shows the GDP structure by industrial origin. Shares of manufacturing sector and agriculture sector are 23% and 14%, respectively. The former share is relatively low and the latter is relatively high. IT sector including software sector is the most important among industrial sectors. Machinery, electricity/electronics industries, and food processing and textile industries which have been established long time ago are also important industries. Philippines produce natural gas that is expected to be an important energy source in the country.

Table 1.6.1-2 GDP Structure by Industrial Origin

Unit: %

	2001	2002	2003	2004	2005
Agriculture	20.9	15.1	14.7	15.2	14.4
Mining	0.8	0.8	1.0	1.1	1.2
Manufacturing	31.6	23.1	23.4	23.1	23.4
Electricity, water and gas	4.4	3.1	3.2	3.2	3.7
Construction	6.8	4.8	4.4	4.4	4.4
Trade	19.7	14.0	14.0	14.1	14.4
Other Services	15.8	39.0	39.3	38.8	38.5
Total GDP	100.0	100.0	100.0	100.0	100.0

Source: World Bank

1.6.2 Metrology Law and Related Regulations

As a metrology law, “An Act Establishing a National Measurement Infrastructure System (NMIS) for Standards and Measurements and for Other Purposes” (Republic Act No. 9236) was enacted in July 2003. Items of each Section are as follows:

Section 1: Title

This Act shall be known as “The National Metrology Act of 2003.”

Section 2: Declaration of Policy

Section 3: Definition of Terms

Section 4: Establishment of the National Measurement Infrastructure System (NMIS)

Section 5: Creation of the National Metrology Board (NMB)

Section 6: Functions, Duties and Responsibilities of the Board

Section 7: Registration

Section 8: System of Units

Section 9: Traceability of Measurement

Section 10: Labeling

Section 11: Laboratories and Procedures

Section 12: Freedom of Access to Industrial/Commercial Establishments and Facilities

Section 13: Accreditation Body

Section 14: Accreditation System

Section 15: Progressive Application

Section 16: Prohibited Acts

Section 17 Penalties

Section 18: Appropriations

Section 19: Implementation Rules and Regulations (IPR)

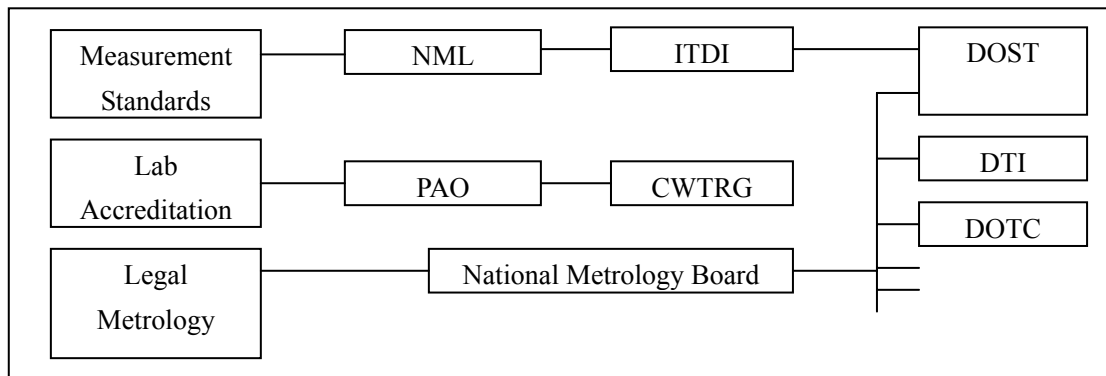
Section 20: Separability Clause

Section 21: Repealing Clause

Section 22: Effectivity

1.6.3 Organization Related to National Metrology Organizations

(1) Administrative government organizations



The DOST (Department of Science and Technology) controls metrology administration. The DOST system consists of five sectoral councils, seven R&D institutes, seven specific and technological service institutes, two collegial bodies, 16 regional offices and over 80 provincial science and technology centers. The ITDI (Industrial Technology Development Institute), which administrates metrology, is one of R&D institutes.

(2) National metrology institute

1) The NML (National Metrology Laboratory) under the ITDI maintains national measurement standards other than standards of radiation and time. The time standard is controlled by the PAGASA (Philippine Atmospheric Geophysical & Astronomical Services Administration) under the DOST. The major functions of NML are as follows:

- Maintaining national measurement standards
- Calibration and measurement service
- Training
- Evaluation of laboratories
- Participation of inter-laboratory comparison
- Guidance service
- Development activities

NML's annual budget for all costs including salaries, which is allocated by the ITDI, is as small as seven million peso (18 million yen). Due to the lack of understanding by

organizations concerned, the budget as well as the personnel tends to be reduced.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

The Philippine Accreditation Office (PAO) was under the BPS (Bureau of Products Standard) which administrates product testing and certification. It is necessary for the BPS to separate an accreditation body for impartiality. In April 2006, an accreditation body was separated to be an independent organization (PAO) by the Executive Order. Furthermore the PAO is planned to raise it to the Bureau (Philippine Accreditation Bureau).

The PAO reports to the Undersecretary of the CWTRG (Consumer Welfare and Trade Regulation Group).

The PAO consists of three divisions for: (i) Planning and administration of certification of ISO9000, 14000, OHSHA, HACCAP, (ii) Plan and administration of accreditation of laboratories based on ISO17025, and (iii) management of PR, APLAC and ILAV. The number of staffs is 11 (accreditation: five plus outside experts). There are not active sections in it.

2) Testing and calibration laboratories

- a) Laboratory accreditation is important in terms of consumer protection. There are 77 accredited laboratories, in which calibration laboratories are 13 and testing laboratories are 64. Additional 30 laboratories are planned to be accredited this year. The application for the accreditation increases year by year.
- b) The main activity of testing laboratory is product inspection (electric appliances, food, beverage, etc.). Laboratories issue certificates for passing products. Laboratories not accredited also inspect goods, causing deterioration of reliability of product inspection. The government instructs them to get accreditation based on ISO17025.
- c) Assessors for laboratory accreditation are researchers of public and private institutes who engage in certification. The number of assessors is not sufficient. The number of trainers to train assessors is not sufficient as well.
- d) The top priority of PAO is accreditation of testing laboratories. Testing laboratories which inspect products according to the regulation should enhance their capability to a level that is internationally recognized (test results of Philippines should be acknowledged internationally). The government understands this as important.
- e) It is necessary to cooperate with other governmental organizations. Concerning the Ministry of Environment, for instance, testing laboratories that measure pollution materials are not accredited. It is important to let the ministry understand that the accreditation is required.
- f) Little proficiency testing (PT) is conducted. There is a plan to establish a special office to deal with PT. However, estimation on participants, costs and others is not achieved.

(4) Legal metrology organization

1) National Metrology Board

The National Metrology Board established based on the National Metrology Act is an organization being mainly responsible for legal metrology consisting of eight ministry and three private entities. The DOST chairs it and the ITDI is a secretariat. Each ministry administrates the corresponding legal metrology. For instance, consumer protection is dealt with by the Ministry of Trade and Industry, verification of legally controlled measuring instruments by the Ministry of Internal Affairs and local governments, and inspection of farm products by the Ministry of Agriculture.

2) Regional offices of DOST

16 regional offices of DOST conduct calibration of legally controlled measuring instruments and inspection (e.g.: inspection of bacteria in mineral water).

3) Local governments

There are one to two inspectors in each municipality to implement verification of legally controlled measuring instruments (mass, weighing instruments and volume). The NML conducts training of inspectors. The verification is implemented only at municipality. The equipment of regional offices as well as inspectors is insufficient. JICA's assistance in equipment supply is expected. The effect might be great with relatively small amount of money.

1.6.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty

Table 1.6.4-1 summarizes the national standards (reference standards) that the NML maintains.

Table 1.6.4-1 National Standards (Reference Standards) that the NML Maintains

Quantity	Standard	Nominal Value or Range
Mass	National 1 kg standard	1 kg
	Set of masses	1 mg to 20 kg
Length	Line Standard, nickel-steel	1 m
	Set of gage blocks	0.5 mm to 100 mm
DC Voltage	Electronic Voltage Standard Cell Bank	1.018 V and 10 V
AC-DC Difference	Thermoelectric Comparator	0.5 to 1100 V
DC Resistance	Standard Resistors	1 ohm and 10 kilo ohms
Frequency	Cesium Beam Primary Frequency Standard	10 MHz output
Pressure	Dead weight piston testers, Dead weight pressure balances, Differential pressure standard	0-500 kPa to 0-55 MPa
Temperature	Fixed point temperature standards (triple point of water to aluminum point)	0.01 to 660 °C
	Pt Resistance thermometer	-38 to 420 °C
	Set of mercury-in-glass thermometers	-41 to 300 °C
	Pt-Rh Thermocouples	0 to 1100 °C
Force	Proving Ring	900 kN
	Set of standard load cells	5 kN to 2000 kN
Viscosity	Pure water; Set of master capillary viscometers	0.12 to 2000 mm ² /s
Density	Pure water; Silicon density standard	1 g/cm ³ ; 2.33 g/cm ³
	Set of standard hydrometers	0.6 to 2 g/cm ³

(2) Traceability and calibration service

1) Traceability

The ITDI asks estimates for periodical calibration of measurement standards to overseas institutes and orders to the institute offering a cheapest estimate. Therefore, there is a possibility that each standard is calibrated by a different institute each time, resulting in getting different uncertainty. The overseas institutes for calibration were KRISS (Korea), NIMT (Thailand) and SPRING (Singapore). NIMJ (Japan) has never made it.

Concerning standard time/frequency, international traceability of UTC is maintained between the NML and NMI Australia.

The domestic traceability is directory from the NML to laboratories and enterprises.

2) Calibration service

The NML and domestic accredited calibration laboratories provide calibration service. However, users tend to ask calibration to overseas institutes (Singapore, Australia, etc.). No consistent traceability is established in Philippines.

1.6.5 Internationalization

Philippines are the following members of international/regional organizations:

- CGPM (Associate member)
- APMP
- OIML (Corresponding member)
- APLMF
- ILAC
- APLAC
- ACCSQ

1.6.6 Assistance by Donors

- (1) PTB/GTZ: It provides trainings according to the request of NML (list of training list). The NIMT also accepts training before training in Germany. PTB assists the NML in providing traveling costs such as air fare for participating seminars and international conferences. The assistance from PTB continues. PTB assists in accreditation such as seminars on new standards and PT training within the framework of ASEAN cooperation.
- (2) KRISS/KOICA: It mainly provides training on design.
- (3) NMI Australia: It mainly involves in training concerning ISO. It can provide training in a specific field. NML Australia assists accreditation within the framework of ASEAN cooperation program including seminars on new standards.
- (4) NZAID: The assistance is mainly general assistance with less specific assistance.
- (5) China: It is possible to receive training, but language is a problem.
- (6) ACCSQ: The ACCSQ mainly covers harmonization of standards including ASEAN standards, especially in the fields of pharmaceutical and cosmetics. There are dialogue partners (New Zealand, Australia, Canada, Germany, China and Japan).
- (7) Proposal for assistance based on bi-lateral protocol (no progress)
 - Taiwan: Legal metrology
 - China: Time/frequency
 - Korea: measurement of exhaust gas
- (8) Group training by JICA
The group training by JICA is too general for experienced staffs, although it is suitable for

new staffs. Training for specific subjects by country is advisable. Similar request is given in Indonesia.

1.6.7 Issues in the Field of Measurement Standards

- The NML does not equip sufficient facilities and equipment as the institute to maintain national measurement standards. The number of staffs as well as their capability is insufficient.
- Legal metrology including the management organizations does not well developed.
- The relationship with industry is not enough.
- Domestic traceability is not well developed.
- It is necessary to enhance the capability of PAO.

1.7 Malaysia

1.7.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Malaysia are 330 thousand km² and 26.1 million in 2005, respectively. Table 1.7.1-1 shows the main economic indicators of Malaysia. The country has developed steadily with the economic growth rates of more than 5% over the past three years. The GDP was US\$131 billion and the GDP per capita was US\$5,042 in 2005.

Table 1.7.1-1 Major Economic Indicators (Malaysia)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)			103,992	118,461	130,770
Real GDP (% increase)			5.5	7.2	5.2
GDP per Capita (US\$)			4,161	4,652	5,042
Budget Revenue (% GDP)	23.8	23.1	23.4	22.1	21.5
Budget Expenditure (% GDP)	29.3	28.7	28.7	26.4	25.3
Overall Public Deficit (% GDP)	-5.5	-5.6	-5.3	-4.3	-3.8
Export of Goods (US\$ million)	88,201	93,387	104,968	126,510	161,484
Import of Goods (US\$ million)	73,358	79,513	82,735	104,304	126,796
Trade Balance (US\$ million)	14,843	13,874	22,233	22,206	34,688

Source: JETRO ; World Bank

(2) Present situation of industry and its priority sector in future

Table 1.7.1-2 shows the GDP structure by industrial origin. The share of manufacturing industry (31%) is the largest and that of agriculture (8%) is relatively low. The sectors that are important for industrial promotion are: electricity/electronics, precision machinery, automobile, food processing, wood processing, etc.

Table 1.7.1-2 GDP Structure by Industrial Origin

Unit: %

	2001	2002	2003	2004	2005
Agriculture	8.8	8.6	8.7	8.5	8.2
Mining	7.2	7.2	7.2	7.0	6.7
Manufacturing	30.0	30.0	30.8	31.6	31.3
Electricity, gas and water	5.4	5.5	5.5	5.5	5.5
Construction	3.4	3.3	3.2	2.9	2.7
Trade	15.1	14.8	14.3	14.3	14.6
Other Services	30.2	30.6	30.4	30.3	31.0
Total GDP	100.0	100.0	100.0	100.0	100.0

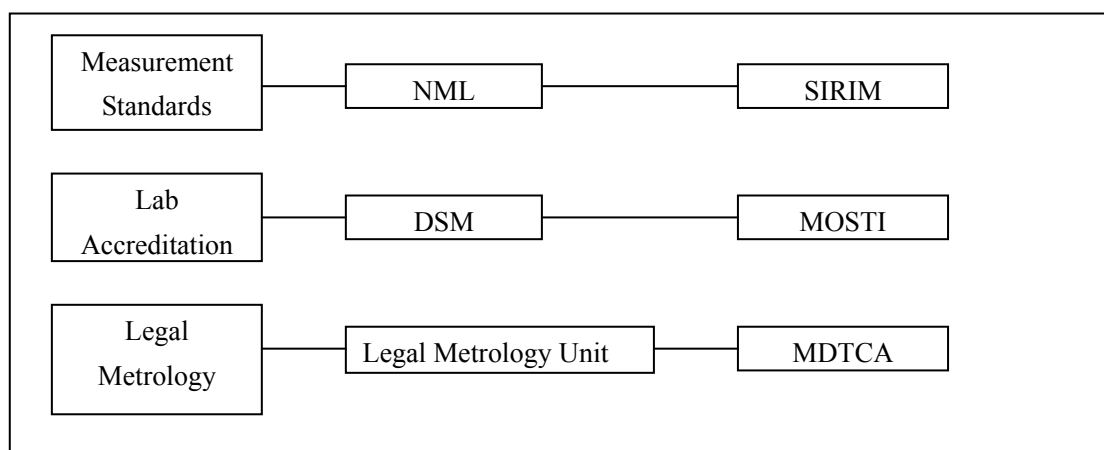
Source: World Bank

1.7.2 Metrology Law and Related Regulations

“Weights And Measures Act 1972” was enacted as legal metrology law. Major related regulations include “Weights And Measures Regulation 1981” and “Pattern or Specification For Weights Or Measures Or Instruments For Weighing Or Measuring Order 1981.” Draft Measurement Law will be reviewed and enacted soon.

1.7.3 Organizations Related to National Metrology Organizations

(1) Administrative governmental organization



Note:

- MOSTI: Ministry of Science, Technology and Innovation
- MDTCA: Ministry of Domestic Trade and Consumer Affairs
- SIRIM: Standards & Research Institute of Malaysia

- NML: National Metrology Laboratory
- DSM: Department of Standards Malaysia

(2) National metrology institute

The NML/SILIM is a national metrology institute. The SIRIM is a corporation and the NML is under the SIRIM. The NML maintains national standards and conduct R&D of standards. The NML has two laboratories in Sepang and Shah Alam. The NML in Sepang has 87 staffs (engineers: 55, technicians: 16, administration: 16). The required number of engineers is about 150 and one engineer covers several laboratories.

The NML in Shah Alam has 120 staffs. It conducts testing in general. The type approval testing is conducted at Shah Alam and the MDTCA approves the test results. As the NML in Shah Alam is busy by dealing with commercial matters, it may not accept training on type approval testing from overseas.

The standard division of NML consists of five sections (Electrical, Mechanical, Thermo-physical, Flow and Chemistry Sections) with 17 laboratories. The NML follows the needs of industry and plans to deal with nano-technology, bio-technology and ICT.

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

The DSM (Departments of Standards Malaysia) is the sole national organization to deal with all standards (documents) and accreditation. The two organizations in the past were united to be the DSM in 1996 and the DSM commemorated 10th anniversary in 2006. The DSM is under the MOSTI.

There is 20 year history concerning accreditation. The technical working group for accreditation has 20 staffs. The symbol mark of accreditation is unified as “Standard Malaysia.”

Concerning laboratory accreditation, there is supplemental requirements other than ISO17025 according to the accreditation fields (testing laboratories: chemical, biology, electricity, temperature, mechanical, etc.; calibration laboratories: heat/temperature, mass, length, etc.).

Assessors are registered based on the requirements (at least two year experience in specific field etc.). At present 133 assessors are registered in all fields. The DSM gives them training. There are two assessor assemblies a year to introduce new knowledge and improve technology.

The Standard Malaysia is acknowledged by MRA of ILAC and APLAC. It is acknowledged by 55 institutes in 44 countries for ILAC and 26 institutes in 17 countries for APLAC.

2) Testing and calibration laboratories

There are about 300 accredited laboratories as of the end of 2006, in which the testing laboratories are 240, the calibration laboratories are 46 and the medical laboratories are three. About 50% of laboratories are private laboratories. About half of the private laboratories make laboratory activities as a main business. Therefore, customers can choose a laboratory that meets their requirements.

The certification of accreditation is valid for three years and activities are investigated every year. The auditing is made in the third year and the certification can be renewed, if there is no problem.

(4) Legal metrology organization

There are three divisions under the MDTCA. The Enforcement Division is one division of the MDTCA and has the Legal Metrology Unit in it. This Unit deals with development of legal metrology (policy making) and administration.

The Legal Metrology Unit receives technical assistance and advice on policy of legal metrology from the SIRIM.

The MCM (Metrology Corporation Sdn Bhd) conducts the verification and re-verification of legally controlled measuring instruments. The MCM is a private company with 160 staffs. It has 34 branch offices (3-4 offices in one state on average) in the country. The Legal Metrology Unit and the MCM do not deal with watt-hour meters (the DNB, a private company similar to the MCM, deals with them), taxi meters (the Ministry of Transportation deals with them) and water meters (state corporation deals with them).

1.7.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty (accuracy)

- Mass (kg): Stainless weight one-kg set ($\pm 0.10\text{mg}$)
- Length (m): Iodine-stabilized Helium-Neon 633 nm and 543 nm laser (0.024MHz (633 nm laser) 、 ± 0.3 MHz (543 nm laser))
- Time (second): Ensemble of five cesium time and frequency standards ($\pm 10^{*-12}$)
- Voltage (V): Josephson Junction 1 volt and 10 volt array and Zener voltage reference standard ($\pm 0.1\text{ppm}$)
- DC resistance (Ω): Quantum Hall Effect Resistance Standard System ($\pm 0.1\text{ppm}$)
- Volume
- Pressure
- Flow
- Acoustics/vibration
- Temperature (cd): Standard luminous intensity candela ($\pm 0.9\%$)

(2) Traceability and calibration service

1) Traceability

National standards are traceable to the following institutes:

- NMIJ
- NIST (USA)
- BNM-LNE (France)

2) Calibration service

The NML calibrates the secondary standards that the MCM maintains.

1.7.5 Internationalization

Malaysia is members of the following international/regional organizations:

- BIPM
- APMP
- OIML
- APLMF
- ILAC
- IAF
- PAC
- APLAC
- ACCSQ

The NML/SIRIM has as close relationship with the APMP and APMP-DEC and participates in WG3 of ACCSQ. The NML/SIRIM has an international network with Thailand, Indonesia and Viet Nam. It has less contact with Singapore that is well developed and Philippines, Myanmar and Cambodia that are less developed. It has relationship with KRISS and NMI Australia as well.

1.7.6 Assistance by Donors

There are no assistance except Japan. Japan provided assistance twice in the past, both of which were successful. Since the scale of chemical metrology is small, the assistance in this field is desired.

1.7.7 Assistance for Other ASEAN Countries

The Malaysia Training Cooperation Program (MTCP), a training program supported by a governmental fund, mainly aims at friendship, since the fund is small. No training has been conducted on metrology, because counterpart countries did not request it.

The training of accreditation is for training of domestic organizations. If Malaysia receives trainees from ASEAN countries, it is possible through the ACCSQ. The WG2 deals with accreditation. There is no bi-lateral cooperation. PTB holds seminars on accreditation, but the number of seminars is not so often.

Recently, Malaysia invited Myanmar, Laos and Cambodia for training of accreditation. Since accreditation has not been established in these countries, it is necessary to make them understand the basic concept of accreditation such as ISO17025 and assessment with observation of accredited laboratories.

1.7.8 Issues in the Field of Measurement Standards

- Development of chemical metrology for analysis of food components and measurement of pollutants in environment
- Production of reference material

1.8 Thailand

1.8.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Thailand are 513 thousand km² and 64.8 million in 2005, respectively. Table 1.8.1-1 shows the main economic indicators of Thailand. The country has developed steadily with the economic growth rates of more than 4% over the past four years. The GDP was US\$176 billion and the GDP per capita was US\$2,659 in 2005.

Table 1.8.1-1 Major Economic Indicators (Thailand)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)			142,640	161,349	176,222
Real GDP (% increase)	2.1	5.4	7.0	6.2	4.5
GDP per Capita (US\$)			2,233	2,484	2,659
Budget Revenue (% GDP)	15.1	16.1	17.1	17.0	
Budget Expenditure (% GDP)	17.7	17.5	16.8	17.0	
Overall Public Deficit (% GDP)	-2.6	-1.4	0.3	0.0	
Export of Goods (% GDP)	65,113	68,853	80,320	96,245	110,107
Import of Goods (% GDP)	62,057	64,721	75,824	94,410	118,191
Trade Balance (% GDP)	3,056	4,132	4,496	1,835	-8,084

Source: JETRO, World Bank

(2) Present situation of industry and its priority sector in future

The shares of manufacturing and agriculture are 35% and 10%, respectively. The development of automobile industry (Detroit of Asia), electricity/electronics, food industry (Kitchen of the World), apparel industry (Bangkok Fashion City), IT industry, tourism industry, etc. is being promoted as an important industry.

Table 1.8.1-2 GDP Structure by Industrial Origin

Unit: %

	2001	2002	2003	2004	2005
Agriculture	9.1	9.4	10.3	10.1	9.9
Mining	2.5	2.5	2.7	2.7	3.1
Manufacturing	33.4	33.7	34.5	34.5	34.7
Electricity, gas and water	3.2	3.2	3.2	3.2	3.1
Construction	3.0	3.0	3.1	3.1	3.1
Trade	16.7	15.9	15.1	15.1	14.8
Other Services	32.0	32.2	30.9	31.3	31.2
Total GDP	100.0	100.0	100.0	100.0	100.0

Source: World Bank

1.8.2 Metrology Law and Related Regulations

(1) Metrology law

As the metrology law, “National Metrology System Development Act, B.E. 2540 (1997)” was enacted. According to the law, the “Board of the National Metrology” composed of related ministries and chaired by the minister of MOST shall be established to control the metrology administration as well as to establish the NIMT with description of responsibilities of NIMT.

(2) Legal metrology law

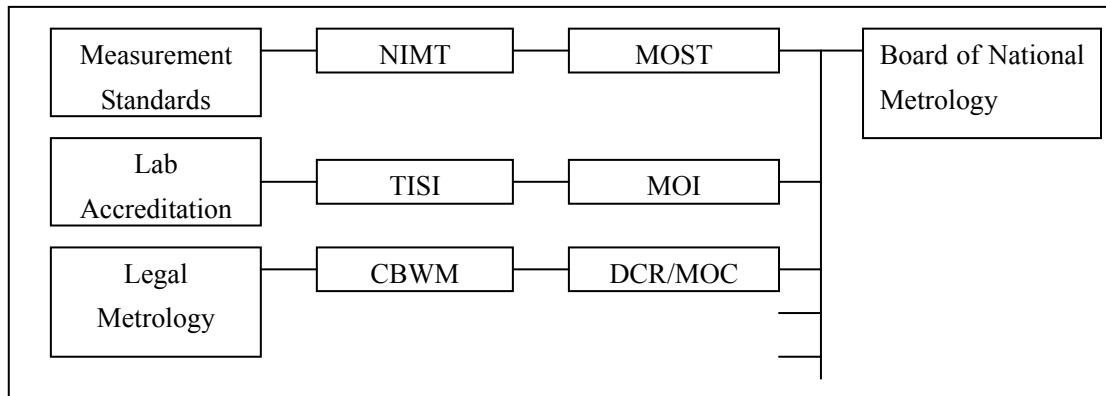
As the legal metrology law, “Weights and Measures Act B.E. 2542 (1999)” was enacted. The law is consists of the following:

Preliminary

Chapter 1	General Provisions
Chapter 2	Standards of Weights and Measures
Chapter 3	Weighing and Measuring Instruments
Chapter 4	Verification
Chapter 5	Powers and Duties of the Weights and Measures Inspector
Chapter 6	Packaged Commodities
Chapter 7	Weighing and Measuring Instruments for Exports
Chapter 8	Offences and Penalties

1.8.3 Organizations Related to National Metrology Organizations

(1) Administrative governmental organization



(2) National metrology institute

The NIMT (National Institute of Metrology (Thailand)), a national metrology institute, is under the MOST (Ministry of Science and Technology). The NIMT was inaugurated in August 2006; however, some standards is under installation. The technology transfer of 42 standards are planned in Japanese technical assistance, and that of 39 standards has been already finished. The technical transfer will be completed in October 2007.

The NIMT has 142 staffs including 82 measurement engineers. The organization with ten departments is as follows:

- Policy and Strategy Department
- Administration Department
- Acoustics and Vibration Metrology Department
- Mechanical Metrology Department
- Electrical Metrology Department
- Thermometry Metrology Department
- Dimensional Metrology Department
- Photometry Metrology Department
- Chemical Metrology & Biotechnology Department
- Industrial Relation Section

(3) Accreditation body and testing and calibration laboratories

1) Accreditation body

The TISI (Thai Industrial Standards Institute), under the MOI (Ministry of Industry), is an governmental body to deal with national standards. Five divisions, Standards Bureaus 1-4, and the ONAC (Office of the National Accreditation Council), directly deals with national

standards. The Standards Bureau 4 and the ONAC deal with accreditation of testing and calibration laboratories. There are 500 staffs in the TISI, in which 55 staffs are in the Standards Bureau 4 and 25 staffs in the ONAC. The TISI only administrates the accreditation domestically.

The Standards Bureau 4 implements the TLAS (Thai Laboratory Accreditation Scheme). The TLAS is a voluntary scheme and accredits testing and calibration laboratories based on standards of ISO/IEC. There is a policy to conduct proficiency testing (PT), but it is not conducted yet. Assessors are nominated among public laboratory researchers due to the cost limitation. In-house training is made for training of assessors.

2) Testing and calibration laboratories

There are 80 calibration laboratories and 119 testing laboratories that are accredited as of January 2007. The TPA (Technology Promotion Association (Thailand-Japan)) is most active among calibration laboratories, giving service to 2,600 customers with calibration of 26 thousand instruments annually. The target for calibration period by the TPA is one week. The TPA tries to get customers by holding explanatory meetings at industrial parks. The NIMT should follow this marketing attitude.

(Note) PA: The TPA was established in 1973 with the aim of technology transfer from Japan and contribution to development of Thai society. The Japanese counter-part is the JTECS (Japan-Thailand Economic Cooperation Society). The major activities other than calibration and environmental analysis include training business, company diagnosis/consulting business, publishing business, language school business, etc. The Thailand-Japan Institute of Technology with Engineering Dept., ICT Dept., Administration and Management Dept. (including Master course)) will be inaugurated in June 2007.

(4) Legal metrology organization

The CBWM (Central Bureau of Weights and Measures) under the DIT (Department of Internal Trade) of the MOC (Ministry of Commerce) administrates the legal metrology. The CBWM has about 150 staffs including branch offices. The number of staffs in Bangkok (head office) is 60.

There are four branch offices in Chengmai (North), Kohn Kehn (Northeast), Chonburi (East) and Surat Thani (South, construction scheduled in next year). There are 23 DIT branch offices that conduct verification of legally controlled measuring instruments in 76 provinces. The income of verification fee is two million Baht (seven million yen)/month. The CBWM does not deal with watt-hour meter and taxi meter that are dealt with by related ministries.

Type approval system will be made and the certification and capability of manufacturers will be clearly defined. At present, the CBWM trusts capabilities of manufacturers concerning type approval and confirms the performance of products by sampling tests. It is not a real type approval.

(Note) Type approval provides certificate to a measuring instrument of passing the type approval testing

which consists of physical testing and performance testing.

There were assistance by PTB in legal metrology and it terminates now. The amount of assistance was 420 DM (about 300 million yen). The assistance by Germany is done at smaller money with big effects. The amount of money by Japanese assistance is large.

1.8.4 Functions and Services of National Metrology Institute

(1) Kinds of national standards and uncertainty

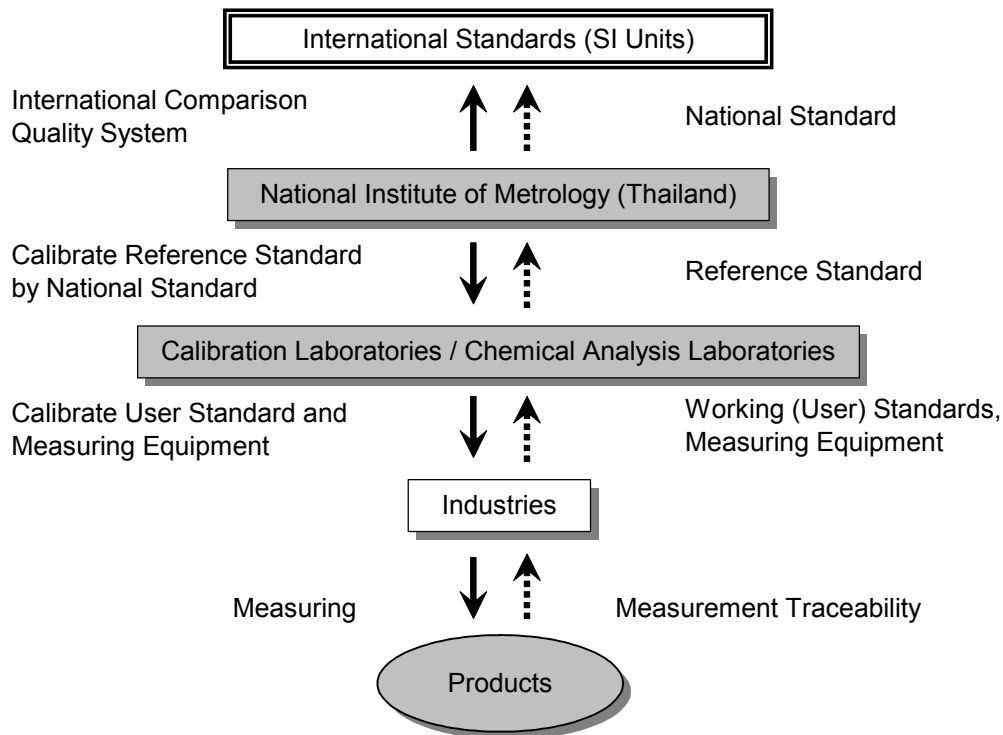
The national measurement standards that the NIMT administrates are as follows:

- Dimension
- Temperature
- Electrical & Frequency
- Acoustic & Vibration
- Chemical
- Mass
- Pressure
- Hardness
- Flow
- Torque
- Force

(2) Traceability and calibration service

1) Traceability

Figure 1.8.4-1 illustrates the national metrology traceability system.



Source: NIMT

**National Metrology System
(Measurement Traceability Chain)**

Figure 1.8.4-1 National Metrology Traceability System

2) Calibration service

The major customers of NIMT are independent calibration laboratories and laboratories within a company. NEC (Thailand) is a typical customer related to Japanese companies. Customers of governmental laboratories and company laboratories are less than 10% each of all customers. It takes more than two months for calibration service, which should be improved. For instance, it takes 2-3 weeks for calibration service by SPRING, Singapore.

1.8.5 Internationalization

Thailand is the following members of international/regional organizations:

- BIPM
- APMP
- OIML

- APLMF
- ILAC
- APLAC
- ACCSQ

1.8.6 Assistance by Donors

The major assistance to Thailand comes from JICA and PTB. JICA assists in setting of the primary standards calibration technology of secondary standards and preparation of calibration manual, and PTB assists in calibration and examination for accreditation of the secondary.

(1) JICA: Assistance to the NIMT

- Providing Yen Credit Loan for the NIMT construction project
- Providing technology transfer to the NIMT (training in Japan and dispatching experts): see Table 1.8.6-1

Table 1.8.6-1 JICA-NIMT Project: The Project on Technical Strengthening of National Institute of Metrology (Thailand)

	Project Duration	
	Phase I (Oct. 2002-Oct. 2004)	Phase II (Oct. 2004-June 2007)
Counterpart Training in Japan	20 persons	16 persons
Dispatch of Experts	22 persons	17 persons

Remarks:

Counterpart raining in Japan: 3 months

Dispatch of Expert: 1 month

Disseminate through Seminar and Workshop

- 19 seminars
- 5 ASEAN Seminars and Workshop on measurement standards in Bangkok
- 2 Joint trainings on measurement standards in Thailand
- 2 AOTS Training in Thailand

(2) PTB

PTB's assistance based on the bi-lateral cooperation agreement includes the assistance in construction of verification center. It also includes accepting trainees in the DAM (German Academy for Metrology). PTB's assistance will be completed in 2008. Table 1.8.6-2 shows the PTB-NIMT project: the promotion of the Thai calibration service project.

Table 1.8.6-2 PTB-NIMT Project: The Promotion of the Thai Calibration Service Project

	Project Duration	
	Phase I (July 1999-June 2003)	Phase II (July 2003-June 2008)
Counterpart Training in Germany	22 persons	8 persons
Dispatch of Experts	25 persons	21 persons

Remarks: Disseminate through Seminar and Workshop

- 1 seminar and 1 workshop for technology transfer
- workshops for project planning

PTB provide the following assistance for technical cooperation agreement between Thailand and Philippines:

- 1) Dispatch German expert to Philippines
- 2) Investigate needs and specify the kinds of standards to be taken
- 3) Decide priority among specified standards
- 4) Direct assistance by the NIMT (Standard to be taken: mass; Thai expert sent to Philippines for instruction and Philippine staffs come to the NIMT for training; calibrate mass standards at the NIMT)
- 5) After completion of training, German laboratory staff visits Philippines to check the development of capability.

1.8.7 Assistance for Other ASEAN Countries

Cooperation with and assistance to neighboring countries are conducted by the following two methods:

- (1) Bi-lateral technical collaboration agreement is made. Metrology is included in it (e.g. Viet Nam: The Project for the Collaboration of Scientific and Technical Basis of National Measurement Standards, November 2005-December 2006)). At first, the basic training is conducted to acknowledge the importance of metrology. Then the training of measurement engineers is conducted together with JICA (ASEAN seminars). Japanese expert provides lessons in the morning and the work shop is made in the afternoon by practice using NIMT's facilities.
- (2) Concerning export of marine products, Thailand provides direct assistance to Myanmar and Cambodia. It helps testing laboratories to keep safety of marine products. By establishing testing laboratories in Thailand, they can be introduced in European and Japanese lists of qualified testing laboratories.

1.8.8 Issues in the Field of Measurement Standards

(1) Improving marketing capability of NIMT

It is important to acquire “customer’s satisfaction” for the NIMT to be acknowledged as an advanced national measurement institute internationally, by grasping needs of metrology in the country and providing sufficient service in response to the needs. It sometimes happens for laboratories just inaugurated that it can not provide sufficient services. The NIMT does not limit the customers to calibration laboratories, but responds to the needs from the whole industry. It is a question that Thai calibration laboratories can deal with all needs of customers. The NIMT takes in the needs that calibration laboratories can not cope with including testing on request and R&D, but the activities are not sufficient. In order to make it, the NIMT should endeavor to promote marketing actively to potential customers by establishing suitable organization, promoting HRD and securing budget.

(Note) The institutes that follow the market needs are Singapore and Viet Nam (QUATEST 3), followed by Malaysia.

The NIMT can learn from these activities. The TPA in Thailand is also active to acquire customers and the NIMT can learn from it as well.

1.9 Singapore

1.9.1 Present Situation of Industry and Its Priority Sectors in Future

(1) Basic information

The land area and the population in Singapore are 697 km² and 4.35 million in 2005, respectively. Table 1.9.1-1 shows the main economic indicators of Singapore. Although the economic growth rate in 2003 was low, the country has developed steadily in 2004 and 2005. The GDP was US\$117 billion and the GDP per capita was US\$26,840 in 2005.

Table 1.9.1-1 Major Economic Indicators (Singapore)

	2001	2002	2003	2004	2005*
Nominal GDP (US\$ million)			92,369	106,822	116,775
Real GDP (% increase)	-2.0	3.2	1.4	8.4	6.4
GDP per Capita (US\$)			22,156	25,353	26,836
Budget Revenue (% GDP)	27.8	23.5	21.6	21.3	
Budget Expenditure (% GDP)	22.1	18.8	18.6	17.1	
Overall Public Deficit (% GDP)	5.7	4.7	3.0	4.2	
Export of Goods (US\$ million)	121,826	125,219	144,296	179,674	207,338
Import of Goods (US\$ million)	116,020	116,483	127,996	162,967	189,745
Trade Balance (US\$ million)	5,806	8,736	16,300	16,707	17,593

Source: JETRO, World Bank

(2) Present situation of industry and its priority sector in future

Table 1.9.1-2 shows the GDP structure by industrial origin. The manufacturing sector shares 27%, whereas the share of agriculture/mining sectors is negligible small. Electronics industry is well developed among manufacturing industry. There are oil refineries and petrochemical plants in operation from old days. In future, bio and medical fields seem

promising. There is a plan to double the production amount in manufacturing sector by 2018.

Table 1.9.1-2 GDP Structure by Industrial Origin

Unit: %

	2001	2002	2003	2004	2005
Agriculture/Mining	0.1	0.1	0.1	0.1	0.1
Manufacturing	22.9	24.1	23.9	26.3	26.8
Electricity, gas and water	2.1	1.8	1.7	1.6	1.5
Construction	5.6	4.7	4.3	3.8	3.6
Trade	12.8	13.8	14.1	14.4	14.8
Other Services	56.5	55.4	55.8	53.8	53.2
Total GDP	100.0	100.0	100.0	100.0	100.0

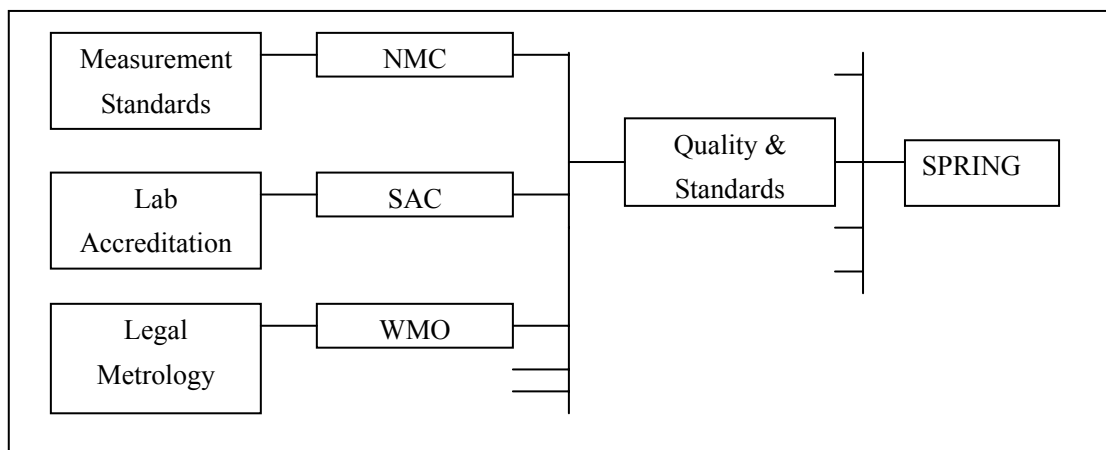
Source: World Bank

1.9.2 Metrology Law and Related Regulations

- (1) Law of Metrology: Republic Act No. 9236 (The National Metrology Act of 2003): AN ACT ESTABLISHING A NATIONAL MEASUREMENT INFRASTRUCTURE SYSTEM (NMIS) FOR STANDARDS AND MEASUREMENTS AND FOR OTHER PURPOSES
- (2) Legal Metrology Law and Regulations: Weights and Measures Act, Chapter 349, Revised 2005; Weights and Measures Regulation, Revised 2005
- (3) Measurement standards and laboratory accreditation: SPRING ACT (Chapter 303A)

1.9.3 Organizations Related to National Metrology Organizations

- (1) Administrative governmental organization



The Quality & Standards Group under the SPRING (Standards, Productivity and Innovation Board) administrates the measurement standards, laboratory accreditation and legal metrology.

(2) National metrology institute

The National Metrology Center (NMC) has 68 staffs (60%: measurement engineers) and the floor area of laboratory is 1,200m². The annual budget of NMC is US\$4.5 million. It calibrates and measures as follows:

- Measurement of length
- Measurement of electro-magnet
- Measurement of electro-magnetic wave
- Mechanical measurement
- Measurement of optical radiation
- Measurement of time/frequency
- Measurement of temperature

The mission of NMC and major functions are as follows:

Mission:

To meet the needs and enhance the competitiveness of enterprises by providing a competent and internationally recognized national measurement system

Major functions:

- Establish and upgrade the national physical measurement standards
- Maintain and disseminate the measurement standards to ensure traceability of measurements to the International System of Units (SI)
- Provide calibration and measurement services, training and consultancy for industry
- Conduct development activities in measurement technology

(3) Accreditation body and calibration laboratories

1) Accreditation body

The SAC (Singapore Accreditation Council) under the SPRING is the national authority for accreditation of conformity assessment body. The SAC accredits not only testing and calibration laboratories based on ISO17025 but also certification based on ISO900, ISO14001, OSHMS, HACCP. The four schemes are covered: accreditation scheme for product certification bodies, inspection bodies, laboratories and management systems certification.

The primary objective of SAC is to develop, maintain and improve the standards of conformity assessment activities in Singapore. The SAC-SINGLAS (Singapore Laboratory Accreditation Scheme) is a national scheme for technical evaluation of testing and calibration laboratories based on specific technical requirements of ISO/IEC17025 in each field.

Furthermore, it aims at promoting trade and commerce by participating in MRA between bi-lateral and/or multi-lateral relationships. The SAC have already made agreement on MRA with regional and international organizations for more than 90 accreditation systems.

The SAC has relationships with the ILAC, PAC, IAF, APLAC and EA. It participated in MRA with the ILAC (testing and calibration), APLAC (testing, calibration and inspection), EA (testing and calibration), and IAF (QMS certification).

2) Testing and calibration laboratories

There are 223 accredited laboratories, in which 56 are in the field of metrology. The laboratories are classified into chemistry, mechanical, electricity, medical, civil engineering, testing and calibration, NDT and environment.

(4) Legal metrology laboratory

The WMO (Weights and Measures Office) under the SPRING administrates legal metrology. The WMO has an office and small laboratory in the building of SPRING. It administrate measuring instruments of liquor, flow meters, oil dispensing pumps, scales for length measurement and NAWI (non-automatic weighing instruments). The other ministerial organizations control the watt-hour meters and taxi meters. The functions of WMO are as follows:

1) Pre-market activities

- Designating private sector companies as Authorized Verifiers
- Registering approved weighing and measuring instruments for trade use
- Verification of instruments (100% by Authorized Verifiers (private) in FY 2009)

2) Post-market activities

- Inspecting regulated instruments for inaccuracies & tampering
- Conduct audit reviews on Authorized Verifiers
- Investigate complaints on short weights & measures

Future directions of WMO are as follows:

- Monitor Authorized Verifiers
- Develop new capabilities: Verification of CNG and hydrogen dispensers
- Continue to train inspectors/Authorized Verifiers on relevant OIML Recommendations (NAWI, fuel dispensers, pre-packaged goods, etc.)

1.9.4 Functions and Services of National Metrology Institute

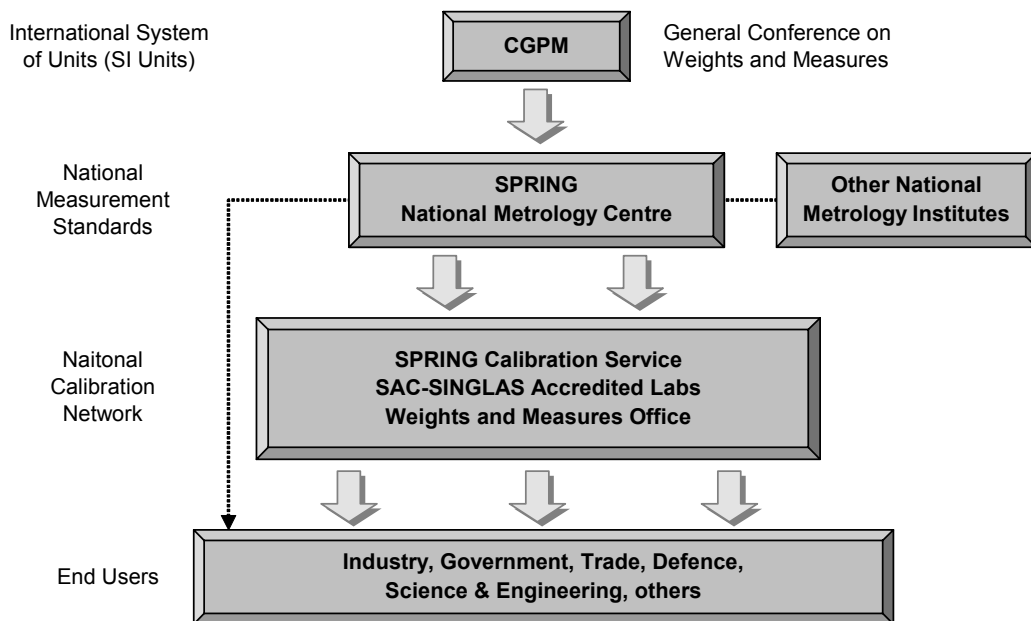
(1) Kinds of national standards and uncertainty

- Mass: prototype of kg (K-83)
- Length
- Volume
- Pressure
- Flow
- Acoustics/vibration
- Temperature

(2) Traceability and calibration service

1) Traceability

Figure 1.9.4-1 illustrates the traceability system of measurement standards.



Source: SPRING

Measurement System in Singapore

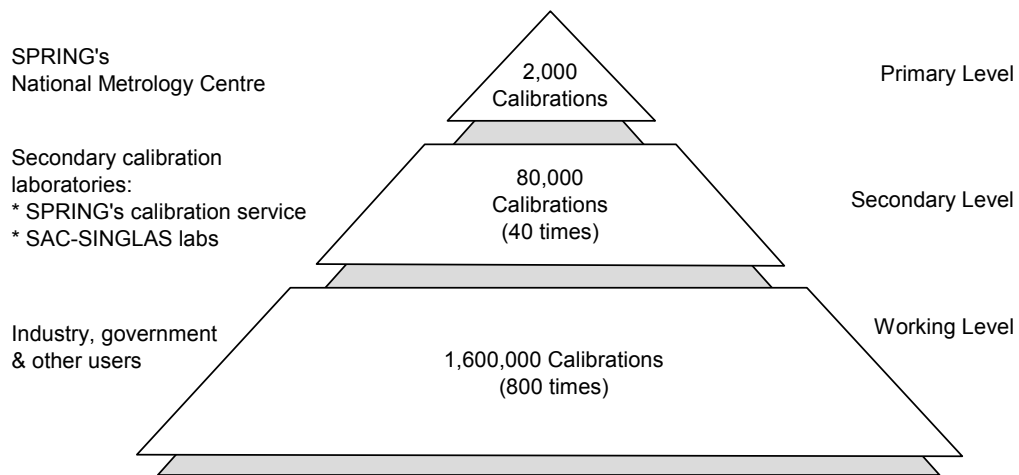
Figure 1.9.4-1 Traceability System of Measurement Standards.

2) Calibration service

The SPRING conducts about 6,000 calibration services for primary and secondary

standards annually. The number of customers is about 700, in which SMEs are 70%. The delivery time is 2-3 weeks. It provides special short delivery service and collection/delivery service.

Figure 1.9.4-2 shows the impact of national metrology program.



Source: SPRING

Impact of National Metrology Programme

Figure 1.9.4-2 Impact of National Metrology Program

1.9.5 Internationalization

Singapore is the following members of international/regional organizations:

- BIPM
- APMP
- OIML
- APLMF
- ILAC
- APLAC
- ACCSQ

1.9.6 Assistance by Donors

There is no assistance by donors.

1.9.7 Assistance for Other ASEAN Countries

Singapore provided the following assistance:

- Consultancy service to Philippines and Middle East countries
- Training on metrology to Indonesia, Thailand, etc.
- Consultancy service for measurement infrastructure in Abu Dhabi
- APEC Work Shop on quality management system and uncertainty

1.9.8 Issues in the Field of Measurement Standards

In Singapore, the measurement standards are developed by the following steps as shown in Table 1.9.8-1.

Table 1.9.8-1 Development and Road Map of measurement Standards (Phase 5)

Phase	Description
Started in 1975	Funding from UNDP
Phase 1 (1985)	Replaced aged equipment
Phase 2 (1986 to 1988)	Expanded facilities
Phase 3 (1992 to 1995)	Established some primary standards
Phase 4 (1996 to 2000)	Developed new primary standards
Phase 5 (2004 to 2008)	Develop capabilities to support key growth industries

Source: SPRING

The industrial sectors supported by the measurement standards program are: semi-conductors, precision processing, aerospace, chemical/petrochemical, defense, construction and medicine. In Phase 5, the program aims at acquiring capacities for new emerging industry (life science, bio technology, medicine, optics and ICT).

Considering the past achievement in Singapore, it is considered that the abovementioned target will be fulfilled. Therefore, there is no specific issue.

**Chapter 2 Situation on Linkage within the ASEAN
Region Concerning Development of
Measurement Standard System in the
Region**

Chapter 2 Situation on Linkage within the ASEAN Region Concerning Development of Measurement Standard System in the Region

2.1 Impact on Development of Measurement Standard System in the ASEAN Region Caused by the Change of International Situation through Globalization of Economy such as Economic Linkage

2.1.1 Changes of Roles of National Metrology Institutes after 1980s

In order to understand the roles of measurement standards as wider meaning in the fields of ordinary lives of people, commercial trade, international trade, industry, science, etc., it might be a good way to overview the history from the conclusion of the Meter Convention to the completion of international framework for the present measurement standards. The reason is that it is the process that the BIPM and member countries of the Meter Convention clarifies the positioning of needs and requests within the framework of measurement standards and select them through international discussions, not merely extending the fields of measurement standards by thoughtlessly accepting the needs and requests from time to time.

The fundamental concept of the Meter Convention does not change at present after 130 years when it was concluded. The role of national measurement institute of member countries has been clearly defined since the conclusion of the Meter Convention.

The activities to unify the measurement units internationally since the end of French Revolution in 1789 determined the framework by the conclusion of the Meter Convention in 1875. The role of the BIPM, which is a leader in activities in the Meter Convention at present, had been discussed whether it is a research institute or it is a mere organization to keep standards of member countries for comparison (1872-1875). It was decided by voting by representatives (diplomats) of member countries that the BIPM be a research institute. This fact seems giving great influence on activities on the Meter Convention and the characteristics of national metrology institutes of member countries.

From the end of the 19th century to the beginning of the 20th century, national metrology institutes are established in major countries in the world: the PTB in Germany in 1887, the NPL in U.K. in 1900, the NSB in U.S.A. in 1903 and the Central Weights and Measures Verification Offices in Japan. The NPL and the NSB proposed that the range covering the Meter Convention be extended to all physical quantities, that were agreed by most members at the 6th CGPM in 1921 and the unit of electricity were included in the Meter Convention.

After that, there were discussions on inclusion of practical measurements and legal

metrology into the range of the Meter Convention. In 1937, an agreement to establish a legal metrology organization was drafted, and it was decided at the 9th CGPM in 1948 that it should be dealt with in another organization. In 1955, the OIML was established by an agreement and the legal metrology activities started.

The definition of the unit of “meter” changes as follows:

- Definition by a prototype of meter at the 1st CGPM in 1889
- Definition by a spectrum wavelength of krypton 86 atom in 1960
- Definition by light velocity in vacuum in 1983 supported by laser technology development

This trend from the “definition by artificial instrument” of “prototype of meter” to the “universal definition” by atom or physical constant clearly follows the spirit of the Meter Convention. In 1990, the definition of temperature scale is amended. These activities are conducted by the CC (Consultative Committee) organized by activity in the BIPM as a leader. The definition of covering basic units becomes wider by adding mol (material unit) and candela (luminous intensity).

In 1990s, in order for measurement in chemistry, biology and pharmacy to be traceable to the SI Unit (extension of covering range), the decision for establishment of the CCQM (Consultative Committee for Quantity of Material) was decided (the CIPM in 1993).

In the latter half of 1990s, in addition to the activities on the definition and indication toward more universal and more precise units of physical quantity, there arose the necessity to structure a scheme to secure the international equality of units of physical quantity (i.e.: national standards) indicated by the national metrology institute of each country. It is because securing reliability of developed technology between nations for reduction of TBT in trade and maintenance of aircrafts, securing compatibility among precise industrial products, and so on become necessary.

For this reason, the CIPM proposed concrete scheme to fulfill the above needs in 1998 (so called Blevin report: National and international needs relating to metrology: International collaborations and the role of the BIPM). The scheme of traceability of measurement for developing countries is proposed in the report.

Based on it, the mutual recognition arrangement (CIPM-MRA) for the national standards of member countries of the Meter Convention and the calibration certificates were proposed, and it is concluded by a signatory of directors of national metrology institutes in October 1998.

After that the signatory countries increases, and each country participates in international comparison defined in MRA, improves quality system, acquires ISO17025 certificates, and registers to Appendix-C (Data base on calibration capability) of CIPM-MRA.

The above is the history of international activities based on the Meter Convention, whose philosophy is consistent from the establishment: to return the outcome from the measurement standards based on natural science to social activities. Therefore, it excludes areas that do not meet this principle, such as legal metrology and industrial measurement even if it is important.

The change of roles of national metrology institutes after 1980s can be taken by the abovementioned history. The important points among the roles of international metrology institutes are as follows:

- To facilitate research on more precise and more universal definition and indication of measurement units
- To maintain national standards by international linkage
- To supply national standards based on international standards

2.1.2 Measures to Cope with International MRA in Each Country

The activities and needs of national metrology institutes are listed as follows. The order of number of activities is generally from the fundamental activities for development and definition of national standards, etc. to response to social needs etc. The order of number of needs is generally from the academic needs required for standards with high accuracy to the practical needs such as quality inspection etc.

Activities

- 1) Re-definition of basic units, R&D on indication of present basic units and improvement
- 2) Development of precise measurement technology aiming at above
- 3) Maintenance of national standards of basic unit quantity
- 4) Definition of disseminated standards of each basic unit
- 5) Development and maintenance of standards of introduced unit quantity
- 6) Participation in international comparison and supplemental comparison
- 7) Participation in regional comparison and supplemental comparison
- 8) Supply of standards to domestic testing and calibration laboratories
- 9) Service to testing on request
- 10) Development of laboratory accreditation system to secure reliability of testing and calibration laboratories by accreditation body
- 11) Participation in activities of international organization, international cooperation

- 12) PR activities of measuring standards and supply of information
- 13) Development of legislation system to include abovementioned whole subjects and enable organizational activities smoothly

Needs

- 1) Request for high accurate calibration from academic research fields, supply of standards to them, cooperation of research, R&D of measuring instruments
- 2) Supply of standards to high-tech fields and calibration on request
- 3) Contribution to establishment of primary standards with foreign national metrology institute through international comparison
- 4) Horizontal and vertical international cooperation of technology
- 5) Supply of standards to testing laboratories
- 6) Contribution to industrial standardization
- 7) Supply of standards to the fields of mining and industrial production technology, domestic public work (testing for public health, material testing for public work), calibration and inspection on request
- 8) Quality inspection of exported and imported goods
- 9) Supply of information on measurement standards and industrial standards

The signatories to the CIPM-MRA in the ASEAN are the following six countries:

- Indonesia (KIM-LIPI) in 1960
- Malaysia (NML-SIRIM) in 2001
- Philippines (NMLPHL) in 2002 (associate member)
- Singapore (SPRING) in 1994
- Thailand (NIMT): 1912
- Viet Nam (VMI-STAMEQ): 2003 (associate member)

2.2 Situation of Development of Measurement Standard System in the Whole ASEAN Region and Linkage between the ASEAN Nations

2.2.1 Functions and Activities of APMP (Asia Pacific Metrology Programme)

The APMP was established in 1977 as a regional organization under the Meter Convention by Australia as a leader of establishment. The initial objectives for the foundation are to exchange information among regional metrology institutes, assistance to developing countries and improvement of calibration technology.

The members of APMP are the following 32 institutes from 21 economic zones. Six countries (underlined>) are participated in it.

Australia, Bangladesh, China, Chinese Taipei, Fiji, Hong Kong, India, Indonesia, Japan, Korea, North Korea, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Viet Nam

The associated members are five institutes of five economic zones as follows: Canada, Egypt, Jordan, Russia, South Africa and Syria.

There are the following Technical Committees (TCs) in operation: TCAUV (acoustics/vibration), TCEM (electromagnet), TCFE (fluid flow), TCL (length), TCM (mass), TCPR (optical measurement), TCQM (quantity of mass), TCQS (quality system), TCRI (radiation), TCT (temperature/heat property), TCTF (time/frequency)

There are regional organizations similar to the APMP: EUROMET, COOMET, MENAMET, SADC MET and SIM (NORAMET, SURAMET, CARIMET, CAMET, ANDIMET and SURAMET). It is an important activity to exchange and cooperation with these regional organizations.

In November 1999, the chaired country of APMP was transferred from Australia to Japan. In October 1999, just before the transfer, the CIPM-MRA was concluded. As a result, the roles of APMP as well as the roles of Japan as a chaired country changed greatly, because the roles of RMO (Regional Metrology Office) are clearly defined in the Blevin report and CIPM-MRA.

In the CIPM-MRA, in order to participate all national metrology institutes including those of developing countries in the CIPM-MRA, a core regional organization among existing regional organizations are positioned as a liaison organization with the BIPM and the results of activities of regional organizations are reported through the core organization. By this, the major activities include technical assistance, training, and certification and registration of calibration capabilities of national metrology institutes of member countries based on the CIPM-MRA.

The main activities of the TC (Technical Committee) are the work for verification of measurement capability of each institute by evaluation of measurement results of reference standard (block gauges, weights, etc.), which is taken around among participating metrology institutes (RMO key comparison). These data are reported to the joint committee (JCRB) with the BIPM and regional organizations, and supplied to other regional organizations in the world for verification. Through these verifications, these results are finally registered to the Appendix C of CIPM-MRA as the Calibration and Measurement Capability. This can secure the reliability of calibration certificate issued by national metrology institute of each country and enables the mutual recognition.

By the abovementioned mutual recognition scheme, it can be understood that the

participation of each national metrology institute in the regional organization and, domestically, the development of traceability with national standards as a summit, the measurement of physical quantities, and the improvement of calibration capability are very important.

2.2.2 ACCSQ: ASEAN Consultative Committee on Standards and Quality

ACCSQ was established in 1992 with the objective to eliminate the technical barriers related to standards and conformance. ACCSQ has been focusing on harmonization of standards, technical regulation and mutual recognition arrangements on conformity assessment. The structure of ACCSQ is illustrated in Figure 2.2.2-1.

(1) WG1: Working Group on Standards and Mutual Recognition Arrangements

The scope of activities of WG1 is as follows:

- Monitoring the implementation of the sectoral MRAs in ASEAN
- Establishment of an ASEAN Guide to MRAs
- Harmonization of national standards to international standards
- Assistance in promoting GRP concept to regulators
- Confidence building among regulators in the use of harmonized standards
- Promotion of transparency of technical regulations
- Exploring new areas for development of MRAs and standards harmonization in ASEAN
- Development of a mechanism for cooperation between standards bodies and regulatory agencies
- Recommending to the ACCSQ, proposals, activities or issues for ASEAN cooperation in relevant international and regional organizations such as ISO, IEC, APEC and ASEM

(2) WG2: Working Group on Accreditation and Conformity Assessment

The scope of activities of WG2 is as follows:

- Enhancing the capability of accreditation bodies in ASEAN member countries to achieve regional/international recognition
- Enhancing the competence of conformity assessment bodies in ASEAN member countries to facilitate the implementation of mutual recognition of test reports and certifications
- Assisting new member countries in accreditation and conformity assessment
- Monitoring the certification bodies within ASEAN

(3) WG3: Working Group on Measurement Traceability

The scope of Activities of WG3 is as follows:

- To align legal metrology in ASEAN to support the objectives of the ASEAN Free Trade Area (AFTA) and to ensure that the modernization of legislation in legal metrology by ASEAN Member Countries will not result in the introduction of new technical barriers to trade
- To establish ASEAN cooperation in the area of legal metrology and to improve the national legal metrology systems, through cooperation in technology, human resources and management experience
- To hold discussions and promote ASEAN interest in legal metrology with other national, regional and international organizations

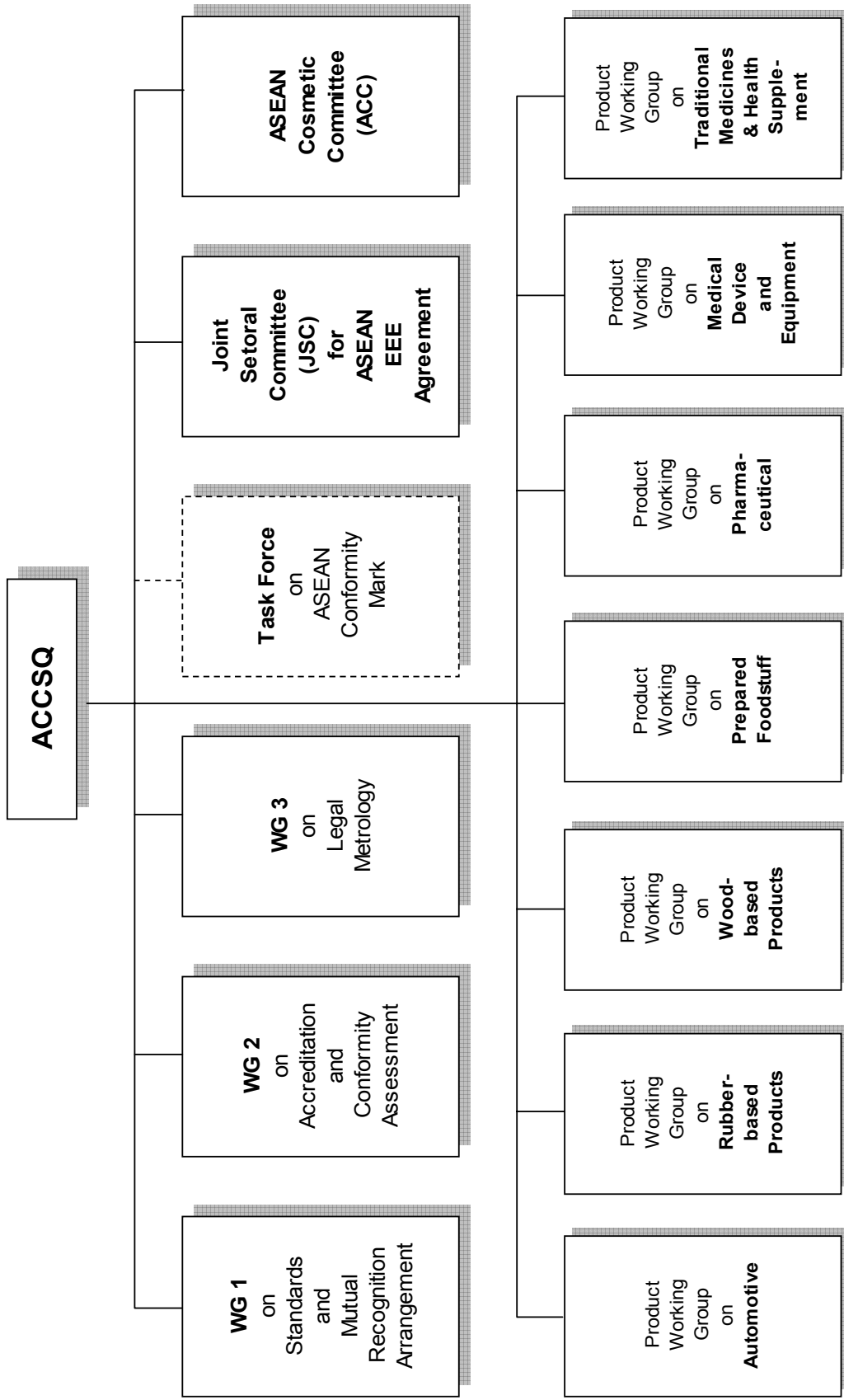


Figure 2.2.2-1 Structure of ACCSQ

2.2.3 IAI (Initiative for ASEAN Integration)

At the Fourth ASEAN Informal Summit held on 22-25 November 2000 in Singapore, the ASEAN Leaders agreed to launch an Initiative for ASEAN Integration (IAI), which gives direction to and sharpens the focus of collective efforts in ASAEAN to narrow the development gap within ASEAN as well as between ASEAN and other parts of the world.

Based on the above concept, the IAI Work Plan for Narrowing the Development Gap within ASEAN to Assist New Member Countries and expedite greater regional economic integration, promote equitable economic development and help alleviate poverty in Cambodia, Laos, Myanmar and Viet Nam (CLMV) is prepared. The Work Plan has been implemented on a six-year basis (July 2002-June 2008).

The IAI Work Plan for CLMV focuses on the following four priority areas:

- Infrastructure development (transport and energy)
- Human resources development (Public sector capacity building, labor & employment, and high education)
- Information and communications technology
- Promoting regional economic integration (trade in goods and services, customs, standards and investment)

There are 100 projects in the IAI Work Plan (as of 2005). The funds are mostly provided from donors. If no donors are interested in the project, ASEAN members try to provide own funds. There are nine projects concerning standards, including UNIDO projects and AADCP project (see Chapter 4). ACCSQ monitors the progress of these projects.

2.2.4 Linkage between Two Countries

There is lots of technical assistance conducted between developed and developing countries in the Asia Pacific region. However, bi-lateral cooperation between the ASEAN countries is not so many. The following is the situation of bi-lateral cooperation in the ASEAN region (see other related chapters for detail):

- Singapore: There is no bi-lateral agreement. It receives trainees as required.
- Malaysia: There is no special bi-lateral agreement. It provides assistance to hold seminars as required.
- Viet Nam and Lao: Viet Nam cooperates with Lao in legal metrology development.
- Thailand and Viet Nam: Exchange of experts, mutual comparison of standards and exchange of experience are conducted.
- Thailand and Philippines: There is a technical cooperation agreement (PTB assists a

part of activities.).

- Thailand, Myanmar and Cambodia: Thailand assists other two countries in analyzing marine products for export.

Chapter 3 JICA's Support on Metrology Standards at ASEAN Region

Chapter 3 JICA's Support on Metrology Standards at ASEAN Region

3.1 History of JICA's Support on Metrology

JICA's projects related to metrology in ASEAN regions are listed below. Starting from "The Study on the Development Programmes of Industrial Standardization, Testing and Metrology in Thailand" in 1987, JICA has conducted total of nine projects in four countries including Thailand, Malaysia, Indonesia and Viet Nam. Of those nine projects, five projects were conducted in the form of the development study, one project was conducted by the grant aid, and three projects were in the form of the technical cooperation project. The outlines of nine projects are summarized in Table 3.1-1.

- (1) The Study for Upgrading the Measurement Centre, SIRIM (Development Study): June 1993 ~ January 1994.
- (2) The Project for Upgrading the Measurement Center, SIRIM 2 (Technical Cooperation Project): March 1996~February 2000.
- (3) The Study on the Development of Legal Metrology System in the Republic of Indonesia (Development Study): August 1993 ~ November 1994.
- (4) The Study on Development of Legal Metrology System in the Republic of Indonesia (Development Study): January 2006 ~ December 2006
- (5) The Study on the Development Programmes of Industrial Standardization, Testing and Metrology in Thailand (Development Study): February 1987 ~ November 1987
- (6) The Project for the Development of Industrial Standardization and Industrial Metrology Testing Center in the Kingdom of Thailand (Grant Aid): Phase 1: November 1988, Phase 2: July 1989
- (7) The Project for Thailand Industrial Standardization, Testing, and Training Center (Technical Cooperation Project): December 1989 ~ November 1994
- (8) The Project on Technical Strengthening of National Institute of Metrology (Thailand) (Technical Cooperation Project): Phase 1 October 2002 ~ October 2004, Phase 2 October 2004 ~ October 2007.
- (9) The Study on Development of Industrial Standardization, Metrology, Testing and Quality Management in The Socialist Republic of Viet Nam (Development Study): March 1997 ~ January 1998

Table 3.1-1 JICA Projects on Metrology and Industrial Standards

Project Title	The Study for Upgrading the Measurement Centre, SIRIM	The Project for Upgrading the Measurement Center, SIRIM 2	The Study on the Development of Legal Metrology System in the Republic of Indonesia	The Study on Development of Legal Metrology System in the Republic of Indonesia	The Study on the Development Programmes of Industrial Standardization, Testing and Metrology in Thailand	The Project for the Development of Industrial Standardization and Industrial Metrology Testing Center in the Kingdom of Thailand	The Project for Thailand Industrial Standardization, Testing, and Training Center	The Project on Technical Strengthening of National Institute of Metrology (Thailand)	The Study on Development of Industrial Standardization, Metrology, Testing and Quality Management in The Socialist Republic of Viet Nam
Country	Malaysia	Malaysia	Indonesia	Indonesia	Thailand	Thailand	Thailand	Thailand	Viet Nam
Scheme	Development Study	Technical Cooperation Project	Development Study	Development Study	Development Study	Grant Aid (Phases 1 and 2)	Technical Cooperation Project	Technical Cooperation Project	Development Study
Counter Part Agent (C/P)	SIRIM Berhad	SIRIM Berhad	DOM (Directorate of Metrology, Department of Domestic Trade, Ministry of Commerce)	DOM (Directorate of Metrology, Department of Domestic Trade, Ministry of Commerce)	TISI (Department of Industrial Standardization, Ministry of Industry) TISTR (Thailand Institute of Scientific and Technological Research, Ministry of Science and Technology)	Phase 1: TISI, Phase 2: TISTR	TISI	NIMT (National Institute of Metrology (Thailand))	STAMEQ (Ministry of Science, Technology and Environment, Directorate for Standards and Quality)
Purpose of the Study/Project	Master Plan for strengthening SIRIM's metrology division	Technology Transfer for strengthening SIRIM's metrology division	Master Plan (M/P) for strengthening and enhancing of DOM, Metrology Training Center and Central Verification Center	Master Plan (M/P) and Action Plan (A/P) for strengthening of Legal Metrology System which involves DOM, Regional Verification Office (RVO), Metrology Training Center (MTC), etc.	Planning and designing of "Industrial Standardization, Testing and Training Center" (under TISI), and "Industrial Standardization and Testing Center" (under TISTR)	Phase 1: Building construction and equipment provision for "Industrial Standardization, Testing and Training Center" (under TISI) Phase 2: Building construction and equipment provision for "Industrial Standardization and Testing Center" (under TISTR)	Technical transfer for strengthening of "Industrial Standardization, Testing and Training Center" (under TISI)	Technical advice for the designing and planning of NIMT construction, technical advice for selection of metrology related equipment, technical transfer for metrology standards and accreditation, and execution of third country training	Master Plan (M/P) and Action Plan (A/P) for strengthening of Viet Nam metrology and standards related organizations including STAMEQ, VMI, QUATEST and SMQ
Period	June 1993 ~ January 1994	March 1996 ~ February 2000	August 1993 ~ November 1994	January 2006 ~ December 2006	February 1987 ~ November 1987	Phase 1: November 1988 Phase 2: July 1989	December 1989 ~ November 1994	Phase 1: October 2002 ~ October 2004, Phase 2: October 2004 ~ October 2007	March 1997 ~ January 1998
Input	Total Budget: 83,000,000 JPY Total Man- Months: 21.50MM Number of Experts: 5 persons	Equipment Grant Aid Total: 350,000,000 JPY Number of Experts: Long term: 7 persons, Short term: 24 persons C/P Training: 14 persons	Total Budget: 130,000,000 JPY Total Man- Months: 35.10MM Number of Experts: 11 persons	Total Budget: 150,000,000 JPY Total Man- Months: 36.02MM Number of Experts: 7 persons	Total Budget: 95,000,000 JPY Total Man- Months: 54.50MM Number of Experts: 14 persons	(Grant Aid) Phase 1: 2,650,000,000 JPY Phase 2: 1,590,000,000 JPY	Equipment Grant Aid Total: 110,000,000 JPY Number of Experts: Long term: 12 persons, Short term: 32 persons C/P Training: 23 persons	Equipment: (Facilitated by yen-credit by JBIC) Number of Experts: Long term: 5 persons, Short term: 29 persons C/P Training: 46 persons	Total Budget: 180,000,000 JPY Total Man- Months: (unknown) Number of Experts: 13 persons
Recommendation / Project Activities	(Recommendations on the Report) 1) Metrology System and Law of Metrology 2) Malaysia's Current Metrology Systems and problems 3) SIRIM Metrology Center's current conditions and problems 4) Prospective of Malaysia's industry 5) Recommendation for the enhancement of SIRIM Metrology Center	(Project Activities) Technology transfer of standards setting, maintaining, and calibration technology on Length, pressure, electricity, frequency and related fields	(Recommendations on the Report) 1) Recommendation for enhancement and change of metrology related laws, regulations and acts 2) Consideration of the function and organizational structure of DOM and regional verification office and their equipments 3) Newly creation of training center, and improvement of facilities and equipment for training of metrology technicians 4) Creation of industrial sub-sector associations involving metrology 5) Creation of private sector's metrology related associations 6) Creation of metrology promotion association	(Recommendations on the Report) 1) Establishment of legal metrology system 2) System of legal metrology 3) Strengthening of DOM's function 4) Development of LMS center 5) Improvement of RVO 6) Improvement of metrology technology 7) Plan for HRD 8) Investment plan	(Recommendations on the Report) 1) Current condition and problems of industrial standards, verification and metrology system 2) Enhancement programs for Industrial standards, verifications and metrology system 3) Details of each project 4) Effects on Thai industry and export promotion by improving industrial standards, verification and metrology system	(Project Activities) Phase 1: Building construction and equipments provision for "Industrial Standardization, Testing and Training Center" Phase 2: Building construction and equipment provision for "Industrial Standardization and Testing Center"	(Project Activities) Technology transfers in two fields: standardization and quality control and testing	(Project Activities) Technology transfers of standards setting, maintaining, and calibration in the field of Sound, weights, electric/ electronic, time/frequency, length, temperature, photometry and chemical analysis (see Table 3.1-2)	(Recommendations on the Report) 1) Setting of project target 2) Industrial standardization and quality control on selected survey sectors 3) Evaluation of current industrial standardization, metrology, verification, and quality, and improvement and recommendation for the strengthening of those
Others	This project was continued to the next project "The Project for Upgrading the Measurement Center, SIRIM 2".		The yen-credit by Japanese OECD (current JBIC) was considered and process was executed; however, due to the economic crisis it was canceled.	Currently, Indonesia government is considering and processing JBIC Japanese yen credit for the DOM project.	The next project "The Project for the Development of Industrial Standardization and Industrial Metrology Testing Center in the Kingdom of Thailand (Grant-Aid)" was conducted.	The next project "The Project for Thailand Industrial Standardization, Testing, and Training Center" was conducted. Phase 2's C/P organization TISTR's metrology department later became the NIMT for the organization restructuring.		In 2000, for the new NIMT building and equipment, JBIC's 24 th and 25 th yen-credit loan project "National Metrology Standard Development Project" was conducted.	

Table 3.1-2 Human Resources Development Assistance for the NIMT

Year	Subjects	Organization	Training in Japan
2002	Improvement of reliability (Document and technology)	NITE、NMIJ	
	Radiation temperature	NMIJ	Yes
	Plug / ring	JQA	Yes
	Roundness	Nagano pref.	Yes
	Wave length	NMIJ	Yes
	Acoustics	JQA	Yes
	Hardness	NMIJ	Yes
2003	Environmental development of calibration room	NMIJ	Yes
	AC Power	JEMIC	Yes
	Improvement of reliability (Document and technology)	NITE, NMIJ (2persons)	
	DC high voltage	JEMIC	Yes
	Calibration manual	NMIJ	
	Profile coordinating machine	NMIJ	Yes
	High frequency power / voltage	JQA	Yes
	Humidity standard	NMIJ	Yes
2004	Roughness standard	NMIJ	Yes
	Environmental development of calibration room	NMIJ	Yes
	Calibration manual	NITE	
	Improvement of reliability (Document and technology)	NITE, NMIJ	
	Standard angle	NMIJ	Yes
	Attenuation of high frequency	JQA	Yes
2005	Periodical inspection	NITE	
	Standard flatness	NMIJ	
	Calibration manual	NMIJ	
	Vibration / Acceleration	NMIJ	Yes
	Time / frequency	NMIJ	Yes
	Improvement of reliability (Document and technology)	NITE, NMIJ	
	H-ion activity	NMIJ	Yes
	Force	NMIJ	Yes
	Large weight	NMIJ	Yes
	Humidity	JQA	Yes
2005	Inorganic chemistry	NMIJ	Yes
	Standard liquid	NMIJ	Yes
	Calibration manual	NMIJ	
	Accreditation document examination	NITE (2 persons)	
	Accreditation (Technology)	NMIJ (2 persons), JEMIC	Yes
	Standard magnetism	JEMIC	Yes
	Fixed point of temperature	NMIJ	Yes
	Laser power	JQA	Yes
	Chemical standards	NMIJ	Yes
	Standard gas	NMIJ	Yes
	Standard electromagnetism		Yes

3.2 Current JICA Projects in ASEAN Countries

3.2.1 National Institute of Metrology (Thailand) Project

The NIMT (National Institute of Metrology (Thailand)) was established in 1997 by the Act of “National Metrology System Development Act (B.E. 2540)” as a national metrology institute under the Ministry of Science and Technology (MOST).

From October 2002, JICA’s technical cooperation project, “The Project on Technical Strengthening of National Institute of Metrology (Thailand)” was conducted for the purpose of strengthening the NIMT for a period of five years. In this project, the following five activities were conducted: 1) advices for designing and constructing the building, 2) setting of primary standards, 3) technology transfer of calibration technology, 4) assistance in preparation of calibration manual, and 5) laboratory accreditation. The outcomes of the technology transfer are disseminated through execution of training and seminars.

The Japan Bank of International Cooperation (JBIC) provided Japanese yen-credit loan of approximately 3 billion yen (about US\$26 million) to Thai government to construct new NIMT building and to procure advanced measurement equipment with supervision of Japanese experts by JICA’s technical cooperation project.

German PTB is also providing technical support to the NIMT and other Thai metrology related organizations (For the outline of PTB technical support to Thailand, please refer to 4.1.2).

Outline of JICA’s technical cooperation project is as follows:

(1) Advices on designing and construction of building

For the construction of NIMT building, JICA experts provided technical advices on laboratory environment standards, laboratory administration methods and construction technology, etc. NIMT’s building was completed on June 31, 2005, and the inauguration ceremony was held on August 14, 2006 with participation of the Royal Family of Thailand.

(2) Technology transfers

As of December 2006, the technology transfer of 39 quantities of measurement standards were implemented. The following are the main transferred fields. Total of 42 quantities are planed to be transferred until the end of the project in October 2007.

- AUV: Vibration/Acceleration and Acoustics
- Mass: Large-Mass, Density, Mass, Force and Hardness (Rockwell/Vickers) (Pressure: Planning for technological transfer later)
- EM: RF Volt, AC Volt, Group R, RF ATT, Laser Power, DCH, Watt Hour, AC Power, RF Power, Magnetic (Flux/Intensity) (QHR: Planning for technological transfer later)
- TF: Time/Frequency
- Length: Roughness, Flatness, CMM, Angle, Roundness, Plug/Ring and Wavelength

(Line-Scale: Planning for technological transfer later)

- T: Radiation, Fixed Point and Humidity
- PR: Spectra-Irradiance (Photometry: Planning for technological transfer later)
- QM: Chemical-Analysis, Standard-Gas, Organic, Inorganic, pH

(3) Laboratories accreditation

Laboratory accreditation under JICA support (short-term experts dispatched from IAJapan) was completed in 14 quantities as of December 2006, and total of 19 quantities is planned to be accredited by the end of October 2007. The accreditation is conducted jointly with TISI staffs. The main field of laboratory accreditation is on the following fields:

- AUV: Acoustics
- Mass: Hardness (Rockwell)
- EM: DCH
- TF: Time/Frequency
- Length: Roughness, Flatness, Angle, Roundness, Plug/Ring, Wavelength
- QM: pH

(4) Holding of training and seminars

Using NIMT's equipment, facilities, local C/P staffs and Japanese dispatched experts, training and seminars are held (see Appendix E). There were total of five seminars for ASEAN countries and nineteen seminars for Thai domestic organizations concerned. Also there were two training courses conducted by JICA and two training courses conducted by AOTS to metrology staffs in ASEAN countries. The number of foreign participants to training courses and seminars, which were conducted at the NIMT, is listed in Table 3.2-1. Those seminars and training courses has been lectured by dispatched Japanese experts. After the lecture in class room by Japanese experts, the practical training is mainly conducted by NIMT's staffs.

Table 3.2-1 Metrology Related Training and Seminars for ASEAN countries at the NIMT

Country	2003		2004	2005			2006			Total Participants
	ASEAN Seminar	ASEAN Seminar	ASEAN Seminar	ASEAN Seminar	JICA Training	AOTS Training	JICA Training	ASEAN Seminar	AOTS Training	
Bangladesh							1			1
Brunei*				1				1		2
Cambodia*	1	1	2	2	2	4	2	2	3	19
Fiji			3				2			5
India					2		2			4
Indonesia*	3	3		3	1	4	2	2	3	21
Laos*	1	2	2	2	2	2	2	2	3	18
Malaysia*	2	3	2	3	2	4	2	1	3	22
Mongolia					1	3	2		2	8
Myanmar*	1		2	2	2	3		2	3	15
Nepal					1		1			2
Pakistan					2		1			3
Philippines*	1		3	2	1	2	1	2	3	15
Singapore*	2	2	2	2	1			1		10
Sri Lanka					1					1
Thailand*					5		3		6	14
Viet Nam*	2	2	4	3	2	4	2	2	3	24
Total	13	13	20	20	25	26	23	15	29	184

Source: Dr. Yoshiaki AKIMOTO “NIMT Project-Results, Subjects, Prospect” on P.6

*: ASEAN Countries

3.3 Comparison of JICA Cooperation in ASEAN Countries

The JICA cooperation in each country and the situation afterwards are summarized as follows:

3.3.1 JICA’s Metrology Projects in Thailand

(1) Thailand Metrology Project in 1980s (development study and grant aid)

Thailand is a country to receive the largest Japan’s cooperation in metrology in term of number of projects as well as total budget. The first project was “The Study on the Development Programmes of Industrial Standardization, Testing and Metrology in Thailand” (development study) in 1987. With the recommendation in the study, the next project, in the form of grant aid project, “The Project for the Development of Industrial Standardization and Industrial Metrology Testing Center in the Kingdom of Thailand (Phase 1 and Phase 2)” was conducted. The projects of Phase 1 and Phase 2 were implemented to the different counterpart organizations.

(2) Phase 1 of grant aid and technical cooperation project (project for the Ministry of Industry)

Phase 1 of grant aid project was to support the Thai Industrial Standards Institute (TISI) of the Industrial Standard Bureau in the Ministry of Industry, by constructing building and providing facilities and equipment for the “Industrial Standardization, Testing and Training Center”. Using the new Center, JICA later conducted technical cooperation project called “The Project for Thailand Industrial Standardization, Testing and Training Center”. With this JICA’s support, the center set up six laboratories in the fields of electric/electronics, mechanical, industrial material, chemical, construction material, foods/agricultural products, and also the training department for promotion of private sector’s laboratory in testing activities.

After the economic crisis of 1997, Thai government conducted organizational reforms. As a part of this reform, in 1999, the Ministry of Industry presented “Industrial Restructuring Plan” and some of Ministry of Industry’s departments became partly privatized organizations called “Institutions”. With this reform, the center’s laboratories were restructured, and some laboratories were merged, and became independent organizations such as the Electric and Electronics Institute (EEi), Thai Automotive Institute (TAI), Thailand Textile Institute (TTI) and National Food Institute (NFI), etc.

(3) Phase 2 of grant aid and JICA expert dispatch (Project for the Ministry of Science and Technology)

Phase 2 of the grant aid project was to support Thailand Institute of Scientific and Technology Research (TISTR) of the Ministry of Science and Technology, by constructing “Industrial Standard and Testing Center” and providing measurement standards and equipment. JICA later sent Japanese experts to the center for technology cooperation.

A part of the TISTR later became the NIMT. In 1997, by the “National Metrology System Development Act, B.E. 2540”, the TISTR’s metrology standard division and the DSS (Department of Science Service) metrology division were merged to become the NIMT on June 1, 1998.

(4) Technical cooperation project to the NIMT

JICA has provided technical support to the NIMT from October 2002 to October 2007, as a form of technical cooperation project called “The Project on Technical Strengthening of National Institute of Metrology (Thailand)”. The Japan Bank of International Cooperation (JBIC) provided yen-credit loan to Thai government for the new NIMT building and metrology equipment.

(5) Consideration on metrology in Thailand

JICA has provided a variety of schemes for technical cooperation to Thailand’s

metrology development for a long period. The cooperation includes a development study, grant aid, technical cooperation projects, yen-credit loans and expert dispatches. However, due to Thai government's restructuring, institutional reforms and restricted budget and personnel cost, the metrology technology levels and research capabilities did not improve as much by itself, and mostly stayed as it was, after the technology transfer by JICA.

Recently, however, with international donor organizations such as PTB and JICA continuously providing technological support to the NIMT, and the JBIC providing yen-credit loan, the NIMT succeeded in introduction of advanced measuring instruments and technology. Using the NIMT's facilities, the NIMT becomes a center for fostering metrology engineers in ASEAN countries through the third party training by JICA and AOTS as well as ASEAN seminars by the METI.

Further development of NIMT is expected to enable technology development by itself, to keep and foster capable staffs for dissemination of technology to private sectors by absorbing and utilization of the transferred technology.

3.3.2 JICA's Metrology Projects in Malaysia

(1) Malaysian metrology projects (development study and technical cooperation project)

JICA's first metrology project to Malaysia was "The Study for Upgrading the Measurement Centre, SIRIM" (development study) in 1993. With this study's recommendation, the next project, "The Project for Upgrading the Measurement Center, SIRIM 2", was executed in the form of technical cooperation project from March 1996 to February 2000.

(2) Malaysia's activities on metrology toward self-sustainability

During the progress of JICA project, on September 1, 1996, the SIRIM became a government-owned independent organization from national governmental research organization. The purpose of this reform was to become more self-independent with less governmental influence. With this reform, the SIRIM can have more freedom to hire skilled laboratory staffs by paying higher salaries. Previously, when the SIRIM was a governmental organization, it could not pay competitive salaries to private sectors, due to the constraints of governmental regulation, and thus had difficulty in hiring top-level researchers.

Even after the reform, major funds are provided by the government, and the SIRIM is recognized as a national metrology institute with advanced R&D and testing capability.

After the completion of JICA technical cooperation, the SIRIM made continuous efforts to strengthen measurement standards. In June 2004, the SIRIM established National Metrology Laboratory (NML) in Sepang, which is located for about 40 minutes from Kuala Lumpur by car, to concentrate on R&D and maintenance of measurement standards and calibration. The SIRIM is still conducting testing activities at SIRIM's headquarter in Shah

Alam, Kuala Lumpur.

(3) Consideration on metrology in Malaysia

The NML has a stable financial source from government, and makes continuous effort to improve its measurement technology, facilities and equipment. It also employs capable researchers with high salary. The NML's director has led this. The NML can secure three important factors of fund, technology and human resources for sustainable development by persuading the government for acquisition of required budget and cooperation from organizations concerned.

Malaysia's technology levels in measurement standards and calibration are considered high after Singapore and Thailand in ASEAN countries.

3.3.3 JICA's Metrology Projects in Indonesia

(1) Indonesian metrology projects (development study)

JICA conducted two development studies (M/P). The first study was conducted in 1993 called "The Study on the Development of Legal Metrology System in the Republic of Indonesia", and the second study was conducted in 2006 called "The Study on Development of Legal Metrology System in the Republic of Indonesia". The counterpart (C/P) organization was the Directorate of Metrology (DOM) of the Ministry of Trade for both study.

For the modernization of DOM's facilities, which was a part of the first study's recommendation, Japan's yen-credit loan was approved. However, due to the economic slump of Indonesia afterwards, the project was canceled.

The implementation of legal metrology, which was administrated by the DOM belonging to the central government, was transformed to local governments except technical matters in 2001 due to the de-centralization. With this major change of environment, the former M/P study had to be reviewed, and then the second development study was executed from January 2006 to January 2007. The second M/P study has recommended the modernization of DOM's facilities. Currently, Indonesian government is considering to apply the JBIC yen-credit loan to this project.

(2) Consideration

JICA did not conduct a technical cooperation project in metrology field. However, based on the recommendation of the first M/P, Indonesian government is promoting establishment of Legal Metrology Standardization (LMS) Center. It is expected that the recommendation provided in the second M/P study including the development of legal metrology system, modernization of DOM's facilities, upgrading of Metrology Training Center (MTC) and improvement of Regional Verification Office (RVO) be realized.

3.3.4 JICA's Metrology Project in Viet Nam

(1) Viet Nam's metrology project (development study)

In 1997, JICA's development study called "The Study on Development of Industrial Standardization, Metrology, Testing and Quality Management in The Socialist Republic of Viet Nam" was executed. After the project, JICA did not conduct a technical cooperation project. The major technical transfer and assistance in supply of facilities were done by UNIDO, PTB, KRISS, etc.

On the other hand, the VMI is planning to establish a new national metrology center in Hoa Lac high-tech-parks in the suburbs of Hanoi. The VMI submitted the feasibility study (F/S) report to government and received its approval. Currently, the VMI wishes JICA's support for the design and detailed study of the center.

(2) Consideration

After the JICA's development study (M/P), Viet Nam government has efficiently improved their measurement technology using supports from UNIDO and other donors. Those improvement areas include legal metrology, measurement standards and calibration.

Viet Nam government understands the importance of measurement standards. Therefore, it will continue developing facilities and equipment, and disseminating legal metrology nation wide.

Viet Nam supports Laos in legal metrology which is really required in the country. The technology of Viet Nam is used in it.

**Chapter 4 Technical Cooperation on Metrology
Standards in ASEAN Region by Other
Donors**

Chapter4 Technical Cooperation on Metrology Standards in ASEAN Region by Other Donors

4.1 United Nations Industrial Development Organization (UNIDO)

UNIDO was established in 1967 to support modernization and industrialization of developing countries. UNIDO's supporting activities for developing countries are preparation of developments plans for national industrial development, technology transfer, investment promotion activities, surveys and research activities, etc. One of the major activities is technical cooperation and it also have a function as an execution body for United Nations Development Program (UNDP).

4.1.1 Laos, Cambodia and Viet Nam

(1) Project name

“Market Access and Trade Facilitation Support for Mekong Delta Countries through Strengthening Institutional and National Capacities Related to Standards, Metrology, Testing and Quality (SMTQ)”

(2) Project purposes

The purpose of the project is to reduce technical trade barriers (TBT) and to promote development of industry and export by supporting and strengthening national organizations dealing with national metrology, standards, testing and quality, etc.

The main targets are: (i) Capacity building of governmental organizations according to the needs of industrial sub-sectors and export market (corresponding to assistance in market access and TBT) and (ii) Improvements of technical infrastructure to be required.

UNIDO also provided Laos and Cambodia with advice and comments o drafting of metrology law and preparation of master plan.

(3) Contents of assistance

The project's major support is to provide measuring instruments with technical transfer using the provided equipment. One expert specially assigned for this project travels three countries for providing technical supports, and also asks for short-term specialists for specific assignments. A leader who coordinates the project at UNIDO headquarter, visits three countries for monitoring purpose from time to time (a few times a year). Among UNIDO's donated equipment to Laos and Cambodia, most measurement standards and instruments used in legal metrology such as mass standards and volume standards are manufactured by the VMI in Viet Nam.

- (4) Counterparts (C/P)
- Viet Nam: STAMEQ (including VMI, QUATEST and BOA)
 - Laos: STEA
 - Cambodia: DISM
- (5) Budget and period
- Phase 1: Period - from May 2003 to July 2005 Budget - US\$ 908,520 (total funds including project supporting fund are from Norway's NORAD).
 - Phase 2: Period - from September 2005 for total of approximately 3 years; Total budget - US\$ 1,500,000 (funds from NORAD).

4.1.2 Viet Nam

(1) Project name

“Market Access Support through the Strengthening of Capacities related to Metrology, Testing and Conformity”

(2) Project contents and activities

This project was to supplement UNIDO/NORAD project by SECO's (Switzerland) fund at about US\$900,000 for the period from 2004 to 2006. Most of the support is supply of equipment.

4.2 PTB and GTZ

PTB is a German national metrology institute established in 1887 with 1,500 staffs. PTB provides technical supports to development countries using funds from BMZ, EU, World Bank, IDB, GTZ, etc. For ASEAN countries, PTB provides the following technical supports:

4.2.1 Thailand

(1) Project name

“Promotion of the Thai Calibration Service”

1) Project outline

Technical supports to the CBWM, NIMT and TISI

2) Project purpose

(i) Networking of calibration laboratories, (ii) Structuring and expansion of CBWM's service system, (iii) Strengthening of TISI/TLAS as the accreditation body, (iv) Improvement of awareness of public and industry on metrology system, and (v) Various supports for

initiation of NIMT's services

3) Contents of assistance

- PTB assisted the CBWM in supply of equipment and training. It also assisted in construction of RVC (Regional Verification Center) of CBWM. All assistance to the CBWM has already finished.
- PTB assisted the NIMT in accreditation, technology for setting calibration of secondary standards, etc. before the commencement of NIMT's service in new laboratory. The third country training in cooperation with the NIMT, and PTB was carried out once in 2006 for torque. PTB does not conduct training actively like JICA.

4) Counterparts

- CBWM
- NIMT
- TISI

5) Budget and period

- Phase 1: from July 1999 to June 2003
- Phase 2: from July 2003 to June 2008
- Total fund contribution by German side for Phase 1 and Phase 2: 2,360,000 EURO

Total dispatched experts by PTB were 46 persons (including short and long terms). The participants in C/P trainings in Germany were 30 persons. Previously, the Phase 2 period was until June 2006, but due to the request from Thailand, it was extended to June 2008. As of January 2007, there is no PTB long-term expert stationing at the NIMT, and the project is carried out from time to time by short-term experts from Germany.

(2) Project name

“Advisory Service for the Development of Quality Infrastructure (MSTQ) with Special Emphasis on Agriculture Products”

1) Project purpose

The project aims at strengthening the fields of metrology, standards, testing and calibration and accreditation for economic infrastructure in agriculture.

2) Contents of assistance

The project is a part of the German-Thai cooperation program “Enhancing the competitiveness and eco-efficiency of SMEs”, which is coordinated by GTZ in collaboration with PTB.

3) Counterpart

TICA (Thailand International Development Cooperation Agency)

4) Budget and period

- Period: from May 2006 to April 2009
- Total fund contributed by Germany: 700,000 EURO

4.2.2 South-East Asia

(1) Project name

“Promotion of Regional Cooperation in South East Asia for the Establishment of MSTQ Structure”

(2) Project purpose

The project aims at disseminating the MSTQ (Metrology, Standards, Testing and Quality) system by assisting two trade organizations: ACCSQ (ASEAN Consultative Committee on Standards and Quality) and SAARC Standing Group on Standards, Quality Control and Management.

By implementing the project, the following will be achieved:

- (i) To facilitate consultation and information exchange by close linkage among persons in charge in the level of board, organization, country and ASEAN region
- (ii) To structure MSTQ organization in the region and countries, taking into account free trade zone, including technical regulations
- (iii) To promote awareness of importance of MSTQ and MSTQ service
- (iv) To extend MSTQ activities of country to those of the region

(3) Contents of assistance

The assistance includes the financial support such as traveling costs for participation in training and seminars and meetings by country staffs belonging to two organizations.

(4) Counterparts

- ACCSQ
- SAARC Secretariat

(5) Budget and period

- Phase 1: From August 2001 to July 2005
- Phase 2: From August 2005 to July 2007
- Total fund contribution by German side: 1,500,000 Euro

4.2.3 Other Technical Support to ASEAN Countries Conducted by PTB

The following technical supports are provided by PTB:

(1) Cambodia and Laos

Supports are provided on legal metrology and are mainly on equipment supply. For the DISM in Laos, mass standards and volume standards were provided. For the DOM in

Cambodia, mass standards, volume standards, three coordinate measuring machine, electric balance and balances were provided.

(2) South Asia and South-East Asia

PTB provides support through the framework of the APMP and APLMF, including financial assistance in mainly oversea trainings (support of traveling expenses etc).

(3) Philippines: Support by cooperation with PTB and the NIMT

PTB is providing support to the NML by using NIMT's facilities and staffs. In 2006, PTB expert was dispatched for surveying the NML to find out current conditions and its needs. After the survey, one NML staff was sent to the NIMT in Thailand for specific training, and in January to February 2007, two NIMT staffs will be sent to the NML for technology transfer on pressure. When the NML staff went to the NIMT for training, she brought measurement standards (pressure) for calibration at the NIMT. This calibration fees were also paid by PTB.

4.3 Australia: AusAID and NMIA

4.3.1 Support to ASEAN Countries

Using the AADCP (ASEAN-Australia Development Cooperation Programme) framework, technical supports related to measurement standards are provided.

(1) Project name

“Development of National Master Plan on Standards, Conformity Assessment and Accreditation System for CLMV Countries”

1) Project purposes

The project aims at promoting registration, development of facilities/technology and capacity building in CLMV countries.

The main focus is on CLMV countries to enhance administration capabilities to identify, design and accept harmonized standards and conformity assessment system.

2) Contents of assistance

This project was mainly for CLMV countries to develop master plan for standards and conformity assessment system.

3) Counterparts

- ASEAN Secretariat
- ACCSQ

- 4) Budget and period
 - Period: for three years from 2004
 - Budget: about A\$2,000,000.-

- (2) Project name

“Support using the ACCSQ”

- 1) Project purpose

To foster staffs of metrology organizations in ASEAN countries by using ACCSQ framework

- 2) Contents of assistance

This project is conducted under the framework of ASEAN support, and mainly technical support by training and seminars is conducted. In the past, specific training courses such as laboratory accreditation, ISO and proficiency test (PT) were conducted. The training was held at the NMIA, CSIRO, etc. with the support of AusAID.

4.4 New Zealand: NZAID

Within the ASEAN framework, “MEKONG Metrology Capacity Building Project” is currently conducted by NZAID. The field survey conducted in 2004 concluded that the conditions of CLM countries’ metrology system was at the same level as follows:

- Governmental organizations concerned are lack of understanding of international activities, proper registration system, regulations, policy and strategies.
- Important infrastructure (i.e., laboratories and facilities) and equipment are not appropriate for daily metrology services by government.
- Staffs for metrology are lack of expertise for proper metrological activities.
- There are no vehicles to carry metrological equipment for regional activities.

Under these conditions, the survey team proposed that the capacity building in legal metrology is needed. However, the report did not provide specific recommend action for Viet Nam, since Viet Nam has been already at an advanced level. Supports to each country by the project are described below.

4.4.1 Cambodia

- (1) Project name

“Support to the Establishment of Second RVC (Sihanoukville)”

(2) Project purpose

Support to Cambodia's metrology related field (mainly legal metrology)

(3) Contents of assistance

It is decided to grant equipment to the No.2 RVC in Sihanoukville. The contents of grant is under discussion as of September 2006. It is planned to mainly provide equipment for legal metrology and motorcycles for verification in remote areas. Cambodia will provide land and building. The project period is from the end of 2006 to the end of 2008.

(4) Counterpart

DOM (Department of Metrology)

4.4.2 Laos

(1) Project name

“Survey and support to Laos metrology related fields”

(2) Project purposes

Support to Laos' metrology related field (mainly legal metrology).

(3) Contents of assistance

A survey mission was dispatched in 2006 to discuss the contents of measurement instruments to be supplied and technical supports. The equipment of about US\$100,000 is considered as a grant aid mainly in the fields of mass, volume and length. Also motorcycles to support the regional activities are included. The planned project period is from the beginning of 2007, and details are under discussion.

(4) Counterpart

- DISM (Department of Intellectual Property, Standardization & Metrology)

4.4.3 Myanmar

(1) Project name

“Survey on Metrology in Myanmar”

(2) Contents of assistance

A survey mission was dispatched to discuss the contents of measurement instruments to be supplied and technical supports. However, due to the Myanmar's military government and unstable political conditions, the execution of technical cooperation is not clear at this moment.

4.5 Republic of Korea: Korea Research Institute of Standards and Science (KRISS)

KRISS was established in 1975 as a Korean national metrology institute. KRISS has been providing technical support to development countries by offering training courses in Korea, and sending experts to abroad in collaboration with Korean International Cooperation Agencies (KOICA).

4.5.1 Viet Nam

(1) Project name

“Support to the Viet Nam Metrology Institute (VMI)”

(2) Project purposes

On May 24, 2003, the minutes of understanding (MoU) for technical cooperation were signed between KRISS and the VMI for the second time (Phase 2: from 2003 to 2008), and the supporting project was executed based on this agreement. The main purposes of this project are to enhance VMI capability in maintaining measurement standards and instruments, develop calibration skill, and enhance R&D capabilities of measurement standards. As a reference, the first MoU was signed on February 14, 1997 as a phase 1 project from 1999 to 2003.

(3) Contents of assistance

Based on the above agreement, the Mutual Recognition Arrangement (MRA) is concluded between the two countries, and technical cooperation in specific field and exchange of experts are under way. Three engineers of the VMI got training at KRISS for three months from September 2003 to November 2003. KRISS provided ultra-high voltage testing laboratory to QUATEST 1 and QUATEST 3.

The cooperation between KRISS and the VMI continues now. Two to three trainees of the VMI are sent to KRISS for three months for training of every year. Since KRISS calibrate measurement standards at cost of 10~20% of actual cost, most standards are calibrated at KRISS.

(4) Counterparts

- VMI (Viet Nam Metrology Institute).
- QUATEST 1
- QUATEST 2

(5) Budget and period

- Phase 1: May 1999 to May 2003.
- Phase 2: May 2003 to May 2008; Total budget: unknown. For the budget for equipments (high voltage testing laboratories) provided during May 2003 and December 2005 for the VMI, QUATEST 1, and QUATEST 3 was about US\$1,500,000.

4.5.2 Technical Support to ASEAN Regions

(1) Project name

“Metrology Workshops in Metrology at KRISS”

1) Project outline

Since 1983, with funds from Korean International Cooperation Agency (KOICA), metrology workshops have been conducted at KRISS every year. For 19 years, total of about 260 metrology experts has been invited from 54 countries for training.

2) Project name

“Sales of KRISS-made reference materials and calibration of measuring instruments”

3) Contents of assistance

KRISS sells reference materials (standard gas, chemical reference materials, etc.) to metrology institutes in ASEAN countries. It also calibrates measurement standards. Among countries with MoU (Viet Nam, Thailand and Indonesia), KRISS conducts calibration at cost of 10~20% of actual cost for Viet Nam.

4.6 The People’s Republic of China : National Institute of Metrology (NIM)

4.6.1 Thailand

(1) Project name

“Joint-Research and Development under the Thai-Chinese Scientific Cooperation”

(2) Project purpose

The NIMT and the NIM China signed the MoU agreement on August 18, 2000 as a part of cooperation projects in science and technology between Thai and Chinese governments. The content of MoU was to conduct technical cooperation between the NIMT and NIM China on metrology and related fields for a period of five years exchange of scientific/technical information and know-how and cooperation of related technology. Details are specified in the agreement by item and scope for cooperation.

(3) Contents of assistance

Based on the MoU, a director of the NIMT visited the NIM China for further discussion of joint execution projects. Also in August 2001, the director of the NIMT revisited China for presenting a draft of joint survey projects. The content of this joint survey was about moisture content of rice (dryness); however, since the NIM China did not conduct of researches in this field, the project was not selected.

4.6.2 Viet Nam

(1) Project name

“Support to Viet Nam VMI”

(2) Project purposes

The VMI and the NIM China signed the MoU agreement for the technical cooperation for (i) international standards, and (ii) technical support for city gas flow measurement.

(3) Contents of assistance

Cooperation for international standards contributes maintenance of measurement standards and upgrading of administration in the VMI. The cooperation for gas flow measurement includes technical cooperation of verification of gas meters for consumers and flow meters and measurement of gas containers. China also bears cost for participation in training/seminars at the NIM China.

4.6.3 ASEAN Countries

(1) Project name

“Specific Training at the NIM China”

(2) Project purpose

The project aims at improvement of technical capability for maintaining and calibrating measurement standards, and technology transfer for specific needs in metrology.

(3) Contents of assistance

The NIM China provides staffs of metrology institutes in ASEAN countries with specific training and technical instruction. It can individually implement training and technology transfer for areas of metrology that recipient countries wishes. China arranges everything for them; however, the problem is a language: interpreters are necessary.

4.7 Viet Nam: Viet Nam Metrology Institute (VMI)

4.7.1 Laos

(1) Project name

“Support to the DISM in Laos”

(2) Project purposes

Support to Lao government in metrology.

(3) Contents of assistance

Since 1988, as a bilateral cooperation between Viet Nam and Laos, the VMI continuously provides technical cooperation in metrology. This technical cooperation started earlier than the establishment of Lao STEA’s metrology department in 1994. Current Lao metrology foundation was established by the support from Viet Nam government. Most of Lao mass and volume standards were provided by the VMI as a grant aid. By the Viet Nam grant aid, in 2006 Lao Metrology Center (testing center) was build in Vientian and measurement standards and equipment were provided.

The provided equipment are for legal metrology: water meter testing bench, balances, volume flow meters, mass standards, volume standards, etc. Viet Nam bears cost of meetings and joint seminars on metrology.

4.8 Thailand: National Institute of Metrology (Thailand) (NIMT)

4.8.1 Viet Nam

(1) Project name

“The Project for the Collaboration of Scientific and Technical Basis of National Measurement Standards”

(2) Project purpose

This project is a mutual cooperation in metrology between Thailand and Viet Nam. The project aims at improvement of technology for both countries and accumulation of experience in inter-laboratory comparison of national measurement standards. It is not an assistance from one country to another.

(3) Contents of assistance

The project carries out for mutual development in measurement technology between two countries. From the VMI to the NIMT, six experts were dispatched for checking

calibration procedure on December 19-23, 2005, and eight experts were dispatched for inter-laboratory comparison on September 25-30, 2006. From the NIMT to the VMI, two experts were dispatched for inter-laboratory comparison on hardness and torque standards, and one expert for comparison on pressure standard on December 11-15, 2006.

(4) Counterpart

- VMI

(5) Budget and period

- Period: from November 2005 to December 2006
- Budget: not available

4.9 Others: Support form Private Sectors

Mitsutoyo, a Japanese private company, donated measurement standards and instruments to Laos and Cambodia. For the DOM in Cambodia and DISM in Laos, Mitsutoyo provided about 5 to 6 of their products, such as block gauges, electric measurement instruments, three coordinate measuring machine and electric balances.

**Chapter 5 Issues of ASEAN Region and Subjects for
Assistance Required in Metrology
Standard**

Chapter 5 Issues of ASEAN Region and Subjects for Assistance Required in Metrology Standard

5.1 Features of Each Group Country

Table 5.1.1 shows the GDP and estimated measuring instruments in the ASEAN countries. The estimation was made by Mr. Pian, Director of NIMT, et al. He made analysis of the number of measuring instruments in Thailand and applied the method to the estimation in other countries. Therefore the estimated values are not accurate ones, but it is useful to grasp the features by country.

(1) Group 1: Cambodia, Laos and Myanmar (CLM countries)

The Group 1 countries are less developed in industry with GDP of less than US\$10 billion and GDP per capita of less than US\$500. The basic measurement instruments of length, volume and flow are dominant. Legal metrology controls these measuring instruments, and measuring instruments used in industry are not so many.

Among three countries, Myanmar is considered more developed in industry than the other two countries, because there are relatively large numbers of measuring instruments of electricity/frequency and pressure/vacuum, which are used in industry.

Therefore, Cambodia and Laos should start development of legal metrology and Myanmar requires introduction of basic equipment of industrial measurement and HRD in addition to legal metrology.

(2) Group 2: Viet Nam, Indonesia and Philippines

The Group 2 countries are middle-developed in industry with GDP of more than US\$40-50 billion and GDP per capita in the order of US\$500 - 1,000. The estimated number of measuring instruments used in legal metrology/industrial metrology is large. These countries have already achieved the development of measurement standards to a certain level and further efforts are required.

(3) Group 3: Malaysia and Thailand

The Group 3 countries are fairly well-developed in industry with GDP of more than US\$100 billion and GDP per capita of more than US\$2,000. These countries have already achieved the development of measurement standards to a higher level and can transfer their experience to neighboring countries.

(4) Group 4: Singapore

Although Singapore has small population of 4.2 million, its GDP is about US\$100 billion that is almost the same value with the other ASEAN nations. The GDP per capita is as high as about US\$25 thousand that makes Singapore one of advanced countries in the world. It is a country to be able to conduct technology transfer of measurement standards.

Table 5.1-1 GDP and Estimated Measuring Instruments in ASEAN Countries

	GDP in 2004 (US\$ million)	GDP/capita (US\$)	Dimension	Electrical & Frequency	Mass	Temperature	Pressure & Vacuum	Volume & Flow
<Classification I>								
Cambodia	4,600	337	42,251	nil	188,478	48,470	nil	44,012
Laos	2,400	416	6,242	1,427	24,346	4,533	3,121	3,807
Myanmar	9,600	192	55,454	6,184	141,701	77,064	85,235	47,210
<Classification II>								
Vietnam	45,200	550	351,689	14,589	815,736	497,255	380,075	306,864
Indonesia	257,600	1,184	1,112,683	110,524	1,666,760	1,242,788	1,744,069	682,715
Philippines	86,400	1,041	2,951,070	468,737	1,112,541	729,841	66,747	159,904
<Classification III>								
Malaysia	117,800	4,672	6,485,489	1,045,620	2,610,792	2,087,702	1,162,313	472,859
Thailand	163,500	2,621	3,028,370	421,483	1,656,365	1,119,346	784,639	355,901
<Classification IV>								
Singapore	106,800	24,641	8,691,650	1,383,219	2,684,195	2,537,533	1,393,767	500,272

Source: Pian Totarong and Chainarong Cherdchu; "Metrology Demands for ASEAN Economy" except GDP and GDP/capita (Source: METI)

5.2 Issues with Respect to Design of Measurement Standards System for Legislation etc. Concerning Metrology

5.2.1 Group 1 countries

(1) Common

Group 1 countries have no basic metrology law. At present, a part of other laws and regulations covers regulations concerning metrology. Each country recognizes the necessity of metrology law and the law is drafted, which is under deliberation. The metrology laws in Cambodia and Laos are drafted using the OIML Document by assistance by UNIDO, covering only basic subjects. Myanmar has no individual metrology law. The subjects related to metrology is included in the Standardization Law.

Therefore, it is necessary to supplement regulations in implementation of the metrology law. Japan and advanced ASEAN countries can assist in this field based on their experience.

(2) Cambodia

There is no metrology law in Cambodia. The Law of Metrology based on the OIML Document drafted by UNIDO's assistance is under deliberation in the cabinet meeting. Then, it will be sent to the Diet, but it is not clear when the law is enacted. In implementing the metrology law, the preparation of regulations on legal metrology is especially important.

(3) Laos

There is no metrology law in Laos. The Law of Metrology based on the OIML Document drafted by UNIDO's assistance is under deliberation. There is a plan to prepare a law concerning laboratory accreditation. In implementing the metrology law, the preparation of regulations on legal metrology is especially important.

(4) Myanmar

There is no metrology law and the Standardization Law, under deliberation in the law department, covers metrology (metrology measurement standards, accreditation, etc.). Since Myanmar has a potential of industrialization, it is necessary to establish regulations concerning measurement standards as well as legal metrology.

5.2.2 Group 2 countries

(1) Common

The development of legislation related to metrology is promoted in these countries. However, the items concerning type approval do not cover the requirements of the OIML Recommendation. The type approval testing is composed of structural testing (physical

testing) and performance testing. The former is hardly conducted. When countries export measuring instruments, the type approval based on the proper type approval testing will be necessary and the law should specify it.

(2) Viet Nam

The “Ordinance of Metrology” (October 6, 1999) was enacted in 1999. It is planned to amend it in 2009 including internationalization and self-supporting accounting system of related institutes. The VMI (Vietnam Metrology Institute) will draft it for submission to the STAMEQ (Directorate for Standards and Quality), which will be transferred to the MOST (Ministry of Science and Technology). In addition there are orders for implementation and MOST orders. They requested assistance for amendment of metrology law.

(3) Indonesia

There is the “Law No.2 Concerning Legal Metrology” and there are governmental decrees, presidential orders and ministerial decrees to implement the law. However, some parts are not well coordinated and the amendment would be required in future. It takes time and difficult to pass the Diet for amendment of law and regulations.

Indonesia has recognized the importance of type approval. The type approval testing is one of pillars for modernization of the DOM. It might be a good idea to conduct type approval testing of the ASEAN countries intensively at the DOM.

(4) Philippines

There is the metrology law: “An Act Establishing a National Measurement Infrastructure System (NMIS) for Standards and Measurements, and for Other Purposes” which was enacted as the Republic Act No. 9236 in July 2003.

5.2.3 Group 3 countries

(1) Common

The definition of type approval is ambiguous in the law. Thailand is in the same situation as the Group 2 countries.

(2) Malaysia

The “Weights And Measures Act 1972” was enacted as the legal metrology law. Major related regulations include the “Weights And Measures Regulation 1981” and the “Pattern or Specification For Weights Or Measures Or Instruments For Weighing Or Measuring Order 1981.” The “Measurement Law” has been already drafted and will be enacted soon.

(3) Thailand

There is the “National Metrology System Development Act, B.E. 2540 (1997)” as the metrology law. Under this law, the “Board of the National Metrology”, chaired by the minister of the MOST and consisting of related ministries, is organized to administrate the metrology policy. The law also specifies the establishment of the NIMT and its duties and responsibilities.

There is the “Weights and Measures Act B.E. 2542 (1999)” as the legal metrology law.

5.2.4 Group 4 country

(1) Singapore

There is a measurement law: “The National Metrology Act of 2003” and a legal metrology law: “Weights and Measures Act, Revised 2005” that were made amendments recently. Therefore, it is considered that there is no significant problem, because they seem to incorporate the recent situation of internationalization and changes of domestic environment.

The production of legally controlled measuring instruments is small in Singapore. Concerning the type approval for imported measuring instruments, Singapore approves the type approval of exporters without type approval testing in the country.

5.3 Issues on Reliable Measuring Methods in Environmental Field in Whole ASEAN Region and Technological Issues on Development Methods of Reference Materials

5.3.1 General

In general, the concentration of air pollutants of exhaust gas from cars, flue gas and others is measured by analyzers. The measured values are compared with the measurement results of reference material (standard gas) whose concentration has already known. Even if the sampling is made correctly and skilled engineer measures the concentration of pollutants with precise analyzers; however, if the standard gas used in measurement is incorrect, the measurement results become unreliable ones. Since the concentration of pollutants directly influences to the health of human beings, the measurement values should have enough reliability.

Therefore, both of measurement method and reference materials are important in chemical metrology. In other fields of chemical metrology, the situation is the same.

The following are the fields required for reference materials:

- Chemical metrology and reference materials required for maintenance of environments, health and safety: Standard gas for analysis of exhaust gas, reference materials for analysis of waste water, reference materials for analysis in the field of medical treatment and reference materials for analysis of foodstuffs
- Basic reference materials to support scientific technology: reference materials based on metrology law and traceability system including standard liquids of metal, standard liquids of pH, standard gas and standard liquids of organic materials
- Reference materials to develop scientific technology and enhance international competitiveness: reference materials of high-tech materials, reference materials for analysis of surface of alloy metals

Among the above three fields, the development of chemical metrology and reference materials for environment, health and safety is an urgent matter. Along with it, the range of legally controlled measuring instruments used in chemical metrology, restriction of utilization methods (method for adjustment of measuring instruments etc.) and reference materials should be defined in metrology law.

5.3.2 Measuring Methods

(1) Measurement of food composition (situation in Indonesia)

The study team does not have enough time to survey testing laboratories which measure concentration of environmental pollutants and components of foodstuffs. Concerning measurement of components of foodstuffs, it had surveyed at some testing laboratories as follows:

The BPMB (Product Testing Office) in the Directorate of External Trade under the Ministry of Trade deals with inspection of exporting and imported foodstuffs. Meanwhile, the DOM in the Directorate of Internal Trade under the same ministry administrates legal metrology.

There are 37 BPSMB (Regional Laboratory for Testing and Quality Control) under control of provincial governments to inspect exporting and imported foodstuffs. The BPMB provides BPSMBs with technical assistance. Most BPSMBs are accredited based on ISO 17025 by the KAN; however, their levels are fluctuated. The BPMB provides the BPSMBs with necessary facilities on request and facilities of BPSMB, although they are not latest ones, almost fulfill requirements. The skills of staffs seem little problems.

The exporting foods to be inspected, which have a variety in regions, include palm oil and its derivatives, cocoa, coffee, nuts, crops (rice, casaba, etc.). The study team also visited private testing laboratories, which only inspect foreign materials in cocoa and rice and measure moisture contents. Their skills were low.

Since the measuring instruments for food components are not defined as legally controlled measuring instruments in Indonesia, the BPMB seems to calibrate BPSMB's measuring instruments. The KIMIA-LIPI in the LIPI under the Ministry of Technology and Science deals with chemical metrology.

(2) Environmental measurement

In ASEAN countries except Singapore and Malaysia, air pollution by the exhaust gas from cars and motorcycles are very serious. It is an urgent matter to take necessary measures to reduce it. Regular measurements of concentration of air pollutants are important to plan measures against pollution. Therefore, it is necessary to develop the system to measure concentration of pollutants in ASEAN countries.

5.3.3 Reference Materials

ASEAN countries purchase reference materials from abroad. Since some reference materials change in properties easily with time, they should be properly used and stored. Every country that requires reference materials wishes to produce reference materials in its country. However, since the required quantity is small, it is considered effective that one country in ASEAN produces them and delivers them to other countries.

5.3.4 Necessity for Assistance

All ASEAN countries have a necessity of chemical metrology, but Class 1 countries could not implement it due to the lack of technology, equipment and funds. The assistance to other countries in HRD, technology and equipment is required.

5.4 Assistance Suitable for Each Country in ASEAN Region and Its Possibilities

ASEAN countries' regional technical cooperation is not active at present. Only long-term bi-lateral cooperation in ASEAN region is Vietnam's (VMI) support to Lao DISM. On the other hand, most technical cooperation projects assisted by overseas donors will be terminated by 2008. After these projects, technical cooperation in metrology to ASEAN region is not clear now.

In order to accelerate activities in metrology in ASEAN region in future, regional collaboration and assistance are considered indispensable. Advanced countries in metrology

should provide support to less advanced countries. Until now, ASEAN countries were passive in receiving technical supports from developed countries such as United States, Europe, and Japan. However, this way of thinking must be changed. ASEAN countries themselves should shift to collaboration for their development within ASEAN region. The following describes the way of collaboration among ASEAN countries and the recommended implementation scheme.

5.4.1 Supports through Regional Metrological Meetings and Conferences (Multilateral Cooperation: Use of ACCSQ)

The ACCSQ is a committee which national metrology institutes in ASEAN region participated in. Using the ACCSQ scheme, the regional collaboration should be promoted.

(1) Current ACCSQ Scheme for collaboration in metrology

The ACCSQ's working groups (WG) discuss projects for assistance (usually request bases by participating countries). If proposed projects are approved by the ACCSQ, they become open to dialogue partners. If one of the dialogue partners takes up a project for execution, that country will sponsor the project as a donor and provide funds and/or technical supports. Dialogue partners are European Countries (Germany etc.), United State, Australia, New Zealand, Korea, Japan, etc. One project is usually assisted by one donor.

If there is no donor for the project, member countries find their own funds as well as resources to conduct the project; however, these cases are few.

(2) Recommended scheme to strengthen ACCSQ's collaboration

Strengthening collaboration using the ACCSQ scheme is necessary: not only current scheme of requesting dialogue partners as a donor for technical cooperation, but also increase of new schemes by advanced ASEAN countries which provide technical supports in metrology and provide funds to developing countries such as CLM countries etc. Countries belonging to Groups 3 and 4 countries should take the lead for supporting countries of Groups 1 and 2.

5.4.2 Cooperation by Bi-lateral Agreements among ASEAN countries

(1) Cooperation scheme for assisting less advanced national metrology institute by advanced national metrology institute

This scheme is that Group 3 and Group 4 countries provide technical support to group 1 and Group 2 countries. Viet Nam is classified as a Group 2 country, but it has already provided technical cooperation and grant aid to support development of Laos (Group 1 countries) in metrology. This Vietnam-Laos relationship is one example as this type of support. PTB's support to the Philippine NML using the NIMT in Thailand can be

categorized as this type. Japan has already proposed the supply of measurement standards from the NIMT to ASEAN region based on the experience and knowledge for seminars and training.

(2) Linkage and collaboration between national measurement institutes at similar technical level

The measurement technology in countries belonging to Group 2 (Indonesia, Philippines and Vietnam) and Group 3 (Malaysia and Thailand) is different in the degree of development: a certain country may develop in a specific field, whereas others are not. Each country can learn advanced fields of other countries through exchange of experts by bi-lateral cooperation agreement. By doing so, both countries will be developed each other. Japan should consider supporting those activities technically and/or financially.

5.4.3 ASEAN Countries' Technical Levels in Metrology and Technical Cooperation Supporting Structure

The countries, which can provide technical cooperation in metrology, are considered to be Group 3 and Group 4 countries. In this section, (i) technical levels of metrology institutes for providing technical cooperation, and (ii) official development assistance organization in each country are described.

In order for those countries to actively support neighboring countries, the government policies must support the technical cooperation activities. Japanese government needs to consider how to persuade those Group 3 and 4 countries to support neighboring countries' development.

(1) Singapore

1) SPRING

SPRING's technological level in metrology is high, and can provide technical support including training to other countries by SPRING's own resources (human resources, facilities and fund). Especially for the training, the SPRING has provided training to Singapore's private sector concerning calibration, secondary measurement standards, etc. The SPRING commented that it could conduct training to staffs in ASEAN countries. The training courses that the SPRING can conduct are four fields: maintaining and managing measurement standards, legal metrology, calibration of measuring instruments and accreditation. There might be two methods to conduct training by the SPRING. One method is through the third-country training program with joint execution with other donors such as JICA, and other is through the SCP, Singapore government's original technical cooperation program.

2) SCP (Singapore Cooperation Programme)

Singapore Cooperation Programme (SCP) was established in 1992 as an international cooperation program implemented by the Ministry of Foreign Affairs. The Singapore's support to development countries was started in 1960s. "Japan Singapore Partnership Programme (JSPP)" was signed in 1994 between Japanese government and Singapore government, and in 2001, it was renewed to "Japan Singapore Partnership Programme for the 21st Century (JSPP21)". With this agreement, JICA and SCP jointly conduct third-country technical cooperation in Singapore.

3) Contents of assistance

The SCP has not yet conducted technical supports in metrology to other countries. Most of technical supports conducted by the SCP are group trainings in Singapore. The SCP provides training by two types: one is bi-lateral cooperation, and the other is a joint training program together with other donors (third-country training). For both types, training is conducted in collaboration with Singapore's organizations concerned. There are about 250 courses (group training) a year. Of these, about 40 to 50 courses are third-country training. JICA is the largest contributor for the third-country training. JICA provided joint training with 24 courses in 2006. Singapore and a donor shares equal cost in SPC's third country training program. The SCP provides arrangements for logistics such as participants' ticket, hotel and visa. All lecturers are Singapore's local experts in principle.

4) Expectation to Singapore

Since Singapore is most advanced in measurement standards in ASEAN region, Singapore should take lead in providing assistance with technical cooperation to national metrology institutes in ASEAN region. Singapore should contribute to upgrade ASEAN national metrology institutes by accepting staffs of metrology institutes for providing group training and specific fields trainings as well as dispatching experts to abroad.

(2) Malaysia

1) SIRIM-NML

The SIRIM-NML is the second in technology level of measurement standards after the SPRING in Singapore. It is considered that the SIRIM-NML could conduct group training and seminar for about one week in specific field in metrology with their own resources (human resources, facilities and fund). The SIRIM-NML has already provided short programs such as seminars and conferences to ASEAN metrology institutes and Malaysia's private sector.

2) MTPC (Malaysian Technical Cooperation Programme)

Malaysian Technical Cooperation Programme (MTCP) under the Economic Planning Unit (EPU) of President's Office was established in September 1980, to provide technical cooperation to development countries.

3) Contents of assistance

Most of technical supports conducted by the MTCP are group training in Malaysia. The MTCP provides training courses by two types: one is joint cooperation together with other donor and the other is own achievement. In 2006, 126 training courses were conducted by the MTCP alone. The total number of courses conducted jointly with others was not known, but ten courses were conducted with JICA. Malaysia and the donor equally share the cost for third-country training programs, and Malaysia arranges logistics such as participants' ticket, hotel and visa. Usually, all lecturers for MTCP's third country training programs are Malaysia's local experts. JICA, the MTCP and the SIRIM jointly conducted training in the fields of "Mold and Die Design Technology (1994 – 1998)", "Analytical Instrumentation for Ceramics (1995 – 1998)", "APEC Partners of Progress (PPT) Project: Standards and Conformity Assessment Schemes (1997 – 2000)", and "SME Promotion using ITC Technology (2006 – 2008)".

4) Expectation to Malaysia

The SIRIM-NML should continuously enhance its technical level of measurement standards, and should transfer technology by providing specific training to engineers of national metrology institutes from Group 2 countries. For supporting Group 1 countries, the NML should assist in legal metrology by collaboration with the Testing Department of SIRIM and the Legal Metrology Unit of the MTDCA. It is considered that Malaysia could provide technical cooperation to other developed countries with its technology, capability and fund.

(3) Thailand

1) NIMT

The technical transfer to the NIMT is under way by JICA and PTB. It seems that the NIMT is in short of staffs, measurement technology, financing resources and experiences to some extent. Until the completion of JICA's technical cooperation project at latter part of 2007, the NIMT should concentrate on absorbing transferred technology. The NIMT also requires to extend their services in response to the needs from industry. It can learn much from the SPRING in Singapore, NIMT Club and the TPA in Thailand.

**Chapter 6 Roles Requested to Japan Concerning
Development of Measurement Standards
in the ASEAN Region**

Chapter 6 Roles Requested to Japan Concerning Development of Measurement Standards in the ASEAN Region

The measurement standards consist of standards related to the basic seven units and standards of acoustics/vibration, radiation and flow (gas and liquid). The kinds of total measurement standards including working standards can be counted over one hundred. The measurement standards should be developed by careful investigation of kinds and levels of standards that are necessary in the country, taking into account what standards are indispensable in industrial development and what standards can support legal metrology.

There are many countries, such as the VMI in Viet Nam, that wish development of primary measurement standards in countries; however, it is not always necessary for all countries to develop all kinds of primary standards. It is recommended that they maintain national measurement standards that meet their national conditions in terms of kinds and levels of standards, and conduct periodical calibration by getting assistance from the neighboring countries that maintain the primary standards.

There are a variety of measuring instruments with many kinds that are required verification under the legal metrology law. The legally controlled measuring instruments are specified in metrology law or legal metrology law. It is necessary to legislate it first. Among CLM whose legal metrology laws are under preparation, Cambodia and Laos to which UNIDO provides assistance require support for further development of legislation, technology to maintain supplied equipment and dissemination of legal metrology nationwide.

On the other hand in Myanmar, since there are few measurement standards/instruments that are indispensable for implementation of legal metrology, it is necessary to supply equipment with technical assistance in addition to the abovementioned assistance. It is also important to draw up a comprehensive master plan on measurement standards and legal metrology in the country.

CLM are behind in industrial development, and the difference between the legal metrology and measurement standards is small. It is necessary to provide assistance in metrology by not clearly separating the two.

The primary industry, producing agricultural and marine products, is a main industry in developing countries. Those countries are less developed in measurement standards. Some of them request assistance in chemical metrology and production of standard materials to guarantee the safety of foods. The production of standard materials requires advanced technology as well as large investment. For this reason, it is recommended that they purchase

standard materials from advanced countries in measurement standards.

Figure 6-1 shows the comparison of level and activities of metrology institutes in ASEAN countries. The CLM countries stay at low levels in development of measurement standards and activities. Based on this finding, the roles requested to Japan are described below.

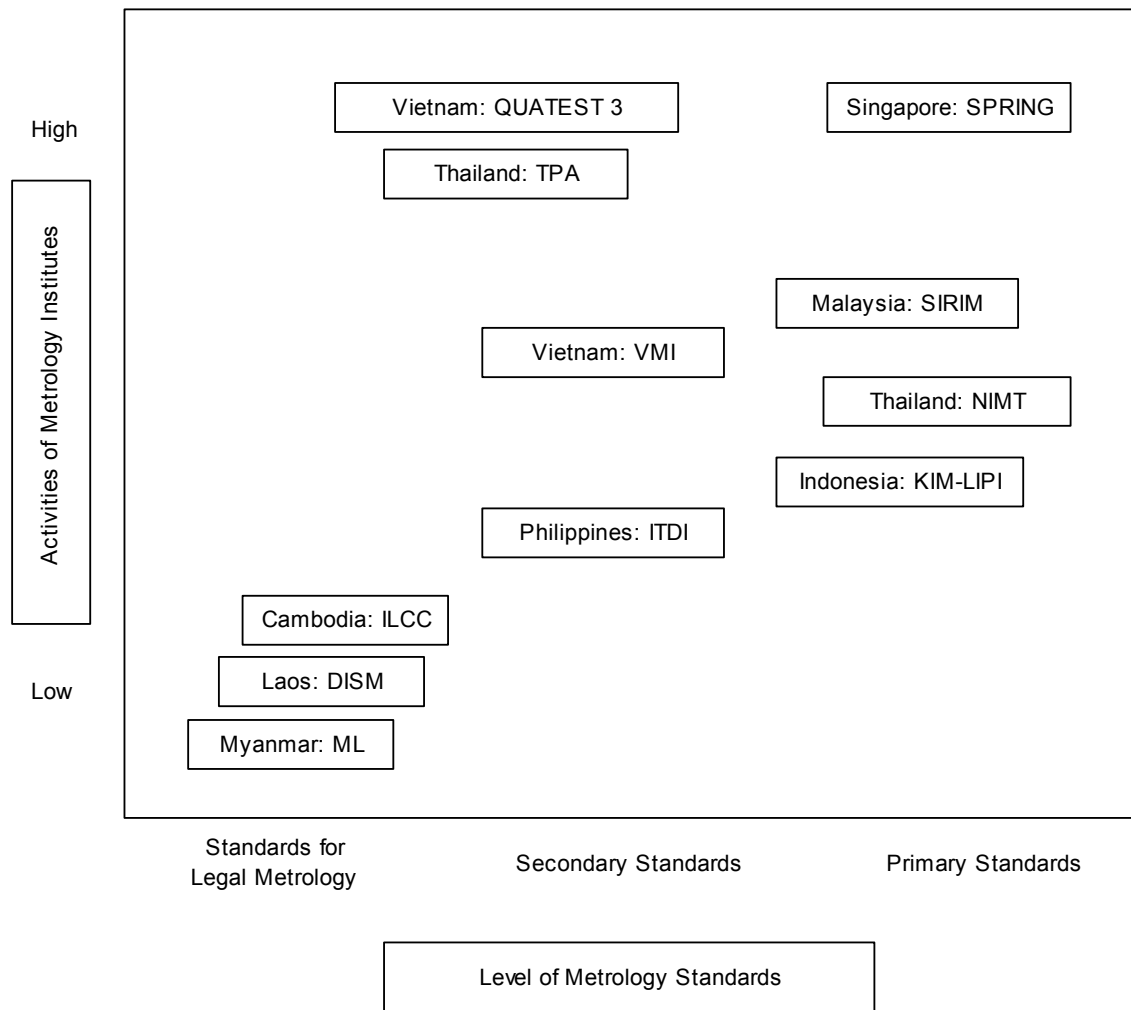


Figure 6-1 Comparison of Level and Activities of Metrology Institutes in ASEAN Countries

6.1 Roles Requested to Japan for Cooperation in System Design of Legislation etc. Concerning Metrology

6.1.1 Group 1: Cambodia, Laos and Myanmar

Countries of Group 1 have no comprehensive metrology law whose draft is under discussion. However, the contents of drafts are rather simple ones and some difficulties are anticipated in implementing the metrology law. Therefore, regulations to supplement the law are necessary. In addition, there are few staffs with capabilities to plan and implement the metrology policy.

UNIDO provides assistance to Cambodia and Laos and the assistance will terminate in 2008. It is questionable that the sustainability in promoting metrology is kept after that. The assistance by Viet Nam to Laos is mainly for equipment supply and less for policy making.

Therefore, it is considered necessary that JICA assists in metrology policy making and implementation of the policy after 2008. Especially, of great importance is dissemination of legal metrology to local areas and development of traceability.

6.1.2 Group 2: Viet Nam, Indonesia and Philippines

Viet Nam asked JICA for providing advice on amendment of metrology law that is scheduled in 2009. It will be dealt with dispatching Japanese experts and providing specific training. The contents of the project might include: (i) understanding of Japanese experts about legislation and existing laws and regulations in Viet Nam, (ii) counterpart training on legal metrology, (iii) discussion with the counterpart on legal metrology law and (vi) joint work for amendment of existing law. The total period for dispatching is considered 3-6 months.

Each country is less developed in metrology law in chemical metrology. The situation is the same for countries of Groups 2 and 3. The basic knowledge can be given by JICA's group training, followed by dispatching Japanese experts for specific requirements.

6.1.3 Group 3: Malaysia and Thailand

It is the same situation as Group 2 concerning chemical metrology. Concerning other subjects, the experience of Thailand and Malaysia can be transferred to other countries.

6.1.4 Group 4: Singapore

It is the same situation as Group 3 countries concerning chemical metrology. Concerning other subjects, the experience of Singapore can be transferred to other countries.

6.2 Human Resources Development (HRD) for Metrology Technology

In planning HRD cooperation, it is necessary to thoroughly grasp the needs of recipient country. It is important to make discussion in depth with persons in charge on what kinds of training is necessary. Since it is considered that trainers are in short, it is also important to foster trainers.

When JICA conducts HRD cooperation, the following four methods are usually applied:

- Group training courses (usually comprehensive general courses)
- Specific fields' training courses (courses designed for specific needs)
- Technical transfer through expert dispatches (technical cooperation project or single expert dispatches)
- Technical transfer of policy making methods through the development study, and technical transfer through pilot projects within the development study

Possibilities for application of those methods are described below:

6.2.1 HRD Needs

(1) Group 1 countries (Cambodia, Laos and Myanmar)

Cambodia, Laos and Myanmar are currently not industrialized yet. Thus HRD needs are mainly in legal metrology. It is recommended to conduct the development study to transfer policy-making methods to counterpart personnel. The pilot project can be conducted in the development study, and it is effective to provide technical transfer on how to maintain, calibrate and use measurement standards and equipment on the job training for the development of national metrology system. For the support after the development study, group training, specific fields' training and expert dispatches can be considered.

1) Technical aspects

The following HRD can be considered using schemes such as the group training, specific fields' training, expert dispatches (technical cooperation project and/or single expert dispatches) and pilot projects in the development study.

- a) Verification techniques on legally controlled measuring instruments (balances, truck scales, water meters, watt-hour meters, fuel dispensers, etc.)
- b) Technical transfer of monitoring methods for pre-packaged goods
- c) HRD for maintaining and managing measurement standards and traceability

2) Aspects for planning and administration of policy and systems (training for managers)

The following HRD can be considered using schemes such as the expert dispatches

(technical cooperation project and/or single expert dispatches), specific fields' training and development study:

- a) HRD for designing and executing metrology law system and metrology policies
- b) HRD for planning system to disseminate legal metrology nation wide
- c) HRD for establishing operational system of legal metrology system

(2) Group 2 countries (Indonesia, Philippines and Viet Nam)

Indonesia, Philippines and Viet Nam are in progress of industrialization and have reached to a certain level in each field in maintaining and managing metrology standards, establishment of traceability, calibration technology, laboratory accreditation and legal metrology. In order to further strengthen them and to develop technology, the specific fields' trainings and expert dispatches (technical cooperation project or single expert dispatches) are required.

1) Technical aspects

The following HRD can be considered using schemes such as expert dispatches (technical cooperation project and/or single expert dispatches) and specific fields' trainings:

- a) HRD to efficiently use currently owned measurement standards and equipment
- b) HRD for use of chemical metrology (including manufacture of reference materials, standard gases and standard oils (viscosities)), and calibration using reference materials
- c) HRD for improvement of testing abilities on environment and food inspection (chemical and bio)
- d) HRD for assessors for laboratory accreditation
- e) HRD of planning and executing PT
- f) HRD for type approval testing (Indonesia)
- g) HRD for improvement of calibration techniques for metrology equipment (electric/electronics, temperature, pressure, length and mass)

2) Aspects in implementation of policy (training for managers)

The following HRD can be considered using schemes such as the expert dispatches (technical cooperation project and/or single expert dispatches) and specific fields' trainings (including C/P trainings):

- a) HRD for planning future prospects including vision and mission in metrology field
- b) HRD for proper management of metrology institutes and laboratories
- c) HRD for coordinating international activities
- d) HRD for promoting marketing in response to industrial needs

(3) Group 3 countries (Malaysia and Thailand)

The level of measurement technology of Malaysia and Thailand are at high level after Singapore in ASEAN region. Both countries have already reached to higher level in domestic industry including sectors of manufacturing of electric/electronic parts, auto parts and machine parts, and food processing. Therefore, the needs for measurement standards, laboratory accreditation, legal metrology and calibration are high. Malaysia and Thailand can level up their technology level through conducting the third country technical cooperation for HRD to neighboring countries together with Japan.

1) Technical aspects

The following HRD can be considered using schemes such as the specific fields' trainings and expert dispatches (technical cooperation project):

- a) HRD for developing, maintaining, and managing new type of measurement standards that are required for high-tech products such as electric measuring
- b) HRD for chemical metrology (including manufacture of reference materials, standard gas and reference oils (viscosities)), and calibration of reference materials
- c) HRD for improvement of testing abilities for inspection of environment and food
- d) HRD for assessors for laboratory accreditation
- e) HRD for planning and executing PT

2) Aspects in implementing policy (training for managers)

The following HRD can be considered using schemes such as the specific fields' trainings (including C/P trainings) and expert dispatches (single expert dispatches):

- a) HRD for planning future prospects including vision and mission in metrology field
- b) HRD for proper management of metrology institutes and laboratories
- c) HRD for coordinating international activities
- d) HRD for promoting marketing in response to industrial needs

(4) Group 4 country (Singapore)

Singapore is the most advanced country in measurement technology in ASEAN region, and has already reached to an international level. Therefore, there are no HRD needs. Singapore can absorb technology of Japanese experts by conducting HRD together with Japan in the third country technical cooperation to neighboring countries.

Currently SPRING does not have facilities to produce reference materials, and has not yet established testing laboratories for environment; however, the SPRING has already applied budgets to Singapore government. Those facilities will be developed by the end of 2007.

6.3 Collaboration with Japan's Accreditation Body

6.3.1 Group 1

Three countries of CLM do not a member of the APLAC. First of all, it is important for these countries to develop measurement standards and legal metrology. On the other hand, the WG2 of ACCSQ tries to facilitate accreditation and conformity assessment and plans to assist these countries in accreditation and conformity assessment.

Within the framework of the AADCP (ASEAN-Australia Development Cooperation Programme), the “Development of National Master Plan on Standards, Conformity Assessment and Accreditation System for CLMV Countries” is in progress.

Therefore, since there are needs for assistance in accreditation to CLV countries, the assistance from Japan cannot be considered at present due to the fact that Australia prepares the master plan now.

6.3.2 Group 2

The Group 2 countries have already established accreditation bodies, but require capacity building. It is necessary to improve capability of calibration laboratories by conducting PT (proficiency testing). Assistance in training of assessors and planning and implementation of PT is considered by Japan together with Singapore or Malaysia.

6.3.3 Group 3

Malaysia (DSM) is a signatory to the MRA of APLAC and ILAC and conduct PT. They told that it could receive trainees from neighboring countries through the ACCSQ framework.

Thailand plans to conduct PT and it is considered necessary to assist it in planning and implementation of PT. Concerning PT, Japan and Malaysia or Singapore could assist Thailand.

6.3.4 Group 4

Singapore (SAC) is a signatory to the MRA of APLAC and ILAC and conduct PT. It is considered that the laboratory accreditation is at high level as well. Singapore is a country that can train assessors and assist in PT.

6.4 Consideration on Assistance by JICA's Scheme

(1) Discussion on policy concerning technical cooperation

Japan has provided various ODA (official development assistance) in metrology fields.

In Thailand, JICA has provided the NIMT with technical assistance in metrology standards, and the capability of NIMT has been significantly enhanced. In addition to the conventional ODA scheme, it is important to extend the outcome from NIMT's assistance to the neighboring countries using NIMT's resources (so called "South to South Cooperation").

JICA's mission and strategies for "South to South Cooperation" should be clearly defined. What is obtained by it? What is the target for the assistance? How long is it continued? What system is applied for the assistance? Do Japanese experts participate in the assistance? How to train and evaluate trainers of assisting country? How to develop curriculums? How to measure the effects of assistance? And so on.

(2) Assistance corresponding to the specific needs of each country

In general, as requested from many countries, it is effective for assistance to dispatch experts, HRD by technical training and timely assistance as required. It is also important to respond quickly when the request is given.

CLM countries can not clearly separate functions between legal metrology, industrial standards and measurement standards and the priorities for development are in this order. It is important to develop first from what is really necessary and to structure the system to support it.

In Viet Nam, the amendment of metrology law and a plan to move the VMI are under way for further stepping up the metrology. JICA's assistance is requested for it. Several donors now assist Viet Nam. Under this situation, it is necessary for JICA to discuss what policy it should be taken for the assistance of Viet Nam.

Many countries are exporting foods. The measurement of components including toxic materials in it is requested and standard materials are necessary to calibrate measuring instruments. It is also important to measure pollutants in air and water to maintain environment, which did not discussed well during the survey. The assistance in chemical metrology should be considered comprehensively among countries concerned.

On the other hand, each country purchases standard materials from overseas countries and it wishes to produce it in the country. However, producing them in each country is not a good idea.

For reference, some countries told the following:

JICA's group training for legal metrology is too general for staffs with experience in

metrology. If possible, JICA can accept training according to the specific needs of the country.

(3) Utilization of the framework of ACCSQ

Advanced ASEAN countries except Thailand (MOST) do not seem to have a governmental policy to actively assist developing ASEAN countries. Under these circumstances, the assistance by the former countries to the latter countries is only made through the ACCSQ (with donors or individually). ASEAN made an assistance program (see 2.2.3). For instance, the assistance to Myanmar in HRD on metrology includes “standardization and metrology”, “harmonization of standards” and “MRA”. A master plan on standardization and implementation of metrology is required, but it is not realized.

It is important to cooperate with advanced ASEAN countries in assisting CLMV, it is necessary for JICA to discuss the possibility to develop the system using the framework of ACCSQ to match JICA’s scheme.

(4) Possibilities of “South to South Cooperation” by NIMT

Cambodia and Laos have already received equipment from UNIDO, New Zealand, PTB and Viet Nam (to Laos) with some assistance in HRD. Australia has been instructing metrology system and MRA in the ASEAN region. There is a plan to unite an economic zone between Viet Nam and Cambodia. Under these circumstances, the following are important when the NIMT provides assistance:

1) It is important to clarify the significance of assistance the ASEAN institutes in training of staffs on a long-term basis by collaboration with Japan. The effects of assistance seem not so effective and do not last long, if the NIMT provides temporary assistance in training as request basis. It is necessary to discuss with countries the targets to be achieved by training and what kind of training is suitable to enable it. Then the following preparation should be made:

- Design Japan’s system for effective assistance
- Structure system of NIMT and supporting organizations for assistance
- Plan and implement trainer’s training
- Prepare suitable curriculum
- Plan the use of NIMT facilities
- Plan the required budget

In the course of these planning, the collaboration with the TPA that is an excellent testing and calibration laboratory having training facilities should be discussed. It is also necessary

to know the needs for the training for the specific subjects (see below).

- 2) In order to conduct training in cooperation with the NIMT, it is necessary for both Japanese and Thai persons involving in the project to investigate the country beforehand to know the real needs. Concerning CLMV, Viet Nam and CLM are different in development of measurement standards, and ask for different needs. The former is pursuing industrial development and measurement standards have been developed along with the growth of industry. On the other hand, the latter is behind in industrial development except some sectors including apparel sector, resulting in less needs for precise measurement standards. It is necessary for CLM to develop legal metrology, equip measurement standards suitable for legal metrology (partially supplied by UNIDO assistance etc.), use them properly, and train staffs on how to plan, manage and implement legal metrology. Indonesia, which is a leading country in legal metrology in the ASEAN region, could assist in the training.
- 3) The process of assistance by the NIMT and PTB (a series of the process including site survey, discussion to know the real needs, decision of priority, training by exchange of engineers and calibration of standards) is a good example in consideration of assistance with Japan and the NIMT. It is necessary to conduct site survey to discuss training plan that is useful for actual work.
- 4) A combination of trainings in the recipient country and the NIMT in Thailand should be considered. For instance in Myanmar, the number of trainees who can join the foreign training is limited due to the limitation of budget as well as the lack of understanding of government. In order for as many as trainees to join the training, it is necessary to conduct training in Myanmar. This enables trainers know the real situation of the country, leading to fruitful training in the NIMT which will be conducted afterward by preparation of useful curriculum. In this case, it should be confirmed beforehand that Myanmar, whose government influences invitation by political reasons, can receive such training seminar.
- 5) The training for middle-class management is also necessary. It is useful to transfer the experience of NIMT that has developed measurement standards including policymaking, coordination with other ministries concerned, and know-how on planning, development and administration. These experiences would be helpful for recipient countries to develop and use measurement standards. The Japanese experience can be added as required.
- 6) The following-up of training is also important. The post evaluation on not only capacity building of trainees but also how to use it and how to disseminate it within the organization in charge is necessary. The PDCA circle for training system including the feedback of evaluation results should be established.
- 7) According to the existing scheme, it might be difficult for Japanese experts to visit countries other than one country. To facilitate this program, some measures should be considered. For instance, one expert involves in two projects in recipient country and

Thailand, or one expert participated in two projects: one is the needs survey by development study and the other is training program in Thailand.

In promoting assistance in the ASEAN region as a whole, the present system based on bi-lateral assistance might restrict its activities. It is necessary to establish a system enabling multi-lateral implementation according to the project purpose. Or, Japan makes an agreement for cooperation with the ASEAN like Australia.

- 8) The NIMT can assist Philippines other than CLMV. The NIMT should collaborate for improvement together with Singapore (SPRING), Malaysia (SIRIM) and Indonesia, which improves measurement standards by the IDB's assistance, by periodical visits, exchange of information, etc.
- 9) As mentioned above, the levels of recipient countries are different and organizations of Thailand to deal with the assistance differ according to the requirements. Therefore, the collaboration not only with the NIMT but also with the CBWM and TISI is necessary. Meanwhile, the tools for assistance should be extended to the AOTS, JETRO, etc. other than JICA. The use of TPA's capacities including training know-how and training facilities should be discussed. That is, it is necessary to structure the system to cope with by "All Japan and All Thailand."
- 10) A new project that is proposed by the NIMT is a project to assist CLMV in measurement standards selected among basic quantities of national standards (mass, length, temperature and electricity), which suit the level of national conditions. The concepts of the project are as follows:

The NIMT will invite engineers of a recipient country for 3-4 months to provide training (class room lessons and practice training) of measurement standards and calibration from the basics to practical application. After the completion of training, the NIMT staffs will visit the recipient country to instruct setting of national measurement standards, calibration technology and preparation of calibration certificates.

(5) Collaboration with Singapore and Malaysia

Concerning collaboration with Singapore, since the SPRING conducts training of not only staffs of SPRING but also employees of private companies, Japan can ask the SPRING for training of other ASEAN nations by sharing costs with Singapore. In this case, the SPRING designs the curriculum of training. It is considered that the SAC can provide training in accreditation and conformity assessment.

Concerning Malaysia, since the SIRIM cannot spare enough staffs for training and it has not enough experience in training, it is difficult to carry out a consistent training program except short-term training. It is considered that the DSM can provide training in accreditation

and conformity assessment.

(6) Needs for assistance of each country

The following are the needs for assistance except that described in 6.2.

1) Cambodia, Laos and Myanmar

There are several donors in assistance. The fields of metrology are not classified well in these countries. The assistance in policymaking and capacity building for implementation will be effective. In Cambodia and Laos, since the training to use supplied standards and equipment is not conducted sufficiently, the training to use specific standards and equipment is considered useful.

In Myanmar, since there is little assistance from donors, there are few measurement standards/instruments in comparison with other two countries. It is necessary to equip basic measurement standards and measuring instruments with HRD to handle it. It is also required to draw up a master plan and implement what are recommended in it as the action plan.

2) Viet Nam

The development of measurement standards is in progress steadily. The key for success is well-established organizations, hierarchy of standards and traceability and grasp of needs. It wants JICA's assistance in amendment of metrology law and VMI development plan (move to Phoa Lac). Concerning a plan on movement of the VMI, it is requested to dispatch experts to provide advice for requirements of construction of national metrology institute including layout of laboratories, design know-how for laboratory construction, vibration and air conditioning, and selection of measurement standards.

3) Philippines

- Training in specific fields (technology to disseminate standard of 1 kg to 1 mg-100 kg, calibration technology of precise barometer, technology on high frequency, etc.)
- Transfer of technology on chemical metrology including how to plan it
- Grant for necessary standards and equipment

4) Indonesia

- Development of legal metrology after the de-centralization
- Acceleration of establishment of NMI Indonesia
- Assistance in type approval testing technology and management method of type approval in case that the DOM deals with type approval testing exclusively in the

ASEAN region (subject to agreement among concerned countries)

5) Malaysia

- Assistance in policy making
- Transfer of technology on chemical metrology

6) Thailand

- Transfer of technology on chemical metrology
- Assistance in planning and implementation of PT

Appendix

Appendix A Work Schedule of Field Survey

Appendix B List of Persons for Interviews

Appendix C Questionnaire

Appendix D Collection Data List

Appendix E Record of Seminars

Appendix A Work Schedule of Field Survey

Appendix A : Work Schedule of Field Survey

1st Field Survey (September 21 ~ October 15 / 2006)

No.	Month/Day	Schedule	Place
1	September/21 (Thr)	KAN/BSN	Jakarta
2	22 (Fri)	KIM-LIPI, KIMIA-LIPI, JICA	Jakarta
3	23 (Sat)	Data arrangement	Jakarta
4	24 (Sun)	<i>Transfer (JKT/SIN/RGN)</i>	Yangon
5	25 (Mon)	JICA, JETRO, EOJ, Electric Manufacturer	Yangon
6	26 (Tue)	Dept. of Standard	Yangon
7	27 (Wed)	Electric Manufacturer, EOJ, JICA	Yangon
8	28 (Thr)	<i>Transfer (RGN/BKK)</i>	Bangkok
9	29 (Fri)	<i>Transfer (BKK/VTE)</i> , JICA	Vientiane
10	30 (Sat)	Data arrangement	Vientiane
11	October/1 (Sun)	Data arrangement	Vientiane
12	2 (Mon)	DISM	Vientiane
13	3 (Tue)	DISM, Japanese Manufacturer, JICA	Vientiane
14	4 (Wed)	<i>Transfer (VTE/PNH)</i> , JICA	Phnom Penh
15	5 (Thr)	UNIDO, ILCC	Phnom Penh
16	6 (Fri)	LPG, lubrication Filling Up Factory, DOM, JICA	Phnom Penh
17	7 (Sat)	<i>Transfer (PNH/SGN)</i>	Ho Chi Minh
18	8 (Sun)	Data arrangement	Ho Chi Minh
19	9 (Mon)	QUATEST 3	Ho Chi Minh
20	10 (Tue)	<i>Transfer (SGN/HAN)</i> , JICA	Hanoi
21	11 (Wed)	STAMEQ, Japanese Car Manufacture	Hanoi
22	12 (Thr)	VMI, BOA	Hanoi
23	13 (Fri)	QUATEST 1, Hanoi Japan C/C, Japanese Motorcycle Manufacture, JICA	Hanoi
24	14 (Sat)	<i>Transfer (HAN/TYO)</i>	
25	15 (Sun)	<i>Av. Tokyo</i>	

2nd Field Survey (January 9 ~ January 27 / 2007)

No.	Month/Day	Schedule	Place
1	January/9 (Tue)	<i>Lv. Japan (TYO/MNL)</i>	Manila
2	10 (Wed)	JICA、 The Japanese Chamber of Commerce、 ITDI/DOST	Manila
3	11 (Thr)	NML/ITDI、 PAO	Manila
4	12 (Fri)	NML/ITDI、 JICA	Manila
5	13 (Sat)	Data arrangement	Manila
6	14 (Sun)	<i>Transfer (MNL/SIN)</i>	Singapore
7	15 (Mon)	JICA、 SIRIM、 NMC、 WMO、 SAC	Singapore
8	16 (Tue)	FLUKE、 MOGAS FLOW LAB	Singapore
9	17 (Wed)	<i>Transfer (SIN/KUL)</i> 、 JICA	KL
10	18 (Thr)	Legal Metrology Unit/MTDCA、 NML/SIRIM	KL
11	19 (Fri)	DSM、 JICA	KL
12	20 (Sat)	<i>Transfer (KUL/BKK)</i>	Bangkok
13	21 (Sun)	Data arrangement	Bangkok
14	22 (Mon)	JICA、 MOST	Bangkok
15	23 (Tue)	NIMT	Bangkok
16	24 (Wed)	CBWM	Bangkok
17	25 (Thr)	TISI、 DENSO	Bangkok
18	26 (Fri)	TPA、 JICA	Bangkok
19	27 (Sat)	<i>Ar. Japan (BKK/TYO)</i>	

Appendix B List of Persons for Interviews

Appendix B: List of Persons for Interviews

Cambodia		
1. Department of Metrology (DOM) (Metrology Center)		
	Mr. Ho Kadeb	Director, Department of Metrology (DOM), Ministry of Industry Mines and Energy
	Mr. Kim Chandara	Deputy Director, Department of Metrology (DOM)
2. Industrial Laboratory Center of Cambodia (ILCC)		
	Sreang Samnang	ILCC
	Mom Setha	ILCC
	In Sambo	ILCC
3. Private Company		
CAMGAS Co., Ltd.		
	Mr. Him-Komry	LPG Marketing Manager
Lao		
1. Department of Intellectual Property, Standardization & Metrology (DIPSM), Prime Minister's Office Science, Technology and Environment Agency (STEA)		
	Mr. Nheune SISAVAD	Director General, Dept. of Intellectual Property, Standardization & Metrology
	Mr. Khamphut PHENGMEUANGKHOUN	IP public awareness officer, Affairs and Dissemination Division, Dept. of Intellectual Property, Standardization & Metrology
	Mr. Soumana CHOULAMANY	Director, Standards and Quality Division
	Mr. Bounthiam PHIMVONGSA	Director of Metrology Division
	Mr. Viengkham SINGSONEXAY	Deputy Director of Metrology Division
	Mrs. Nhommla PHETSARATH	Technical Officer
	Mrs. Nisith Chanthalom	Technical Officer
2. Private Company		
Tokyo Coil Engineer (Lao) Co., LTD		
	Teerawoot Chudam	Administration Manager
Myanmar		
Myanmar Scientific & Technological Research Department, MOST		
	Dr. Aye Myint	Director General
	Dr. Zaw Min Maing	Director
	Dr. Khin Maung Latt	Professor & Head, Dept. of Engineering Physics, Yangong Technological University
	Dr. Khin Nar Zaw	Principal Scientist, Dept. of Standards
Vietnam		
1. STAMEQ, Metrology Department, Directorate for Standards and Quality, Ministry of Science and Technology		
	Mr. Nguyen Hung Diep	Director, Metrology Department, STAMEQ
	Mr. Vu Van Hong	Deputy Director, International Cooperation Dep., STAMEQ
	Mr. Tran Quy Gian	Senior Officer, Metrology Department, STAMEQ
	Mr. Nguyen Manh Hung	Head of Planning and Cooperation Section, Vietnam Metrology Institute (VMI)

	Ms. Ho Minh Trang	Senior Accreditation Officer (In Charge of International Section, Bureau of Accreditation)
	Mr. Tran Thuy Ha	Officer, Metrology Department, STAMEQ
	Mr. Trinh Muil Tain	Officer, International Cooperation Department, STAMEQ
2. Vietnam Metrology Institute(VMI)		
	Mr. Nguyen Dac Loc	Deputy Director, Vietnam Metrology Institute
	Mr. Nguyen Manh Hung	Head of Planning and Cooperation Section, Vietnam Metrology Institute (VMI)
3. Bureau of Accreditation Directorate for Standards and Quality		
	Mr. Vu Xuan Thuy	Acting Director, Bureau of Accreditation
	Ms. Ho Minh Trang	Senior Accreditation Officer, Bureau of Accreditation
4. Quality Assurance and Testing Center 1 (Quatest 1)		
	Mr. Nguyen Canh Toi	Deputy Director, Quatest1
	Mr. Ngyin Tran Quan	Officer, Quatest1
	Ms. Ho Minh Trang	Senior Accreditation Officer, Bureau of Accreditation
5. Quality Assurance and Testing Center 3, (Quatest 3) Directorate for Standards and Quality		
	Mr. Tran Van Dung	Director, Quatest 3
	Mr. Dinh Van Tru	Vice Director, Quatest 3
6. Private Company		
Toyota Motor Vietnam Co., LTD		
	Tetsuzo Suzuki	Product Director, Toyota Motor Vietnam Co., Ltd
	Tran Hoang Hai	Manager, Quality Control Department, Productive Division, Toyota Motor Vietnam Co., Ltd
Yamaha Motor Co., LTD		
	Katsuaki Watabe	Factory Director
	Hitoshi Inagaki	Manager, Quality Assurance Division
Indonesia		
1. KIM-LIPI		
	Mr. Dede Erawan	
	Dr. Ir. Hussein Avicenna Akil, M. Sc.	
2. DOM		
	Oke Nurwan	Head of Sub-directorate, Metrological Facility & Cooperation
	Rusmin Amin	Facility & Cooperation Section
3. KAN/BSN		
	Kukuh S. Achmad	Director, Laboratory and Inspection Body Accreditation
	Sunyoto	Chief Secretary, Laboratory and Inspection Body Accreditation
Philippines		
1. National Metrology Laboratory (NML), Industrial Technology Development Institute (ITDI) Department of Science and Technology (DOST)		
	Mr. Edgardo Juan	Chief, National Metrology Laboratory
	Dr. Nuna E. Almanzor	Director, Industrial Technology Development Institute
2. Philippine Accreditation Office (PAO) Department of Trade & Industry Philippines		

	Ms. Perla F. Baje	Manager, Laboratory Accreditation, PAO
	Ms. Cirila S. Botor	Officer-in-Charge, PAO
Malaysia		
1. Metrology Unit (Legal Metrology) Ministry of Domestic Trade and Consumer Affairs (MDTCA)		
	Mr. Mohd Khalis Bin Kasim	Metrology Unit Director, MDTCA
	Mr. Peter J. Berinus Agang	Assistant Director, Legal Metrology, MDTCA
	Ms. Sapiah Binti Mdhd Ndr	Assistant Director, Legal Metrology, MDTCA
	Ms. Faizah Binti Othman	Assistant Director, Legal Metrology, MDTCA
2. National Metrology Laboratory (NML) SIRIM Berhad		
	Mr. Md Nor Md Chik	Senior General Manager, NML, SIRIM Berhad
	Dr. Osman Zakaria	Head, Chemical Section, NML, SIRIM Berhad
3. Department of Standards Malaysia (DSM) Ministry of Science, Technology & Innovation		
	Mr. Shaharul Sadri Alwi	Senior Principal Director, Accreditation Division, DSM
	Mr. Wan Rukiman Wan Mamat	Principal Assistant Director, Accreditation Division, DSM
Thailand		
1. Ministry of Science and Technology (MoST)		
	Dr. Saksit Tridech	Permanent Secretary, MoST
2. National Institute of Metrology (Thailand) (NIMT) Ministry of Science and Technology (MoST)		
	Dr. Pian Totarong	Director, NIMT
	Dr. Yoshiaki AKIMOTO	Chief Advisor, JICA/NIMT Project, Phase II
	Ms. Ikuko NIIZEKI	Coordinator, JICA/NIMT Project, Phase II
	Mr. Veera Tulasombut	Head of Mechanical Metrology Dep., NIMT
	Mr. Anusorn Tonmueanwai	Head of Length Laboratory, NIMT
	Mr. Arkom Krachangmol	Ass. Head of Photometry Metrology Dep. NIMT
	Dr. Charun Yafa	Chemical Metrologist, NIMT
3. Central Bureau of Weights and Measures (CBWM) Department of Internal Trade (DIT), Ministry of Commerce (MOC)		
	Mr. Veerasak Visutthatham	Director of Central Bureau of Weights & Measures (CBWM), DIT, MOC
	Mr. Chartree Areewong	Director of Weights & Weighing Instruments Standards, CBWM, DIT, MOC
	Mr. Samanya Theppabutra	Weights and Measures officer, CBWM, DIT, MOC
4. Department of Internal Trade (DIT), Ministry of Commerce (MOC)		
	Mr. Siripol Yodmuangcharoen	Director-General, Department of Internal Trade, MOC
	Mr. Veerasak Visutthatham	Director of Central Bureau of Weights & Measures (CBWM), DIT, MOC
	Mr. Chartree Areewong	Director of Weights & Weighing Instruments Standards, CBWM, DIT, MOC
5. Thai Industrial Standards Institute (TISI) (Office of the National Accreditation Council (ONAC)) Ministry of Industry (MOI)		

	Mr. Yanneupat Uthongsap	Chief of Laboratory Accreditation Group 4, Laboratory Accreditation Group 4, Standard Bureau 4, TISI, MOI
	Mr. Bussaba Saelim	Standard Officer, Laboratory Accreditation Group 4, Standards Bureau 4, TISI, MOI
	Ms. Nathinee Chantajaru	Foreign Relations Officer, Regional Organizations Group, International Relation Division, TISI, MOI
	Dr. Sutavadee Techajunta	Head, Technical and Accreditation Cooperation Group, ONAC, MOI
	Ms. Ekani Romyanon	Head, Certification Body, Accreditation Group 1, ONAC, MOI
	Mr. Rangsan Nimitsawan	Head, Inspection Body, Accreditation Group, ONAC, MOI
6. Technology Promotion Association (Thailand-Japan) (TPA)		
	Dr. Bandhit Rojarayanont	Executive Director and Director General
	Mr. Mitr Veeratham	Section Manager, Calibration Services and Environmental Analysis Department
	Mr. Supanithi Ruangthong	Media Creation and Support Manager, Education & Training Department
	Ms. Yukiko Yabuuchi	Advisor
7. Private Company		
Denso International (Thailand) Co., Ltd.		
	Koichi Nakamura	Senior Coordinator, Quality Control Department
	Mr. Munggorn Chaigimanon	QC & Calibration Lab., General Manager
	Mr. Ruch-Ake Phakdee	Head of Laboratory/Senior Officer, Calibration Center
Singapore		
1. Spring Singapore		
	Mr. Steven TAN Beng Chye	Deputy Group Director, Corporate Development, SPRING
	Dr. CHUA Sze Wey	Deputy Director, National Metrology Center, SPRING
	Mr. S Koban	Senior Manager, Weights & Measures Office, SPRING
	Mr. LEE Shih Mean	Senior Metrologist, Mechanical Metrology Department, National Metrology Center, SPRING
	Mr. CHANG Kwei Fern	Director, Accreditation, SPRING
	Ms. LEE Shou Yin	Manager, Corporation Communications, SPRING
	Mr. Adrian ANG Pau Yuen	Inspector, Weights & Measures Office, SPRING
2. Singapore Accreditation Council		
	Ms. CHIN Poh Yin	Head (Laboratory), Singapore Accreditation Council
3. Private Company		
Fluke South East Asia Pte. Ltd.		
	Mr. Yeo Cheng Ngee	Regional Sales Manager, Precision Measurement Group/ASEAN, Fluke S. E. A. Pte. Ltd.
	Mr. Wong Leong Yoh	Sales Program Manager, Precision Measurement Group/ASEAN, Fluke S. E. A. Pte. Ltd.
	Mr. Ricky Chuan	Senior Sales Engineer, Fluke S.E. A. Pte. Ltd.
	Mr. Anthony Ng	Service Manager, Fluke S. E. A. Pte. Ltd.
MOGAS FLOW LAB Pte. Ltd.		
	Mr. Teoh Seng Eng	General Manager, Mogas Flow Pte. Ltd.

Appendix C Questionnaire

Appendix C Questionnaire

Country: Indonesia

JICA Study Team for the Project Study on Effective Metrology Standard System of ASEAN Countries

Questionnaire for

The Project Study on Effective Metrology Standard System of ASEAN Countries

Questionnaire to

Ministry of Research and Technology, and Ministry of Trade

(For Department in charge of Metrology Policy)

The purpose of this questionnaire survey is to find out current status, progress, and needs of each country's metrology system, and to find a direction of Japan's future technical cooperation in this field on ASEAN countries. Please answer following questions. The JICA study team will visit your organization during Indonesia survey trip from September 20, 2006 till September 24, 2006 and collect this questionnaire sheet. Thank you very much for your kindness and for understanding.

Person in charge

Name:		Title/Position:	
Organization's name and address		Telephone/FAX:	
Date:		E-mail:	

Part I: Request for information

Please provide the following materials concerning metrological activities, if possible.

- Documents indicating present government policies relating to metrological control, such as measurement standards, legal metrology, laboratory accreditation, industrial standards, etc.
- Documents on the government's future plan for the metrology system.
- The latest chart of your organization with the number of staffs of each department and section

Part II: QuestionnaireQ1: Government's policy on metrological control

Please describe the government's policy on metrological control and its relationship with other policies, e.g. relationship with policies on consumer protection, industrial standards, industry promotion, export promotion, promotion of science and technology, etc.

Q2: Laws and regulations relating to metrological control

Please indicate current laws and principal regulations on metrology system and related fields.

- 1) For measurement standards
- 2) For laboratory accreditation
- 3) For legal metrology

Q3: Organizations and functions for metrological control

What organizations or departments do you have for metrological control including government (ministry, center, and lab...etc) and non-government ones. Please indicate their names, functions and approximate number of staffs, if available, e.g. national metrology institute, accreditation body, legal metrology institute, R&D laboratories, and calibration/testing laboratories, etc.

Q4: Government policy on measurement standards and traceability

Please describe the government policy on measurement standards and traceability.

Q5: Government policy on laboratory accreditation

Please describe the government policy on laboratory accreditation in relation to the traceability, legal metrology, industrial standards and testing of industrial products, international cooperation, etc.

Q6: Government policy on legal metrology

Please describe the government policy on legal metrology in relation to the measurement standards, traceability, industrial

standards and testing of industrial products, international cooperation, etc.

Q7: Budget allocations

Please indicate the government's approximate budget allocation and percentage to each organization for their metrological activities.

Q8: Future plan

Do you have any future plan to promote metrological activities, including human resources development, internationalization, affiliation to international organizations, international/bilateral cooperation...etc? If so, please indicate them.

Q9: Collecting and dispatching information concerning metrology policy making

How do you collect information concerning metrology and related technologies for policy making, e.g. scientific, technological, technical, and managerial...etc including oversea R&D information. How do you publicize and dispatch information to domestic and oversea organizations, and to the public, e.g. exchange of annual report, visit each other, etc.?

Q10: Technical support from oversea donors for metrology

1) Has your country ever received any technical support on metrology, including administration training, from oversea donors, e.g. from PTB, AusAID, KOICA, NZAID, etc?

(1) From PTB

(2) From AusAID or CSTRO

(3) From Others

2) Does your country have any plan to receive technical supports from oversea donors? If so, please describe them.

Q11: Problems to be solved

Do you have any problems on metrological activities, e.g. dissemination of measurement standards, enlightenment, consumer protection, fraud in measurements, market surveillance, etc? If so, how do you overcome those problems?

Q12: Any request to the international/regional metrology organizations and oversea donors

Do you have any requests to international/regional metrology organizations or international donors in the fields of metrology?

Q13. Necessity of a master plan for development of metrology system

Do you think that your country needs a master plan for development of metrology system and human resources?

Q14. About NMII

1) Policy on activities at NMII

2) For the realization of NMII (Any expected obstacles and problems)

Thank you very much for your cooperation.

Questionnaire for

The Project Study on Effective Metrology Standard System of ASEAN Countries

Questionnaire to the National Metrology Institute

(KIM-LIPI, DOM, KIMIA-LIPI, and BADANG)

The purpose of this questionnaire survey is to find out current status, progress, and needs of each country's metrology system, and to find a direction of Japan's future technical cooperation in this field on ASEAN countries. Please answer following questions. The JICA study team will visit your organization during Indonesia survey trip from September 20, 2006 till September 24, 2006 and collect this questionnaire sheet. Thank you very much for your kindness and for understanding.

Person in charge

Name:		Title/Position:	
Organization's name and address		Telephone/FAX:	
Date:		E-mail:	

Part I: Request for information

Please provide the following materials, if possible.

- Annual reports of your organization
- List of publications (papers, reports, guidelines, manuals, leaflets, etc.)
- The latest chart of your organization with the number of staffs of each department and section
- Financial records (annual budget allocation) of your organization

Part II: Questionnaire

Q1: Metrology system and traceability of measurement, and their future plan

1) Please describe the metrology system and traceability of measurement, in relation to the dissemination of measurement standards, cooperation with the other organizations etc., and their development plan or improvement plan, if any.

2) Is there any field of measurement standard of which quality system has been accredited by any accreditation body? If any, please indicate the fields of measurement standards and accreditation body and standard used for accreditation.

Q2: Physical quantities of the currently maintained national measurement standards, their maintenance, control and, research and development

1) Please indicate the physical quantities of the national measurement standards currently maintained by the national metrology institute, e.g. length, mass, time, pressure, force, etc.

2) How do you maintain these standards, e.g. by bilateral comparisons, APMP key comparisons, etc?

3) Do you need to develop any other measurement standard? If so, how do you develop them?

Q3: Future plan to develop facilities and equipments

1) What kind of facilities and principal equipments do you currently have?

2) Please describe your future plan, if any, to develop or improve facilities and equipments?

3) Future correspondence to the disorder or confusion on metrology standards (mass and length)

Q4: Human resources development (HRD)

1) Do you have any HRD program for metrology? If so, please indicate the type and details of the program, e.g. on the job training, seminar, workshop, etc, and their organizers, trainers affiliations, participants qualifications, relationship with oversea organizations, if any, etc.

Name of the program, type of the training course and the details

2) Have your staffs ever participated in oversea training courses, seminars intended for human resource development, etc.? If so, please indicate them.

Name of the program, organizer, number of participants from your organization, etc

Q5: Outline and functions of the other national metrology institutes

Is there any other national metrology institute for the other physical quantities, e.g. chemical standards, radiation standards, etc.? If so, please provide their names, outlines, functions and approximate number of staffs.

Q6: International, regional and bilateral cooperation

1) Have your staffs ever participated in any international, regional or bilateral cooperation concerning measurement standards, e.g. hosting meetings, seminars, training courses, participating in international/regional meetings such as meetings of APMP, etc? If any, please indicate them.

2) What international/regional organizations do you join? If any, please indicate them.

Q7: Collecting and dispatching information on metrological activities

1) How do you collect information from oversea on metrological activities and technologies, e.g. meetings, scientific, technological, technical, and managerial...etc?

2) How do you publicize and dispatch information to domestic organizations and to the public?

3) How do you publicize and dispatch information to oversea organizations concerned, e.g. exchange of annual report, visit each other, etc.?

Q8: Technical support from oversea donors for metrology, especially for measurement standards.

1) Have you ever received any technical support for metrology from oversea donors, e.g. from PTB, AusAID, NZAID, KOICA, and IDB...etc? If so, please describe them.

(1) From PTB

(2) From IDB

(3) From Others

2) Do you have any plan to receive technical supports from oversea donors? If so, please describe them.

Q9: Problems to be solved

Are there any problems or difficulties on development of measurement standards, traceability or metrological activities? If any, how do you overcome them?

Q10: Request to the international/regional metrology organizations and oversea donors

Do you have any request to international/regional metrology organizations or international donors in the fields of metrology? If so, please describe them.

Thank you very much for your cooperation.

Questionnaire for
The Project Study on Effective Metrology Standard System of ASEAN Countries

Questionnaire to KAN
(Laboratory Accreditation Body)

The purpose of this questionnaire survey is to find out current status, progress, and needs of each country's metrology system, and to find a direction of Japan's future technical cooperation in this field on ASEAN countries. Please answer following questions. The JICA study team will visit your organization during Indonesia survey trip from September 20, 2006 till September 24, 2006 and collect this questionnaire sheet. Thank you very much for your kindness and for understanding.

Person in charge

Name:		Title/Position:	
Organization's name and address		Telephone/FAX:	
Date:		E-mail:	

Part I: Request for information

Please provide the following materials concerning metrological activities, if possible.

- Annual reports of your organization
- List of publications (papers, reports, guidelines, manuals, leaflets, etc.)
- The latest chart of your organization with the number of staffs of each department and section
- Financial records (annual budget allocation) of your organization

Part II: Questionnaire

Q1: Process and procedures of the designation as an accreditation body.

1) Please describe the process that your organization has been designated as an accreditation body, or the intent of establishment.

2) How is your organization designated as an accreditation body? What are the procedures for it?

3) How do you accredit a laboratory as a testing and calibration laboratory? What are the procedures for it?

4) What standard do you use for accreditation of testing and calibration laboratories?

5) How do you designate peer reviewers for accreditation? What are their qualifications?

Q2: Current demands (needs) to testing and calibration laboratories

1) What needs do the clients have of the testing and calibration laboratories?

2) Please provide the current conditions of testing and calibration laboratories from the point of view of accreditation.

3) How many laboratories are currently accredited as a testing and calibration laboratory? Please provide the number of accredited laboratories by sectors, i.e. government laboratories and private ones. Please indicate major fields of accreditation, if possible, e.g., metrology, industrial testing, agricultural testing, etc.

Number of accredited government laboratories and major fields of accreditation

Number of accredited private laboratories and major fields of accreditation

Q3: Future plans for accreditation scheme

Do you have any plan for improvement of accreditation scheme? If any, please describe it.

Q4: Human resources development (HRD)

1) Do you have any HRD program for accreditation? If so, please indicate the type and details of the program, e.g. on the job training, seminar, workshop, etc, and their organizers, trainers affiliations, participants qualifications, relationship with oversea organizations, if any, etc.

Name of the program, type of the training course and the detail

2) How do your staffs study procedures and skills of accreditation?

3) Have your staffs ever participated in oversea training courses, seminars intended for human resource development, etc.? If any, please indicate them.

Q5: Collecting and dispatching information on accreditation

Currently, how do you collect information concerning laboratory accreditation? How do you publicize and dispatch information to the domestic organizations, the public people and oversea, e.g. exchange of annual report, visit each other, etc.?

Q6: International, regional and bilateral cooperation

Have your staffs ever participated in any international, regional or bilateral cooperation concerning laboratory accreditation, e.g. hosting meetings, seminars, training courses, participating in international/regional meetings concerning laboratory accreditation such as meetings of APLAC, etc? If any, please indicate them.

2) What international/regional organizations do you join? If any, please indicate them.

Q7: Technical support from oversea donors for laboratory accreditation

1) Have you ever received any technical support on laboratory accreditation from oversea donors, e.g. from PTB, AusAID, KOICA, NZAID... etc? If any, please indicate them.

2) Do you have any future plan to receive technical supports for laboratory accreditation from oversea donors? If so, please indicate them.

Q8: Problems to be solved

Do you have any problems or some technical difficulties concerning promotion of laboratory accreditation? If any, how do you overcome them?

Q9: Any request to the international/regional metrology organizations and oversea donors

Do you have any request to international/regional metrology organizations or international donors in the field of laboratory accreditation? If so, please describe them.

Thank you very much for your cooperation.

Questionnaire for
The Project Study on Effective Metrology Standard System of ASEAN Countries

Questionnaire to DOM
(Legal Metrology Organization)

The purpose of this questionnaire survey is to find out current status, progress, and needs of each country's metrology system, and to find a direction of Japan's future technical cooperation in this field on ASEAN countries. Please answer following questions. The JICA study team will visit your organization during Indonesia survey trip from September 20, 2006 till September 24, 2006 and collect this questionnaire sheet. Thank you very much for your kindness and for understanding.

Person in charge

Name:		Title/Position:	
Organization's name and address		Telephone/FAX:	
Date:		E-mail:	

Part I: Request for information

Please provide the following materials concerning metrological activities, if possible.

- Annual reports of your organization
- List of publications (papers, reports, guidelines, manuals, leaflets, etc.)
- The latest chart of your organization with the number of staffs of each department and section
- Financial records (annual budget allocation) of your organization

Part II: Questionnaire

Q1: Legal metrology system

We would like to know legal metrology system of your country, such as legislation, technical infrastructure, type approval testing, verification system, etc.

1) Measurement law

- (1) What is the purpose of the measurement law of your country?
- (2) When was it enacted? When were major amendments made to it, and what was the gist of the amendments?
- (3) What kind of measuring instruments is the measurement law applied to?

2) Technical Infrastructure

- (1) What facilities and testing/measuring instruments do you have in your institute? Please indicate some principal ones.
- (2) What are they used for?

3) Type approval testing

- (1) What measuring instruments is type approval testing applied to?
- (2) What organization conducts type approval testing?

4) Verification

- (1) What measuring instruments is verification applied to?
- (2) What organizations conduct verification?

Q2: Organizations and their functions for legal metrology

Please describe the functions of your organization and other organizations concerning legal metrology, and provide their

organization charts, if available.

Name of the organization

Functions

Q3: Traceability for legal metrology

1) What standards measuring instruments are maintained at your institute for legal metrology, e.g. type approval testing, verification, etc? For example, standard weights, a standard kW-h meter, a standard scale of length, and standard volume tanks...etc

2) How are those above mentioned standards maintained? Are they calibrated by the primary standards? If so, how often are they calibrated? Are they traceable to the national standards?

3) Is there any field of legal metrology of which quality system has been accredited by any accreditation body? If any, please indicate the fields of measurement standards and accreditation body and standard used for accreditation.

Q4: Dissemination of legal metrology

How do you disseminate legal metrology to the public? Do you have any regional offices for legal metrology services? If so, please describe the relationship between them.

Q5: Future plan for legal metrology system, facilities and equipments

1) Do you have any plan to improve facilities and equipments in your institute? If so, please describe it.

2) Do you have any plan to improve legal metrology system in your country? If so, please describe it.

Q6: Human resources development (HRD)

1) Do you have any HRD program for legal metrology? If so, please indicate the type and details of the program, e.g. on the

job training, seminar, workshop, etc, and their organizers, trainers affiliations, participants qualifications, relationship with oversea organizations, if any, etc.

Name of the program, type of the training course and the details

- 2) Have your staffs ever participated in oversea training courses, seminars intended for human resource development, etc.? If so, please indicate them.

Name of the program, organizer, number of participants from your organization, etc

Q7: Dissemination and promotion of legal metrology to the public

What activities do you perform for dissemination, promotion and enlightenment of legal metrology to the public?

Q8: Collecting and dispatching information on legal metrology

- 1) How do you collect information from oversea on metrological activities and technologies, e.g. meetings, scientific, technological, technical, and managerial...etc?

- 2) How do you publicize and dispatch information to domestic organizations and to the public?

- 3) How do you publicize and dispatch information to oversea organizations concerned, e.g. exchange of annual report, visit each other, etc.?

Q9: International, regional and bilateral cooperation on legal metrology

Have your staffs ever participated in any international, regional or bilateral cooperation concerning legal metrology, e.g. hosting training courses, seminars, meetings, participating in international/regional meetings, etc.? If so, please indicate them.

Q10: Technical supports from oversea donors for legal metrology.

- 1) Have you ever received any support from oversea donors, e.g. from PTB, AusAID, KOICA, NZAID, etc.? If so, please

indicate them

2) Do you have any future plan to receive technical supports from oversea donors? If so, please indicate them.

Q11: Problems to be solved

Are there any problems or difficulties concerning development of legal metrology? How does your organization (laboratory) overcome those problems?

Q12: Any request to the international/regional legal metrology organizations and oversea donor organizations

Do you have any requests to international/regional metrology organizations or international donors in the fields of legal metrology? If any, please indicate them.

Thank you very much for your cooperation.

Appendix D Collection Data List

Appendix D: Collection Data List

Title	Issuing Organization	Remarks
Cambodia		
Asia-Pacific Legal Metrology Forum - Circular 47 Jan.2005	APLMF	Catalogue
Country Report of Kingdom of Cambodia	Ministry of Industry, Mines and Energy	Leaflet
Department of Metrology (DOM)	Department of Metrology (DOM)	Catalogue
Lao		
Division of Standards & Quality	DISM/STEA	Catalogue
Metrology Division	- ditto -	Catalogue
Lao PDR Economic Monitor	The World Bank	Catalogue
Myanmar		
Earth Group of Companies Profile	Earth Trading Co., Ltd.	Catalogue
Outline of JICA Myanmar Office	JICA Myanmar Office	Leaflet
Technology for Safety & Reliability	Earth Industrial (Myanmar) Co., Ltd	Leaflet
Transformer	SOE Electric & Machinery Co., Ltd.	Catalogue
Vietnam		
Directorate for Standards and Quality – STAMEQ	Bureau of Accreditation	
Missions of the National Metrology Institute	National Metrology Institute	Leaflet
Prosperity Through Quality - STAMEQ	Directorate for Standards and Quality	Catalogue
Indonesia		
Chemistry for Better Life	Lembaga Ilmu Pengetahuan Indonesia (LIPI)	Catalogue
MM 2100 Industrial Town	Marubeni Corporation	Catalogue
Philippines		
Department of Science and Technology	Department of Science and Technology	Catalogue
Techno Bulletin	Industrial Technology Development Institute (ITDI)	Leaflet
National Metrology Laboratory	- ditto -	Leaflet
Malaysia		
Department of Standards Malaysia Application Kit	Skim Akreditasi Makmal Malaysia (SAMM)	Leaflet

Title	Issuing Organization	Remarks
National Metrology Laboratory	National Metrology Laboratory	Catalogue
Malaysia	Ministry of Domestic Trade and Consumer Affairs	Power Point
Metrology News	SIRIM	
Better Standards for Better Life	- ditto -	
Greeting from the Senior General Manager	- ditto -	
Towards Achieving Traceability in Chemical Measurement	- ditto -	
The World of Standards	Department of Standards Malaysia (DSM)	Catalogue
Commemorative Moment of DSM 1996-2006	- ditto -	Catalogue
Standards & Accreditation News	- ditto -	Booklet
Thailand		
DENSO Thai DENSO Group Outline	DENSO International (Thailand) Co., Ltd.	
Development-Calibration-Accuracy-Lab. Calibration Section	- ditto -	Power Point
National Institute of Metrology Ministry of Science and Technology	National Institute of Metrology Ministry of Science and Technology	Catalogue
NIMT Project – Results, Subjects, Prospects -	- ditto -	Power Point
Metrology Info	- ditto -	Catalogue
Metrology Demands for ASEAN Economy	- ditto -	Catalogue
History of Metrology in Thailand	- ditto -	Power Point
TPA Newsletter	TPA	Leaflet
Translation of the Weights and Measures Act B.E.2542	General Bureau of Weights & Measures	Catalogue
Guide to JTECS and TPA	JTECS/TPA	Catalogue
The Legal Metrology in Thailand	Ministry of Commerce	Catalogue
The National Standards Body of Thailand	Thai Industrial Standards Institute, Ministry of Industry	Catalogue
Thai Laboratory Accreditation Scheme (TLAS)	TLAS	Power Point
Thai-Nichi Institute of Technology	Technology Promotion Association	Power Point
National Metrological System Development Act, B.E.2540		Leaflet
Ministry of Science and Technology	MOST	Catalogue
Singapore		
Enterprise Today	SPRING	Catalogue
Standards and Conformance for Business Growth	- ditto -	Catalogue

Title	Issuing Organization	Remarks
Business Excellence Awards 2006	- ditto -	Catalogue
Making it BIG is SMEs	- ditto -	Catalogue
Enabling Enterprise	- ditto -	Catalogue
National Accreditation Programme	- ditto -	Catalogue
National Accreditation Framework	- ditto -	Power Point
The Validation and Calibration Link	Mogas Flow Lab	Catalogue

Appendix E Record of Seminars

Appendix E: Record of Seminars

No.	Date	Measurement Quantity	Short-Term Expert	Counterpart	Title	No. of Participant
1	Feb. 11, 2003	Radiation Thermometer Standard	Dr. Fumihiko SAKUMA	Mr. Narudom Noujkow	Seminar on Measurement Standards and Calibration Service 1. Radiation Thermometer and Calibration in Japan : Dr. Sakuma 2. Establishment of Radiation Thermometer Standards in Thailand : Mr. Narudom	29 persons
2	Feb. 13, 2003	Plug and Ring Standard	Mr. Kazuo TOMIYAMA	Mr. Samana Piengbangyang	Seminar on Measurement Standards and Calibration Service 1. Japanese Traceability system of Diameter Standard: Mr. Tomiyama 2. Calibration of Ring Gauge using Optical Inner Diameter Measuring : Mr. Samana	46 persons
3	Feb. 28, 2003	Roundness Standard	Mr. Yuji WAKABAYASHI	Mr. Samana Piengbangyang	Seminar on Measurement Standards and Calibration Service 1. Current Situation of Roundness Measurement : Mr. Wakabayashi 2. Calibration of Roundness Tester using Indexing Table : Mr. Samana	21 persons
4	Apr. 2, 2003	Wavelength Standard	Mr. Jun ISHIKAWA	Ms. Monludee Ranusawat	Seminar on Measurement Standards and Calibration Service 1. Current Situation of Wavelength Standard in National Metrology Institute : Mr. Ishikawa 2. Establishment of Length Standard and Traceability system in Thailand : Mr. Anusorn 3. Establishment of Wavelength Standard and Uncertainty measurement of Iodine Stabilization He-Ne Laser : Ms. Monluddee	72 persons
5	Apr. 9, 2003	Acoustics Standard	Mr. Hiroaki NOMURA	Miss Surat Pattarachindanuwong	Seminar on Measurement Standards and Calibration Service 1. Technical Transfer to NIMT on Acoustics : Mr. Nomura 2. Verification of SLM and Sound Calibration : Miss Surat	38 persons
6	May 6, 2003	Hardness Standard	Mr. Hajime ISHIDA	Mr. Tassanal Sanponpute	Seminar on Measurement Standards and Calibration Service 1. Rockwell Hardness Measurement and Calibration : Mr. Ishida 2. Rockwell Traceability System of Thailand: Mr. Tassanal	19 persons
7	May 7, 2003	Hardness Standard	Mr. Hajime ISHIDA	Mr. Tassanal Sanponpute	Seminar on Measurement Standards and Calibration Service 1. Rockwell Hardness Measurement and Calibration : Mr. Ishida 2. Rockwell Traceability System of Thailand: Mr. Tassanal	104 persons
8	Dec. 12, 2003	AC Power and Calibration	Mr. Masao YAMAWAKI	Mr. Sittisak Pimsut	Seminar on Measurement Standards and Calibration Service 1. Current Situation of AC Power Standard in JEMIC : Mr. Yamawaki 2. AC Power Calibration Method in JEMIC: Mr. Sittisak	107 persons

No.	Date	Measurement Quantity	Short-Term Expert	Counterpart	Title	No. of Participant
9*	Jan.27, 2004	Acoustics Standard	Mr. Takeshi FUJIMORI	Ms. Surat Pattarachindanuwong	Seminar on Measurement Standards and Calibration Service 1. Current Situation of Acoustics Standard in Japan : Mr. Fujimori 2. Acoustics Standard and Calibration Service in Thailand : Mr. Virat 3. Calibration Technique of Sound Level Meter and Acoustical Calibrator at NIMT : Ms. Surat	50 persons
10*	Jan.27, 2004	Wavelength Standard	Mr. Jun ISHIKAWA	Ms. Monludée Ranusawud	Seminar on Measurement Standards and Calibration Service 1. Length Standard today : Mr. Ishikawa 2. The Open Laser Project : Mr. Ishikawa 3. Calibration Technique of Wavelength Standard in NIMT : Ms. Monludée 4. Calibration Service of Gauge Block in Thailand : Mr. Anusorn	191 persons
11*	Feb. 24, 2004	Geometrical Standard	Dr. Sonko OSAWA	Mr. Narin Chanthawong	Seminar on Measurement Standards and Calibration Service 1. Dimensional Metrology in NMIJ : Dr. Osawa 2. Gauge Calibration Technique Using a CMM : Dr. Osawa 3. Calibration Techniques of Gear Wheel Using CMM in NIMT : Mr. Narin 4. Calibration Service of CMM in Thailand : Mr. Anusorn	184 persons
12*	Feb. 24, 2004	DC High Voltage Standard	Mr. Tomeji IGUCHI	Mr. Danai Pattarakijkul	Seminar on Measurement Standards and Calibration Service 1. Current Situation of DC High Voltage Standard in Japan : Mr. Iguchi 2. Traceability of DC Voltage up to 1kV in Thailand : Ms. Alchana 3. Calibration Technique of DC High Voltage Standard in NIMT : Mr. Danai	83 persons
13	Apr. 22, 2004	RF/Microwave Measurement Standards	Ms. Keiko SATO	Mr. Charat Wichianmongkonkul	Seminar on Measurement Standards and Calibration Service 1. RF Power and RF Voltage Traceability system in JQA : Ms. Sato 2. RF&Microwave Measurement Fundamentals : Ms. Sato 3. Calibration Technique of RF Power and Calibration Services at NIMT : Mr. Charat	76 persons
14	Aug. 20, 2004	Roughness Standard	Dr. Kazuya NAOI	Mr. Samana PhengBanyang	Seminar on Measurement Standards and Calibration Service 1. Trend of Calibration Technique for Surface Texture Measurement Standards : Dr. Naoi 2. Establishment of Roughness Standard and Calibration Service in NIMT : Mr. Samana 3. Roughness Calibration in NIMT : Mr. Muhammad	61 persons
15	Sep. 23-24, 2004	Calibration Procedure	Mr. Katsuburo KANO		Seminar on Introduction to Accreditation 1. What is Accreditation 2. Outline of ISO/IEC 17025	78 persons

No.	Date	Measurement Quantity	Short-Term Expert	Counterpart	Title	No. of Participant
16*	Jan. 26, 2005	ASEAN Seminar			Plenary lecture 1. JQA Activities for Promoting Industries : Mr. Yamasaki 2. Harmonization of Hardness Standards in the World : Mr. Takagi 3. How to Strengthen Metrology in Chemistry System in ASEAN : Dr. Chamarong 4. World Trends of Resistance Standard : Dr. Kinoshita 5. Metrology Demands for ASEAN and APMP DEC : Dr. Plan 6. Current Situation of JICA/NIMT Project : Dr. Akimoto 7. Importance of the Measurement and Intellectual Infrastructure in Modern Society : Ms. Nakamura	287 persons
17*	Jan. 26, 2005	Hardness Standard	Mr. Satoshi TAKAGI	Mr. Tassanal Sanponpote Ms. Rugkanawan Wongpithayadisai Mr. Montree Pakkratoke Dr. Khanchai Kosonthongkee	Seminar and Workshop on Measurement Standards and Calibration Service 1. Verification of Indenters for Hardness Standards : Mr. Takagi 2. Calibration Service of Hardness Standard in Vietnam : Mr. Sanh Vo 3. Establishment of Hardness standard in Thailand : Mr. Veera	74 persons
18*	Jan. 26, 2005	Chemical Standard	Dr. Akira NOMURA	Dr. Preeyaporn Pookrod Mr. Bunthoon Loangsi Ms. Nongluck Tangpaisarnkull	Seminar and Workshop on Measurement Standards and Calibration Service 1. Metrology in Chemistry and Certified Reference Materials : Dr. Nomura 2. Calibration Service of Chemical Standard in Malaysia : Mr. Khirul Anuar Mohd 3. DISM Activities in Laos : Mr. Singsonexay Vleangkham 4. Recent Activities of Metrology in Chemistry in NIMT : Dr. Preeyaporn	101 persons
19*	Jan. 26, 2005	Resistance Standard	Dr. Joli KINOSHITA	Ms. Natenapit Chookunthom	Seminar and Workshop on Measurement Standards and Calibration Service 1. Dissemination of DC Resistance Standards in Thailand : Mrs. Aichara 2. SPRING Singapore Resistance Standards Calibration Service : Mr. Ang Chee Klang 3. Calibration Service of Resistance Standard in Vietnam : Mr. Dien Khac Tran 4. How to Maintain Group of 1 Ohm Standard : Ms. Natenapit	76 persons
20	Feb. 16, 2005	Angle Standard	Dr. Tsukasa WATANABE	Mr. Wacharin Samit	Seminar on Measurement Standards and Calibration Service 1. Angle Standard Present condition of National Institute of Metrology (NMI) : Dr. 2. Angle Traceability System in Japan : Dr. Watanabe 3. Autocollimator Calibration System at NMJ : Dr. Watanabe 4. Rotary Encoder Calibration System at NMIJ : Dr. Watanabe 5. The Calibration Method of Polygon Mirror : Mr. Wacharin 6. The Calibration Method of Angle Gauge Block : Mr. Wacharin 7. Angle Measurement with a Sine Bar : Mr. Wacharin 8. Angle Traceability System in Thailand : Mr. Anusorn	73 persons

No.	Date	Measurement Quantity	Short-Term Expert	Counterpart	Title	No. of Participant
21	Mar. 28, 2005	RF Attenuation	Mr. Shigeru IGARASHI	Mr. Charat Wichianmongkonkun	Seminar on Measurement Standards and Calibration Service 1. The Handling Method in High Frequency Equipments : Mr. Igarashi 2. Callibration Service of RF Attenuation in JQA : Mr. Igarashi 3. Callibration Techniques and Uncertainty of RF Attenuation Measurement : Mr. Charat	78 persons
22	Jul. 18, 2005	Flatness Standard	Dr. Toshiyuki TAKATSUJI	Mr. Muhammad Madden	Seminar on Measurement Standards and Calibration Service 1. World Trend of Flatness Standard: Dr. Takatsuji 2. Establishment of flatness standard by measure of relative methods: Dr. Takatsuji 3. Application of Interferometer techniques to metrology: Mr. Anusorn 4. Establishment for Thailand flatness standard: Mr. Muhammad	45 persons
23*	Nov. 30, 2005	ASEAN Seminar			Plenary lecture 1. Development and maintenance of Measurement Standards-Today and Future in Japan: Ms. Nakamura 2. Recent Activity of CCL: Dr. Matsumoto 3. "e-trace" New Dissemination System for Measurement Standards: Dr. Yoshida 4. World Trends of Vibration and Acceleration Standard: Mr. Ota 5. World Trends of Time and Frequency Standard: Dr. Suzuyama 6. Compact, Low-cost, and Programmable Josephson Voltage Standards System : Dr. Shoji 7. How to make ASEAN Measurement Recognizable: Dr. Pian	183 persons
24*	Nov. 30, 2005	e-trace	Dr. Haruo YOSHIDA Dr. Hitoshi SASAKI	Mr. Chalit Kumtawee	Seminar and Workshop on Measurement Standards and Calibration Service 1. Josephson Voltage Standard for "e-trace": Dr. Yoshida 2. Compact Primary AC-DC Transfer Standard for e-trace Calibration: Dr. Sasaki 3. International Comparison of AC/DC Transfer Standard: Mr. Chalit	84 persons
25*	Nov. 30, 2005	Time and Frequency Standard	Dr. Tomonari SUZUYAMA	Mr. Somchai Nuamsettee	Seminar and Workshop on Measurement Standards and Calibration Service 1. Frequency Remote Calibration using GPS Common View Method at NMIJ :Dr. Suzuyama 2. Time and Frequency Activities at NMI, SIRIM Berhad, Malaysia: Mr. Ahmad Sahar 3. Time Transfer in Thailand: Mr. Somchai	40 persons
26*	Nov. 30, 2005	Vibration and Acceleration Standard	Mr. Akihiro OTA	Mr. Pairoj Rattanangkul	Seminar and Workshop on Measurement Standards and Calibration Service 1. Recent Progress of Vibration and Acceleration Standard in Japan: Mr. Ota 2. Vibration Standards and Calibration Services. SPRING Singapore :Mr. Chan Chee Keong 3. Vibration Standards and Calibration Services of Vibration in Thailand: Mr. Virat	48 persons
27	Mar. 23, 2006	pH Standard	Dr. Susumu NAKAMURA	Ms. Nongluck Tangpaisarnkul	Seminar on pH Measurement 1. Development of Metrology for pH Measurement in Thailand: Dr. Chaiarong 2. Measurement of Hydrogen Ion Activity using the Harned Cell: Dr. Nakamura 3. How to Measure pH Value Accurately by Secondary Methods: Dr. Nakamura 4. pH Meter Calibration: Ms. Nongluck	96 persons

No.	Date	Measurement Quantity	Short-Term Expert	Counterpart	Title	No. of Participant
28	Apr. 3, 2006	Humidity Standard	Mr. Yoshihiro IMURA	Ms. Thasorn Sinhaneti	Seminar on Humidity Measurement 1. Two - Pressure Generator Standard : Mr. Imura 2. Hygrometer Calibration in Thailand : Ms. Thasorn	44 persons
29	Aug. 18, 2006	Inorganic and Organic Standard Solutions	Dr. Akiharu HIOKI	Ms. Nongluck Tangpaisankul	Seminar on Inorganic and Organic Standard Solutions 1. Metrology in Chemistry in Thailand - Past, Present and Future : Dr. Chainarong : Dr. Hloki 2. Overview and International Situation on Elemental Standard Solutions and Titrimetry 3. Practice on Elemental Standard Solutions at NIMT : Ms. Nongluck	57 persons
30	Aug. 18, 2006	Inorganic and Organic Standard Solutions	Mr. Katsuhiko HIGUCHI	Dr. Preeyaporn Pookrod	Seminar on Inorganic and Organic Standard Solutions 1. Overview and International Standard on Organic Standard Solutions and Chromatography : Mr. Higuchi 2. Practice on Organic Standard Solutions at NIMT : Dr. Preeyaporn	57 persons

Remark:

* ASEAN Seminar