4.1.3.6 Recommendation on enhancement of testing and inspection capacity

(1) Enhancement of testing capacity

For the product certification it is necessary to verify that the products, components and materials for which certification is sought do actually meet the required levels. The target levels which will be required of a given product are specified in the standards, although the required levels and substances will obviously vary depending on the standards applied such as international standards, national standards, industrial association standards and in-house standards. The testing methods to be followed are also indicated in the standards. Therefore testing capacity should be determined by assessing the capability to carry out tests on all items specified in the applicable standards.

More specifically, the testing capacity can be assessed in respect of 1) availability of the necessary equipment to assure the degree of precision required by the test items specified in the standards, 2) availability of technical staff capable of understanding and carrying out the testing required by the standards using the said testing equipment and 3) availability of equipment and staff numbers to respond to the demand for tests (actual number of tests to be performed). In addition it is also necessary to assess the financial and managerial capabilities and organizational structure of the laboratory which can assure impartial operation, state of calibration of testing equipment to ensure accuracy of tests, provision of applicable standards, and training of staff for upgrading of their testing capabilities.

Conformity tests on products have been discussed in Section 4.1.2.1. It is usual to carry out tests on certain representative samples of a finished product, since such tests often involve destructive testing. With the commonly applied testing system for product certifications in the case of mass produced products the conformity of product quality depends on the tests carried out by the producer itself and the assessment for certification is made only by checking the manufacturing process and quality control system applied in the factory in order to confirm the capability of the factory to maintain a stable production of the product in conformity to the standards.

There are eight different categories as shown in Table 4-4 defined by the ISO with regard to the different combinations of product testing and inspection of factory capacity which can be adopted for product certification.

Types 5 or 6 are used for the product certification of products which relate to the protection of general consumers .

These types of factory inspections are carried out by inspectors or assessors based on an on-the-site inspection. The inspection capacity depends on the capability of inspectors/assessors to assess the adequacy of the management capability of the applied factory. More specifically, the assessment capacity could be determined on the basis of 1) availability of experienced or qualified engineers who have capability to carry out the inspections/assessment of factories with a clear understanding of the aim of the inspection/assessment, and 2) availability of adequate number of those engineers to meet the demand for inspections. Another aspect for determining inspection capacity is the management capability of the institution undertaking the inspection to maintain an impartial inspection/assessment and also provide inspectors/assessors with appropriate training to upgrade their capabilities.

(2) Securing adequate ARQS assessors

As mentioned in Chapter 3, ARQS is the assessment and registration system based on the ISO 9000 Series. Currently SIRIM has 10 qualified assessors for the ARQS. They are only stationed at the SIRIM's Headquarters, and therefore have to travel for inspections of the factories located throughout the country. This is due to the absolute shortage in the numbers of assessors. It is likely that the number of applicants for ARQS will increase, and it is essential, as stressed in Chapter 3, to arrange for the prompt increase in assessors, including assessors to be stationed in the branch offices.

It is recommended to implement an appropriate training program for staff in order to increase qualified assessors.

(3) Increase of factory inspectors for product certification systems

Currently the initial and follow-up inspections are carried out by inspectors who belong to the Inspectorate Unit of SIRIM's Headquarter as well as those stationed at each branch office. The number of staff in charge is about 20 at present. It is likely that applications for product certification will increase, and the number of initial and follow-up inspections will increase accordingly. To meet the increase in inspections, as stressed in Chapter 3, it is essential to increase the factory inspectors, including inspectors stationed at branch offices in order to respond to increasing demands in the regions.

It is recommended to implement an appropriate training program for candidates who apply for the qualification examination of inspectors so that qualified inspectors can be increased as required.

(4) Practical use of SAMM laboratory accreditation scheme

As mentioned earlier, SAMM is the laboratory accreditation scheme based on the ISO Guide 25. The assessors carrying out quality system assessment under this scheme must have 1) a specified level of academic achievement and 2) a certain period of job experience for assessment, and then 3) pass a qualification examination after attending a special training course.

Currently there are 25 qualified assessors working in SIRIM. In addition to the follow-up inspections of the eight SAMM accredited laboratories, inspections for re-accreditation are carried out on the laboratories for rubber and rubber products accredited under the RRIM scheme and also on the chemical testing laboratories accredited by the IKM. Moreover the follow-up inspections of accredited laboratories will also increase accordingly. In order to meet the increasing inspections, it is recommended to implement an appropriate training program for candidates who apply for qualification examination of inspectors so that qualified inspectors can be increased.

SAMM is to give assurance on competence of testing capability and management capability of accredited laboratories, and therefore the SAMM accredited laboratories have an assured capability. It is recommended to promote a wider utilization of the SAMM accredited laboratories to carry out tests for the product certification which requires test reports issued by impartial testing laboratories. This will contribute to promoting more applications for SAMM accreditation.

4.2 Metrology System

4.2.1 Present Status

4.2.1.1 Importance of metrology

In the modern world metrology systems are crucial to determining the foundations of all social and economic activities. The establishment of such a system provides the rational and uniform foundations which underlie industrial and economic activity. The correct management of such a system is therefore a key factor to achieving the economic development and elevation of national welfare and culture.

Further, as economic activity becomes increasingly globalized in international circumstances it is increasingly necessary to undertake the global standardization of metrology in conjunction with the increasingly international nature of trade and cultural exchange.

The energetic efforts of international organizations such as the OIML are directed to realizing a common groundwork on the international level, and these activities have served as the framework for establishing an internationally uniform system of weights and measures which will contribute to further economic and cultural development. The operations of the ISO, IEC and ILAC also depend on the establishment of a metrology system and its correct administration.

Metrology refers to the measurement of the qualities such as dimensions and weight of given objects. In terms of pure metrology any measurement necessarily involves a certain degree of error, and in this sense there is no such thing as absolute measurement. Correct measurement can be defined as a measurement which has the minimum margin of error and so is as close as possible to the true measure.

The early stages of industrial development are those of manual processing and the management of finished products is of a very rudimentary nature. Of course production exceeding the specified dimensional limits is frequent and gives rise to many defective products. As industry progresses and develops so the precision of finished products is upgraded and methods of production management are also upgraded. In this stage of industrial evolution the measurement of finished products and measurements of preceding processes is crucial to the control of the precision of product finishing. As industry develops so the awareness of the necessity and importance of metrology gradually grows, and so ever finer levels of preci-

sion in metrology are demanded in order to carry out correct measurements. At present it is possible to carry out measurements of extremely minute quantities of length, mass, or volume, as a result of years of research work and ongoing research tries to develop ways of measuring even smaller quantities and degrees.

However, when taking actual measurements of length for example, it is necessary to employ a concrete measuring tool which is to a standard measure and is divided into uniform gradations. It is only possible to determine the accuracy of measurements taken with such tools when one has a clear idea of the level of precision of the gradations indicated by the tool which is used. For example, with a device whose smallest gradation is 1mm it must be confirmed whether this can be used to precisely measure a 1mm quantity. Even if the precise measurement of 1mm is confirmed to be possible it is obvious that such a device could not be used to measure 0.1mm lengths. In this way the precision of each measuring device used must be confirmed. This can only be done through the comparison of precise measuring devices, and ever more precise devices are used as the exemplary models for comparison by which gradation values are established and corrected. This action is known as calibration. If this process of comparison and improvement is continued to its limit then obviously one will eventually reach the point of referring to the standard devices for weights and measures which are to form the basis of national measurement. The access to such standards is known as traceability, and the system which clearly indicates the hierarchy of standards is the traceability system. At the pinnacle of this system are the national standards which form the final reference point for determining the degree of precision of all other individual measuring devices and indicate clearly the precise gradation values.

This system can be visualized as in Figure 4–3.

4.2.1.2 Current metrology system

(1) *Malaysian metrology system*

The traceability system in Malaysia consists of the Measurement Centre (formerly named the National Metrology Laboratory) of SIRIM founded in 1979 with technical cooperation from Japan. This is the agency responsible for maintaining and administering national standards. The same body also maintains and administers secondary standards. Nusantara Technologies which is a SAMM Accredited Laboratory carries out calibration services in the fields of pressure and length, but otherwise SIRIM is responsible for the calibration of general measuring devices. Also as will be explained in detail later, SIRIM as part of its work in the field of the

legal framework for metrology carries out calibrations of the measuring equipment in the possession of the verification center of each state. SIRIM therefore constitutes the central organization relating to metrology in Malaysia.

(2) Measurements Centre of SIRIM

The Measurements Centre has a Measurement Standards Research Unit and a Measurement Service Unit. The former is in charge of the maintenance and management of standards while the later is entrusted with the provision of calibration services.

The Measurements Centre has 44 engineers, consisting of 14 in the Measurements Standards Research Unit and 30 in the Measurements Services Unit.

Table 4-5 shows the number of calibration services carried out by the Measurements Centre in the last three years.

There has been an annual increase in the number of calibration activities carried out. This is due to an increasing awareness of the necessity of calibration of measuring equipment as part of industrial development, and so the trend is expected to continue to pick up momentum in the future.

Table 4-6 shows a list of the main equipment and facilities of SIRIM.

Many of the facilities and equipment owned by SIRIM were provided by Japan as part of the program of technical cooperation and ten years have passed since these were originally received. Part of the equipment is out of order, and there is a shortage of spare parts for some pieces but overall the equipment continues to function well. However, it is necessary to replace or acquire new up-to-date equipment and devices for those now outdated. There is a pressing need for equipment and devices of sufficient precision to meet the current level of industrial development. Further, with the equipment in its possession the SIRIM is only able to handle the following seven metrological aspects; length, mass, volume/flow, temperature, electrical, acoustics and force/pressure. However a standards system and calibration services must be established for other fields (such as photometrics, vibrations, reference materials, etc.) in view of present and future industrial development.

Table 4-7 summarizes the existing range and accuracy of measurements which can be handled with the equipment and technical expertise of the Measurements Centre, and Table 4-8 indicates the measurement range and precision which will be needed

in the future.

(3) SIRIM Branch Offices

The Measurements Centre of SIRIM is the central pillar of the Malaysian metrology system, carrying out the maintenance and management of national standards and also providing calibration services. The following outlines the branch offices of SIRIM which carry out calibration.

1) Northern Branch Office of SIRIM

A general outline of the Northern Branch Office of SIRIM located in Penang was presented earlier. In 1990 a Metrology Calibration Laboratory for electrical quantity was installed. This laboratory has three metrological engineers and carries out about 500 calibration works per year. The main measuring devices available at this laboratory are power meters, voltage reference standards, standard resistor, frequency meters and impedance meters.

Penang is the largest industrial zone in the northern part of Malaysia, and there are as many as 430 firms located in the industrial estates there alone. Of these firms about one seventh are manufacturing companies in electric-related industries. The object of the calibration services carried out by the branch office is the measuring equipment available in these manufacturing factories. However, the available branch office equipment can only be used for carrying out electrical measurements, and the basic physical properties such as length, mass and volume can not be covered. As a result the manufacturing firms are forced to apply for such calibration services either to the SIRIM's Headquarter, the SISIR in Singapore or in the case of foreign affiliates to refer back to head offices overseas. SIRIM, in recognition of this situation, plans to make facility provisions in conjunction with the program for future construction of a laboratory in the Northern Branch Office (scheduled for completion in 1995) so that the calibration of aspects of physical quantity will be rendered possible in this branch.

2) The Southern Branch Office of SIRIM

A general outline of the Southern Branch Office of SIRIM located in Johor Bahru was presented earlier. There is a plan to install a Metrology Laboratory for electrical quantity here in 1993. In preparation for this, a preliminary survey of the firms in the area around Johor was conducted. According to this survey it is predicted that in view of the facilities, machinery and measuring equipment of

firms in this area the calibration services will be most required in the areas of electrical quantity, followed by temperature and machinery related physical quantity.

At present the firms located in Johor Bahru entrust calibration of their company equipment either to the SIRIM's Headquarter or to the SISIR of Singapore (which is closer in terms of geographical distance than the SIRIM's Headquarter).

(4) Other agencies

Besides SIRIM (i.e. the Headquarter and the Northern Branch Office) the only other agency which carries out calibration services is the SAMM accredited laboratory of Nusantara Technologies Sdn. Bhd.

Located in Kuala Lumpur, Nusantara Technologies is a joint venture company of Malaysia and Singapore which was founded in 1989. The associated company Singapore Test Services Pte. Ltd. gives technical assistance and support. Nusantara Technologies has SAMM accreditation to carry out calibration in the fields of length and pressure. The main equipment which it possesses are a gauge measuring machine, co-ordinate measuring machine, hydraulic pressure calibrator, mu-checker, flatness meter, profile projector and pressure test gauge.

The laboratory carries out several hundred calibrations annually with the small number of calibration engineers it employs. Further, despite the fact that the laboratory is somewhat cramped these calibration services are carried out in controlled conditions of uniform temperature and humidity.

Although the range of activities which can be covered is limited, Nusantara Technologies makes a definite contribution to the field of calibration.

4.2.1.3 Legal metrology

Since the subject of legal metrology is out of the scope of the present study, only a brief summary is presented.

(1) The Weights and Measures Act

The Weights and Measures Act of Malaysia was enacted in 1972, with a 10 year transition period up to 1981 to bring standards up to international levels.

The Act was composed of the following five chapters with 35 articles.

Chapter 1: Preface
Chapter 2: Units and standards
Chapter 3: Mass and Length in Transactions
Chapter 4: Administration Agencies
Chapter 5: Summary of rules and regulations

Chapter 3 of the Act sets forth the definition of metrology in commercial transactions, as follows:

1) transactions where the measured quantities or units of materials or products directly relate to the sum to be paid for the said goods.
2) legally binding contracts in which the results of measures or measurements directly relate to the sum agreed to be paid in the said contracts.
3) the determination of fees such as customs clearance charges, customs fees, or other similar charges

The measuring devices which are designated in relation to the above are as follows:

1) scales used in commercial transactions
2) straight meter length rulers and tape measures (for land and building purposes) used in commercial transactions
3) gasoline measuring devices used in commercial transactions
4) LPG flow meters used in commercial transactions
5) taxi meters
6) noise meters

(2) Administration of legal metrology

The legal metrology of Malaysia comes under the jurisdiction of the Ministry of Domestic Trade and Consumer Affairs, the Enforcement Division.

Regional offices and branch offices for legal metrology are located in each state and there a total of 28 offices having a total staff of about 600 inspectors.

(3) Implementation of Legal Metrology

The main inspections carried out on measuring devices are the regular annual inspections, follow-up inspections after repairs and the inspections carried out in

response to claims from users. Supervision of market conditions is also implemented.

Verification is carried out by the regional offices and branch offices for metrology, and the standard devices which assure such approvals are regularly calibrated by SIRIM.

4.2.1.4 Role of the Measurements Centre of SIRIM

This unit is the technical backbone of the metrological system since they establish, maintain and administer national standards as well as carrying out calibration services. In order to ensure that they satisfy their important role and have a sufficient scale of budgetary allocation it is necessary to focus authority in one agency and desirable that such services be entrusted to an agency with a high degree of independence.

The Measurements Centre of SIRIM is currently placed under the administration of the Standards Division and there is a danger that limits may operate on its potential functioning since adjustments in investment, personnel and running budget may be considered necessary on a unit level. It is recommended to establish an independent division for metrology.

4.2.2 Recommendations on Enhancement of Industrial Metrology Systems

The present state of calibration services available is affected by,

a) the limited range of fields and accuracy of calibration, and
b) the poor calibration capacity in the regions.

Increased precision in production is a prerequisite of industrial development and it is essential to carry out calibration of a high degree of accuracy over a wide range of fields for this purpose. Therefore SIRIM as the national metrology center must be capable of responding to such needs. At present there are limits to both the range of industrial field and level of precision covered by the SIRIM measurement equipment. Therefore expansion of measuring equipment and recruitment of related metrological engineers is an urgent task. Further, the fields of measurement calibration which can be actually implemented by the two centers in branch offices located in Penang and Johor Bahru (to be implemented in very near future) are limited to the field of electrical quantity, while there is no center for carrying out calibration in Sabah or Sarawak. Reinforcement of measuring facilities of the

branch offices located in the provinces is desirable. The following are proposed for the enhancement of measurement capacities.

4.2.2.1 Reinforcement and expansion of the measurement calibration capacities of SIRIM's headquarters

The following are areas for which measurement equipment should be installed to permit the Headquarter of SIRIM, acting as the central pillar of Malaysia's metrology system, to respond to future industrial development.

1) Acoustics
2) Photometry
3) Vibration
4) Reference materials

Further since existing equipment is somewhat superannuated it does not come up to present industrial levels in terms of precision. The installation of more precise equipment is needed in the following areas, 1) length 2) mass 3) volume and flow 4) temperature 5) electrical and 6) force and pressure.

However it is considered both difficult and unnecessary to establish a measurements laboratory in Malaysia of international level for the following reasons.

1) The huge amount of capital investment and the massive annual expenditure required for the set-up of facilities and their subsequent operation.
2) The large staff of measurement engineers (several hundred personnel) required for the maintenance and management of the metrological standards.

Therefore it is recommended to establish a development program which defines the areas of highest priority. Such a program would be set up on the assumption of making use of the burden sharing systems of the international network currently promoted by the advanced industrial nations and of the traceability systems on offer.

Incidentally, Dr. Kind the Director of PTB and Chairman of the International Committee for Metrology, made the following comments in his speech of Autumn, 1991. Dr. Kind noted that at present there is an increasing sophistication of metrology which is resulting in an ever increasing level of costs and that it is sufficient to have 5 to 10 research centers working to realize and maintain a given primary standard of a certain measure, while other countries can maintain national standards

by the using the traceability system. This sort of system is implemented in Europe by multinational cooperative agreements such as EUROMET, the WECC, etc. which meet the scientific, industrial and administrative needs of individual member countries. The construction of similar international networks has begun in other areas of the world supported by international organizations.

The proposal made here by Dr. Kind seems justified and rather than attempting to realize and maintain its own independent metrology laboratory for establishment and maintenance of primary standards it is necessary for the SIRIM to envisage the role of its measuring facility as being that of one base in an Asian network.

In line with the above thinking it is considered that the most appropriate approach will be to entrust the maintenance and management of the various standards to the international metrology centers and to have the Measurements Centre of SIRIM maintain and administer the national standards which are traceable to the standards maintained by the above international centers and interfaces for establishment of national traceability.

4.2.2.2 Expansion of capacity for implementing calibration in the regions

The need for calibration in the regions has increased enormously due to the rapid industrial development of these areas. Since the calibration must be carried out periodically while keeping the disturbance of the manufacturing processes to a strict minimum it is strongly desired that such calibration be carried out as early as possible. To meet this demand it has become necessary to expand the capacity for implementing calibration services at the branch offices of SIRIM. Therefore there are increasing needs for calibration laboratories located at industrial centers, particularly in Penang where one is located at present and in Johor Bahru where another is soon to be located. However, the two centers of the above branch offices will only cover the area of electrical quantity for the time being, and it is considered necessary to install measuring facilities to also cover the basic industrial aspects of length, mass, volume, force and pressure.

Table 4-1 TESTING AREAS AND LOCATION OF LABORATORY

	Preservative Agents	Rubber	Cement	Metal
Kuala Lumpur	1			
Selangor	2	1		
Penang	1			1
Sabah			1	

Table 4-2 MAJOR TESTING FACILITIES OF RTC

Name of Facilities
Scanning Electron Microscope
Viscometer
Creep Tester
Universal Testing Machine
Autograph
Impact Tester
Friction Tester
Burst Strength Tester
High-speed Tire Endurance Testing Machine

Table 4-3 LIST OF LABORATORIES ACCREDITED BY IKM

Name of Laboratory	Area of Accreditation
Agrolab sdn.bhd.	Soil, Plant, Fertilizer, Water
Analytical Laboratories sdn.bhd.	Water & Effluent, Metals & Ores, Pesticides, Feedmeal
Ancom sdn.bhd.	Pesticides, Cu, Cr, As
Associated Testing Laboratory sdn.bhd.	Edible Oil, Water & Effluent
Biochem Laboratories sdn.bhd.	Edible Oil
Caleb Brett (M) sdn.bhd.	Edible Oil
Celcure Chemicals (M) sdn.bhd.	Chemicals – Wood Preservatives
Chemical Company of Malaysia bhd.	Fertilizer, Pesticide
Chemical Laboratory (M) sdn.bhd. (PJ)	Edible Oil, Water & Effluent, Pesticides, Metals & Ores, Lead in Blood
Chemical Laboratory (M) sdn.bhd. (JB)	Edible Oil, Water & Effluent
Chensain Konsultant sdn.bhd.	Water & Effluent, Edible Oil, Soil, Plant, Fertilizer
Central Laboratory	Palm Oil, Water Effluent
CSC Kemico (SEA) sdn.bhd.	Water & Effluent
Consolidated Laboratory sdn.bhd.	Edible Oil, Pesticide
Core Laboratories (M) sdn.bhd.	Water Effluent, Petroleum
Ebor Laboratories	Water Effluent, Soil, Plant Fertilizer, Edible Oil, Pesticide, SMR Rubber, Latex
Edtech Associates sdn.bhd.	Water & Effluent, Feedmeal, Edible Oil, Metal & Ore, Fertilizer, Pesticide, Cement
Envilab sdn.bhd.	Edible Oil, Water & Effluent, Feedmeal, Fertilizer
Fedmas Assy Office sdn.bhd.	Precious Metals
Golden Hope Quality &Technology Center	SMR, Latex, Effluent
Golden Hope Oil Palm Research Station	Soil, Plant, Fertilizer
Gurthrie Research Chemara	Plant, Soil, Fertilizer, Effluent, Palm Oil
Jaya Laboratories	Edible Oil
Kedah Cement sdn.bhd.	Cement
KL–Kepong Edible Oils sdn.bhd.	Edible Oil
Lam Soon (M) bhd.	Edible Oil
Makmal Cerakinan	Water & Effluent, Soil, Plant, Fertilizer, Pesticide
Malayan Testing Laboratory sdn.bhd.	Plant, Fertilizer, Water & Effluent, Edible Oil, Feedmeal
Malaysia Mining Corporation bhd.	Metals & Ores
Metal Reclamation (Ind) sdn.bhd.	Metals
Omic Laboratory (M) sdn.bhd.	Edible Oil
Palm Oil Research Institute of Malaysia	Edible Oil, Effluent
Laboratory Gas Processing Plant	Petroleum
Laboratory Petronas Penapisan (T) sdn.bhd.	Petroleum, Water & Effluent
Rahman Hydraulic Tin bhd.	Edible Oil, Metal & Ore, SMR, Effluent, Fertilizer, Feedmeal
Revertex R&D and Q.S. Testing Lab. sdn.bhd.	Latex & Effluent
Scientific Testing & Analytical Laboratory (M) sdn.bhd. (Selangor)	Edible Oil, Feedmeal
Scientific Testing & Analytical Laboratory (M) sdn.bhd. (Johor)	Edible Oil, Feedmeal, Fertilizer
Syarikat Sebangun sdn.bhd.	Ores, Minerals, Water
Syarikat Testing Laboratory	Edible Oil
Tesek Cement bhd.	Cement & Coal
Technichem Laboratory sdn.bhd.	Edible Oil, Water & Effluent, Feedmeal
Technology and Q.C. Center	Palm Oil, Effluent, SMR, Latex
Testing Services (Sabah) sdn.bhd.	Palm Oil Products
Ulu Tiram Central Laboratory	Water & Effluent, Oil, Latex, SMR, Fertilizer
Wembley Rubber Products (M) sdn.bhd.	Latex, Water & Effluent

Source: BERITA/INSTITUTE KIMIA MALAYSIA, January 1991

Table 4-4 THIRD PARTY CERTIFICATION BASED ON ISO

	Product Testing	Factory Inspection	Follow-up Factory Inspection
Type 1	Type Testing	No	No
Type 2	Type Testing	No	No
	Sampling Testing from Market	No	
Type 3	Type Testing	No	No
	Sampling Testing from Factory		
Type 4	Type Testing	No	No
	Sampling Testing from Market		
	Sampling Testing from Factory		
Type 5	Type Testing	Yes	Yes
	Sampling Testing from Market		
	Sampling Testing from Factory		
Type 6	No	Yes	No
Type 7	Batch Testing	No	No
Type 8	100 % Testing	No	No

Table 4-5 NUMBER OF MEASUREMENT CALIBRATION SERVICES

	1989	1990	1991
Length	336	350	2,260
Mass	4,374	4,416	7,258
Volume/Flow	1,406	1,425	296
Force/Pressure	482	518	704
Temperature	536	583	1,378
Electrical Measurement	803	924	1,100
Time Frequency	–	–	151
Total	7,937	8,216	13,147

Source: SIRIM

Table 4-6 LIST OF THE MAIN EQUIPMENT & DEVICES OF SIRIM (1)

– Length –

Equipment Name	Specification
Standard Straight Rule	1m, 1mm/div, JIS class 01 H-shape
Standard Straight Rule	1m
Standard Tape Measure	10m, 20m, class 1
Gauge Blocks	1 to 100mm, 112 pcs. JIS class 1
Gauge Blocks	1 to 100mm, 112 pcs. JIS class 2
Gauge Blocks	750mm, class 1
Gauge Blocks	1,000mm, class 1
Gauge Blocks	125, 150 175, 200, 250, 300, 400, 500mm, class A
Gauge Blocks	125, 150 175, 200, 250, 300, 400, 500mm, class B
Wedge Gauge Blocks	50 x 15mm, +/- 3" 12 kinds
Polygon Mirror	12 faces, +/- 5"
Angle Measuring Rotary Table	accuracy: 0.25"
Height Master	Separate type, 5 to 310mm
Calibration Table of Straight Rule	1m, 1mm, accuracy: 3 μ m
Standard Rule	1m, 1mm, class 1
Standard Rule	1m, 1mm, class 2
Calibration Table of Tape Measure	10m, +/-50 μ m
Ultra Digital Electronic Comparator	500mm
Dial Indicater	10mm, 0.01mm, +/- 0 to 100
Dial Indicater	1mm, 0.001mm, 0-100-0
Dial Indicater	0.1mm, 0.001mm, 50-0-50
Dial Indicater	20mm, 0.01mm, +/- 0 to 100
Dial Indicater	50mm, 0.01mm, +/- 0 to 100
Inside Micrometer	50 to 300mm, 25mm step, 10 kinds
Outside Micrometer	0 to 300mm, 25mm step, 12 kinds
Outside Micrometer	0 to 100mm, 0.001mm, 25mm step, 4 kinds
Micrometer	Holtest, Type II, 20 to 50 mm, 0.005mm, 6pcs.
Micrometer	Holtest, Type II, 50 to 100mm,0.005mm, 5pcs.
Vernier Caliper	Type M, 300mm, 1/20mm
Vernier Caliper	Dial type, 150mm, 0.01mm
Vernier Caliper	Type CM, 1,000mm, 0.02mm
Test Indicator	JIS type, 0.8mm, 0.01mm, 0-40-0
Test Indicator	Universal type, 0.8mm, 0.01mm, 0-40-0
V-Block	25mm
Aotocollimeter	Type 6D
3 Co-ordinate Measuring Machine	X: 800mm, Y: 550mm, Z: 450mm, 1 μ m
Toolmakers Microscope	X: 100mm, Y: 50mm
Universal Measuring Instrument	
Roundness Meauring Instrument	
Lasor Measurement System	
Non-touch Displasement Measurement Machine	Measuring Range: 40mm +/- 20mm, Accuracy: +/- 20 μ m
Surface Roughness Tester	Readablilty: 0.01 μ m, Cut-off: 0.25, 0.8, 2.5mm

Table 4-6 LIST OF THE MAIN EQUIPMENT & DEVICES OF SIRIM (2)

– Mass –

Equipment Name	Specification
Standard Weight	1kg
Direct Reading Micro	20g, 1 μ g
Balance	50kg, 20mg, w/weights
Standard Weight Set	1,2,2,5,10,20kg, 1,2,2,5,10,20,20,50,100,200, 200,500g, 1,2,2,5,10,20,20,50,100,200,200,500mg
Balance	1kg, 0.1mg
Balance	100kg, 5g
Balance	200kg, 10g
Balance	200g, 1mg, w/weights
Balance	3kg/30kg
Balance	1kg, 0.1mg
Proving Ring	100KN, Compression
Proving Ring	300KN, Compression
Proving Ring	50KN, Dial gauge type, 0.2%
Standarzing Box	600KN,Standard
Standarzing Box	3,000KN, Standard
Dead Weight Pressure Tester	1,000kgf/sq.cm, 0.1%, Autoloading

Table 4-6 LIST OF THE MAIN EQUIPMENT & DEVICES OF SIRIM (3)

– Temperature –

Equipment Name	Specification
Standard Thermometer	400mm length, 0.000017, 8 kinds
Standard Platinum Resistance Thermometer	13K to 250℃, 25.5Ω +/– 1Ω
Standard Platinum Resistance Thermometer	90.188K to 630.74℃, 25.5Ω +/– 1Ω
Standard Platinum Resistance Thermometer	90.188K to 961.93℃, 25.5Ω +/– 1Ω
AC/DC Standard Resistance	25Ω
Vertical Calibration Unit	200 to 1,100℃
Oil Bath	Room temp. to 250℃
Standard Resistance Thermometer	Pt
Standard Thermocouple	PR–10%, C–800–15
Standard Thermocouple	PR–13%, C–800–35
High Temperature Calibration Unit	Calibration range: 600–1400℃
High Temperature Furnace	Temperature range: 600–1500℃
Standard Thermopcouple	C–800–65
Ice Point Unit	0℃
Cold Junction Unit	30 points, 0℃ +/– 0.02℃
Saltpeter Bath	Keiryouken–type, Samples: 10, Dia:120mm
Precision DC Potentiometer	Range: 0.01000 to 111.110mV
Temperature Fixed Point Cell	Sn, Zn,
Low Temperature Bath	–100℃ to 0℃

Table 4-6 LIST OF THE MAIN EQUIPMENT & DEVICES OF SIRIM (4)

- Volume -

Equipment Name	Specification
Movable Flowmeter Testing Equipment	Range: 12 to 150 cu. m/h
Standard Flowmeter	
Air Separation Equipment	
Pump	150 cu. m/h
Standard Tank	5kl, for oil
Standard Tank	2kl, for oil
Standard Tank	500l
Standard Wet Gas Meter	Range: 0.2 to 0.6 cu. m/h
Standard Wet Gas Meter	Range: 0.3 to 1.0 cu. m/h
Standard Wet Gas Meter	Range: 0.6 to 2.0 cu. m/h
Standard Wet Gas Meter	Range: 1.2 to 4.0 cu. m/h
Standard Tank	200kl, for liquid
Piston Prover for Gas	100l, for air
Piston Prover for Gas	100l, for LPG
Temperature/Humidity Chamber	Temp.: -10 to 80℃, 3 μ m, Humi.: 30 to 95%RH

Table 4-6 LIST OF THE MAIN EQUIPMENT & DEVICES OF SIRIM (5)

– Electrical –

Equipment Name	Specification
Standard Resistor	0.001Ω, 0.01Ω, 1kΩ, 10kΩ, 100kΩ, 1MΩ
Standard Resistor	0.1Ω, 1Ωx3, 10Ωx3, 100Ωx3
Variable Resistor	0.100 to 1,111.210Ω
Variable Resistor	0 to 111.1110Ω
Oil Bath	Temp.: 20 to 40℃, Stability: 1mK/mon., 10mK/year
Voltage Standard	10V, 5mA, 1.0185V, 2kΩ Stability: 2ppm/year, 0.1ppm/℃
Precision DC Potentiometer	
Decade Resistance Box	
Precision Digital Multimeter	
Standard Resistor	0.001Ω, 0.01Ω, 1,000Ω, 10kΩ, 0.1Ω, 10MΩ
Precision Double Bridge	0.1mΩ to 111.1Ω
AC Power Meter Calibration System	Range: 3 to 600V, 0.1 to 30A, 0.2%
Digital AC Power Meter	Rated voltage: 3 to 600V, Rated current: 30A, three phases
Standard Cell Air Bath	
AC/DC Differntial Voltmeter	DC: +/– 0.0025%, AC: +/– 0.05%
Reference Standard Capacitor	1,000 pF
Precision RLC Digibridge	12Hz to 100kHz
Thermal Transfer Standard	
Frequency Synthesizer	1μHz to 21MHz
Rubidium Frequency Standard	
DC Voltage Reference Standard	
Digital Electrometer	Up to 100 quadrillion Ω
DC Calibrate Set	A: 0 to 36A, V: 0 to +/– 1,200V
AC Calibrate Set	

Table 4-7 EXISTING VS PREVISION EQUIPMNET

	Existing Equipment		Prevision of Future Capacity	
	Range	Accuracy	Range	Accuracy
Length	0.01 μm – 10m	+/– 2ppm	0.001 μm – 100m	+/– 0.5ppm
Mass	1mg – 1 ton	+/–0.02 mg	0.01mg – 1 ton	+/– 0.5ppm
Force	0 – 220 ton	+/– 0.025%	0 – 300 ton	+/– 0.005%
Pressure	0 – 8,000psi	+/– 0.01%	0 – 1,500psi	+/– 0.001%
Temperature	–50℃ – 1,400℃	+/– 0.01℃	–250℃ – 2,000℃	+/– 0.001℃
Voltage	0 – 1.5kV	+/– 1ppm	0 – 50kV	+/– 0.05ppm
Electrical Resistance	0 – $10^{16}\Omega$	+/– 1ppm	0 – $10^{18}\Omega$	+/– 0.05ppm
Electrical Current	0 – 100A	+/– 10ppm	0 – 1,000A	+/– 1ppm
Inductance	0 – 100H	+/– 0.02%	0 – 9,000H	+/– 0.002%
Capacitance	0 – 1,000F	+/– 0.002%	0 – 9,000F	+/– 1ppm
Frequency/time	0 – 1GHz	+/– 10^{-11}	0 – 25GHz	+/– 10^{-13}
RF/Microwaves	None		25GHz	+/– 0.01%
Photometry	None		Full laboratory	
Magnetic	None		Full laboratory	
Acoustics	70 – 140dB	+/– 0.1dB	20 – 150dB	+/– 0.01%
Refernce Materials	None		Full laboratory	

Source: SIRIM

Table 4-8 EQUIPMENT AND FACILITIES FOR THE METROLOGY LABORATORY (PLAN)

Field	*Equipment and Divices*
1. Length	Standard gauge block sets, electronic micrometers, standard gauge blocks used for calibration, micrometers, hight masters, profile projectors, etc.
2. Mass	Standard weights (for F1 class or below), precision balances, comparators, balance tables, etc.
3. Force/Pressure	Standard proving rings, load cells, precision voltmeters, hardness standards, pressure calibrators, standard pressure gauges, etc.
4. Temperature	Standard platinum resistance thermometers, thermocouples, temperature ovens, etc.
5. Volume/Flow	Electric platform scales, standard tanks, etc.
6. Electrical Measurements	Standard cells, woltage stadards, standard resistances, differential voltmeters, power amplifiers, multimeters, standard capacitances, etc.
7. Photometry	Standard lamps, integrated spheres, *spectrophotometers, standard light sources*
8. Accoustic	In-echoic chamber, standard microphone sets, standard sound level meters, etc.
9. *Bibration*	*Exticitors, signal separators, standard* pick-up, standard bibration level meters
10. Different Standard Material	Standard materials, analizers, etc.

Source: SIRIM

Figure 4-1 ORGANIZATION OF THE TECHNICAL SERVICES DIVISION, SIRIM

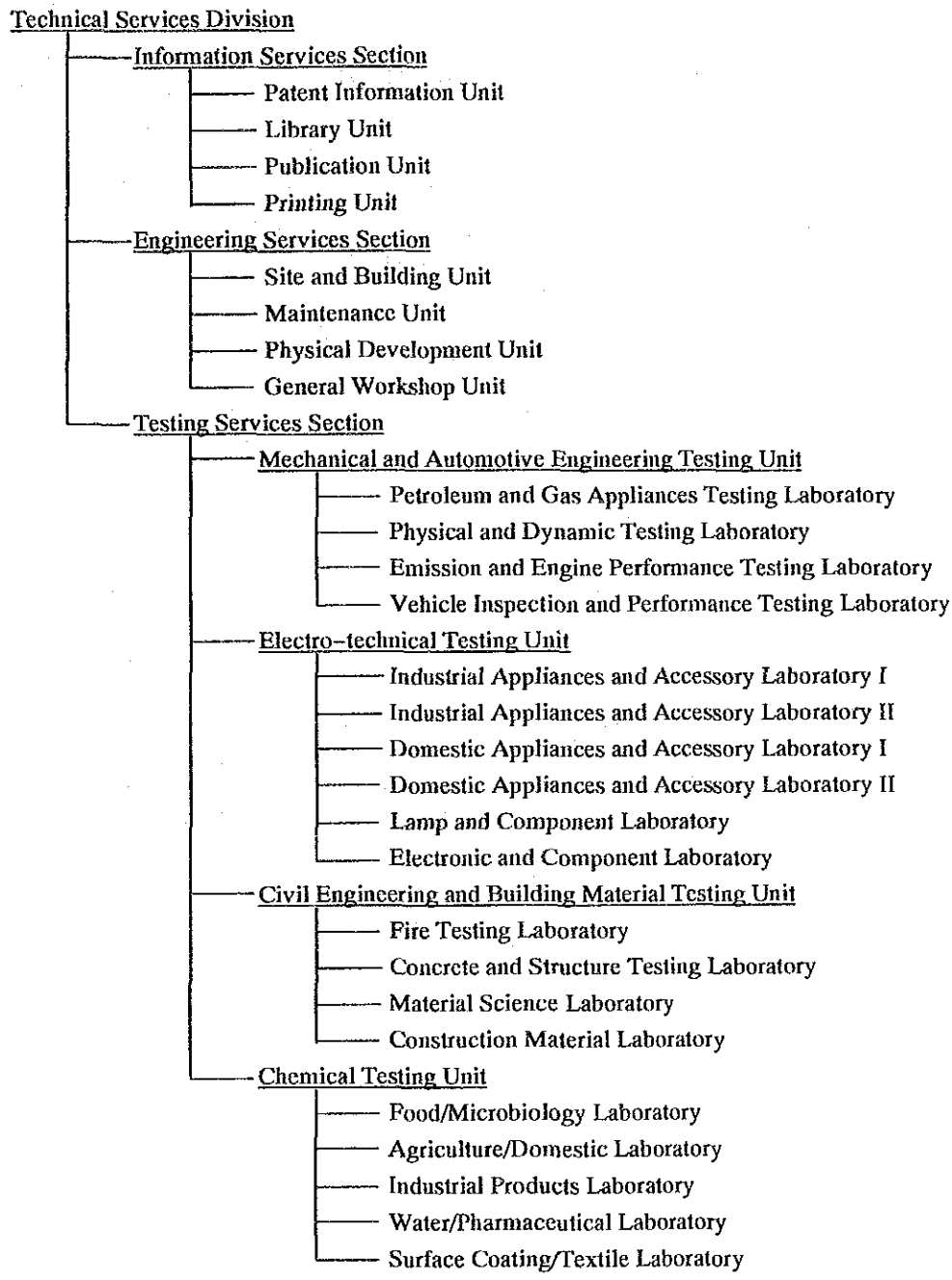


Figure 4–2 ORGANIZATION CHART OF THE PORIM

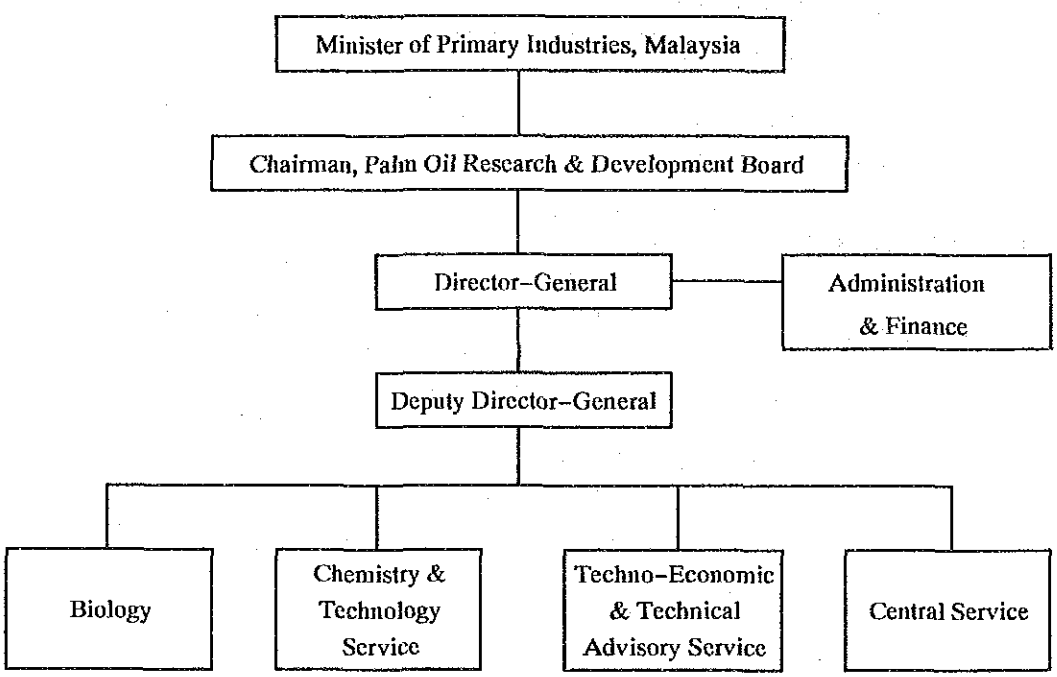
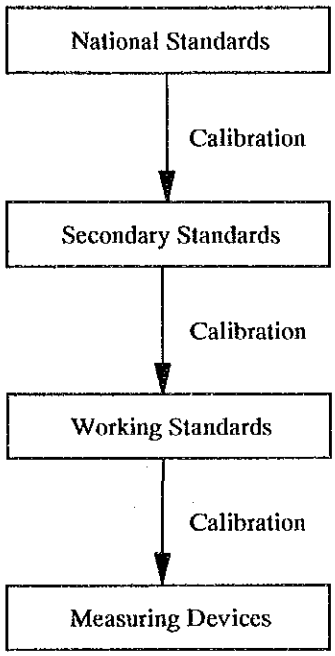


Figure 4-3 TRACEABILITY SYSTEM



5. Total Quality Management and Measures for Enhancement and Promotion of Quality Awareness

The current state of product management in Malaysian industry has been reviewed in Chapter 2 (2.2). This chapter reviews the current activities of institutions and academies which are related to the promotion of quality management in industry, and discusses 1) effective measures to be taken for the education and dissemination of quality awareness (5.1), and 2) organizational structures which are more effective for enhancing activities for the promotion of quality management among industry (5.2). Furthermore, this chapter discusses necessary policies, incentives and supporting measures for promoting quality management among industry, particularly focusing on the small- and medium-scale industries (SMIs) (5.3).

5.1 Education and National Program on Quality Awareness

In Malaysia a movement to disseminate greater national awareness of quality has been promoted by the Ministry of the Youth and Sports since 1989. This movement undertaken under the slogan "Kualiti Teras Kejayaan" is divided into three sections concerned with 1) government agencies and institutes, 2) industry and service sectors, and 3) state governments respectively. Every year awards are given to firms and institutes for outstanding merit.

On a national level an upgrading of quality management will not be achieved only by stimulating awareness among manufacturers and distributors. It is necessary to encourage increased awareness and expectations of quality among consumers also.

For successful progress of quality management in factories, it is essential to organize participation of all employees in quality management. In this approach, the quality management could also bring about an improvement of applied technology. This requires the consciousness of all employees of the importance of quality and so this should be cultivated primarily through basic education. Further, the current shortage in staff responsible for quality management is a major obstacle to advances in this field. In order to develop human resources for quality management it is important to include teaching of the subjects which form the basis of quality management in school education.

5.1.1 Measures to Disseminate Awareness of Quality Management among Managers

The most important factor for a firm wishing to reinforce quality management is awareness of the management on the needs for quality management.

In the questionnaire survey of firms conducted for this present study, only 10% of the responses cited a low level of awareness regarding quality management among management as an obstacle to undertaking of quality management. Even in the questionnaire survey conducted by the FMM, quality management was listed as one of the five most important aspects of company policy over a number of years. In fact it was noted as one of the most important aspects of companies in all cases.

In the present questionnaire survey, it is noted that increased costs and the expense of time involved were given as factors obstructing quality management in 27% and 26% respectively of the responses. These answers, in contrast to such factors as personnel shortage or ignorance of methods listed in respectively 48% and 40% of the responses, reflect a passive attitude towards undertaking quality management and are due to an insufficient appreciation of the benefits that quality management brings about in improvement of technology.

Such a passive attitude towards quality management was especially marked among the small and medium size enterprises (SMEs) which do not have any connections with export markets or foreign affiliates operating in Malaysia. The following actions would be effective for encouraging their awareness.

1) Intensive campaign emphasizing the potential benefits from quality management.
2) Activities for increasing awareness of management of firms of the role of the product certification system as a step to making them realize the necessity of quality management in order to apply for product certification.
3) Education of consumers on use of quality products thereby encouraging firm managers to undertake quality management.

5.1.2 Quality Education in School

In Malaysia the shortage of industrial manpower is increasingly becoming serious as the industry continues its rapid expansion. This has resulted in head hunting or job hopping of talented or highly qualified personnel, and this problem has discouraged many firms from providing training for their staff. This problem is especially

serious among quality control engineers, because of the significant shortage of supply over demand for such engineers. In order to ease this supply shortage, extensive development of human resources for quality management through school education is indispensable.

(1) Quality management education in universities/colleges

It is important to provide courses in applied statistical methods in the universities/colleges, since this forms the basis of quality management.

In this regard the following is noted of universities/colleges in Malaysia[1]:

1) Basic statistical methods are included in courses.
2) There are courses in applied statistics (experimental design, non parametric data analysis, multivariate analysis, although these are only compulsory in some departments).
3) Some universities carry out factory training courses from 8 to 24 weeks so that practical training is gained as part of university education.
4) An expansion of the QC department of USM is underway and increases in lecturers and student numbers planned.
5) University staff maintain close contact with industry through advisory services.

Note: 1) According to survey results of ITM (Institut Teknologi MARA), Selangor; USM (Universiti Sains Malaysia), Penang; and UTM (Universiti Technologi Malaysia), Johor.

In Japan, quality control courses form part of the curriculum in the Faculty of Technology of some universities but such courses are not found in all universities, and are not always compulsory even when offered. As a result about two thirds of graduates from a Faculty of Technology of Japanese universities have an insufficient knowledge of the statistics studies basic to quality control. In comparison with Japan, it is observed that the education of quality management is more advanced in Malaysia.

In the case of the staff of small and medium-scale enterprises (SMEs), such personnel seem to have little time to acquire the basic knowledge of standardization and quality management through participation in seminars conducted on standardization and quality management after joining in firms.

University graduates and postgraduates tend to obtain the most important posts both in public and private sectors. The positive attitude of top management is the most important factor determining the undertaking of quality management in firms, but at the same time the middle ranking managers who draw up the concrete implementation plans and promote their realization also have an important role. In order to nurture personnel who will be engaged in large firms as well as SMEs, it is important to provide education in universities/colleges for a basic knowledge of standardization and quality management in general and in particular of the statistical principles and their application which are the basis of quality control.

(2) Quality management education up to high school

In Malaysia the educational system has been well established, achieving a comparatively high level of education. In accordance with the Education Law of 1961 education is provided in primary schools for six years, in junior high school (secondary school) for three years, in high school for 2 years followed by a two year preparatory course for students wishing to go on to university.

After completion of junior high school the SRP (Sijil Rendah Pelajaran) examination is taken and only those students passing this can proceed on to high school. After completion of two years of high school the SPM (Sijil Palajaran Malaysia) examination is taken and only those students passing this can proceed on to study in the university preparatory courses. After completion of the two year preparatory course the STPM (Sijil Tinggi Pelajaran Malaysia) examination is taken and entrance qualification to university is awarded to those students with excellent marks. However, there are only seven universities in all.

No education relating to standardization, quality or quality management is provided in either the elementary, junior high or high school levels. Vocational training schools also have no training program relating to standardization and quality management due to the limited training time provided in courses. The dissemination of the basic concepts and principles of quality management should be taught in school. Therefore it is recommended to provide a course teaching the basics of standardization together with instruction in the basic concepts and principles of quality management in the curricula of schools.

Another important issue is to provide effective training to lower grade graduate employees on quality management. Job-hopping especially among the university/college graduate engineers is a serious problem obstructing the establishment of quality management systems in industry. This causes damage not only

to individual companies but to the industrial sector as a whole since the competence of the employees will not be improved unless they can accumulate working experience and integrate this to the stock of company expertise. An increasing number of companies, irrespective of their scale, try to employ some 12SPM graduates and then nurture these through on-the-job and other training courses.

In general there is a large difference between the status of engineers and technicians in the current employment system of Malaysia. Many engineers are engaged in supervisory positions despite their limited working experience. This is a result of the shortage of engineers. If education on quality awareness and basic principles of quality management were provided in schools, it would contribute to reducing the above problem. However, it would be necessary to examine effective curriculum to be included, since to date quality consciousness has only been integrated into school education in a very few cases.

It is important to provide basic education in school with regard to fundamental subjects for quality management as well as awareness of quality. This is an important step for enhancing quality management in industry and eventually furthering industrial development in Malaysia. Many SME managers often comment that many of the seminars and training courses currently held are not useful for them. Their staff are mostly graduates of 12SPM or lower, and have very limited knowledge on standardization and quality management. Since participants need to have some basic knowledge of standardization and quality management to follow the seminars and training courses in many cases the lectures are often not easily understood by the SME's management or staff.

Another issue often pointed out as impairing pursuance of quality management is the difficulty of communicating with operating personnel. This difficulty is of course partly linguistic but also results from the inability of operators to understand the principles and methods of quality control practices. It is concluded from the various information gathered from industry that education in Malaysia is largely of a cramming, rote learning type and that aspects of creative or rational problem solving are given little emphasis.

The Japanese Chamber of Trade & Industry, Malaysia (JACTIM) presented the following recommendations as the result of a questionnaire survey carried out on its members in 1991.

1) Establishment of new technical universities.
2) Expansion and reinforcement of vocational training centers and engineering colleges.
3) Improvements in general education (in particular in maths and English).

(3) Provision for standardization and quality management in school curricula

It is necessary to include standardization and quality management studies in the curricula of the early schooling phases (primary and secondary education) so as to cultivate the correct understanding of these subjects and disseminate awareness of quality management.

In the higher levels of education the curricula should include the basic principles and applications of statistics so that students can gain an understanding of how these are applied in actual practice.

In universities it should be made compulsory for all students in the first two years to obtain credits in studies for the basics of standardization and quality management and statistics to be rendered compulsory courses. For students of the Sciences, instruction in the basic disciplines of applied statistics (experimental design, multivariate analysis, quality engineering) should be provided before graduation and competence gained in research and development and quality improvement studies.

In vocational training schools training should be provided not only on specific manufacturing technologies and operational skills but also on the basic principles and application of standardization and quality management.

5.2 Tasks involved in the Promotion and Training of Total Quality Management

5.2.1 National Systems for the Promotion of Total Quality Management

The National Productivity Corporation (NPC) placed under the control of MITI is the public institution mandated to carry out promotion of total quality management, and this institution undertakes education and dissemination of quality management to industry with government subsidy. Organizations in the private sector active in

the promotion of quality management are the IQCM (Institute of Quality Control, Malaysia) and in Penang the QRSP (Quality and Reliability Society of Penang). (Annex 4 shows details of the organization and activities of the NPC.)

SIRIM pursues the establishment of quality assurance systems in industry including SMIs through its activities for establishment of standards, certification, testing, inspection and calibration as well as implementation of other relevant schemes.

In order to enhance the activities for promotion of quality management, it is essential to establish close cooperation among the various institutions concerned in the promotion of quality management. SIRIM, NPC, IQCM and QRSP should unite their efforts to achieve a more efficient diffusion and promotion of the overall campaign.

The NPC has several training centers well equipped with training facilities including classrooms and lodging facilities. Further facilities in the branch offices located at main industrial centers in regions are also being reinforced. It is also equipped with a large library. However, in order to further diffuse quality management the publication and sales of textbooks, journals and books on quality management is required. In this field NPC's activities are still weak. Also the transmission of educational programs on television or the use of correspondence courses should be considered.

In order to stimulate a greater interest in quality management a much wider range of PR activity to encourage enthusiasm for the application of quality management in everyday undertakings will be needed. At present there is no overriding central organization which coordinates and presides over the activities of these various promotional bodies. As a result the activities of the various institutions are unrelated and this prevents the maximum efficacy in diffusion and promotion from being realized and also means that important aspects relating to quality management are left out.

It is necessary to undertake more effective steps and measures for intensifying the promotion and diffusion of quality management. In order to achieve these aims it is proposed that a National TQC Council be established with membership drawn from private industries, professional organizations, universities and public sector agencies to plan, coordinate and implement a comprehensive program to promote and disseminate TQC practice in industry.

5.2.2 Organization for Diffusion and Guidance of Total Quality Management

Under the National TQC Council, specific institutions should be mandated to undertake the promotion and technical guidance on quality management practices. These institutions will act as the central driving force of TQC activities in terms of the accumulation of TQC application, experience, dissemination of application methods and the coordination of TQC training programs in the country. Their activities will include the formulation of national TQC training programs, the organization of TQC seminars, the operation of qualification systems for QC experts, the publication of TQC application experience, and translation of TQC materials into Malay.

(1) Responsible organization

The NPC has been engaged in the dissemination of QC Circles over the last ten years, and is currently promoting TQM/TQC as well as ISO 9000. NPC has adopted a management-orientated approach. At the same time, however, a technology-orientated approach to diffusion is also important, and for this SIRIM is better equipped. In view of the special strengths of these two institutions it seems that the activities of the NPC and SIRIM carried out independently would provide a much more effective means of diffusion. In order for those two institutions to carry out their duties with efficiency, it is important that the role, functions and scope of activities be defined for the NPC and SIRIM respectively. Such coordination will be the responsibility of the National TQC Council, and the NPC and SIRIM will therefore undertake their activities under the Council's direction. The secretariat for the Council shall be appointed in either NPC or SIRIM. Nevertheless, if this approach is not workable, another option would be to establish a "TQC Foundation".

In the same way there are private institutions which hold seminars and provide guidance concerning quality management methodology (details of their organizational structure and activities are given in the Annex 4).

The IQCM is a representative institution for the promotion of quality management organized with private members in Malaysia. The members at present consist of about 160 individual members and about 50 corporate members. Many of the corporate members are SMEs. This institution focuses on diffusion of quality management system developed in the UK. However, its financial capacity is rather weak and so the activity is not active.

The QRSP is a private institution for the promotion of quality management in Penang. It has 148 individual members and 25 corporate members, with 60% of the members engaged in the electronics industry, 14% in the electrical industry and 7.5% in other manufacturing industries. Collaboration with these private organizations is also important.

(2) Quality management levels

In Malaysia emphasis has been placed on the promotion of an internationally recognized quality system, namely that of ISO 9000 Series. The quality system based on ISO 9000, however, is only one of tools for quality management. The key for successful application of quality management in factories is the establishment of company standards and their improvement with the participation of all the employees, as well as actual application of practical quality management based on an effective quality system.

In the questionnaire survey of the present study, many of the responses indicated that they have company standards. It seems, however, that the majority of these firms have referred to the specifications provided by clients as company standards. Company standards serve as the basis for accumulating operational experience in manufacturing processes and improving applied technology. However many firms at present have not gone beyond the stage of merely inspection, and they do not take necessary procedures to improve their company standards according to the results of the quality management in the improvement of company standards. In fact many firms limit the function of quality control to merely the screening out of defective products manufactured.

Recognizing the limitation of the quality system based on the ISO 9000 Series, more emphasis should be put on the promotion of TQC.

(3) Training

For the promotion of TQC it is important to implement a nation-wide training system for TQC. One task is how to utilize training facilities owned by foreign affiliates for training their staff by providing them with incentives to do this. In the case of Singapore, there are some training facilities established jointly by foreign affiliates and the agencies of Singapore Government with the aim of assisting technology transfer to Singapore. A similar approach should be considered in Malaysia.

NPC and other institutions frequently hold various seminars and training courses regarding productivity and quality management. It is important to have follow-up contacts with participants to assess the effectiveness of these seminars and training courses as a basis for their improvement and intensification. It is recommended that such follow-up assessment shall be constantly conducted by the sponsor or organizers of seminars and training courses.

There are some firms, although not many, where staff in charge of quality management are nurtured on in-house training programs. The staff of foreign affiliates are trained on quality management by participating in in-house training held by their parent company or by competent staff dispatched from the parent company to supervise the quality management. On the other hand, staff in charge of quality management in local firms have no opportunity for upgrading their expertise. Most of the training courses currently held were only an introduction to basic principles of quality management and did not serve to indicate the application of quality management to meet specific manufacturing processes. The highly appreciated trainings were the training courses on quality management provided for parts manufacturers by foreign affiliates engaged in electric/electronics and automobile industries. These training courses were held by those foreign affiliates themselves or in association with relevant manufacturers' associations or the NPC.

(4) Access to quality management information

There is little data or documentation available to form the basis of upgrading quality management in local firms. In the libraries of the NPC and SIRIM a considerable volume of overseas information is amassed. However, use is limited since the location of these libraries is inconvenient and also data and documents translated into Malay are not available. The quality control staff have no trouble making use of the English documents, but they have to consume extra time and exert efforts for translating these into a Malay since a Malay version of the documents is needed to provide operators with technical guidance on quality management.

At a regional level, such activities may be undertaken by regional quality centers which are under preparation jointly by NPC and SIRIM. At the same time, efforts are also needed to organize private sector counterparts such as QRSP in Penang, especially in the regions not covered by the regional quality centers.

(5) Consultancy services

Consultancy services are one of the most effective measures to assist firms to apply quality management to their firms. Quality system consultants currently registered are qualified as consultants for quality systems based on ISO 9000. In addition to these consultants, there is a need for specialized consultants to provide consultancy services for application of quality management practices. The main function of the quality system consultants is to guide and assist firms in introducing quality systems based on the ISO 9000 Series. The expected function of the specialized consultants for quality management is to provide firms with technical guidance with regard to the establishment of company standards, application and improvement of these standards, and establishment of quality management system which meet manufacturing processes and production system of their factories.

In order to promote the application of effective quality management in factories, it is necessary to provide comprehensive consultancy services combining the orientation and guidance of quality management system and techniques with advice on applicable process technology and management aspects.

Such consulting services are not available in Malaysia. In Japan the Matsushita Electric group has a subsidiary consulting firm to provide such consulting services and this consulting firm has been providing consulting services for quality improvement to SMEs in Malaysia which supply parts to the Matsushita Malaysia group. The assistance of such consulting companies is effective because they provide guidance in setting up quality management systems tailored to the particular needs of the manufacturing processes adopted in factories rather than just give general advice on quality management systems. There is a wide ranging and strong demand for such consulting services.

(6) The need for research on quality management systems suited to the Malaysian society and economy

Every country has its own social and cultural characteristics, which are reflected also in the management behavior and business practices of industry in the country. Thus, although the principle of quality management is common, for successful application to industries, the application method of quality management appropriate to each country needs to be developed to meet its national characteristics. For successful promotion of quality management in industries, especially for SMIs in Malaysia, it is necessary that competent institutions undertake research work for identifying and devising application methods of quality management effective in

Malaysia.

Listed below are specific factors to be taken into account when examining application methods of quality management appropriate to Malaysia:

1) High rate of job-hopping.
2) Significant difference in function and status between engineers and technicians.
3) Multi-cultural and multi-lingual society.
4) Existence of a large number of SMEs; most of their staff are 12SPM graduates.

Such research work can be undertaken by joint efforts of NPC and SIRIM and also in collaboration with other institutes and universities. Nevertheless, an alternative possibility is to establish an organization responsible for R&D and promotion of quality management, if the joint efforts of NPC and SIRIM are not workable. This new organization would be responsible for undertaking R&D, and training and consultancy services of quality management for companies, etc.

5.3 Promotion of Quality Management among Small- and Medium-Scale Industries (SMIs)

There is a significant gap of technology and quality between local SMIs and foreign affiliate and large firms, and this has prevented linkages between these sectors, and forced the latter to rely on imported materials for its production. Improved quality of SMI products is essential for a balanced development of industry in Malaysia. However, the promotion of quality management to SMIs is a more difficult task, the following points require special attention:

1) Development of industrial standards or guidelines, to be used as the basis for SMIs to establish their in-house standards for application of quality management.
2) Provision of incentives to encourage SMIs' to invest on quality management.
3) Provision of tax credit on the increased costs of SMIs as sub-contractors as a result of application of effective quality management.
4) Research on application methods of quality management applicable to SMIs, and technical extension services and consultancy services, as well as financial assistance such as ITAF.

6. Recommendation on Enhancement and Promotion of Industrial Standardization and Quality Assurance

6.1 Goal and Framework of the Promotion Program

6.1.1. Industrial Development Strategy, and Enhancement and Promotion of Industrial Standardization and Quality Assurance

6.1.1.1 Issues of industrial development in Malaysia, and development strategy

(1) Issues of industrial development

Issues of economic and industrial development in Malaysia, as discussed in Chapter 2, may be summarized as follows.

National economic policy under the Second Outline Perspective Plan (OPP2) and Sixth Malaysia Plan (SMP) called for sustaining the momentum of economic growth by promoting the expansion of the manufacturing industry, particularly export-oriented industry which will provide the leading role for achieving the economic growth targets.

There was, however, recognition of risks associated with increasing competition in the export of manufactured products as well as the structural weakness of the existing industrial base heavily concentrated on two sub-sectors, namely, the electrical and electronic and the textile and apparel and also standing on limited linkages both within the sub-sector and with the rest of the economy, notably with SMIs.

Thus, in order to remain competitive in the export of manufactured goods and to sustain a rapid economic growth, emphasis of industrial development policy was placed on promoting new sources of growth, while maintaining the importance of the foregoing two sub-sectors, with the following thrusts:

1) Broadening and deepening the manufacturing base through further enhancing the development of new sources of growth, product improvement in terms of quality and technology, the promotion of greater inter-industry and sectoral linkages, encouraging local firms to upgrade their product quality and support services so that industries located in FTZs can obtain their inputs from local firms;

2) Enhancing and sustaining the competitiveness of manufactured exports through the production of sophisticated high quality and high value added products, and productivity growth; and

3) Improving and expanding the capability of SMIs to supply the required production inputs of the larger enterprises and also to penetrate into export markets.

In view of this development policy, efforts for the promotion of the balanced development of industries and integrated export activities by means of (a) expanding export-oriented industries and (b) enhancing linkages with local supporting industries particularly SMIs are seen as the main tasks for industrial development.

In order to expand exports of manufactured products, especially high-technology-based, high value-added products, every effort is needed to enhance the international competitiveness of those products manufactured in Malaysia.

(2) Industrial development strategy

As may be seen from the experience of the Asian NIEs, the most successful of the several strategies for industrial development adopted in many developing countries is to accelerate foreign investments in the industry, particularly export industry thereby expanding the export-oriented industry with the support of foreign investors for export marketing while elevating technology levels of the local industry through a transfer of technology encouraged by strengthening linkages between the foreign affiliate firms and local firms.

Malaysia also adopted this strategy after different approaches sought in the process of industrialization, and this promoted export-oriented industrialization. As indicated in Chapter 2, however, many of those industries developed with foreign investments have slight linkages with existing indigenous industries. As a result, in Malaysia there exist a large number of small local firms engaged in manufacturing industries which have no links with the export-oriented industries, while there are also a considerable number of manufacturing companies having weak linkage with local firms as represented by the FTZ companies.

In view of the current industrial trends in the advanced industrial countries, many manufacturers there are still seeking to establish or expand production bases in the

Southeast Asian countries including Malaysia. In order to attract their interest, Malaysia needs to nurture more local firms which can act as linkage or supporting industries for foreign investors.

One of the underlying constraints in developing linkages between foreign affiliate firms and local firms is the inadequate technical capabilities of local firms for absorbing transferred technology. Most foreign affiliate companies are reluctant to nurture local suppliers of required parts and materials, unless they have technical capabilities of absorbing transferred technology to some extent, since technical guidance and assistance to be exerted for nurturing capable local suppliers are costly and time-consuming for foreign affiliate companies. Furthermore, it is uncertain yet whether such local firms will be able to act as qualified suppliers. At present as there are only a very limited number of capable local firms, most foreign affiliate mainstay manufacturers operating in Malaysia are dependent on imported parts and materials or supplies from other foreign affiliate manufacturers which have been established to domestically produce those parts and materials to meet the requirements of the foregoing mainstay manufacturers.

In view of these needs, the key thrusts of industrial development strategy for Malaysia should be 1) to further industrialization based on foreign investments, while encouraging 2) the upgrading of technical capabilities of local firms for absorbing technology and 3) the development of local supporting industries ,and thereby 4) promoting the elevation of the technical level of those local supporting industries and their linkages with the foreign affiliate mainstay or associated parts and materials manufacturers.

Another important concern for the successful advancement of Malaysia's industrial-ization would be to shift industries away from the labor intensive industries which were once competitive due to the cost advantage of Malaysian labor in the past, towards more sophisticated industries for which Malaysia can sustain competitive-ness using the comparative advantages of other factors besides labor cost.

The labor shortage and labor cost increase are becoming more significant in Malay-sia due to the rapid expansion of industry. These conditions in Malaysia will force labor intensive industries to move to other countries where cheap labor forces are abundant. On the other hand, the sophisticated-technology based industries, which require a continuous innovation of technology, tend to remain in the industrialized countries, since these have the supporting basis for such innovation. In this con-text, Malaysia should focus on the possibility of developing industries which are in-between the foregoing two types of industries. The development of the more

sophisticated industries should be coordinated with that of sophisticated supporting industries. The technical capabilities of local firms are far below the levels to meet such requirements, and therefore the immediate needs to be met by promoting foreign investments in these fields, while encouraging the transfer of their technology to local firms, as well as upgrading technical capabilities of local firms for technology absorption and quality management so that they function as capable supporting industries in the future.

The firms which are engaged in those supporting industries should continuously devote themselves to the improvement of technology so that they can produce more sophisticated components, parts and materials with their own product development to meet the requirements of mainstay manufacturers which may change along with the evolution of high technology industries. Hence local firms engaged in the supporting industries should undertake long-term efforts for staged upgrading of their technical capabilities, so that they can develop and produce those components, parts and materials using their own technologies so as to meet the needs of users in the future.

Malaysia should pursue the advancement of balanced industrialization with the development of the inter-industry and sectoral linkages, particularly focusing on enhancement of supporting industries, as well as the provision of appropriate supports to the industry with regard to the following aspects:

1) To assure the credibility of Malaysian products in export markets, which is essential for the industrialization led by export-oriented industry.

2) To take appropriate coordination and adjustment for pursuing industrial development while protecting the quality of human life from any adverse affects which may arise from the industrial development and also inflow of new industrial products on markets.

3) To sustain the competitiveness of Malaysian industry by the institutional buildup of technical infrastructures.

6.1.1.2 Major tasks for the enhancement and promotion program, and selection of strategic industries for the program

The industrial standardization and quality assurance, in conjunction with various policy measures provided for industrial development, function as technological infrastructure and also as the technological basis for policy implementation to guide

the sound growth of industry through the improvement of quality.

The quality management encourages individual firms to improve specific manufacturing technology adopted for their production. Hence the promotion of quality management in industry should be actively carried out by means of elevating management' quality awareness, disseminating philosophy of quality management, and providing technical guidance for practicing the quality management system and techniques.

For quality management, it is important to determine the technical standards to be used as the basis for the management, and then coordinate their improvement with the raising of quality level attained through the quality management.

Industrial standardization should be adapted to differences in needs over time or by country. One main task is to match standardization to the objective and specific needs of industrial development in the country concerned. In Malaysia industrialization has progressed rapidly within a short period with the transfer of industries from other countries, unlike industrialization in the advanced industrial countries which was a long-term process. Hence Malaysia must tackle all the issues which the industrialized countries faced in the long process of their industrialization. One critical issue is how to sustain industrial development while protecting the quality of human life.

(1) Priorities for the industrial standardization and quality assurance in view of economic and industrial development in Malaysia

1) Promotion of greater inter-industry and sectoral linkages by raising quality levels of local firms

Major actions to be taken include 1) the enhancement and development of industrial and technological bases, 2) the enhancement and promotion of quality management, and 3) the promotion of the use of standards in quality management.

The enhancement of industrial and technological bases through standard development and updating is to define basic or common items and ensure compatibility of those defined items, including technical standards for terms, symbols, common testing methods and reference materials. More specifically, this means the terms used for quality control, for measurement, the common rules for drawing, standard numbers, reference gases, reference solutions, reference materials for hardness, screws, etc. Such standards contribute to the development of association standards

and the enhancement of standardization and quality management among individual manufacturers, and also encourage the technological improvement of SMIs.

2) Assurance of credibility of Malaysian products in export markets

The credibility of Malaysian products can be assured in export markets through establishing the conditions that industry in Malaysia applies quality management using the internationally acceptable methods and standards, and that the testing institutions undertaking assessment of quality are those accredited with internationally recognized standards.

The adaptation of national standards to international environment will be one of the important tasks to be tackled in the pursuance of standardization in Malaysia, since the industrial development is led by export industry based on foreign technology. The Malaysian authorities have already taken several actions in this direction to date. In response to the further internationalization of European markets due to the unification of EC, exporters to the EC markets will be required to adopt international standards and internationally recognized certification. Thus, internationally acceptable standardization is a basic requirement for Malaysian industry.

Industrialization in Malaysia is closely connected with the globalization of the international operations of manufacturers of the industrialized countries. Along with the expansion of their international operations, trade between Malaysia and its neighboring countries will also increase for parts, components and materials which complement each other. In view of this trend, Malaysia should adapt Malaysian standards to international levels with a view not only to encouraging the internationalization of the domestic industry but also of initiating the establishment of common standards with neighboring countries in connection with the AFTA.

3) Coordination and adjustment for pursuing industrial development while protecting the quality of human life

In the industrialized countries, the current concern is to take appropriate coordination and adjustment of industrial development as well as technology development with a view to protecting the quality of human life, but this issue has arisen as industrialization has reached an advanced level at the end of a long process. In the developing countries the situation today is quite different, since the industrialization there mirrors the situation of industries established in the industrial countries. This situation has brought about drastic changes in consumers' markets, regardless of extent of industrial diversification in these countries.

These countries, tend to pay less concern for the coordination with quality of human life, putting more emphasis on industrial development, because the measures to protect the quality of human life often cause additional costs for production and distribution of products.

In Malaysia the standardization related to the protection of environment and consumers is of a very limited scope, covering only a part of protective requirements such as those related to the safety of automobiles, and there are still many areas on which standardization should be intensified so as to satisfy minimum requirements for such protection.

Further, as the industrialized countries are the main export markets for Malaysia and are more strict in regulating the industrial goods to protect the environment and human life, guiding the domestic industry to meet such requirements will contribute to upgrading technology capabilities of manufacturers so that they can meet the requirements of export markets. If such action is not taken in Malaysia, it will adversely affect the export of Malaysian products and also restrain the elevation of awareness of quality management.

Standards to be developed in this stage will be those of testing method of factory drainage, exhaust gas, measurement methods of exhaust gas of automobile, automeasurement instruments of pollution etc. to prevent pollution and ensure a favorable social and natural environment. Though the required standards may vary depending on the major issues at that time relating to environment protection.

The standards related to consumer goods such as dimension of clothes, base size of lamp bulb and detergent are also useful in improving quality, durability, safety of consumer goods, ensuring compatibility, and rationalizing specifications and consumption modes.

The development and revision of standards to save resources and energy, such as those for testing method of fuel and energy of refrigerator, stoves and automobiles and also those for equipment for saving resources and energy, significantly contribute to development and diffusion of resource and energy saving-type products.

4) *Strengthening competitiveness of industry through institutional buildup of technical infrastructure*

The development of technical infrastructure as well as economic infrastructure plays a crucial role in strengthening the competitiveness of industry. The technical infrastructure includes those related to R&D for development of technology, technical guidance and training, and testing. Industrialization in Malaysia in the past largely depended on labor intensive industries mainly developed with foreign investment, and based on technology transferred from industrial countries adopted without any modification or improvement. However, as already mentioned in the foregoing section, it is likely that those labor intensive industries will be shifted to other countries where cheaper labor forces are available. Manufacturers in the industrialized countries, at the same time, are shifting many of their production bases abroad, except those based on the most sophisticated high technology or those requiring continuous efforts for innovation of technology as well as development of products to meet the changing needs of the market. They are seeking the countries where technical infrastructure enable transferred industries to sustain competitiveness and continuing improvement. In order to promote such investment in Malaysia, the institutional buildup of technical infrastructure, including the enhancement of R&D institution and supporting industries, is vital.

Although various new technologies have been transferred to Malaysia, the development of national standards for these remains a future task for Malaysia. Most of technologies in Malaysia are those developed abroad,and Malaysia is not at the level to improve these technologies by themselves. It seems too early to develop national standards related to those new technologies at the present level of technical capabilities of the industry, because this would limit flexible response to continuous innovation of technologies. If standards are established at a high level unsuited to Malaysian industry, these standards will remain unused. Therefore, the standardization in this field should be initiated with the adoption of international standards in response to the upgrading of technical capabilities of industry in the country.

(2) Strategic industries for enhancement and promotion of industrial standardization and quality assurance

It would be more effective to undertake activities for the enhancement and promotion of standardization and quality assurance in the strategic industries first, and then expand these to other industries once the effect of such activities is confirmed.

The strategic industries for the enhancement and promotion of standardization and quality assurance should be the industries which have been identified as those for development, and also in which the effect of standardization and quality assurance may be significant.

1) Strategic industries identified for priority development in the industrial development plan

As reviewed in Section 2.1., the Government has identified several industries as strategic industries for industrial development as indicated in the IMP, OPP2 and SMP. These strategic industries comprise resource-based industries and non-resource-based industries, and emphasis is placed on the development of linkages among these industries. This development strategy led to successful development of industry in Malaysia taking advantage of Malaysia's abundant natural resources.

In recent years, increasing emphasis has been placed on the development of supporting industries, which supply components and parts as well as intermediates to other industries, and the promotion of SMIs, which are expected to play a significant role in the supporting industries.

2) Strategic industries vital for achieving balanced development of industry

The importance of the foregoing industries may be justified through the analysis of input-output table of Malaysian industry.

According to past input-output table the overwhelming majority of industries in Malaysia were engaged in the manufacturing of final products at the initial stage of industrialization. Increasing number of industries, however, have diversified to the manufacturing of intermediates in keeping with the progress of industrial evolution. These intermediate supply industries are mostly dependent on natural resources endowed in Malaysia, such as wood, petrochemicals, and nonferrous metal products. Machinery, electric and electronics industries which are non-resource industries, on the other hand, had only minimal linkages with other industries until the early part of the 1980's as indicated in the input-output table in 1983 which is the latest table available.

3) Strategic industries in which the effect of standardization and quality assurance may be significant

The industries in which the effect of standardization and quality assurance may be significant, are those indicated in 1) below and, at the same time, being situated as 2) below:

1. Industries which require the assurance of high/stable quality or strict conformity to specifications, including those:

   a. requiring high precision;
   b. requiring interface to be maintained;
   c. requiring particular consideration given to safety, health, and environment protection, as well as consumer protection; or
   d. requiring quality or specifications of the material not easily defined by its appearance.

2. Industries which currently have difficulties in meeting the above conditions or which may probably face similar difficulties in the future. Nevertheless, the enhancement and promotion of standardization and quality assurance will not be urgent for the industries for which technology improvement or any other measures have been undertaken to solve such difficulties.

4) Selection of strategic industries for the enhancement and promotion of industrial standardization and quality assurance

Based on the above the top priority, in selecting strategic industries for the enhancement and promotion of standardization and quality assurance, should be given to the core industries which have significant impact on the development of relevant local industries and thereby promote the balanced development of industry, and also which require a steady supply of high quality products. The thus selected priority industries are the component parts industries relevant to the automotive industry and the electric and electronic industry. These include a part of metal engineering industry which supply these component parts, and the plastics processing industry.

The second priority is given to the industry for which assurance of quality is the key for stable growth. The rubber related industries, particularly rubber glove manufacturing industry which is a resource based export industry, is the industry under this category and in fact this industry requires further efforts to ensure the

stability of product quality.

The third are the industries which are engaged in the fields for domestic markets and have no linkage with export industries but for which the upgrading is vital to the enhancement of bases for expanding the supporting industries in future. These include another part of small and medium-scale metal engineering industries.

6.1.1.3 Existing government programs related to the enhancement and promotion

The following are the key policy and the action plan adopted by the Malaysian Government,which are related to the enhancement and promotion of industrial standardization and quality assurance.

1) Strategies to Improve Quality Through Standards and Certified Products (approved by the Cabinet in October 1991)

2) National Action Plan for Industrial Technology Development (APITD)

The former sets the basic direction of activities on standard development and certification, and the latter sets the basic guideline of action plan for the enhancement and promotion of quality management in the industry, particularly SMIs. The enhancement and promotion program presented in the subsequent sections have been formulated in line with the basic direction set in the above policy and plan.

6.1.2 Main Issues to be Considered for the Enhancement and Promotion of Industrial Standardization and Quality Assurance in Malaysia

As has been discussed in Chapters 3 to 5, the system and organizational structure for the enhancement and promotion of industrial standardization and quality assurance in Malaysia have been well established. Further, the Cabinet Paper clearly indicates the strategy to be undertaken for the activities of standardization. In the promotion of quality assurance, Malaysia has aggressively disseminated quality systems, focusing on those based on the internationally accepted ISO 9000. For this purpose, Malaysia has disseminated the ARQS, the certification scheme for those systems, and also QSCRS, the sub-system of ARQS.

However, as discussed in Chapter 2, and also as noted in the Cabinet Paper, some weaknesses are observed in these activities. These are highlighted below.

1) The degree of diffusion on standardization and awareness of quality management is extremely different by industry and level of companies. The small and medium enterprises, particularly those having no relation with export business or foreign affiliate companies generally have little awareness of these aspects.

2) Even among the manufacturers who are aware of importance of standardization and quality management, only a few understands required action for standardization and quality management precisely as demanded in export markets or by supply users of stable quality and high precision products. Many of manufacturers undertake quality management only to the extent to meet the specific requirement from the market, and they have no system yet for improving their technologies through quality management.

3) The prevailing view among manufacturers is that standardization is a task to be undertaken by the government or its agencies, particularly SIRIM, and thus most are unaware that the standardization will benefit the industry itself.

4) Although the government has a definite policy and strategy for the enhancement and promotion of standardization and quality assurance, there are various constraints in implementing these, because of a weakness in the base for implementation. These are;

   a) There is no counterpart on the industry side to draft standards, and such work therefore falls mostly on SIRIM.

   b) There is no established function to assess the effectiveness of standards at an application level and to reflect it to standards, so that it is difficult to carry out the updating of standards effectively.

   c) As many manufacturers have only superficial knowledge on quality management, no guidelines have been prepared for the application of quality system based on ISO 9000 to meet the needs of individual industries. Hence many of them feel it a complicated system involving many unnecessary steps and procedures, although considering its application necessary to meet their business needs.

5) Public testing facilities are inadequate both in the quantity and quality to meet the needs of the rapidly developing industry.

6.1.3 Framework of the Program

There are four thrusts, as mentioned in the former section, to be pursued for the enhancement and promotion of industrial standardization and quality assurance. These are:

1) Enhancement of inter-industry and sectoral linkages through upgrading technology and quality of local firms, including:
   a) Enhancement and development of industrial and technological basis;
   b) Enhancement and promotion of quality management in the industry; and
   c) Promotion of usage of industrial standards in quality management practice.

2) Assurance of credibility of Malaysian products in export market.

3) Enhancement of coordination and adjustment for pursuing industrial development while protecting quality of human life.

4) Sustaining competitiveness of industry through institutional buildup of technical infrastructure.

The necessary activities to be undertaken for attaining these objectives are summarized in Table 6-1. There are four areas which should be reinforced as the basic facilities for enhancing the standardization and quality assurance. These are:

1) To intensify the certification system as an incentive for the industry and individual firms to undertake the standardization and quality management more aggressively;
2) To establish more standards which function as the technological base for quality management;
3) To intensify the educational and training system to support the undertaking of quality management by the industry; and
4) To upgrade the testing system and facilities required for quality management.

1) Intensification of the certification system as an incentive for undertaking quality management

The most effective incentive for manufacturers to encourage the undertaking of quality management is to ensure that quality management surely brings more returns in their business. For instance, the product certification system since it encourages manufacturers to undertake quality management as the basis for apply-

ing product certification. Use of certification systems is an effective measure in this sense. Because it contributes to the sales promotion of manufacturers through assurance of the quality of certified products. The quality system certification also contributes to the sales promotion of manufacturers, since it assures credibility of the certified manufacturers to manufacture quality products.

In addition to these voluntary certification systems, it is also necessary to enforce the mandatory certification system in order to guide manufacturers to undertake the quality management, particularly in countries where quality awareness of consumers is still low.

In Malaysia, the most effective areas for the intensification of certification systems are a) the product certification for the automotive parts industry which is closely related to the SMIs, particularly focusing on assurance of safety, pollution control and mechanical performance, b) the product certification for the products to be procured by the government agencies and public corporations, and c) the quality system certification based on ISO 9000.

The intensification of the certification systems should be associated with 1) the development of standards to be used as the basis for the certification, 2) improvement of the systems to be more effective, 3) dissemination of the systems into the industry and market, and 4) enhancement of the management mechanism for implementation of these systems.

2) Development of standards as the technology base

The development of technical standards is indispensable as the base for undertaking quality management. For the manufacture of parts to be used for automotive and electric and electronic products, these standards are provided by the customers in the form of specifications. However, manufacturers who manufacture products only in accordance with the specifications of final products given by their buyers, or who manufacture products based on their own designs, have to develop applicable standards by themselves. The development of in-house standards is difficult for firms weak in technical capabilities. It is desirable to develop these standards as national or association standards to make these standards available for quality management in individual firms, and to upgrade them as their in-house standards through the quality management.

SIRIM is the sole agency responsible for standard development, but it has constraints in expanding the activities for standard development. Hence, for more

standards to be developed in keeping with the growth of industry, it is necessary to take the following measures:

1) To concentrate the development of national standards in priority areas;
2) To adopt as many international and foreign standards as the national standards as applicable;
3) To decentralize standard development;
4) To undertake research required for the development of standards; and
5) To carry out the above activities in accordance with the phased programs set up for the expansion of standard development.

It is important to encourage more active participation of manufacturers' representatives in the development of standards, and then guide them to organize technical committees in their associations for development of association standards to supplement to national standards.

Another important task is to institute research required for the development of standards through collaboration among existing research institutions and industrial associations. It is to investigate and analyze basic factors which form the bases for standards, such as the analysis of the causes of traffic accidents and research on required strength of components to define the basis for establishing standards for safety components of automobiles, and the research on convenience of use, strength and size of products as the basis for establishing standards relating to the products designated for the government and public procurement. These researches will contribute also to the development of indigenous technology in the future.

3) Support for the undertaking of quality management by manufacturers

Support for the undertaking of quality management by manufacturers should include not only the direct assistance but also dissemination of quality awareness to the market and general public. The assistance to the manufacturers will include 1) the formulation of guidelines for introduction of quality systems, and 2) the establishment of a public institution as well as the nurture of quality system consultants to be engaged in appropriate technical guidance with regard to quality management.

Quality system certification based on ISO 9000 will become essential for manufacturers. Nevertheless, it will burden the small and medium-scale manufacturers who supply their products to the domestic users, as they are unable to adopt the quality system with the seminars and guidance provided currently because these seminars and guidance are very general without any specific guidance taking into account

particularities of individual industries or business groups like SMEs. It is necessary to undertake appropriate promotion and assistance programs to encourage the manufacturers' associations to formulate the guidelines for quality system applicable to individual industries.

Such promotion and assistance programs should be carried out at each industrial center. The dissemination of quality awareness to the market and general public should aim 1) to elevate their awareness on importance of quality, and also 2) to give them basic knowledge as to what is quality management and how the control management is carried out.

4) Upgrading of testing system and facilities

Testing system and facilities are essential tools for carrying out quality control. It is necessary to enhance the testing system and facilities at the three levels of 1) individual factories, 2) public institutions, and 3) accredited private or other laboratories.

Since industry in Malaysia is dispersed over several industrial areas, separate testing facilities should be established at each industrial center.

The recommendations presented in the subsequent sections cover the following four functions:

1) Intensification of the activities for development and updating of standards
2) Intensification of the certification activities
3) Upgrading and expansion of testing and calibration capacity
4) *Enhancement and promotion of quality management*

The recommendations on each of the foregoing four functions comprise the following three levels:

(1)Recommendations on direction and measures to be taken for the enhancement of industrial standardization and quality management (Section 6.2).

(2)Action programs/projects to be undertaken in connection with the implementation of the recommended measures, comprising the following three types of programs (Section 6.3):

1) Programs to strengthen institutional or organizational system
2) Projects for upgrading relevant facilities
3) Training programs relating to certification and testing

(3)Package programs for actions to be undertaken on specific industrial sub-sectors (Section 6.4).

These are the action programs to be implemented by the agencies or institutions most directly concerned by the program measures. The action programs will be carried out by the agencies working in close cooperation to coordinate these in a comprehensive manner. The programs will focus on specific industries or business groups which have been selected in line with the strategies for industrial development as well as for the enhancement of standardization and quality assurance.

The current government program is wide ranging and covers most of these program components. Some of these programs, however, require improvement and intensification to define the steps for actual implementation.

6.2 Recommendations on Direction and Measures to be Taken for the Enhancement and Promotion of Standardization and Quality Management

This section recommends the measures to be taken for the enhancement and promotion of standardization and quality management.

These recommendations are categorized and summarized in Table 6-1, while details of the recommendations with a discussion of issues and rationale, are given in Chapters 3 through 5 of the main text (the section numbers are shown in the table).

6.3 Action Programs and Projects to be Undertaken in connection with Implementation of the Recommended Measures

The following are the action programs and projects to be undertaken in connection with the implementation of the measures recommended in Section 6.2 above.

(1) Programs for strengthening institutional or organizational systems

1) Decentralization program of standard development.
2) Program for encouraging industrial associations to participate in standard development.
3) Program for instituting of research network to undertake research required for the development of standards.
4) Program for specifying the duties and responsibilities of quality officers of firms (as an assessment item to be included in a factory assessment for certification, and for implementing a new certification scheme thus including the assessment of firm's quality officers).
5) Program for specifying qualifications of the quality officers of firms (which is to be included as an assessment item in the new certification scheme proposed in 4) above).
6) Program for specifying the assessment of firm's in-house standardization (which is to be included as an assessment item in the new certification scheme proposed in 4) above).
7) Program for instituting the national level organizations for TQC promotion.

(2) Projects for upgrading testing facilities

1) Upgrading the testing facilities set up for certification tests at the SIRIM Headquarters.
2) Setup of testing facilities for contract tests at a) the SIRIM Branch Offices in Penang and b) Johor Bahru.

In addition to the above, the upgrading of metrology and calibration facilities is essential. The conceptual direction of the upgrading was discussed in Chapter 4. Details, however, need to be defined based on the further study about the future of industrial metrology in connection with the national metrology system in Malaysia.

(3) Training programs for staff in charge of the certification and testing.

1) QC training program for to be qualified quality system auditors.
2) Training program for recruited staff in charge of quality system auditing.
3) Training program for recruited staff in charge of factory inspection for product certification.
4) Training program for staff in charge of testing.

6.3.1 Programs for Strengthening Institutional or Organizational System

6.3.1.1 Decentralization program of standard development

See 3.2.3.2 (3) of Chapter 3.

6.3.1.2 Program for encouraging industrial associations to participate in standard development

See 3.2.5 (3) of Chapter 3.

6.3.1.3 Program for instituting a R&D network to undertake research required for development of standards

(1) Implementing body: SIRIM

(2) Other organizations involved: RRIM, PORIM, MARDI

(3) Actions to be taken prior to implementation

1) Institutional setup: To formulate long-term, medium-term, and annual plans for standard development by SIRIM.
2) Organizational setup: To establish an ad hoc committee with representatives of various R&D institutes including universities, which functions to determine the subjects of research which are conducted as the basis for standard development.
3) Legal aspect: none
4) Coordination aspect: as stated below

(4) Implementation procedure

1) Formulate draft long-term, medium-term, and annual plans for standard development by SIRIM.
2) Invite the opinions of the Standard Technical Committee on the required R&D for standard development.
3) Establish the foregoing ad hoc committee to determine the subjects of research to be entrusted to the research institutes including SIRIM.
4) Based on the subjects of research decided by the ad hoc committee, prepare an annual implementation program for the research, including time schedule and required expenses.
5) Appropriate budget for conducting the research and entrust these to appointed R&D institutes.
6) Monitor by the ad hoc committee the progress of research with the review of progress reports submitted by the R&D institutes undertaking the research programs.
7) Assess the outcome of research conducted, and present results to the Standard Technical Committee as the basis for drafting standards.

6.3.1.4 Program for specifying the duties and responsibilities of quality officers of firms (as an assessment item to be included in a factory assessment for certification, and for implementing a new certification scheme including the assessment of firm's quality officers)

(1) Implementing body: SIRIM

(2) Required period

The program is designed to complete all preparation with a period of two years so that a new certification scheme based the proposed amendment can be implemented

in the third year. The preparatory work consists of a scheme design to be carried out in the first year and the diffusion and finalization of scheme in the second year.

(3) Implementation procedure

1) Scheme design stage (first year)

a) Set up a working committee which is to prepare a draft proposal on defining the duties and responsibility to be assumed by the quality officers of firms as an assessment item to be included in a factory assessment for certification. The committee will consist of senior quality system auditors who have experience on quality system auditing. ISO 9000 is a helpful reference material for this purpose.

b) Set up a consultative committee organized with the representatives of firms' quality control experts, managers of certified factories and of industrial associations, and invite their comments on the draft proposal prepared in a) above. The draft proposal shall be thus finalized by SIRIM in consultation with the consultative committee.

c) Prepare, in consultation with the consultative committee, a proposal of temporary measures to be applied, at the time of transition to a new certification scheme adopting the assessment of quality officers, against the factories having certification license granted under the present certification scheme.

2) Scheme diffusion and finalization stage (second year)

a) Elaborate the certification scheme, including assessment manual and application form for certification, with appropriate amendments based on the result of the foregoing step of preparatory work.

b) Take appropriate measures to disseminate the new certification scheme and temporary measures to all concerned parties (firms and industrial associations, etc.).

c) Provide special measures for extending the validity of the certification license granted under the present certification scheme to a certain period during which the factories having the license can prepare an application for certification under the new certification scheme.

d) Provide appropriate training to the SIRIM assessors with regard to the new certification scheme prior to the implementation of the new scheme.

3) Implementation stage (third year)

The implementation of the new certification scheme will be started following the foregoing two-year preparation stage. During the initial two to three years after implementation, however, the effect and impact of the new scheme as well as the reaction of firms should be carefully watched so further amendments of the scheme where necessary.

(4) Requirement of foreign technical assistance

No foreign technical assistance will be required for this program.

6.3.1.5 Program for specifying qualification of the quality officers of firms (which is to be included in the new certification scheme proposed in 6.3.1.4 above)

(1) Implementing body: SIRIM

The training for quality officers is not necessary to be undertaken by SIRIM. The training may be entrusted to other appropriate training institutes. The curriculum and the examination questions for the qualification, however, are recommended to be formulated by or under the responsibility of SIRIM.

(2) Required period

The program is designed with the same step and time frame as the above program proposed in 6.3.1.4.

(3) Implementation procedure

1) Scheme design stage (first year)

a) Study similar schemes adopted in foreign countries and the present factory conditions in Malaysia, and based on this study prepare a draft proposal on qualification of firm's quality officers, including knowledge and expertise of quality officers required.

b) Set up a consultative committee organized with the representatives of firms' quality control experts, managers of certified factories and of industrial associations, and invite their comments on the draft proposal prepared in a) above. (This committee may be concurrent with that proposed in 6.3.1.4.)

c) Prepare, in consultation with the consultative committee, a proposal of temporary measures to be applied, at the time of transition to a new certification scheme adopting the assessment of quality officers, against the factories having certification license granted under the present certification scheme.

2) Scheme diffusion and finalization stage (second year)

a) Elaborate the certification scheme, including assessment manual and application from for certification, with appropriate amendments based on the result of the foregoing step of preparatory work.

b) Take appropriate measures to disseminate the new certification scheme and temporary measures to all concerned parties.

c) Provide appropriate training to the SIRIM assessors with regard to the new certification scheme prior to the implementation of the new scheme.

3) Implementation stage (third year)

The implementation of the new certification scheme will be started following the foregoing two-year preparation stage. During the initial two to three years after implementation, however, the effect and impact of the new scheme as well as the reaction of firms should be carefully watched for further amendments of the scheme where necessary.

(4) Requirement of foreign technical assistance

It is recommended that technical assistance of foreign quality management experts be sought for the preparation of curricula for the training of firms' quality officers. It is important to upgrade the level of quality management practiced in Malaysia to the level of advanced industrial countries in order to sustain competitiveness of Malaysian products in international markets. To this end it is essential to upgrade expertise of Malaysian quality officers in respect of quality management, since they are responsible for quality management in factories.

The technical assistance will take three years. The foreign experts will be in charge of preparing curricula and textbooks, and training local lecturers.

6.3.1.6 Program for specifying the assessment of firms' in-house standardization (which is to be included as an assessment item in the new certification scheme proposed in 6.3.1.4)

(1) Implementing body: SIRIM

(2) Required period

The program is designed to complete all preparation with a period of one year so that the assessment items be specified in the second year and the certification scheme be amended, and the transfer procedure be defined for the factories certified by the existing scheme. Following these steps, the diffusion and finalization of scheme can be undertaken and the new scheme will be implemented the third year.

(3) Implementation procedure

1) Scheme design stage (first year)

a) Study of similar schemes adopted in foreign countries and of the present conditions of in-house standardization in factories in Malaysia, and based on the study prepare a draft proposal on the assessment of in-house standardization which is to be included as an assessment item in the new certification scheme proposed in 6.3.1.4.

b) Set up a consultative committee organized with the representatives of quality control experts, managers of certified factories and of industrial associations, and invite their comments on the draft proposal prepared in a) above. (This committee may be concurrent with that proposed in 6.3.1.4.)

c) Prepare, in consultation with the consultative committee, a proposal of temporary measures to be applied, at the time of transition to a new certification scheme adopting the assessment of in-house standardization, against the factories having a certification license granted under the present certification scheme.

2) Scheme diffusion and finalization stage (second year)

The same procedure as that for the program proposed in 6.3.1.4 is applied.

3) Implementation stage (third year)

This program will be implemented in the new certification scheme proposed in 6.3.1.4, since it constitutes a component of the new scheme.

(4) Requirement of technical assistance

It is recommended that technical assistance of foreign experts be sought for the preparation and implementation of the assessment of firms' in-house standardization. Since the level of in-house standardization can be improved in accordance with the improvement of Quality Management (QM), the expertise and experience of the advanced industrial countries in respect of in-house standardization will serve as a useful reference.

The technical assistance will be required for three years. In the event of foreign QM experts being engaged for the program proposed in 6.3.1.4, these experts can cover this field of assistance.

6.3.1.7 *Program for instituting national level organizations for QC promotion*

(1) Program contents

1) Establish a National TQC Council chaired by the Minister of MOSTE with membership drawn from private industries, professional organizations, universities and public sector agencies to plan, coordinate and implement a national level QM enhancement and promotion

2) Establish the secretariat organization for the above, or assign it from existing organizations. The secretariat organization is recommended to have the functions of QM promotion by themselves or implement it by entrusting to other existing organizations.

(2) Implementing body: to be designated by the Government

Most of the functions required for the center organization of QM promotion are included in NPC's objectives, except for the registration of qualified QM experts who are engaged in the technical guidance and promotion of QM to firms. However, NPC activities are not active for coordination of relevant organizations regarding QM promotion, as well as research required for application of QM in industry.

It is essential to institute functions and activities to be undertaken by relevant organizations, particularly SIRIM with regard to the technical aspects relating to the diffusion of QM to industry.

(3) Actions to be taken prior to implementation

1) Institutional setup: none

2) Organizational setup:

a) Establish a TQC Council, or reorganize the existing TQC Advisory Committee for this purpose.

b) Establish the secretariat organization or assign it from existing organizations.

c) Strengthening of NPC's activities to undertake 1) research on most appropriate application method of QM adaptable to the Malaysian conditions, and 2) the registration of qualified personnel who are engaged in technical guidance and promotion of QM to industry.

d) Establish a new division in SIRIM to be responsible for undertaking research as well as technical guidance on QM. This division will carry out its duties with support of other centers and divisions in charge of R&D and technical assistance in SIRIM.

e) Expand the function of the above secretariat organization so that it can undertake all necessary functions, if undertaking by NPC and SIRIM proves difficult. Even in this event, close communication and coordination with NPC and SIRIM is indispensable. JUSE in Japan is a typical example for this kind of organization.

3) Legal aspect: Take legal steps to authorize the above committee as the central core for the national level promotion events and also the formulation of annual national promotion plan which designates the activities to be undertaken by relevant agencies or institutions for QM promotion

4) Coordination: Coordinate the relevant agencies and institutions to accept the leading function of the foregoing organization

(4) Implementation procedure

1) Establish divisions responsible for the above functions in NPC and SIRIM, and start the preparatory work including study and research with mutual coordination between NPC and SIRIM on the subjects to be carried out. This work is to prepare the fundamental aspects and framework of overall activities to be determined at the TQC Council and also the framework of the secretariat organization to be set up.

2) Establish the TQC Council headed by the Minister of MOSTE, and establish the secretariat organization or appoint an existing institution acting as the secretariat.

3) Formulate long-term, medium-term, and annual action plans for QM promotion, including appointment of institutions in charge of individual activities and appropriation of budget. The plan shall be reviewed and updated annually.

4) Organize the registration of QM experts who are engaged in the technical guidance and assistance on QM to industry. These personnel will be identified through seminars and training courses held.

5) Undertake publications on QM by NPC and SIRIM based on foreign publications and also on the outcome of research work undertaken by NPC, SIRIM and other institutes.

6.3.2 Projects for Upgrading Testing Facilities

6.3.2.1 Necessity of upgrading testing and metrology/calibration facilities

Investigations are made on the following testing and calibration facilities:

1) Testing facilities:
   a) for certification tests; and
   b) for contract tests.
2) Metrology/calibration facilities relating to industrial standardization and quality control

There is a great need for the upgrading of metrology/calibration facilities. The response to the questionnaire survey also showed a strong demand for calibration. Nevertheless it is still lower than that theoretically required because there are a

number of manufacturers with insufficient quality awareness who ignore the importance of calibration.

The required upgrading of the metrology/calibration facilities include:

1) Upgrading of the existing facilities in the SIRIM Headquarters for improvement of precision;
2) Installation of additional equipment at the SIRIM Headquarters to meet increasing demand from the industry; and
3) Establishment of basic calibration facilities at the SIRIM's Branch Offices to meet the demand for calibration in industrial centers.

The testing facilities for certification tests also need to be upgraded. The existing facilities are inadequate to carry out all testing even on the items required under the present certification system. Besides SIRIM, the existing laboratories accredited under SAMM are also inadequate to carry out such tests.

When the upgrading and expansion of the SIRIM facilities are implemented as proposed in the program, the facilities will be adequate to carry out all testing required for certification in the field of electric machinery and appliances. As for the testing of automotive parts, however, even after upgrading the facilities will only cover limited items of testing.

The contract tests are carried out upon request made by manufacturers. Manufacturers usually request the testing institutes to carry out tests on prototypes of new products which are made on the basis of the specification given by their customers, or tests for analyzing causes when they encounter any technical trouble. Upgrading of these testing facilities is also necessary. After upgrading and expansion, however, SIRIM's facilities for certification tests will be able to cover such tests demanded by industry, especially in Kuala Lumpur and Selangor area. In regions, as there is no testing facilities to meet the demand for testing even in the basic field from the regional industries, it is essential to provide the testing facilities in these areas.

In order to draw up a program for the upgrading of metrology/calibration facilities, a detailed study will be required. As the detail study on metrology system is out of the scope of the present study, only information a conceptual on the upgrading of metrology/calibration facilities is attached in Annex 7 for the reference.

6.3.2.2 Project for upgrading testing facilities

See Table 6–2.

6.3.2.3 Financial analysis of projects for upgrading and expansion of SIRIM testing laboratories

(1) Revenue

Test fees are the revenue source of the testing, which consists of two types of testing, namely, certification tests and contract tests. A projected number of testing for certification and contract tests is given in Table 6–3(1).

The revenue of certification tests is estimated by multiplying the average test fee for one certification test and the number of certification tests carried out.

Table 6–3(2) shows the number of test and inspection items required for each certification test to be conducted for products subject to the mandatory certification. Test and inspection of one product comprises 23.7 items on average. Excluding the items which do not require testing at laboratories, such as "Scope", "Terminology", "Indication", "Sampling Methods", etc., the number of laboratory testings for one certification test is estimated as 15 items on average. Although testing time and complexity of testing vary depending on testing items, assuming the test fee of M$100 for one item according to the SIRIM's fee rate, the test fee is estimated as M$1,500 for one certification test on average.

As contact tests are conducted on test items requested by clients, the time for testing varies substantially in each test. Hence the test fee for contact tests is usually charged on the basis of time spent for testing. In the case of certification tests, one laboratory tester carries out 50 tests a year on average on the basis of 250 annual working days in 8 working hours a day (i.e., 2,000 working hours per year). On this assumption, it is estimated that one tester can earn M$75,000 of test fees per year (M$1,500/test x 50 tests), or M$37.5 per hour (M$75,000/2,000 hours). Assuming fees for contract tests are charged at this hourly rate and a testing time of 32 hours for one test for contract tests in view of the current records, the test fee for consignment test is estimated as M$1,200 for one test on average (M$37.5/hour x 32 hours/test).

(2) Costs of testing

It is assumed that all the project costs for equipment and buildings will be financed by government grant. Hence the costs for testing include only direct operating costs for testing, excluding depreciation of equipment and building costs. The direct operating costs are estimated on the following assumptions.

1) Personnel costs

The projected number of staff required for testing is shown in Table 6-3(3). The personnel costs for staff are estimated as M$36,000 per staff member per year.

2) Welfare and insurance expenses

3% of the personnel costs.

3) Maintenance costs

The equipment costs are estimated at M$20.4 million for the upgrading of the testing facilities at the SIRIM Headquarters, M$7.92 million for the testing laboratory to be set up at the SIRIM Branch Office in Penang and M$7.76 millions for the testing laboratory at the SIRIM Branch Office in Johor Bahru, totaling M$36.08 million. (See Tables 6-2(2) to (4)). Annual maintenance costs are estimated at nil at the first year, 0.5% of the equipment cost in the second year, 1.0% in the third year, 1.5% in the fourth year, 2.0% in the fifth year, 2.5% in the sixth year and 3.0% in the seventh year onward.

4) Utility costs

Utility costs consist of electric power costs estimated at the power consumption of 2 million kWh per year and the rate of M$0.1/kWh and water costs estimated at the water consumption of 14,000 cubic meters per year and the rate of M$0.8/cub. meter.

5) Overheads

3% of the personnel costs.

(3) Projection of revenue and operating costs

The revenue and operating costs for testing which are estimated on the foregoing assumptions are shown in Table 6-3(4). It is assumed that the project will be completed by the end of 1993 and the operation will be started in 1994. As shown in that table, it is likely that the costs account for about 58% of the revenue during the initial two years and then decrease year after year to about 53% in the sixth year onward. This implies that the operation will earn some amount of reserves after covering the operating costs from the initial year.6.3.2.3insert

6.3.3 Programs for Training Staff in Charge of the Certification and Testing

6.3.3.1 QC training program for staff who are to be qualified as quality system auditors

(1) Implementing body: SIRIM

Trainers shall be SIRIM staff who have qualified expertise and experience in quality control. For any training curriculum on which appropriate trainers are not available within SIRIM, external experts could be invited. Training at external institutes is another alternative.

(2) Required period

The preparation of textbooks and other aids to be used for the training is time-consuming work and therefore it will require two years. Prior to the preparation of those text books, it will take one year to design details of the training program as well as collect reference information. Hence the training will start in the forth year from the commencement of the preparatory work.

(3) Implementation procedure

1) Program design stage (first year)

a) SIRIM collects and study reference information to be used as a basis for examining the training curricula and textbooks, and based on the study design details.
b) Visit foreign countries to collect reference information for some aspects of the above if necessary.

2) Program preparation stage (second and third years)

a) Set up a working committee for the preparation of textbooks and other training aids, organized with SIRIM staff and external experts. This committee shall examine and determine training curricula and the content of textbooks and other training aids to be prepared.

b) Prepare the textbooks and other training aids under the initiative of the committee and also with assistance of external experts.

3) Implementation stage (fourth year)

The training will be started in the fourth year. Basic training will be organized as a ten-day course. In addition to the basic training, another training course will be organized, which is orientation and workshop training in respect of quality system standards, auditing techniques and assessment management.

In order to continue to improve the quality system established in factories, it is important for those firms to carry out periodical system auditing internally by their responsible staff. For this end those firms may want to train their staff in the foregoing training course so that they can acquire expertise and experience equivalent to the SIRIM's quality system auditors. In order to respond to such needs, it is recommended that SIRIM will organize a training program for those firms' personnel in charge of internal auditing of quality system.

(4) Technical assistance required

It is recommended that the technical assistance of foreign experts be sought for the preparation of curricula, textbooks and other aids for training. Those experts shall provide advice to the working committee on the training program, curricula, textbooks and other training aids, and also assist in preparing these. The experts may need to be engaged for four years from the preparatory study stage through one year in implementation stage.

6.3.3.2 Training program for SIRIM's recruited staff in charge of quality system auditing

See Table 3-31 in Chapter 3.

6.3.3.3 Training program for SIRIM's recruited staff in charge of factory inspection for product certification

See Table 3-32 in Chapter 3.

6.3.3.4 Training program for SIRIM's staff in charge of testing

See Table 6-4.

6.4 Package Program for Actions Focusing on Specific Industrial Sub-sectors or Business Groups

Presented below are the recommendations for the essential action programs focusing on specific industrial sub-sectors or business groups which are selected in view of industrial development strategy in Malaysia. These programs are to be implemented in a comprehensive manner through the cooperation of the related agencies. It is desirable, moreover, that while emphasis of these programs is to be given to 1) the automotive parts industry, 2) small and medium business enterprises that will be the vendors to the government and public agencies, and 3) the rubber products industry, the rubber glove industry in particular, similar programs be promoted to other strategic industries through the cooperation of both governmental agencies and the industries directly concerned.

6.4.1 Program for Developing Standards and Promoting Quality Management in the Automotive Parts Industry

The automotive parts industry, at present, broadly consists of two groups of parts manufacturers; one group comprising those engaged in the OEM (original equipment manufacturing) of component parts to be supplied to the mainstay automotive manufacturers, and the other engaged in the REM (replacement equipment manufacturing) of replacement parts which are sold to repair markets. Whereas the former group manufactures comparatively high quality parts in conformity to standards and quality control systems indicated by the mainstay automotive manufacturers who are the main customers, the latter group mostly manufactures low quality parts with inadequate quality control. The replacement parts are used for repairs at independent automotive repair shops. Most of those repair shops are small holdings, lacking in quality consciousness, and tend to be price-oriented, while their customers also have more interest in price rather than the quality of replacement parts used for repairs.

The Ministry of Transportation has regulated to force mandatory certification for some automotive safety parts so at to assure safety of those parts, but the thus regulated control items are so far limited to a few items including replacement parts.

Some Malaysian-made parts are being exported, but with the exception of those handled by foreign-affiliated automotive manufacturers or Proton, the quality of those parts is not assured. It is likely that the automotive parts industry may grow as an export industry in the future. Nevertheless, if the exportation of unreliable imita-

tion parts continues, it may damage confidence in Malaysian parts, although it is not certain whether these parts are now being exported with a clear indication of "Made-in-Malaysia".

This program, based on the above understanding, aims to develop the standards used for safety-related automotive parts, and expand the use of the certification system, thereby 1) providing technical standards for parts manufacturers who are engaged in the REM and thus have no access to appropriate technology, and 2) contributing to transportation safety and environment protection through improvement of the quality of safety-related parts, while 3) accelerating the preparation of guidelines for promoting ISO 9000 system within the automobile parts industry. Through the implementation of this program, an efficient mechanism for maintaining coordination and close relations among the government agencies and industrial associations concerned can be instituted. Outline of the program is presented in Table 6-5.

This program will support the umbrella scheme which has been promoted by the Ministry of International Trade and Industry to encourage the development of linkage industries particularly SMIs. Hence it is recommended that this program be undertaken as a sub-program of the umbrella scheme. As this program requires the cooperation of relevant government agencies and public institutions such as SIRIM and NPC as well as relevant industrial associations in the private sector, it is recommended to set up a technical committee which is led by the Ministry of International Trade and Industry and organized with the members drawn from SIRIM, NPC and relevant industrial associations, and also to appoint an institute which acts as the secretariat and performs the core activities of the program.

(1) Implementing body: The above-mentioned working committee, and SIRIM

(2) Required period:

This program is designed with a time frame of two years for a detailed study and the preparation of detailed implementation program including the framework of standards and guidelines to be developed, so that the implementation can be carried out according to the thus prepared implementation program.

(3) Implementation procedure:

1) Detailed study and program preparation stage (two years)

a) Set up the above-mentioned working committee and appoint the secretariat for the committee.

b) Determine a program for carrying out a detailed study and preparatory work.

c) Based on the above program, conduct a detailed study to collect necessary information required for drawing the framework of standards and guidelines to be adopted as well as designing a detailed implementation program. The study includes the survey on selected factories to identify the standards used; the specifications required by customers; actual practice of quality management applied; level of testing and inspection equipment installed; needs for the development of national standards (particularly on a mandatory basis) and association standards or company standards (for quality management) as well as for the preparation of guidelines for developing association or company standards; appropriate quality management system to be applied; needs for the preparation of guidelines and other facilities for introducing such quality management system; and underlying constraints in promoting the development of association or company standards and practicing the quality management system in operation.

d) Based on the above study, draw up a framework of standards to be developed as national standards, association standards and/or company standards, guidelines for the development of the association and company standards and of the guidelines for the application of appropriate quality management system, and also prepare a detailed implementation program for carrying out these work.

e) Make final decision on the above at the working committee, and take actions for budgetary arrangements.

2) Implementation stage (duration of time as determined in the implementation program)

The implementation shall be started promptly after the completion of the foregoing preparation and according to the thus determined implementation program.

3) Technical assistance required

It is recommended that foreign technical assistance be sought for the detailed study and advice in the preparation of the implementation program to be carried out at the preparation stage.

6.4.2 Program for Development of SMIs through Standardization of Products to be procured by Government Agencies and Public Corporations through Product Certification System

This program aims to contribute to the development of SMIs through the development of standards specifying quality and performance of products to be procured by the government agencies and public organizations and the provision of technical assistance to SMIs to improve the quality of their products so as to meet those standards.

Goods and services needed by the government agencies and public organizations are procured under administration of the Ministry of Finance. These government agencies and public organizations individually prepare their own specifications for use in tenders. These specifications are reviewed every two years by a technical committee organized with the representatives of the procurement officers of those agencies and organizations. These specifications relate to each specific product to be procured, but these are not applicable as common standards.

In some cases, foreign or international standards are used in drafting the specifications, but these specifications are prepared only for individual items. The view of the Ministry of Finance is that since the technology level of small manufacturers is low, it is often compelled to accept even lower quality products. At the same time, there is also the fact that as the price for supplying high quality will be high, rather than risk exceeding a budget, the level called for by the specifications has to be lowered.

This program aims to formulate basic standards that can be used in common, in place of specifications drawn up for individual products. These common standards could be encouraged to be used as technical standards for small manufacturers. These include standards for dimensions, strength, methods for painting, methods for welding and other manufacturing methods, as well as methods of testing products, etc.

In order to achieve this, it is necessary to institute functions to study the contents of standards included and to test products produced by SMIs on the basis of these standards.

In this program development of standards is to be entrusted to the competent government agencies and public organizations concerned, so that the activities for drafting standards are expanded.

Further, in order to encourage SMIs to adopt quality systems based on ISO 9000, this program covers the formulating of guidelines for implementing the ISO 9000 quality system adaptable to SMIs and disseminating it to SMIs.

An outline of this program is presented in Table 6-5.

Successful implementation of this program requires the close cooperation among the government agencies and public organizations concerned for procurement. In this context it is recommended to set up a nucleus for implementation (provisionally called the "Public Procurement Standardization Committee") to be led by the representative of a competent ministry which has coordination functions and organized with the representatives of other relevant ministries, agencies and public organizations concerned. SIRIM shall act as the working body as well as the secretariat for the foregoing committee.

(1) Implementing body: The above-mentioned Public Procurement Standardization Committee, SIRIM

It is recommended that SIRIM act as the secretariat of the foregoing committee, including the holding of meetings, preparation of proposals on the issues to be discussed and decided at the meetings, and monitoring and reporting of the progress, and then virtually take initiative of implementation.

(2) Required period

This program is designed to complete the setup of operation scheme with a three-year period, and start the implementation of the scheme in the fourth year.

(3) Implementation procedure

1) Scheme design stage (first year)

a) SIRIM shall prepare a list of the government agencies and public organizations which in procure a large volume of products every year, and select candidates for the member of the foregoing Public Procurement Standardization Committee from among the listed agencies and organizations.

b) SIRIM shall take necessary preparation for the Minister of MOSTE to obtain a Cabinet Approval on the establishment of the foregoing Committee and the main authorities and activities to be carried out by the Committee.

c) SIRIM shall undertake a survey on the main items of products procured in bulk by the government agencies and public organizations and the standards and specifications used for the procurement of those products with a view to establishing national standards or any other forms of standards applicable to the public procurement.

Collected information shall be classified in the following manner:

1. The name of the products procured on the basis of MS standards and the names of agencies/organizations procuring those products.

2. The name of products procured on the basis of tender specifications prepared by applying some items selected from the items specified in national standards or partly modifying the items of MS standards, and the name of organizations procuring those products.

3. The name of products procured on the basis of tender specifications drawn up at a level lower than the applicable MS standards, and the name of organizations procuring those products.

4. The name of products procured on the basis of tender specifications drawn up for the procurement because there are no national standards applicable, and the name of organizations procuring those products.

2) Scheme diffusion and finalization stage (second and third years)

SIRIM, in conference with the agencies or organizations concerned, shall confirm the following policy with regard to the amendment of the existing MS standards, preparation of standard specifications applicable to the procurement (for the cases of 3. and 4. above), and the establishment of national standards (for the case of 4. above):

a) For the case of 2. above, establish standard specifications for the procurement corresponding to the MS standards, if it is judged that the application of MS standards is not practicable.

b) For the case of 3. above, (1) assess the tender specifications presently used for the procurement in order to judge whether it is practicable to make an upward revision of those tender specifications to the level of the MS standards, and (2) apply the existing MS standards or establish standard specifications for the procurement corresponding to the MS standards if it is judged that the upward revision of the tender specifications presently used for the procurement is practically applicable, but (3) if it is judged difficult to immediately enact an upward revision, take alternative measures to establish special MS standards set at a lower level for temporary application and make a gradual revision of those standards to reach the level of ordinary MS standards within a certain period of time.

c) For the case of 4. above, (1) carry out a thorough assessment as to whether the existing tender specifications can be used as MS standards, paying particular attention to the aspects of human health and safety and also to environmental issues, and (2) adopt those tender specifications as the MS standards with appropriate amendment to ensure the protection of these aspects, but (3) for the protective items on which immediate adoption is judged to be difficult in view of the present technology level of industry, establish provisional MS standards set at a lower level for temporary application with the consent at the committee.

It is recommended that the Government undertake special promotion measures for the SMEs engaged in the industrial sector covered by such provisional MS standards in order to upgrade their product quality. Through the repeated upward revision of the provisional standards in keeping with the upgrading of product quality, the level of those provisional standards should be elevated to the level of MS standards as early as possible, because it is not desirable to leave standard specifications for the procurement of governmental and public organizations on

a different level with national standards over a long period of time.

Since it is practically hard to complete the whole within two years, it is recommended to undertake the foregoing work giving priority to the most important fields on which the establishment of those MS standards or standard specifications for the government/public procurement can be completed within that period, and then go on to other fields subsequently.

The priority fields for the establishment of the MS standards and the standard specifications shall be determined by the Public Procurement Standardization Committee and the work shall be carried out by its Technical Committee organized with the initiative of SIRIM with the participation of the representatives of the procurement agencies relevant private industries.

It is recommended that the relevant government agencies and public institutions promptly undertake necessary actions for launching the program including legislative procedures.

3) Implementation stage (fourth year)

The actual implementation of the scheme will be started promptly after the completion of all preparations. However, for some procurement items for which diffusion and finalization can be completed in one year, implementation can begin in the third year of the action program.

During the implementation stage, the actual use of those provisional MS standards thus established in this program shall be closely monitored with a view to taking necessary steps for any modification or upward revision of those standards.

(4) Technical assistance required:

The program can be adequately carried out by relevant agencies with cooperation of relevant industries, and technical assistance of foreign experts will not be required.

6.4.3 Program for Supporting the Rubber Products Industry, particularly Rubber Glove Industry

The rubber glove industry holds the largest share of exports of the rubber products industries, but it consists mostly of small producers.