Thailand

Ex-Post Evaluation of Japanese ODA Loan Project
"National Metrology System Development Project (I) (II)"

Nobuyuki Kobayashi, OPMAC Corporation

1. Project Description

Project Site

Calibration Equipment procured by the project

1.1 Background

After the 1980s, the manufacturing sector in Thailand led economic growth. In the last half of the 1990's, however, the sector faced the necessity of producing more high value-added products for competitiveness in the export market. In order to facilitate trade, international quality inspection tended to become more simplified in the last half of 1990s. During this time, national metrological institutes strived to improve the equivalence of national standards[1] and the establishment of internationally acceptable metrological standards for the export of industrial products was urgent. In Thailand, several institutes set and maintained national standards but only in a few categories and the accuracy of calibration services[2] were unsatisfactory. As reliable calibration services were not available in Thailand, calibration laboratories and corporations used calibration services for their equipment outside the country. However, shipping equipment abroad involved high costs and often damaged equipment.

The National Institute of Metrology (Thailand) (thereafter, NIMT) was established under the Ministry of Science[3], Technology and Environment in 1998. The foundation of NIMT aimed at the establishment of an internationally acceptable metrological standard system. NIMT required calibration equipment covering major metrological categories, a laboratory building which could satisfy the testing environment, and the development of human resources to utilize the equipment. This project supported NIMT in the procurement of equipment and a laboratory building over two phases of yen loans. The Project on the Technical Strengthening of the National Institute of Metrology (Thailand) phases 1/2 (thereafter "the coordinated technical cooperation project"), was a technical cooperation project implemented cooperatively, utilizing calibration equipment for human resource development in metrology.

[1] Metrology standards are standards for units to measure length, weight, time, electric current, and so on.
[2] Calibration is a procedure to assess errors of measurement equipment and prove differences from accurate readings and the uncertainty of measurement.
[3] The name of the executing agency at the time of appraisal

1.2 Project Outline

The objective of this project is to establish national metrological standards by the construction of NIMT's building and the installation of equipment such as meters thereby contributing to the competitiveness of the manufacturing sector in Thailand.

	Phase I	Phase II
Approved Amount / Disbursed Amount	722million yen /691 million yen	2,202 million yen /2,201million yen
Exchange of Notes Date / Loan Agreement Signing Date	September 1999 / September 1999	September 2000 / September 2000
Terms and Conditions	Interest Rate: 0.75% Repayment Period: 40 years (Grace Period: 10 years), Conditions for Procurement: Partial untied (Consulting Service: Bilateral untied)	Interest Rate: 0.75%; Repayment Period: 40 years (Grace Period: 10 years); Conditions for Procurement: Bilateral untied (Consulting Service: Bilateral untied)
Borrower / Executing Agency(ies)[4]	The Kingdom of Thailand /Ministry of Science and Technology[5]	The Kingdom of Thailand /Ministry of Science and Technology[6]
Final Disbursement Date	January 2006	January 2008
Main Contractor (Over 1 billion yen)	-	-
Main Consultant (Over 100 million yen)	Nikken Sekkei Ltd.(Japan)・ PADECO Co., Ltd.(Japan)・ Environmental Engineering Consultants (Thailand)	-
Feasibility Studies, etc.	None	
Related Projects	JICA "The Project on the Technical Strengthening of National Institute of Metrology (Thailand)"	

[4] Name of the executing agency at the time of the ex-post evaluation
[5] NIMT is directly in charge of the implementation, operation and management of this project.
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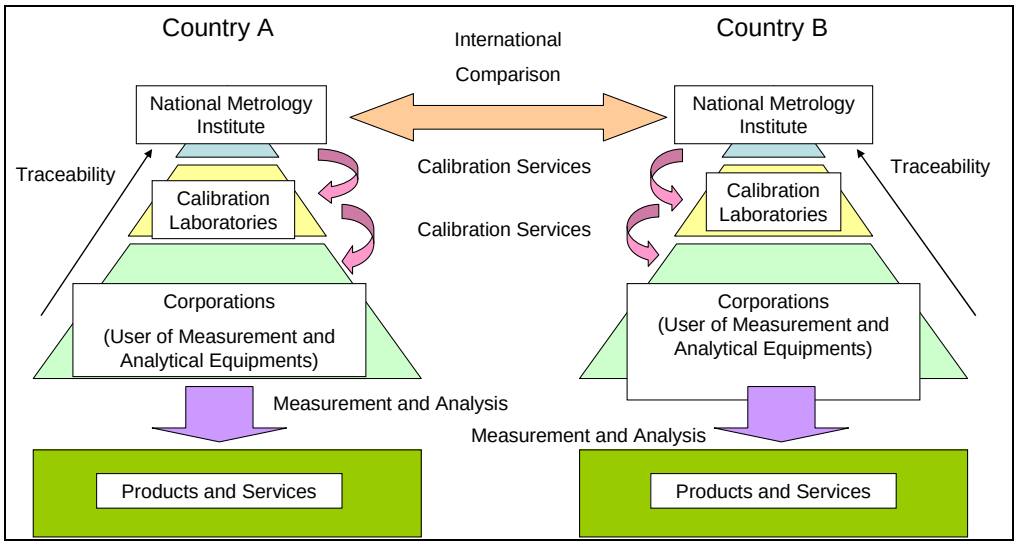
[Column 1] Overview of National Metrology System



A national metrology institute sets and maintains national standards at the apex of a national metrological system. In 1999, the Metric Convention countries, including Thailand, signed the global mutual recognition arrangement of metrological standards. Under the arrangement, National metrological institutes compare their Calibration and Measurement Capabilities (CMC) and strive to establish an equivalence of national standards among the different countries. In the event that CMC prove the equivalence, the calibration certification of other countries is equally treated with the domestic one.

Using national standards, a national metrological institute provides calibration services such as the calibration of metrological standards, the provision of reference material, and the issuance of calibration certificate. With standard instruments, reference materials, and measurement equipment which are provided by a national metrological institute, calibration laboratories provide calibration services for measurement and analytical equipment owned by end users. The accuracy of measurements and analytical equipment is secured via the chain of calibration services beginning with the national standards; from this, an appropriate metrological standard system is established. If the chain of calibration reaches national standards, it is considered that the equipment has traceability to national standards.

In recent years, manufacturers are required to obtain ISO 9001 (quality management system accreditation) for international trade. ISO 9001 demands that corporations make their equipment traceable to international or national standards. For this reason, the establishment of a national metrological system which maintains traceability is a critical issue for the promotion of exports.

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: November 2009 – August 2010
Duration of the Field Study: February 7th, 2010 – March 4th, 2010 and May 16th, 2010 – May 20th, 2010

2.3 Constraints during the Evaluation Study

None

3. Results of the Evaluation (Overall Rating: A)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plan of Thailand

At the time of appraisal, the necessity for a metrological standards system was adequately recognized. The National Metrological System Development Act was approved in August 1997. Based on the act, NIMT was established under the Ministry of Science, Technology and Environment. The act defined NIMT's roles including (1) research and studies on metrology, (2) the provision of calibration services and (3) the development of calibration laboratories in the private sector. In order to set policy goals for the development of national metrology standards, the Thai cabinet approved the Master Plan on the National Metrology System Development. The strategy for the development of a national metrology system laid down that NIMT, at the core of the system, would carry out the technological transfer to the private sector.

At the time of the ex-post evaluation, the National Metrological System Development Act in 1997 was still effective and placed NIMT as the main body to develop metrology standards. Reflecting past developments of national metrology standards, the cabinet approved the Master Plan on the National Metrology System Development (Second Phase) in November 2009. The policy goals of the plan include: (1) the development of NIMT and its network (2) the development of calibration and testing laboratories, (3) the expansion of calibration service clientele and (4) the promotion of international activities.

At the times of both the appraisal and ex-post evaluation, NIMT was the main body developing metrological standards and transferring knowledge to the private sector. There has been no significant change in this policy. This project supported the equipment indispensable for NIMT's attainment of knowledge in metrology and the provision of calibration services. Thus, this project has been relevant with the development plan of Thailand.

3.1.2 Relevance with the Development Needs of Thailand

The Metric Convention countries, including Thailand, signed the global mutual recognition arrangement of metrological standards (CIPM MRA) in October 1999. The objective of CIPM MRA is to facilitate trade by the simplification of quality inspection. In order to accept calibration certifications issued in other countries, metrological standards need to satisfy certain requirements. CIPM MRA establishes a scheme to compare the Calibration and Measurement Capabilities among national metrology institutes (international comparison).

There have been minor adjustments to CIPM MRA since its signing. The objective of CIPM MRA, however, remains intact. Following the arrangement, national metrology institutes actively conduct international comparison. At the time of ex-post evaluation, Thailand is still a signatory of CIPM MRA and NIMT participates in international comparison of metrology.

At the time of appraisal, NIMT was required to prove, by participating in international comparison, that it had adequate capabilities. At the time of the ex-post evaluation, Thailand

needs to establish and maintain an internationally acceptable metrological standard system in order to promote international trade. The project has been consistent with the development needs of Thailand as the equipment procured by the project is used for international comparison.

3.1.3 Relevance with Japan's ODA Policy

At the time of appraisal, Japan's Official Development Assistance Charter (1992) referred to the close relationship between Japan and East Asia, including ASEAN, and placed a special emphasis on assistance to the Asian region. It also respected human resource development. Moreover, in the ODA Annual Report for FY 1998, the country assistance strategy for Thailand regarded the establishment of economic infrastructure as one of the priority areas. It paid an attention specifically to (1) the development of human resources in science and technology for more sophisticated industry and (2) the development of supporting industries to cover a wider range of industries.

The project has been consistent with Japan's ODA Policy. It has been implemented cooperatively with the technical cooperation, nurturing specialists who can set and maintain metrological standards. Indirectly, therefore, it also supports human resource development. Calibration laboratories, NIMT clients, provide critical services for standardized products and support economic activities in Thailand.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

This project financed NIMT for (1) the procurement of calibration equipment, (2) the construction of a laboratory building, and (3) consulting services. Advisors redefined the categories of equipment, reflecting on technological innovations in calibration equipment, NIMT staff capabilities and the scope of the coordinated technical cooperation project, (see Table 1). The increase in the types of equipment is mainly due to reference materials.

Table 1: Changes in the procured equipment

	Categories under the Project
At the time of appraisal (September 1999)	Items: 329 types The procurement of equipment is for 41 categories as follows: Time & Frequency, DC Voltage, DC Current, AC Voltage, AC Current, Power, Energy, Inductance, Resistance, Capacitance, RF Voltage, RF & Microwave Power, Laser Power Measurement, Mass, Temperature (3 types), Humidity, Length, Diameter, Roundness, Straightness, Angle, Roughness, CMM, Flatness, Sound Pressure Level, Accelerometer, Microphone Sensitivity, Reference Material, Luminous Flux, Luminous Intensity, Spectral Irradiance, Magnetics, Force, Flow, Density, Air Flow, Pressure & Vacuum, Photometry, Distribution Temperature
At the time of ex-post evaluation (May 2010)	Items: 397 types The procurement of equipment is for 36 categories. Changes are following: Add: Wavelength, AC-DC high Voltage, Hardness Regroup: Luminous Flux, Luminous Intensity, and Spectral Irradiance are covered by the equipment in Photometry. Cancel: Energy, Flow, Air Flow, Density, Distribution Temperature*

Source: the appraisal document for the phase 1 project, NIMT

Note: *On Distribution Temperature, NIMT procured the equipment with its own budget.

The laboratory building was constructed in the province of Pathumthani as originally planned. Consulting services covered project management, the detail design of the laboratory building, and construction supervision. The scope of consulting services is almost as planned. In addition, advisors were hired for the selection of equipment and the basic design of the laboratory building. However, the consulting services did not include project management in phase II as NIMT founded a project management unit.

Photo 1: Laboratory

3.2.2 Project Inputs

3.2.2.1 Project Period

The project period was significantly longer than planned (194% of the planned period). The delay was mainly due to construction and the prolonged procurement of calibration equipment. Bilateral ties were applied to the procurement of equipment but the equipment to be procured contained some which were manufactured in countries other than Japan and Thailand. For this reason, International Competitive Bidding (ICB) was applied in principle. At the implementation phase, there was no bid at all for some equipment and some unit price surpassed the price estimate. As a result, other procurement methods such as international shopping and direct contracting were also applied. Long-term experts in the coordinated technical cooperation project supported NIMT in the preparation of the technical specification documents for equipment, the obtaining and comparison of requests for proposal.

Table 2: Details of project period

	Plan	**Actual**
Lion Agreement Signing (Phase I)	September 1999	September 1999
Consulting Services	July 2000 – April 2003	July 2000 – August 2005
Construction of Building	December 2001 – April 2003	September 2003 – August 2005
Procurement and Installation of Equipment	February 2000 – December 2003	May 2001 – January 2008
Project Completion (End of Procurement and Installation of Equipment)	December 2003 (52 months)	January 2008 (101 months)

Source: NIMT, the appraisal document for the phase 2 project

3.2.2.2 Project Cost

The project cost was lower than planned (91% of the planned cost). The cost of equipment increases substantially even when the change of project scope (329 types of item at the appraisal, 397 types of item at the ex-post evaluation) is taken into consideration. This is due not only to an increase in the types of item but also to an increase in unit price. For some equipment, the price estimate at the appraisal did not include additional costs such as shipping and installation fees.

Table 3: Breakdown of project cost

(Unit: million yen)

	Plan*	Plan (Adjusted)**	Actual
Construction of Building	1,118	1,118	899
Procurement of Equipment	1,266	1,528	1,750
Consulting Services	370	370	243
Contingency	170	170	-
Total	2,924	3,186	2,892

Source: NIMT

Note 1: *Given that the yen loan portion is above 70 % and that a fair comparison of other portion is difficult, the above analysis covers the yen loan portion only.

Note 2: **Project cost is adjusted in accordance with the number of item types from 329 to 397 (an approx. 21% increase)

Although the project period was significantly longer than planned, the project cost was lower than planned, therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Number of parameters which NIMT can calibrate

The number of parameters which NIMT can calibrate increased substantially during project implementation. In 2008, the scheduled project completion, they reached the target set at the appraisal. Although the project period was prolonged, NIMT meanwhile acquired the ability to provide calibration services in more categories.

Table 4: The number of parameters which NIMT can calibrate

At the time of appraisal (Phase II)		At the time of ex-post evaluation	
Actual (2000)	Target (2004)	Actual (2008)*	Actual (2010)
53	179	250	261

Source: NIMT

Note: * The target in 2004 (project completion in the original schedule) was set for appraisal .For fair analysis, the target is compared with the actual figure in 2008 (project completion in the actual schedule).

(2) Number of ex-house calibration services

As the effect indicator set at the appraisal was not constantly monitored, reliable and comparable data is unavailable. Therefore, an alternative indicator which can allow time series comparison has been selected. The percentage increase of the effect indicator (the number of calibration services) is used as an approximate target. The number of ex-house calibration services grew approximately 200% (see Table 5). For the same period, the number of calibration certificates issued by NIMT recorded a substantial increase. A rigorous analysis on the achievement of the project outcome is difficult. Nevertheless, the before/after analysis clearly shows an increase in calibration services. The calibration services provided by NIMT have strong demand from their clientele.

Table 5: Number of Ex-house calibration services and number of calibration certificates

	Actual (2000)	Actual (2008)	% Increase	Target*	Actual (2009)
Calibration services (Pieces)	1,156	3,465	199.7%	66.8%	3,991
Calibration certificates	1,127	1,765	56.6%	N/A	1,934

Source: NIMT
Note: *The percent increase in the number of calibration services (total of primary and secondary) from 2000 to 2004. This was estimated at the time of the appraisal.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

On both the Financial Internal Rate of Return and the Economic Internal Rate of Return, it is not feasible to estimate the benefit that can be attributed to the project. As the internal rate of return was not calculated at the appraisal, it has not been recalculated at the ex-post evaluation.

3.3.2 Qualitative Effects

(1) Use of Equipment

The use of equipment, mainly expensive equipment[7], is assessed on the basis of interviews with NIMT laboratory staff. The equipment is being used for in-house and/or ex-house calibration services and international comparison or under examination for effective use. Among the equipment, ICP/MS, LC/MS/MS are used for the producing of Certified Reference Materials (CRMs). The time and frequency system has a strong demand as a new regulation requires the companies which charge customers on a time basis to make the measurement of time more accurate. At the time of the ex-post evaluation, the equipment not in use for calibration services was as follows:

Photo 2: Analysis instrument (NOx, SO_2, CO, etc.)

(i) Shore Hardness Testing Machine

There was a methodological change in the measurement of hardness. As clients do not need to measure Shore hardness, opportunities to utilize this equipment have diminished. This equipment, however, will be utilized to provide the calibration service on Leeb hardness by the research work starting in 2013.

(ii) Spectroradiometer

NIMT has been able to provide calibration services for spectral irradiance calibrations of customers' lamps from the beginning of 2008 using the spectoradiometer system. However, there is no secondary laboratory that can provide further calibration service to the end users while there is a lot of demand, especially from the research areas of solar radiation and solar cells. Therefore, NIMT is establishing secondary calibration systems for calibration of radiometers and spectroradiometers and tentatively these two secondary systems will be opened for services by the end of 2011.

(2) Focus Group Discussion for NIMT staff

In order to obtain NIMT staff opinions on the incidence of project effects, a focus group discussion for laboratory staff was conducted (See Column 2).

[7] Price estimate is above 20 million yen; 15 types of item

[Column 2] Results of focus group discussion
Date : February 23, 2010
Place : NIMT headquarters (Province of Pathumthani)
Topic : "How does the equipment provided by the project contribute to the better performance of calibration laboratories and companies?"
Participants : NIMT laboratory staff (one session, 5 persons)

After discussing the above topic, participants were requested to vote for three most agreed-upon opinions. Results were as follows:

Table 6: Results of focus group discussion

Opinion	No. of Votes
NIMT clients can reduce the cost of calibration for equipment and metrological standards	3
NIMT can provide calibratation services to its clients in more parameters.	3
Best Measurement Capability (accuracy) is improved.	3
Traceability is established.	2
Metrologists' knowledge and skills are enhanced	1
Technical knowledge is created.	1
Total (excluding two ineffective votes)	13

Participants regarded cost reductions in calibration services, calibration services in more parameters, and the improvement of accuracy as benefits of the procured equipment. The number of parameters which NIMT can calibrate is shown in "3.3.1.1 Results from Operation and Effect Indicators (1) Numbers of parameters which NIMT can calibrate". NIMT staff consider that the procured equipment has contributed to this increase.

(3) Interviews with calibration laboratories
Interviews with calibration laboratories (three private companies) supposed to have benefitted from the project were carried out in this ex-post evaluation. NIMT directly provides calibration services to all of the laboratories. All interviewees agreed that NIMT can provide calibration services in a much wider range than in the late-90s and that the calibration at NIMT takes less time. Some clients also explained that they do not send equipment to other countries as calibration in Thailand reduces cost. Calibration laboratories expect NIMT to reduce the time needed for calibration. Referring to uneven accuracy (the range of uncertainty) among laboratories, one client expressed a wish that NIMT played a proactive role in guidance for further accuracy in calibration.

This project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended Impacts

(1) Accreditation of ISO/IEC17025
The number of ISO/IEC 17025-accredited[8] calibration laboratories increased from 13 laboratories in 1999 (at the time of appraisal) to 106 laboratories in March 2010[9]. NIMT contributes to the development of calibration laboratories by (1) providing affordable and

[8] ISO/IEC17025 is an international standard for testing and calibration laboratories. The accreditation requirement includes technical capability as well as quality management.
[9] The number of calibration laboratories accredited by Thai Industrial Standard Institute

accurate calibration services in a reasonable period to calibration laboratories and (2) utilizing knowledge of metrology and arranging seminars and comparison among calibration laboratories. An ISO/IEC 17025 accredited laboratory can put an accreditation symbol on its calibration certificate. Companies can then show that they use accurate measurement and analytical equipment in their business operations in the internationally acceptable manner. The increase in accredited calibration laboratories suggests that appropriate calibration services are more readily available.

(2) Number of CMC mutually approved under CIPM MRA
NIMT participates in international comparison as stipulated in CIPM MRA. NIMT's CMC for 8 parameters was approved in 2003. Since then, the number of approved parameters has been gradually increasing (see Table 7).

Table 7: Number of the approved CMC

	2003	2004	2005	2006	2007	2008	2009
Parameters	8	8	8	14	14	14	17
Lines	313	313	313	343	343	343	356

Source: NIMT

At the end of 2009, NIMT's CMC had been approved in 17 parameters. The breakdown of these parameters is 6 parameters in machinery, 8 in electricity and magnetism, 1 in temperature, and 2 in time and frequency. The approval of CMC proves that the national metrology standards in Thailand are equivalent to these in other countries and suggests that the national metrology standards in Thailand are now recognized more widely outside the country.

(3) Interview with calibration laboratory clients
Interviews with calibration laboratory clients (three private companies and one ministry) who are supposed final beneficiaries of the project were carried out in this ex-post evaluation. Several interviewees also agreed that calibration services were available in more categories than in the late-90s and that calibration services took less time. It can be presumed that these project effects are felt by not only calibration laboratories but also final beneficiaries. There was a view that an increase in the number of calibration laboratories had resulted in a decline in the price of calibration services.

3.4.2 Other Impacts
(1) Impacts on the natural and social environment
According to NIMT, the disposal of toxic waste from NIMT's laboratory was outsourced. In addition, resettlement was not carried out because land acquisition was completed before the commencement of the project. Significant negative impacts on the natural and social environment were not observed during the site survey.

While this project contributes to the prevalence of calibration services and the international recognition of the national metrology standards in Thailand, it is presumed that serious negative impacts do not occur.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance
NIMT was under the supervision of the Ministry of Science and Technology at the time of the ex-post evaluation following reorganization of the ministry. No significant change has been made to the National Metrological System Development Act since the appraisal of this project.

Thus, there is no change in NIMT activities as stipulated in the act.

NIMT can be functionally divided into an administrative section (two departments) and a calibration service section (7 laboratories defined by metrological categories). The number of staff is 183 persons including 5 part-time employees. All laboratory staff work on a full-time basis. According to NIMT, staff turnover is low as few employees resign other than those who retire.

3.5.2 Technical Aspects of Operation and Maintenance

NIMT has 18 Ph.D holders, 78 masters degree holders, and 57 bachelors degree holders. Employees with higher education account for more than a half of NIMT staff. After undergoing basic training, a new employee acquaints herself/himself with calibration in the metrology category of which they are put in charge by OJT. Since NIMT offers 30 training courses to external customers, NIMT staff can participate in these courses. NIMT employees have the qualities requisite for the daily operation of the laboratory.

The coordinated technical cooperation project developed human resources in metrology by training for equipment usage in Japan and Thailand, for the assembly of equipment, the establishment of national metrology standards, and for the review of calibration procedure manuals. The technical cooperation project played a vital role in maintaining the effectiveness and sustainability of equipment. In an interview with laboratory staff (9 staff in 6 metrological categories), some staff said that they faced difficulties in understanding the basic concept of metrological standards. Given these difficulties, it can be concluded that the use of equipment does not automatically result in the establishment and maintenance of metrological standards and the provision of calibration services. According to interviewees, training under the technical cooperation project matches the procured equipment. There was one case (freezing point cell) where it took two years between training in Japan and actual use of equipment due to different technical specifications.

Except for the acoustic and vibration laboratory department, all laboratory departments are in the laboratory building financed by the project. As the acoustic and vibration laboratory department requires an anechoic room, the department is located in a building with such a room situated next to the Ministry of Science and Technology. The maintenance of electrical facilities, air conditioning facilities, fire protection facilities and sanitary facilities is routinely conducted in the laboratory building. Temperature is controlled by the use of air conditioners.

3.5.3 Financial Aspects of Operation and Maintenance

The government general budget accounts for approximately 90% of total revenue, though the calibration service fee is increasing (see Table 8). Income adequately covers indispensable expenses for laboratory operation such as personnel expenses and material costs. Depreciation and amortization, a non-cash expense, accounts for a significant portion of total expenditure. Therefore, there is a cushion in liquidity to absorb a reduction of budget allocation. As the cabinet has recently approved the master plan (second phase), financial support for NIMT activities will continue in the foreseeable future.

Table 8: NIMT Income and Expenditure

(Unit: million Baht)

Item	2006	2007	2008
Income	218.9	220.5	332.9
from government general budget	196.6	194.3	301.7
from calibration services	11.4	13.8	16.6
Expenditure	186.0	225.7	253.5
from depreciation and amortization	75.0	88.9	107.8
from personnel expenses	51.3	62.0	74.6
from materials and others	42.4	55.9	52.5
Net Income	32.9	-5.2	79.4

Source: NIMT

3.5.4 Current Status of Operation and Maintenance

The maintenance of equipment, mainly of expensive equipment[10], is assessed on the basis of interviews with NIMT laboratory staff. There is no serious issue preventing the incidence of project effects.

On the inventory management of equipment, the administration department records and maintains the inventory. As each piece of equipment is assigned an ID number, it is easy to distinguish equipment procured by this project from others. On the calibration of equipment, a sticker which shows the calibration date and the effective date is put on every piece of equipment. There is some low-demand equipment which goes beyond its effective date but most of the equipment has calibration in an appropriate cycle (once a year). A repair service is available for all equipment with calibration demand.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The delay in project implementation was significant. In particular, procurement took much longer period than the original plan had assumed. On the other hand, the project is consistent with the development policy of Thailand, development needs and with Japan's ODA Policy. The incidence of project effects is obvious as the metrological standards system has developed. There are no findings that negatively affect the sustainability of project effects.

In light of the above, this project is evaluated to be (A) highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations for the Executing Agency

The project has contributed to an increase in the number of parameters which NIMT can calibrate and, to some extent, the fostering of calibration laboratories. On the other hand, the uncertainties of parameters widely vary among calibration laboratories.

It is desirable that a comparison among calibration laboratories is promoted, that the accuracy of

[10] Price estimate above20 million yen; 15 types of item

their calibration services is inspected, and that guidance is provided for the improvement of accuracy.

4.2.2 Recommendations for JICA

None

4.3 Lessons Learned

The procurement of this project was bilaterally tied. As the equipment included that which was not produced in Thailand and Japan, the procurement of equipment was based on ICB. There are several types of equipment which surpassed the price estimate and some for which there was no bid. For these reasons, several attempts at tendering resulted in a delay in procurement. For a shorter period for procurement, it is desirable, at appraisal, to assess the size of the procurement package and the procurement procedures. In addition, price estimation needs to include shipping and installation fees. At the implementation phase, the procurement procedure needs to be chosen flexibly, depending on the type of product.

Several performance indicators were selected at the appraisal of this project. During the implementation phase, however, the data for some indicators was not collected due to the cumbersomeness of data collection. It is desirable that performance indicators which are appropriate for the measurement of project effects and can be measured routinely are selected. The use of performance indicators in which the executing agency collects data periodically at appraisal might be appropriate.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs	(1) Calibration Equipment: 329 types (41 categories) (2) Construction: Laboratory building (3) Consultanting Services: - Project Management - D/D of Building - Construction Supervision - Advisory services for equipment selection and B/D of bulding	(1) Calibration Equipment: 397 types (36 categories) (2) Construction: Laboratory building (3) Consultanting Services: -Project Management (Phase I only) -D/D of Building -Construction Supervision -Advisory services for equipment selection and B/D of bulding
2. Project Period	September 1999 – December 2003 (52 months)	September 1999 – January 2008 (101 months)
3.Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 1,522 million yen 2,431million yen (857 million Thai Baht) 3,973million yen 2,924million yen 1 Thai Baht = 2.86 yen (As of April 2000)	 - - - 2,892 million yen 2,892 million yen -