The production process is relatively simple, but there is considerable dispersion of quality of the products. Often this is caused not by the production process but by the raw rubber and additives. Although there are standards for raw rubber, they have been established for the raw rubber in general whereas more precise specifications are required for the raw materials for the rubber glove production.

As glove manufacturers do not actually possess equipment for testing raw rubber, they have to accept the rubber supplied by their suppliers.

In order to correct problems arising from the raw materials, it is desirable to procure the rubber in accordance with standards established for adequate materials for production. These standards are not necessarily the national standards, but it is preferable to establish them as the national standards, considering that Malaysia is in a leading position both in supplying raw material rubber and export of rubber gloves.

Further, it is probable that in the future customers will request that ISO 9000 be used as the basis of quality control since rubber gloves are export products. However, manufacturers in this industry have difficulty in introducing ISO 9000 quality systems with only the general guidance available at present, because most of them are small business enterprises. It is desirable to devise guidelines reflecting the scale and characteristics of the companies concerned.

Further, if the industrial association drafts standards and guidelines for introducing quality control system, this will promote their involvement in standardization and quality control activities.

The program is outlined in Table 6–5.

6.5 Recommended Organizational Set-up for Implementation

The proposed programs contain a considerable number of actions which will be undertaken by various agencies with adequate budget for implementation. Table 6–6 shows all recommended actions classified in the number given as "Recommendation Number" in Table 6–1, in which priority for implementation as well as budgetary and personnel requirements are indicated.

The above recommendations need to be implemented not only individually, but in an integrated manner with overall coordination. Therefore, it is desirable to estab–

lish a permanent organization, which is responsible for monitoring the implementation and, if necessary, coordinate, assist, recommend on and improve the programs. Since these recommendations involve many organizations including the government and private sector, this monitoring body should be the one which has capacity for coordination among these organizations. In view of this, the monitoring organization is recommended to be set up at MOSTE in the form of a committee with membership from various ministries and relevant agencies.

Engagement of experienced foreign experts will be effective for successful implementation.

Table 6-1(1) RECOMMENDATION ON ACTIVITIES FOR ENHANCEMENT AND PROMOTION OF INDUSTRIAL STANDARDIZATION AND QUALITY ASSURANCE

Activity area	Tasks	Recommendation	Detailed description in the text	Strategic Position in view of industrialization	Strategic position in view of industrial standardization and quality assurance		Outline of the recommendation	Recommendation No.	Relevant projects/ programs recommended
Development and Updating of Standards	Formulation of development goal of standards	Required number of standards to be targeted	3.2.2	I,III	B		After reviewing the industrial development status and the targeted number of MS standards development set by SIRIM, recommended to increase the standard development capacity.		
		Priority area for standard development	3.2.3	I,III	B		After reviewing the existing MS standards in view of standard fields, recommended the following fields as the priority area for the standards to be developed to support industrial development.		
						1)	Standards related to safety, sanitary, and environment protection.		
							The following are the areas to be focused, among them, in view of industrial development strategy a) Standards related to automotive parts critical to safety	2,49	
							b) Standards related to safety of electrical machinery and appliances	21	
						2)	Standards related to products to be procured by government agencies and public corporations	1,50	
						3)	Standards related to technological factors	21	
		Formulation of annual plan for standards development		I,II,III	B		Recommendation to formulate short-, mid-, and long-term plan for standard development	24,25	
	Intensification of activities for standard development and updating	Adoption of international, and foreign standards into MS more to practicable extent	3.2.4	I	B	1)	Simplifying the procedure for adoption of international and foreign standards	22	
						2)	Entrusting industrial associations, and academe, etc. to carry out selection of necessary standards to be introduced	23	
						3)	Introduction of international/ foreign standards in keeping with development of domestic industry with regard to new technology areas such as information technology and new materials	24	
		Decentralization of standard development	3.2.4	I	B	1)	Promotion of accreditation of standard development organizations based on the accreditation procedure set in the cabinet paper	23,24,25	Decentralization program of standard development
						2)	Recommendation on shot-, mid-, and long-term decetralization process to be taken	24	
		Encourage participation of industrial associations in standard development and dissemination		I	B,C	1)	Entrusting industrial associations to write draft standards	15	Program for encouraging industrial associations to participate in standard development
						2)	Encouraging development of association standards	15	
						3)	Encouraging development of in-house standards by industrial associations for their member firms	15	

Notes: Strategic position in view of industrialization;
I) Promotion of greater inter-industry and sectoral linkages through strengthening quality of local firms, II) Assurance of credibility of Malaysian products in export markets
III) Promotion of technology development with protecting quality of human life, IV) Sustaining competitiveness through institutional buildup of technical infrastructure
Strategic position in view of industrial standardization and quality assurance;
A) Incentives encouraging industries to undertake to QM, B) Development of standards as technological basis for TQM
C) Support to QM activities, D) Upgrading of testing system/facilities

Table 6-1(2) RECOMMENDATION ON ACTIVITIES FOR ENHANCEMENT AND PROMOTION OF INDUSTRIAL STANDARDIZATION AND QUALITY ASSURANCE

Activity area	Tasks	Recommendation	Detailed descrip-tion in the text	Strategic Position in view of industrialization	Strategic position in view of industrial standardization and quality assurance	Outline of the recommendation	Recom-mendation No.	Relevant projects/ programs recommended
Development and Updating of Standards (Cont'd)	Intensification of activities for standard development and updating (Cont'd)	Institution of research network required for standard development	3.2.4	I,III	B	Institution of research network of the existing R & D institutes to entrust them to carry out researches required for standard development	24	Program for instituting research network
		Continuous allocation of additional resources to SIRIM for standard development		I	B		3	
	Strengthening of standard dissemination	Intensification of promotional activities at the national level	3.2.5	I	A	1) Establishment of the center organization for disseminating standards (start with addition of new division to SIRIM)	16	
						2) Development of awarding system for factories and individuals of excellent standardization activities	17	
						3) Designation of standardization promotional month with intensive promotional activities	17	
		Strengthening of SIRIM's activities for standard dissemination	5.2.2	I	B,C	1) Dissemination activities for use of standards in QC	18	
			3.2.5			2) Improvement of services for users of standards		
						a) Improvement of coding system of MS standards	20	
						b) Intensification of publicity activities regarding standard development and certification system	17,19	
						c) Development of sales outlet network of standards in KL and regions	20	
Certification System	Clear definition and intensification of the system	Restructuring of the system	3.3.2	I,III	A	1) Integration of Control Label System into Safety Product Mark System	26	
						2) Integration of Safety Mark System (voluntary certificate system), and Certified Mark System into MS Mark System	26	
		Extension of the system	6.4.1 6.4.2	I,III	A	Intensification of existing certification system and/or establishment of new system as a measures to provide strategic industry with incentives to implement QC, and to ensure safety, consumer protection, and environment protection		Comprehensive action programs
						a) Automotive parts related to safety	2,4,9	
						b) Goods to be procured by government and public agencies	1,50	
		Adjustment of product certification system and ARQS	3.3.2	II	A	Adoption of quality system assessment of ISO 9000 series in product certification system	30	
	Strengthening of assessment system of the existing certification system	Clearer definition of assessment criteria	3.3.3	I,II	A	1) Defining function and qualification of quality officers of firms	27,29	
						2) Inclusion of assessment of in-house standardization in the assessment for certification	27	
		Ensuring number of qualified assessor	3.3.3	I	C	1) QC training for SIRIM staff candidated for quality system assessor	28	Training program
						2) Training of quality system assessor	29	Training program for SIRIM recruited staff
						3) Training of factory assessor for product certification	29	Training program for SIRIM recruited staff

Table 6-1(3) RECOMMENDATION ON ACTIVITIES FOR ENHANCEMENT AND PROMOTION OF INDUSTRIAL STANDARDIZATION AND QUALITY ASSURANCE

Activity area	Tasks	Recommendation	Detailed description in the text	Strategic Position in view of industrialization	Strategic position in view of industrial standardization and quality assurance	Outline of the recommendation	Recommendation No.	Relevant projects/ programs recommended
Certification System (Cont'd)	Promotion of certification systems	Nurturing of QC system consultant	3.3.4	I	C		6,32	
		Establishment of a consulting firm having relationship with SIRIM	3.3.4	I	C	Provision of SIRIM's know-how on QC through the consulting firm	33	
	Internationalization of certification systems	Promotion of international recognition of ARQS	3.3.5	II	A	1) Promotion of bilateral mutual recognition	22,31	
						2) Active participation to international conferences on mutual recognition	22,31	
Testing and metrology system/ facilities for industrial standardization	Strengthening of SAMM accreditation system	Establishment of independent body for system operation	4.1.2	IV	D		34	
		Integration of existing accreditation system of testing labo into SAMM		IV	D		35,41	
		Adoption of SAMM in certification systems operation		II,IV	D		36	
		Promotion of international mutual recognition of SAMM		II,IV	D		37	
	Strengthening of testing capacity	Strengthening of capacity of testing for certification purpose	4.1.3	IV	D	1) Increase in testing capacity of SIRIM HQ for supporting MS Certification System and Mandatory Certification System (especially, to meet the future expansion of mandatory certification system for automotive parts)	38,45	Program for upgrading testing facilities for certification system
						2) Training of testing staff	39	Testing staff training program
		Expansion of capacity for request base testing	4.1.3	IV	D	Increase in testing capacity of SIRIM regional labo for request-base testing demand (covering basic testing items only)	40	Program for upgrading facilities for consignment testing
	Strengthening of industrial metrology system	Strengthening of metrology and calibration capacity of SIRIM HQ	4.2.2	IV	D	Establishment of independent body for operation of metrology center	14,44	
		Strengthening of metrology and calibration capacity of SIRIM's regional labo		IV	D	1) Expansion of calibration capacity of SIRIM in Penang	46,48	
						2) Expansion of calibration capacity of SIRIM in Johor Bahru	47,48	
						3) Expansion of calibration capacity of SIRIM in Sarawak	48	
		Establishment of reference standards capacity		IV	D		48	

Table 6-1(4) RECOMMENDATION ON ACTIVITIES FOR ENHANCEMENT AND PROMOTION OF INDUSTRIAL STANDARDIZATION AND QUALITY ASSURANCE

Activity area	Tasks	Recommendation	Detailed descrip-tion in the text	Strategic Position in view of industrialization	Strategic position in view of industrial standardization and quality assurance	Outline of the recommendation	Recom-mendation No.	Relevant projects/ programs recommended
Encouragement of quality improvement, and QC promotion	Promotion of educational and encouragement activities for quality consciousness	Strengthening of promotional activities for encouraging quality consciousness of business management	5.1.1	I,IV	A,C	Improvement of contents of QC seminars	5	
		Introduction of quality related curriculum	5.1.2	I,IV	A	1) Implementation of basic curriculum of quality control in collage level education	42	
						2) Introduction of quality consciousness education in high school level and lower	43	
	Strengthening of supporting activities of QC promotion for businesses	Institution of organizational structure for TQC promotion	5.2.1	I,IV	C	Institution of organizational structure for TQC promotion with the following function:		Program to establish the center organization
						1) Formulation of national plan of QC promotion, and its coordination among relevant organizations	4,5,13	
						2) Registration of qualified personnel for QC guidance to ensure resources	4,5	
						3) Research on QC application method applicable to Malaysian society and businesses	7	
						4) Implementation of QC promotion activities	14	
		Establishment of Regional Quality Center(s), and development of its function	5.2.1	I,IV	C	Provision of spaces for QC promotion activities in regions	44	
		Nurturing of quality system consultant		I	C		6	
		Formulation of industry-wise guideline for implementation of ISO 9000	3.3.3	I	C	Encouraging industrial associations to make guide lines for implementation of ISO 9000 quality system taking into account the characteristics of their industry	30	
	Promotion of QC among SMEs	Provision of incentives and support of comprehensive program		I,III,IV	A,B,C,D	Comprehensive action in the strategic industry areas	8,9,10,11, 12,49,50,51	Comprehensive action programs
All areas	Successful implementation of the recommendations	Establishment of the system for monitoring implementation				Establishment of permanent committee at EPU with membership from various Ministries and relevant agencies	52	

Supplementary Notes to Table 6-1

Thrust 1: Enhancement of Inter-industry and Sectoral Linkages through Upgrading Technology and Quality of Local Firms

Recommendation

1: Establishment and Diffusion of Certification Systems for the Government (and Public Agency) Procurement

2: Establishment of Certification System for Safety-related Automotive Parts

3: Reinforcement of Assessors, Auditors and Inspectors for the Certification Systems

4: Improvement of Level of Quality Management

5: Improvement of Training System on Quality Management

6: Establishment of Consultant Services specialized for Application of Quality Management Practices

7: Need for Research on Quality Management suited to the Social and Cultural Characteristics, Management Behavior and Business Practices in Malaysia

8: Develop of industrial standards or guidelines, which are used as the basis for SMIs to establish their company standards for application of Quality Management

9: Provision of incentives encouraging SMIs' investment on Quality Management

10: Provision of tax credit on increase in costs of SMIs as sub-contractors as a result of application of effective Quality Management practice.

11: 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.

12: Implementation of package action programs focusing on specific sub-sectors.

13: Establishment of Central Organization of TQM Promotion

14: Establishment of Facilities to support the Undertaking of Quality Management by Industry

15: Measures for Encouraging Participation of Industrial Associations in Standardization Activities

16: Establishment of New Division in SIRIM to Promote Standards and Standardization

17: Proposals on national programs for dissemination of Standards and Standardization

18: Education on Utilization of National Standards

19: National Assembly on Standardization

20: Improvement of Convenience for Users of Standards

21: Areas to be focused on Intensifying Standards Development

22: Positive Adoption of International and Foreign Standards

23: Commissioning of Establishment Work of Standards

24: Institution of Research Network undertaking Research on Technical Aspects required for Standard Development

25: Commissioning of Work for Updating of Standards

Thrust 2: Assurance of Credibility of Malaysian Products in Export Markets

Recommendation

26: Restructuring of the Present Product Certification System

27: Elaboration of Criteria for Factory Assessment

28: Improvement in Qualification of Quality System Auditors/Assessors

29: Specifying the Duties and Qualification of Quality Officers of Firms

30: Adoption of ISO 9000 in Product Certification System

31: Strengthening of Mutual Recognition of Certification Systems

32: Securing Quality System Consultants

33: Establishment of a Consultant Company Linked to SIRIM

34: Administration of the SAMM by an Independent Agency

35: Incorporation of Other Laboratory Accreditation Schemes into the SAMM

36: Authorization of Test Reports issued by SAMM Accredited Laboratories for Application to the Product Certificaion

37: Promotion of International Recognition of Accredited Laboratories

38: Enhancement of Capability for carrying out Factory Inspection

39: Securing Adequate ARQS's Auditors

40: Increase of Factory Inspectors for Product Certification Systems

41: Practical Use of SAMM Accredited Laboratories for Tests required for Application of Product Certification

Thrust 3: Coordination and Adjustment for pursuing Industrial Development while protecting Quality of Human Life

Expansion of Standard Development and Certification System aiming at Safety, Hygiene, Environment Protection and Consumer Protection

Refer to Recommendation:

2: Establishment of Certification System for Safety-related Automotive Parts

21: Areas to be focused on Intensifying Standards Development

Thrust 4: Sustaining Industrial Competitiveness through Institutional Buildup of Technical Infrastructure

Buildup of Basis of R&D for the Future

Refer to Recommendation 24: Institution of Research Network undertaking Research on Technical Aspects required for Standard Development

Recommendation

42: Education Quality Management in Universities/Colleges

43: Introduction of Standardization and Quality Management Studies in School Curricula

44: Establishment of Facilities for Disseminating Quality Management in Regions

45: Upgrading of Testing Facilities for Product Certification in the SIRIM Headquarter

46: Establishment of Testing Facilities in Penang Branch Office of SIRIM

47: Establishment of Testing Facilities in Johor Bahru Branch of SIRIM

48: Implementation of Detailed Study on Enhancement of Industrial Metrology Systems

49: Program for Developing Standards and promoting Quality Management in the Automotive Parts Industry

50: Program for Development of SMIs through Standardization of Products to be procured by the Government Agencies and Public Corporations

51: Program for Supporting the Rubber Based Industry, particularly Rubber Glove Industry

52: Establishment of Committee in MOSTE for Monitoring Development Scheme Implementation

Table 6-2(1) PROJECT FOR UPGRADING TESTING FACILITIES

Testing Field	Facility	Objective	Recom-menda-tion No.	Contents	Estimated cost required	Implementation Prgram			Relevant programs
						Short-term	Mid-term	Long-term	
Certification testing	SIRIM HQ	Upgrading of testing facilities required for operation of new MS Mark system and new Product Safety Mark System	38	1) The existing testing capacity of SAMM accreditated labos is limited and hard to expect its contribution to the operation	Approx. M$20.4 million	1) Development of laws and regulations to transfer to the new system	1) Commencement of testing	1) Study on possible addition and revision of certified products	Training program for recruited testing staff
				2) Testing of products regulated by the existing mandatory certification systems. These facilities can cover most of products to be included in the future.	Required space: 1,500m2	2) Formulation of list of required facilities	2) Implementation of training	2) Implementation of training	
				3) Imported products are assumed to be tested at the labo accredited by SIRIM in the shipping country		3) Design of labo	3) Promotion of mutual recognition with labos abroad	3) Accreditation of labo under CB system	
				4) Testing of electrical field can be covered by the planned upgrading		4) Financial arrangement	4) Participation to CB system	4) Procurement and installation of additional facilities	
				5) Testing of automotive parts field will require additional facilities than planned, if certified products are increased in the different field.		5) Construction of labo			
						6) Formulation of training program 7) Recruitment of testing -- 8) Publicity activities among industries			
Testing for request-base testing	SIRIM HQ	To meet the future increase in demand for request-base testing		1) No additional facility required with facility upgrading planned as above					
				2) Request-base testing of special case is assumed to be handled by the existing R&D centers of each field	None				
	Penang labo, SIRIM		40	1) Facilities mainly for electrical testing	Approx. M$7.92 million	1) Formulation of list of required facilities	Commencement of testing	Procurement and installation of additional facilities	
				2) Testing of special type is handled by SIRIM HQ	Required space: 1,500m2	2) Design of labo 3) Financial arrangement 4) Construction of labo 5) Publicity activities among industries			
	Johor Bahru labo, SIRIM		40	1) Facilities mainly for mechanical testing	Approx. M$7.76 million	The same as above	The same as above	The same as above	
				2) Testing of special type is handled by SIRIM HQ	Required space: 1,500m2	The same as above	The same as above	The same as above	

Table 6-2(2-1) LIST OF MAIN EQUIPMENT REQUIRED FOR UPGRADING LABORATORIES AT SIRIM HEADQUARTERS

	Items of Equipment	Estimated Cost (M$1,000)
I.	Electrical	
	a) Basic equipment	500
	Voltmeter	
	Ammeter	
	Wattmeter	
	Watt–hour meter	
	Multimeter	
	LCR meter	
	Torque meter	
	Caliper	
	Micrometer	
	Profile projector	
	Others	
	b) Environmental testing	1,600
	Temperature–humidity control chamber	
	Temperature chamber	
	Hi–temperature chamber	
	Low–temperature chamber	
	Others	
	c) Heating	200
	Thermocouple type thermometer	
	Thermal recorder	
	Wheatstone bridge	
	Resistance meter	
	Others	
	d) Insulation	200
	Dielectric strength tester	
	Insulation resistance meter	
	High voltage transformer	
	Test finger	
	Test pin	
	Impact hammer	
	Earth continuity tester	
	Others	
	e) Moisture resistance	700
	Rain test apparatus	
	Splash test apparatus	
	Spray test apparatus	
	Others	
	f) Electronic	2,100
	Oscilloscope	
	Signal generator	
	Wave form analyzer	
	Load	
	Shield room	
	Mechanical strength tester for CRT	
	Others	

Table 6-2(2-2) LIST OF MAIN EQUIPMENT REQUIRED FOR UPGRADING LABORATORIES AT SIRIM HEADQUARTERS

Items of Equipment	Estimated Cost (M$1,000)
g) Material	2,400
Softening point measuring equipment	
Flammability testing apparatus	
Hot mandrel testing apparatus	
Arc tracking tester	
Others	
h) Power supply	2,100
Power supply	
Frequency variable power supply	
Voltage regulator	
DC power supply	
Others	
i) Specific equipment	4,000
Endurance tester for switches, thermal cutout, etc.	
Endurance tester for incandescent lamps	
Endurance tester for fluorescent lamps	
Endurance tester for ballasts for fluorescent lamp	
Hot water supply unit	
Anechoic chamber	
Photometric integrated sphere	
Vibration tester	
Others	
II. Automobile Parts	
a) Safety glass	2,100
Visible light transmission test apparatus	
Optical distortion test apparatus	
Abrasion resistance test apparatus	
Radiation resistance test apparatus	
Others	
b) Sheat belt	3,100
Sheat belt dynamic test apparatus	
Temperature-humidity control chamber	
Salt spray test apparatus	
Retractor mechanism testing apparatus	
Buckle testing apparatus	
Others	
c) LPG fuel system	1,000
Universal testing machine	
Radiographic examination apparatus	
Volume measuring apparatus	
Pressure test apparatus	
Vibration test apparatus	
Others	
III. Kerosene stove	
Gas analyzer	400
Surface thermometer	
Temperature-humidity control chamber	
Others	
Total	20,400

Table 6-2(3-1) LIST OF MAIN EQUIPMENT REQUIRED FOR TESTING LABORATORY TO BE SET UP AT SIRIM NORTHERN BRANCH OFFICE

Items of Equipment	Estimated Cost (M$1,000)
I. Electrical	
a) Basic equipment	300
Voltmeter	
Ammeter	
Wattmeter	
Watt-hour meter	
Multimeter	
LCR meter	
Torque meter	
Caliper	
Micrometer	
Profile projector	
Others	
b) Environmental testing	500
Temperature-humidity control chamber	
Temperature chamber	
Hi-temperature chamber	
Low-temperature chamber	
Others	
c) Heating	140
Thermocouple type thermometer	
Thermal recorder	
Wheatstone bridge	
Resistance meter	
Others	
d) Insulation	140
Dielectric strength tester	
Insulation resistance meter	
High voltage transformer	
Test finger	
Test pin	
Impact hammer	
Earth continuity tester	
Others	
e) Electronic	1300
Oscilloscope	
Signal generator	
Wave form analyzer	
Load	
Shield room	
Others	
f) Material	300
Softening point measuring equipment	
Flammability testing apparatus	
Others	

Table 6-2(3-2) LIST OF MAIN EQUIPMENT REQUIRED FOR TESTING LABORATORY TO BE SET UP AT SIRIM NORTHERN BRANCH OFFICE

	Items of Equipment	Estimated Cost (M$1,000)
	g) Power supply	500
	Frequency variable power supply	
	Voltage regulator	
	DC power supply	
	Others	
II.	Mechanical	
	a) Basic equipment	140
	Caliper	
	Micrometer	
	Profile projector	
	Balance	
	Balance table	
	Others	
	b) Hardness	400
	Hardness tester	
	Others	
	c) Strength	1,600
	Universal testing machine	
	Autograph	
	Impact tester	
	Others	
	d) Preparation	500
	Machine tool	
	Others	
III.	Chemical	
	a) Basic equipment	1,300
	Table center	
	Fume hood	
	Glassware	
	Balance	
	Balance table	
	Others	
	b) Analytical equipment	800
	Gas chromatograph	
	Spectrophotometer	
	Others	
	Total	7,920

Table 6-2(4-1) LIST OF MAIN EQUIPMENT REQUIRED FOR TESTING LABORATORY TO BE SET UP AT SIRIM SOUTHERN BRANCH OFFICE

	Items of Equipment	Estimated Cost (M$1,000)
I.	Electrical	
	a) Basic equipment	300
	Voltmeter	
	Ammeter	
	Wattmeter	
	Watt-hour meter	
	Multimeter	
	LCR meter	
	Torque meter	
	Caliper	
	Micrometer	
	Profile projector	
	Others	
	b) Environmental testing	300
	Temperature-humidity control chamber	
	Temperature chamber	
	Others	
	c) *Heating*	*140*
	Thermocouple type thermometer	
	Thermal recorder	
	Wheatstone bridge	
	Resistance meter	
	Others	
	d) Insulation	120
	Dielectric strength tester	
	Insulation resistance meter	
	Test finger	
	Test pin	
	Impact hammer	
	Earth continuity tester	
	Others	
	e) Material	300
	Softening point measuring equipment	
	Flammability testing apparatus	
	Others	
	f) Power supply	500
	Frequency variable power supply	
	Voltage regulator	
	DC power supply	
	Others	

Table 6-2(4-2) LIST OF MAIN EQUIPMENT REQUIRED FOR TESTING LABORATORY TO BE SET UP AT SIRIM SOUTHERN BRANCH OFFICE

Items of Equipment	Estimated Cost (M$1,000)
II. Mechanical	
a) Basic equipment	400
Caliper	
Micrometer	
Profile projector	
Balance	
Balance table	
Gauge	
Others	
b) Hardness	700
Hardness tester	
Others	
c) Strength	2,100
Universal testing machine	
Autograph	
Impact tester	
Compression test apparatus	
Others	
d) Preparation	800
Machine tool	
Others	
III. Chemical	
a) Basic equipment	1,300
Table center	
Fume hood	
Glassware	
Balance	
Balance table	
Others	
b) Analytical equipment	800
Gas chromatograph	
Spectrophotometer	
Others	
Total	7,760

Table 6-3(1) PROJECTED NUMBER OF TESTING

	Certification Tests*	Contract Tests
1994	2,608	2,603
1995	2,808	2,863
1996	3,008	3,149
1997	3,208	3,464
1998	3,408	3,810
1999	3,608	4,191
2000	3,808	4,610

Note: * MS Mark certification and mandatory certification

Table 6-3(2) TEST ITEMS FOR MANDATORY CERTIFICATION

	Products to be Tested	Applied Standards	Number of Test Items
(1)	Plug tops and multiway adaptors	MS589	24
(2)	Switches	BS3676	23
(3)	Socket outlets	MS589	24
(4)	Lampholders	MS769	42
(5)	Ceiling roses	MS770	3
(6)	Bayonet caps	MS769	42
(7)	Fluorescent lamp fittings excl. tubes if imported separately	MS619: Pt.1: Sec.1.1-2.3	26
(8)	Capacitors for fluorescent lamps	MS279	21
(9)	Ballast for fluorescent lamps	MS141	4
(10)	Circuit breakers incl. current-operated earth leakage circuit breakers and miniatuare circuit breakers	MS1139	9
(11)	Instantaneous water heater incl. heating elements if imported separately	MS472: Pt.3: Sec.3.1	31
(12)	Hand operated hair dryers	BS3456: Pt.3: Sec.3.13	31
(13)	Table lamps having accessible metal parts	MS619: Pt.2	11
(14)	Electric kettles incl. heating elements if imported separately	MS472: Pt.3: Sec.3.1	31
(15)	Electric smoothing iron	MS472: Pt.2: Sec.2.3	31
(16)	Electric shavers	BS3456: Pt.102: Sec.102.8	31
(17)	Food mixers/blenders	BS3456: Pt.202: Sec.202.14	31
(18)	Immersion water heater incl. storage water heater	BS3456: Pt.101 and 102: Sec.102.21	31
(19)	Hi Fi sets	MS72	20
(20)	Mosquito matt vaporizers	BS3456: Pt.101 and 102	31
(21)	Toasters	MS472: Pt.2: Sec.2.2	31
(22)	Table fans	MS139	19
(23)	Television	MS72	20
(24)	Vacuum cleners	BS3456: Pt.202: Sec.202.2	31
(25)	Video players	MS72	20
(26)	Washing machines	BS3456: Pt.202: Sec.202.7	31
(27)	Refrigerators	BS3456: Pt.202: Sec.202.24	31
(28)	Rice cookers	MS472: Pt.2: Sec.2.9	31
(29)	Protective helmets for motorcyclists	MS1	13
(30)	Safety seat belt for motorists	MS1175	9
(31)	Safety glasses for motor vehicles	MS595: Pt.1 and Pt.2	10
(32)	LPG fuel systems in internal combustion engines	MS775 (p)	25
(33)	Fire extinguishers	MS1179	11
(34)	Fire doors	MS1073: Pt.1	9
(35)	Non-pressure kerosene stoves	MS971	7

Table 6-3(3) PROJECTED NUMBER OF STAFF FOR TESTING

	1994	1995	1996	1997	1998	1999	2000
Testing for Certification							
Number of Staff for Testing	47	49	49	50	51	51	52
Contract Tests							
Number of Staff for Testing	37	39	40	42	44	46	49
Sub-total	84	88	89	92	95	97	101
Number of Administrative Staff	17	18	18	18	19	19	20
Total	101	106	107	110	114	116	121

Table 6-3(4) PROJECTED REVENUE AND COSTS FOR TESTING

(Unit: M$1,000)

	1994	1995	1996	1997	1998	1999	2000
Revenue							
Testing Fee	7,036	7,648	8,291	8,969	9,684	10,441	11,244
Costs and Expenditures							
Personnel	3,636	3,816	3,852	3,960	4,104	4,176	4,356
Welfare for Personnel	109	114	116	119	123	125	131
Maintenance	0	180	361	541	722	902	1,082
Utilities	211	211	211	211	211	211	211
Overhead	109	114	116	119	123	125	131
Total	4,065	4,435	4,656	4,950	5,283	5,539	5,911
Balance	2,971	3,213	3,635	4,019	4,401	4,902	5,333
Costs/Revenue Ratio	0.58	0.58	0.56	0.55	0.55	0.53	0.53

Table 6-4 TRAINING PROGRAM FOR NEWLY RECRUITED STAFF FOR TESTING

First Year	Training I (for 3 months)	Education and training on outline of ARQS system, product certification systems, procedure of certification, position of SIRIM in the system, together with required attitude as a staff of SIRIM, rules to be observed, and testing practices. At the same time, check their aptitude as SIRIM staff.
	Training II (for 6 months)	Actual testing of easier testing items of MS certification under the supervision of skilled testing staff. Objectives of this training is to make them to understand the contents of test and requirement from standards.
	Training III (for 3 months)	Actual testing of easier testing items basically without supervision. Objectives of this training is to make them to master the contents of test and requirement from standards.
Second Year	Training IV (for 6 months)	Actual testing of sophisticated testing items of MS certification under the supervision of skilled testing staff. Objectives of this training is to make them to understand the contents of test and requirement from standards.
	Training V (for 3 months)	Actual testing of sophisticated testing items basically without supervision. Objectives of this training is to make them to master the contents of test and requirement from standards.
	Training VI (for 3 months)	Actual testing of all the testing items of MS certification without supervision. Advise from skilled testing staff, only if necessary.

Table 6-5(1) PACKAGE PROGRAM FOCUSING ON SPECIFIC INDUSTRIAL SUB-SECTORS

Activity area		Program	Strategic position of the Program: Provision of incentives	Standards development as technological basis	Support to QC activities	Upgrading of testing system/ facilities	Contents
(1) Program for developing standards and promoting quality management in the automotive parts industry							
Development and Updating of Standards	Development of standards in the key area of strategic industrial development	Development of standards relating to automotive safety parts		X			Develop standards required to upgrade quality of automotive parts in replacement equipment market
	Increase in standard development capacity	Encourage participation of industrial associations to standard development and dissemination		X			1) Entrusting standard development to industrial associations 2) Encouraging development of organization standards 3) Encouraging development of in-house standards by industrial associations to their member firms
		Establishment of safety standards for automotive parts	X	X			1) Establishment of law/ regalatory system as a basis of transportation safety and environment protection 2) Formulation of safety standards of automotive parts based on the above law/ regulartory system 3) Formulation of technological standards based on the above safety standards
		Ensuring R&D capacity for development of safety standards of automotive parts		X			Entrusting analysis of cause of trafic accident and other matters which are required as a basis to formulate safety standards of the automotive parts, to the existing R&D institutes
Certification System	Intensification of certification system	Introduction of certification system for automotive safety parts	X				Introduction of product certification system regarding safety related automotive parts, and popularization of the system to the general public
Testing and Metrology System/ Facilities for Industrial Standardization	Strengthening of testing capacity	Upgrading of testing facilities required for testing of automotive safety parts				X	Addition of required facilities for operation of the certification system
Encouragement of quality improvement, and QC promotion	Promotion of QC based on ISO 9000	Formulation of guide line for implementation of ISO 9000 specific to automotive parts industry			X		Encourage industrial associations to make guide lines for implementation of ISO 9000 quality system taking into account the characteristics of their industry

Table 6-5(2) PACKAGE PROGRAM FOCUSING ON SPECIFIC INDUSTRIAL SUB-SECTORS

Activity area		Program	Strategic position of the Program: Provision of incentives	Standards development as technological basis	Support to QC activities	Upgrading of testing system/ facilities	Contents
(2) Program for development of SMIs through standardization of products to be procured by government agencies and public corporations							
Development and Updating of Standards	Development of standards in the key area of strategic industrial development	Promotion of standardization of products procured by government agencies and public corporations		X			1) Standardization of product specifications used in procurement of government agencies and public corporations 2) Development of basic standards used in formulating the above standards
	Increase in standard development capacity	Encouragement of participation of industrial associations in standard development and dissemination		X			1) Entrusting drafting of MS standards to the relevant government agencies and public corporations 2) Encouraging development of organization standards
		Ensuring R&D system for standard development		X			Entrusting R&D required for formulating specifications of procured products to the existing R&D institutes
Certification System	Intensification of certification system	Establishment of new certification system applicable to the products to be procured by the government agencies and public corporations	X				Decision of use of the above standards by government agencies and public corporations for their procurement
Testing and Metrology System/ Facilities for Industrial Standardization	Strengthening of testing capacity	Upgrading of testing facilities required for testing the above products				X	Addition of required facilities for operation of the certification system
Encouragement of quality improvement, and QC promotion	Promotion of QC among SMEs	Formulation of guide line for implementation of ISO 9000 specific to SMEs			X		Encourage industrial associations to make guide lines for implementation of ISO 9000 quality system taking into account the characteristics of SMIs
(3) Program for supporting rubber based industry (particularly rubber glove industry)							
Development and Updating of Standards	Development of standards in the key area of strategic industrial development	Development of standards for raw material rubber specific to rubber glove industry		X			Development of rubber standards specific to rubber glove industry as their raw material
	Increase in standard development capacity	Encouragement of participation of industrial associations in standard development and dissemination		X			1) Entrusting drafting of MS standards to the industrial association 2) Encouraging development of organization standards
		Ensuring R&D system for standard development		X			Entrusting R&D on standards specific to rubber glove industry to the existing the R&D institute
Encouragement of quality improvement, and QC promotion	Promotion of QC based on ISO 9000	Formulation of guide line for implementation of ISO 9000 specific to rubber glove industry			X		Encourage industrial associations to make guide lines for implementation of ISO 9000 quality system taking into account the characteristics of the industry

Table 6-6 IMPLEMENTING BODIES AND BUDGETARY/PERSONNEL REQUIREMENT FOR RECOMMENDED ACTION PROGRAMS/PROJECTS (1)

	Recommendation	Implementing Bodies	Budgetary / Personnel Requirement
◎	1 Establishment and diffusion of certification systems for government (and public agency) procurement	* Promoting & Steering Committee (to be set up) · SIRIM (Secretariat)	• 3 years program: cost of survey; cataloging and drafting specifications: M$ 500,000 • Assignment of SIRIM staff
◎	2 Establishment of certification system for safety-related automotive parts	* Technical Committee (to be set up under MITI) · SIRIM / NPC	• 2 years program: cost of survey; guidance; training and seminars; and employment of external experts: M$ 500,00 • Assignment of SIRIM / NPC staff
	3 Reinforcement of assessors, auditors and inspectors for the certification systems	* SIRIM	• Annual budget for trainings • Assignment of trainers
	4 Improvement of level of quality management	* NPC · SIRIM	• Annual budget for activities at NPC / SIRIM: M$ 100,000/annum • Assignment of NPC / SIRIM staff
	5 Improvement of training system on quality management	* NPC · SIRIM	• Annual budget for activities at NPC / SIRIM Assignment of NPC / SIRIM staff
	6 Establishment of consultant services specialized in the application of quality management practices	* NPC · SIRIM	
○	7 Need for research on quality management suited to social and cultural characteristics, management behavior and business practices in Malaysia	* NPC / SIRIM	• Annual budget for research at NPC / SIRIM: M$ 100,000/annum • Assignment of NPC / SIRIM staff
○	8 Develop of industrial standards or guidelines, which are used as the basis for SMIs to establish their company standards for application of quality management	* SIRIM	• Annual budget:M$200,000/annum • Assignment of SIRIM Staff
	9 Provision of incentives encouraging SMIs' investment in quality management	* MITI / MOF	
	10 Provision of a tax credit on increased costs of SMIs as sub-contractors, result from the application of effective quality management	* MITI / MOF	

(Notes) ◎ New actions to be undertaken with top priority ○ Actions to be undertaken with priority

Table 6-6 IMPLEMENTING BODIES AND BUDGETARY/PERSONNEL REQUIREMENT FOR RECOMMENDED ACTION PROGRAMS/PROJECTS (2)

Recommendation	Implementing Bodies	Budgetary / Personnel Requirement
11 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	* NPC / SIRIM	• (part of Recommendation 7)
12 Implementation of a comprehensive action programs forcusing on specific sub-sectors	(Refer to Recommendation 1,2,51)	
◎ 13 Establishment of a central organization for TQM promotion	* TQM Council (to be set up under MOSTE) · Secretariat (to be appointed: SIRIM or NPC)	• Annual budget for activities: · Launching grant: M$ 10 million · Annual grant: M$ 2 million/annum • Assignment of staff
14 Establishment of facilities to support the undertaking of quality management by industry	* NPC / SIRIM	
○ 15 Measures for encouraging participation of industrial associations in standardization activities	* SIRIM	• Annual budget for activities · Annual grant to associations: M$ 1 million/annum • Assignment of staff
◎ 16 Establishment of new division in SIRIM to promote standards and standardization	* SIRIM	• Annual budget for activities: · Annual grant: M$ 1.5 million/annum • Assignment of staff (5 persons)
◎ 17 Proposals on national programs for dissemination of standards and standardization	* MOSTE / MITI · SIRIM	• Annual budget for activities: M$ 1 million/annum • Assignment of SIRIM staff
18 Education on utilization of national standards	* SIRIM	
19 National assembly on standardization	* SIRIM	
20 Improvement of convenience for users of standards	* SIRIM	• Annual budget for activities
21 Areas to be focused on intensifying standards development	* SIRIM	
22 Positive adoption of international and foreign standards	* SIRIM	
23 Commissioning of establishment work of standards	* SIRIM	• Annual budget for activities
○ 24 Institution of research network undertaking research on technical aspects required for standard development	* SIRIM	• Annual budget for activities: · To use IRPA grant

(Notes) ◎ New actions to be undertaken with top priority ○ Actions to be undertaken with priority

Table 6-6 IMPLEMENTING BODIES AND BUDGETARY/PERSONNEL REQUIREMENT FOR RECOMMENDED ACTION PROGRAMS/PROJECTS (3)

Recommendation	Implementing Bodies	Budgetary / Personnel Requirement
25 Commissioning of work for updating of standards	* SIRIM	• Annual budget for activities
◎ 26 Restructuring of the present product certification system	* SIRIM	
○ 27 Elaboration of criteria for factory assessment	* SIRIM	• Annual budget for activities (for 27–29): M$ 500,000/annum for 3 years • Assignment of staff
○ 28 Improvement in qualifications of quality system auditors/assessors	* SIRIM	• Annual budget for activities • Assignment of staff
○ 29 Specifying the duties and qualifications of quality officers of firms	* SIRIM	• Annual budget for activities • Assignment of staff
30 Adoption of ISO 9000 in the product certification system	* SIRIM	
31 Strengthening of mutual recognition of certification systems	* SIRIM	
32 Securing quality system consultants	* SIRIM	• Annual budget for trainings • Assignment of trainers
33 Establishment of a consultant company linked to SIRIM	* SIRIM	• (to be studied in details)
34 Administration of SAMM by an independent agency	* SIRIM	
35 Incorporation of other laboratory accreditation schemes into SAMM	* SIRIM	
36 Authorization of test reports issued by SAMM accredited laboratories for a application for product certification	* SIRIM	
37 Promoting international recognition of accredited laboratories	* SIRIM	
○ 38 Enhancement of capability for carrying out factory inspection	* SIRIM	• Annual budget for trainings (for 38–40): M$ 800,000/annum • Increase of staff
○ 39 Securing adequate ARQS assessors	* SIRIM	• Annual budget for trainings • Increase of staff
○ 40 Increase of factory inspectors for product certification systems	* SIRIM	• Annual budget for trainings • Increase of staff
41 Practical use of SAMM accredited laboratories for tests required for application of product certification	* SIRIM	

(Notes) ◎ New actions to be undertaken with top priority ○ Actions to be undertaken with priority

Table 6-6 IMPLEMENTING BODIES AND BUDGETARY/PERSONNEL REQUIREMENT FOR RECOMMENDED ACTION PROGRAMS/PROJECTS (4)

Recommendation	Implementing Bodies	Budgetary / Personnel Requirement
42 Quality management education in universities/colleges	* MOE	
43 Introduction of standardization and quality management school curricula	* MOE	
44 Establishment of facilities for disseminating quality management in regions	(Refer to Recommendation 14)	
45 Upgrading of testing facilities for product certification in the SIRIM Headquarters	* SIRIM	• Total Budget: M$ 25 million • Installation of Equipment (Approx. M$ 20.4 million) Expansion of buildings (1,500 sq.m) • Increase of staff
46 Establishment of testing facilities in Penang Branch Office of SIRIM	* SIRIM	• Total Budget: M$ 10 million • Installation of Equipment (Approx. M$ 7.92 million) Expansion of buildings (1,500 sq.m) • Increase of staff
47 Establishment of testing facilities in Johor Bahru Branch of SIRIM	* SIRIM	• Total Budget: M$ 10 million • Installation of Equipment (Approx. M$ 7.76 million) Expansion of buildings (1,500 sq.m) • Increase of staff
48 Implementation of detailed study on enhancement of industrial metrology systems	* SIRIM	• Budget for studies: M$ 500,000 • Assignment of staff
49 Program for developing standards and promoting quality management in the automotive parts industry	(Refer to Recommendation 2)	
50 Program for development of SMIs through standardization of products to be procured by government agencies and public corporations	(Refer to Recommendation 1) * SIRIM	

(Notes) ◎ New actions to be undertaken with top priority ○ Actions to be undertaken with priority

Table 6-6 IMPLEMENTING BODIES AND BUDGETARY/PERSONNEL REQUIREMENT FOR RECOMMENDED ACTION PROGRAMS/PROJECTS (5)

Recommendation	Implementing Bodies	Budgetary / Personnel Requirement
◎ 51 Program for supporting the rubber based industry, particularly the rubber glove industry	* SIRIM	• Annual budget for activities: 2 years program: cost of consultancy and training: M$ 400,000 • Assignment of staff
52 Establishment of committee in MOSTE for monitoring implementation of proposed programs	* MOSTE	

(Notes) ◎ New actions to be undertaken with top priority ○ Actions to be undertaken with priority

ANNEXES

Annex 1

NEEDS FOR THE PROMOTION OF INDUSTRIAL STANDARDIZATION AND QUALITY ASSURANCE IN MAIN INDUSTRIAL SUB-SECTORS

Chapter 1 Automotive and Parts Industry

The automobile parts industry is extremely diverse, encompassing companies belonging to the metal fabrication, plastics processing, glass, rubber, textiles and other industries, and the analysis in this chapter is confined to parts that are supplied ready for assembly in the vehicle production process. Discussion of the specific industries or sub-sectors that make up the parts industries is provided in the appropriate chapters.

1.1 International Trends

1.1.1 International Development in Assembly Industries

Production of automobiles, motorcycles, electric appliances, agricultural machinery and other assembly industry products has hitherto been concentrated in North America, West Europe and Japan, and in broad terms this situation has not changed. However, while on one hand many developing countries are strongly interested in developing industry, major producers of the world have adopted the strategy of securing markets in the developing countries, and because of these conditions a partial shift of production to the developing countries became evident many years ago.

When production of automobiles, motorcycles, electric appliances, agricultural machinery and the like is begun in a developing country, in general it proceeds in the following steps.

1) Importation and diffusion of completely built-up units (CBUs).

2) Adoption of a domestic production policy once demand (or imports) reach a certain level. The methods used are primarily prohibition of imports and erection of tariff barriers.

3) Domestic production by foreign companies (acting alone, or jointly with domestic companies, or through technical cooperation agreements). Starting with semi-knocked down (SKD), there is a shift to assembly of completely knocked down (CKD) products, raising the local content.

Because production up to this point is solely intended to satisfy the requirements of the domestic market, there is no effort to export. Recently, however, there have been many cases of companies from Japan and elsewhere that have shifted production to developing countries, and especially the ASEAN countries, for reasons that from the outset include exportation.

The following may be cited as the background for this.

1) In the Asian region, the exchange rate of local currencies against the Japanese yen and European currencies has declined since 1985, and cost advantages, including those related to labor cost, have been improved.

2) The level of technology in the Asian region has improved, and the basis, including human resources, for the assembly industry has improved, contributing to improvement of the investment environment.

3) The governments concerned have supported policies working through foreign investment for development of industries that had been retarded, namely technology-intensive industries and supporting industries such as parts manufacturing.

This international development has been evident in the electric appliance and electronics industries. Previously, there had been domestic production of air conditioners, washing machines and refrigerators and the like for the domestic markets, but now there is evident 1) a shift toward production of low- and medium-grade products, notably audio equipment, for world markets, 2) a shift from audio to production of color TVs and VTRs and 3) a shift from household goods toward production of copy machines, facsimile machines and other industrial-use goods.

Moreover, in the electronics industry, including semiconductors, mobile telephones, FDDs, HDDs and other products, we can observe instances of companies entering these countries with the purpose of exporting from the very outset. As a result, almost all companies in the American semiconductor industry have production facilities overseas, notably in the NIEs and ASEAN countries, and assembly in the Silicon Valley area in California has been almost completely phased out.

In the case of the automobile industry, the target demand area is still the domestic market, and dependency on parts imported from Japan and other countries is high. The reason is that in general minimum production volume of one model produced at the scale of 100,000, and normally there is a model change at four-year intervals but domestic demand alone permits no more than this. In some countries, however, such as South Korea and Malaysia, we can take note of efforts to export.

Further, in the NIEs that hitherto had been eminently suited as a site for assembly industry, labor costs have risen and in recent years currencies have appreciated swiftly. Because of this, companies that had concentrated on production investment in the NIEs are shifting to the ASEAN region. Not only are companies that had invested in NIEs making this move but so too are companies from the NIEs group itself. The investment environment, including infrastructure, is not as good as that in the NIEs region, but there is still a significant labor cost advantage.

1.1.2 International Development in Parts Industries

Changes of environment for the assembly industries as mentioned above are also seen in the parts industries. In the past the greatest producer of automobile parts was the United States. Production began to decline before and after 1980, however, and the machinery industry itself also lost some of its strength. With a catching-up by Japan and Asian NIEs, there was a rapid decline in output from 1977 to 1980. During this period, there was a major decline in the number of technicians, making it difficult for the industry to recover even when the business cycle entered an upward phase. In Germany and other West European countries, production has been stable or slightly down.

On the other hand, in the Asian NIEs countries:

1) There has been investment of resources in high-value-added areas as part of the industrialization process, and relatively less attention was given to basic industries such as parts production.

2) The return on capital investment in production facilities in the parts industry is low, and for that reason has not attracted much capital.

3) The parts industry, because of the above reasons, has had a difficult time attracting high-quality human resources.

These reasons caused the development of the parts industry to lag, and as a result dependency on Japan for parts has been high.

Nevertheless, because of changes in the economic environment, the following phenomena can be observed in assembly industry.

1) There is an on-going, gradual increase in local production of parts needed for assembly work in the developing countries, and of procurement from adjacent countries.

2) The number of companies in Japan and other industrialized nations that look upon Asia (excluding Japan) as a global supply base for parts is increasing.

3) A movement has emerged in the direction of forming organic linkages between Asian production bases, that have hitherto functioned independently. For example, among automobile assemblers and parts makers, that have a broad range of business relations in the Asian region, study is being made of a "brand to brand complementation scheme" and of cooperative division of work in production. The same kind of movement can be seen in the electric appliance and electronics industries.

Hereafter, the current function of each overseas production base will be reviewed to strengthen their activities by reassigning a new function under linkages among them, taking into account comparative advantages of each base on input factors and market access with an integrated control by the headquarter.

The activities of the Japanese parts industry require close attention in regard to these international development in the industry. As noted above, the parts industry in the NIEs countries does not yet possesses adequate technology. For this reason, there are many instances of automobile assemblers encouraging Japanese parts makers, that have a good reputation for their technology, ability to supply small lots, and ability to produce and deliver for greatest efficiency, to expand overseas in order to supply parts for overseas assembly plants. Japanese parts makers, however, tend to be small in scale and have limited experience in producing overseas. Therefore up to the present time, they tended not to expand overseas unless the investment environment in the host country was very good. Hereafter, however, it is expected that there will be a gradual increase in overseas expansion in response to encouragement by assemblers.

1.2 Present Situation and Tasks in the Malaysian Automotive and Parts Industries

1.2.1 General

Development of the motor vehicle industry has taken through the following steps in Malaysia:

1) Motor vehicle assembly plants were set up to provide employment and to reduce imports of CBU vehicles. This import substitution phase continued from 1967 to 1983, when the Proton company was established. By this time, there were a large number of models being made by a large number of assemblers. In 1984, for example, there were 12 assemblers, producing 90 models from 16 original makers; they assembled 96,400 vehicles. These assemblers were established when motor vehicle sales companies undertook backward integration.

2) Gradually, the motor vehicle component parts industry was developed to cater for requirements in the replacement market and later to increase the local content of locally assembled vehicles.

   The local content program for motorcycles was introduced in 1981, and since then, greater local components have been used in the assembly of motorcycles. These components contribute to local content in excess of 75% for motorcycles assembled locally.

   In the case of passenger cars and commercial vehicles, the introduction of the Mandatory Deletion Program in 1980 had resulted in a total 30 components being localized.

3) The National Car Project was undertaken by Proton with special emphasis on the manufacture of component parts. The Proton project, having the objectives of imposing rationalization in the motor vehicle assembly industry and integration of the assemblers, was given support through tax incentives in both parts procurement and vehicle marketing phases.

Domestic demand, that had been stagnant until 1987, started to grow rapidly that year. With this growth, imports of automobiles, parts and accessories have increased. On the other hand, owing to the effort at production and exporting of the Proton, the export of CBUs has increased.

Many assemblers especially Proton have localized more components on their own initiative. These components contributed to local content of over 60% for Proton Saga and about 30% for other passenger vehicles and commercial vehicles.

Transition of production of automobiles in Malaysia is shown in Table A1-1-1. Local content, moreover, to the extent that can be judged from these tables, is also very high.

Imports of fully-assembled vehicles, and CKD sets, are decreasing, but since 1987 imports of parts are increasing in keeping with the increase in domestic production. Further, it is noteworthy that the exports of fully-assembled vehicles and of parts, although small in scale, have been begun.

1.2.2 Industrial Structure

The motor vehicle industry in Malaysia can be broadly classified into three categories:

1) Motor vehicle assembly industry

a) Local assembly

There are presently 13 motor vehicle assembly plants in operation; 9 passenger and commercial car assemblers and 4 motorcycle assemblers. All assemblers of motor vehicles, including motorcycles, are either foreign-owned companies or joint ventures including foreign companies as partners.

b) Imports

- Used cars
- Reconditioned cars
- CBUs

2) Coach and vehicle body building industry

There are more than 120 companies engaged in the fabrication of motor vehicle bodies of wooded and metal structure. Most companies operate on a small-scale jobbing basis.

3) Component parts industry

The component parts being manufactured locally were initially few and primarily were for the replacement parts market. However, with introduction of specific localization programs for industry in the early 1980s, more components have been produced as original equipment. Presently, there are about 200 companies in operation in the manufacture of automotive components, including motorcycle parts and more than 70% of them are catering for the original equipment market.

There are three types of parts maker. One is the foreign parts supplier that has invested in Malaysia in response to the increase in demand for the parts in that country, or a foreign manufacturer which had entered Malaysia to make other types of products, but has begun the parts production in keeping with the growth of demand. In cases like this, the parts maker can obtain technology from the parent company that made the original investment. It also is possible to rely on the parent company for research and development assistance in the future, and it is therefore possible for the company to continually update its technology.

The second is a domestic company that has not been an objective of capital investment by a foreign company, but is directly supplying parts to the automobile industry. Because of need to assure the automobile assembler of the parts' quality, the company has signed a Technical Agreement (T/A) with a foreign firm, to obtain the necessary technology.

The third type is a domestic company that supplies component parts to a parts company such as described above. These are close to being makers and suppliers of raw materials and component parts for the above, and with the exception of special products there is almost no instances of T/A with foreign companies.

The number of automobile assemblers, and parts makers, is shown according to region and type of business in Table A1-1-2. Of the nine assemblers of four-wheel vehicles, six are in Kuala Lumpur and Selangor, and the parts makers are concentrated there (to the extent of 70% of the total number of parts makers) too.

Relations between assemblers and parts makers are as shown in Figure A1-1-1. There are two types, one that directly supplies parts to assemblers and one that supplies parts for assembly to parts makers (details are given elsewhere).

1.2.3 Domestic Production of Parts

Domestic production of parts has been encouraged from the viewpoint of promotion of industrialization in Malaysia. It has been expected with certainty that the domestic production of parts will promote a transfer of technology from foreign automobile and parts companies. The number of makers of automobile parts has risen to 170, as a result of foreign parts makers' investment in Malaysia in keeping with investment there by the assemblers they normally supply, as well as of the development of domestic companies through the transfer of technology to them

(Tables A1-1-3 and A1-1-4).

The Mandatory Deletion Programme has made a great contribution to domestic production of parts. For those parts the government designated for domestic production, this system prohibited importation of the parts in CKD sets, after a given period of time. Assemblers were required to buy these parts from domestic suppliers. Selection of the parts to be designated was not made unilaterally by the government; Malaysian officials formed a committee with private sector participation so that the plans of companies that intended to produce parts domestically could be reflected in the program.

The parts made in Malaysia on the basis of this are 1) interior and general parts, 2) body parts and 3) electrical parts. Domestic production of 1) engine parts, 2) brake and suspension parts and 3) transmission and steering parts is either delayed or has not yet been begun.

Proton is trying to achieve domestic production of engine and transmission parts. In the case of engine parts, machine processing of flywheels and manifolds has been begun about a year ago. As the next step, domestic production of the materials for making these parts is contemplated. Some progress has been made for brake and suspension parts, as some welding work is now being done in Malaysia.

As stated above, the primary parts companies are foreign-owned or joint ventures with foreign participation whereby access to technology is obtained, and these account for a large share of the total number of companies, but the number of parts makers established by Malaysian investors is increasing. In terms of level of technology, capital and human resources, however, there are still few local companies among the primary parts makers.

Differences are evident among automobile makers' methods of developing their parts suppliers, but because the safety of a motor vehicle is determined to a good extent by the safety assurance provided by its parts, each company assigns high importance to quality assurance.

Most parts now being made in Malaysia belong to these categories:

1) Made in-house.

2) Produced by parts suppliers who supplied the parts to the parent company of the assembler and branched out or formed joint ventures in Malaysia at the assembler's request.

3) Produced by local suppliers by technical guidance from or technical assistance agreement with a parts supplier to the parent company of the assembler.

4) Produced by reputable foreign-owned companies (not closely-cooperating companies, but fully experienced companies).

However, production by domestic companies that have no foreign technology or foreign equity investment is limited to small metal castings and press parts, for which a high degree of precision is not required.

A characteristic of recent trends has been for Korean- and Taiwan-owned companies, that have no working relationship with Japanese companies, to join the primary parts makers group.

There has been almost no attempt at organizing parts suppliers into groups of companies closely cooperating with a specific automobile company, with the exception of companies procuring parts in relatively large quantities like Proton. This is because the parts market in Malaysia is small, and automobile assemblers have to purchase from parts makers that possess superior technology even if the maker belongs to another group. This holds for both foreign-owned and Malaysian-owned companies. In the case of Proton, parts makers have no contractual obligation to produce any other products. It also is ordinary for an automobile company to buy any given part only from one source. The small scale of demand and small number of qualified suppliers are causes of this.

As described below, domestic procurement of parts and materials by primary parts companies shows a considerably different situation depending on the nature of the raw material used (details are in the appropriate chapters of this report).

1) In the case of metal products companies, with the exception of small castings and press parts, the materials used are almost entirely supplied from overseas, or are made by processing of imported materials by foreign-owned companies (metal parts trading companies or distributors) in Malaysia. In the case of metal parts, unless they are to be part of a subassembly of some other material, there

are almost no secondary parts companies. Proton has a plan for domestic production of materials, but as it has been impossible to find a suitable supplier it plans to make them in-house.

2) In the case of plastic parts makers, PVC and polystyrene resins are produced in Malaysia but other materials must be imported. The nature of resins to be used is specified in all cases by the automobile assemblers. As high precision is required for molds, the molds are provided by the buyers, from overseas sources; only a few can be procured in Malaysia. Almost all are primary suppliers of parts, but there are some secondary companies that make fabricated parts such as electric components. Resins and molds for such uses are procured as described immediately above.

3) In the case of electric and electronics parts other than the few plastic parts that are obtained in Malaysia, all are imported and only assembly work is done in Malaysia.

4) Companies supplying other materials (glass, textiles, rubber, etc.) include many that use Malaysian materials; for materials not available from Malaysian sources, imports are used.

Thus, although there is considerable domestic production of parts, almost all parts makers are non-Malaysian companies, who perform only a certain part of the process, and there is a considerable degree of reliance on imports of raw materials, parts and molds. Because the equipment and technology of the metal processing companies, that would normally be called upon to process parts for the automobile industry, do not meet the technological requirements of the assemblers, assemblers resort to in-house production and use of imports and almost no linkage of the metal processing industry to the automobile assembly industry has been accomplished. The same may be said for materials supply, for which dependency on imports is high and only the beginning of creation of domestic supply capability of advanced materials may be discerned.

1.2.4 Replacement Equipment Market

Details about the scale of the replacement equipment market (REM) in Malaysia are not available. It may be readily imagined, however, that the scale of the market is increasing, in keeping with the increases in the number of vehicles on the road.

The distribution scheme for the REM is as shown in Figure A1–1–2. There are two main types of channel. One is that organized by an assembler; it includes the company itself, its sales subsidiaries and agents, repair shops, parts depots, and so on, and the assembler controls what parts are distributed in this way. The only network like this that is national in scale is that of Proton, as it has been able to make and sell a sufficient number of vehicles. The second type is dominated by independent parts distributors, and there is no network of parts distributors, parts sales outlets, and repair shops on the basis of a single central assembler. Therefore, the repair shops and parts sales companies have a large number of possible sources for their goods. It is estimated that there are 400–500 parts sales outlets and primary–level repair shops in all Malaysia. There are, in addition, an estimated 1,200 small or secondary–level repair shops. In contrast to this the number of distribution facilities (repair shops) and sales outlets for Proton's original replacement parts is only 34.

Thus at the secondary level there are a large number of small repair shops that are not closely related to the automobile manufacturers. Because it can be assumed that vehicle owners who ask for repair work at these shops are disinterested in the sources of the parts used, or are more interested in obtaining repairs for a low price, often it is the repair shops that decide on what parts are to be used. For the repair shops, because parts from sources other than the original vehicle maker will be cheaper, they can improve their own profit margins by using them. In many cases, these parts will have been made without proper quality control. It is desirable that there be some form of regulation of parts related to safety, parts that may damage other parts because of lack of balance, and the use of parts having very short usable lifetimes, from the viewpoint of consumer protection, traffic safety, and protection of the environment.

In particular, brake linings and oil filters of low quality are being sold at very low prices, and clutches made of poorly prepared parts are being sold; these comprise safety hazards. At present the safety inspections of automobiles in Malaysia are not adequate, and there is no means whereby sale of products such as these can be controlled. Automobiles are used in Malaysia for relatively long periods of time and it is thought to be indispensable from the viewpoint of traffic safety that inspection of older vehicles be improved.

1.2.5 Current Issues in the Industry

Among the basic issues related to development of the automobile industry in Malaysia is the question of how to develop the parts industry. It is believed that development of manufacturing of component parts to cater to the original equipment market of the assembly sector and the replacement market, adopting the "market expansion approach" to provide the economics of scale required by this industry. To achieve this,

1) Through the National Car Project, increase its local content through in-house manufacture of critical components such as engine and transmission parts as well as through sourcing of other components from component parts makers. For this purpose, nurture a group of component parts makers capable of supplying Proton's requirement.

2) Promote export of motor vehicle component parts as well as CBU vehicles, pursuing the scale of economies. An immediate possibility for consideration would be the market penetration of the ASEAN neighbors through the ASEAN Complementation Scheme.

   This scheme is a "brand to brand complementation scheme." On the basis of this scheme there would be incentives including discounts of 50% on imported products from the ASEAN countries and certification of localized parts.

This assumes that all parts makers involved produce parts that meet international standards. It is necessary, in addition, to prevent distribution of parts other than those covered applicable standards (and, in particular, parts that do not meet the applicable standards). This will be effective not only for improvement of traffic safety and prevention of pollution, but also for promoting the development of companies that maintain high quality standards.

Nevertheless, any effort to increase production in Malaysia will encounter a problem of attainment of economies of scale. Although an increase can be implemented on the justification that it will protect domestic industry, it should be considered with great caution, as there is ample experience that testifies that such an approach ultimately will protect inefficient industries and retard the industrialization process. Therefore, as indicated above, it is necessary to examine not only attainment of economies of scale but also policies for increasing local content.

1.3 Needs and Methods for Promotion of Standardization and Quality Control

1.3.1 Situation Related to Standardization and Quality Control

1.3.1.1 Use of standards

All types of standards are being used by the automobile and automobile parts industries. However, because each automobile company has its own standards, and makes and purchases parts on the basis of them, they provide the basis for standards in the parts industry. These internal standards are based on the standards in the original country of the companies, and ordinarily have higher requirements for quality than the latter.

This is because all automobiles produced in Malaysia (including those made by Proton) are models that are produced outside of Malaysia, or modifications of them.

On the other hand, however, there is need for the cars that are being made to comply with the regulations in the target market. For Proton, that is exporting, this means use of specifications that will be acceptable so as to clear requirements in England, the major export market.

1.3.1.2 Certification system

A certification requirement is imposed for automobile glass, seat belts and a limited number of other parts from the viewpoint of insuring safety.

In the case of seat belts, parts made for this product are being produced by secondary suppliers. Most production, however, is by primary parts suppliers, and they carry out quality control in order to pass certification inspection. What is becoming necessary is to study the extension of the certification requirement to the REM.

Certification of quality control systems is not being used at present because the assemblers are for the most part using the systems developed by the original company overseas. It is thought that if exports increase in the future there will be greater need to use the ISO 9000 Series.

Further, there are some parts makers that have been certified on the basis of the ISO 9000 Series, but this is not being effectively used because the assemblers' requirement that vendors use the assemblers' standards, takes precedence. In the future, nevertheless, this can be expected to change in keeping with the increase in exports and spread of use of ISO 9000 Series in the automobile industry.

1.3.1.3 Quality control systems in individual companies

The assemblers are all foreign-owned or have foreign participation, and are using quality control systems developed in the original foreign countries. They have their own company specifications (technical standards) and work standards, and quality control techniques are at the level of Total Quality Control (TQC).

Companies that are supplying parts to the assemblers not only must satisfy the final product specifications imposed by the latter but are required to have quality control systems that ensure stable quality. The arrangement is formalized through what is called an Inspection Agreement or a Quality Agreement. These agreements include the methods to be used for control of quality, and the assemblers are unyielding in this requirement, and even will make inspections at the vendors' plants, to check that both the system and the data are such that dispersion of quality lies within acceptable range. (In other words, they will only purchase parts from a local vendor if such a system has been adopted; otherwise, the parts will be imported.) The internal standards of automobile assemblers are used as the basis for these quality control systems. There are no instances known of a company that is now using the ISO 9000 Series. In general the assemblers have formulated their internal standards in such a way as to meet the standards and technical criteria of their market, and this is an easier matter than complying with ISO 9000 Series. It is thought that if present systems were to be replaced with ISO 9000 Series systems it would have to be done on the basis of improvement of the existing control systems.

1.3.2 The Japanese and International Standards System, and State of Development of Standards in Malaysia

1.3.2.1 Standards related to automobiles and automobile parts, and parts processing

Standards related to automobiles and automobile parts may be classified as follows.

1) Standards concerned with assuring safety of the vehicle itself, and protection of the environment.
2) Standards for assuring interchangeability of automobile parts.
3) Standards not specifically related to automobiles, but related to materials that may be used in other industries, methods of testing, units, glossary of terms, etc.

4) Standards not specifically related to automobiles, but related to quality control systems that may be used in other industries.

In each country, such standards are officially and privately used as guideline and/or regulation.

1.3.2.2 Standards in Japan

Basic concepts of standards related to automobiles are shown in relevant laws related to road transport in Japan. Details are provided in ministerial directives of Ministry of Transport and government ordinance issued in conjunction with the laws.

On the basis of these fundamental principles, safety regulations for road vehicles related to structure and equipment of automobiles are set forth in the Road Vehicles Act. Technical standards have been prepared for these safety regulations, and make up the basis of standards for motor vehicles in Japan.

Among them, industrial standards, that are applicable to industrial production in general, are stipulated in Japanese Industrial Standards (JIS). There also are Japanese Automobile Standards (JASO), that have been adopted by the industry to assure interchangeability and to supplement JIS (Table A1-1-5). When a JASO standard is deemed suitable for general use for industrial products, recommendation is made to include it in the JIS. As of March, 1992, JIS included 309 standards related to automobiles, and the JASO standards numbered 332. The number of standards for each, by general subject, are as shown in Tables A1-1-6 (1) and (2).

Japanese automobile makers have their own internal standards, on which basis they procure parts and materials, perform assembly work, and conduct interim and final inspection and testing. These internal standards are written in such a way as to clear the safety regulations mentioned above. In their preparation, reference has been made to JIS and JASO standards, that may be quoted or included in the internal standards. These have been refined and improved in the course of carrying out quality control programs. That is, in the process of improvement, each company has incorporated the results of productivity improvement, stabilization of quality, and reduction of costs in their internal standards.

Each manufacturer also has given particular attention to strict quality control for safety-related parts in particular, for those parts that are the objective of safety regulations on the basis of the Road Vehicles Act.

At present (March, 1991) there are 312 ISO standards related to automobiles.

1.3.3 Needs and Orientation of Standardization and Quality Control

1.3.3.1 Introduction

For the following reasons the necessity of standardization and quality control in the automobile and automobile parts industries has special importance.

1) Necessity to ensure traffic safety.
2) By raising the level of that part of the industry that as a parts industry produces essential parts for industry, a contribution to overall elevation of industry is made.
3) A contribution is made to improvement of efficiency of the economy, through rationalization of production of important components.
4) By these means a contribution can be made to promotion of industry (and promotion of exports) by raising the external (market) evaluation of the Malaysian automobile and parts industries.

In order to attain these objectives there is need to develop the following in the context of standardization and quality control.

1) Improvement of the vehicle inspection system as justified from the viewpoint of traffic safety, or improvement of product certification for parts.
2) Improvement of standards for the purpose of elevating industrial technology.
3) Establishing the basis for "appropriate quality control" with the purpose of diffusing appropriate quality control, and improving the means whereby it is diffused.
4) Improvement of testing and inspection systems as needed for promotion of standardization and quality control.

1.3.3.2 Improvement of certification systems

What is necessary in studying the improvement of certification systems are 1) the certification system that is needed in order to insure transport safety, and 2) certification related to the diffusion of quality control.

Two methods are conceivable for certification on behalf of assuring transport safety. One is the system for certifying products related to transport safety, that is presently in use and should be further improved. At present automobile glass, seat belts, helmets and LPG devices undergo mandatory inspection for certification. As stated above, low-quality and in some cases inadequate parts are being sold in the replacement market. It is necessary to bring this system to also bear on replacement parts. It is thus necessary for the mandatory standards to be effective to improve the testing and inspection system so that it can accommodate mandatory inspection. If this cannot be accomplished at an early date, a beginning should be made by developing standards for parts by the industrial association and by providing certification by them for the parts met to the standards, whereby consumer awareness can be improved.

The other direction would be to insure transport safety in keeping with improving and expanding the existing vehicle inspection system for commercial vehicles (buses, trucks, taxis). In order to accomplish this, it is first necessary to improve the motor vehicle repair standards (improving them in keeping with the actual situation in industry) and laws or regulations concerning the vehicle inspection system, as well as improve the arrangements for the inspections themselves. Just improving the arrangements, however, will not guarantee easy functioning of the system. It is necessary at the same time to improve the capabilities of repair shops to do inspections, and for that it is necessary to have an accreditation system to qualify repair shops. Need also exists for research into the actual causes of accidents.

Certification with regard to quality control should be standardized not only on the basis of the level of quality control at parts makers that are already being accepted as qualified vendors of parts to assemblers but with reference also made to other companies, and should, as a quality control certification system conforming to ISO 9000 Series, provide direction for quality control at those companies that thus far have been left out of the linkage process in the automobile industry.

In the future, automobile assemblers will adopt ISO 9000 Series to a greater extent, and the increase in exports of Malaysian automobiles and parts will lead to greater recognition of the need for ISO 9000 Series, in addition to which it can be expected that the number of certified companies will increase.

1.3.3.3 Directions for standard development

What is required of the development of standardization is:

1) Standards that can contribute to elevating the level of industrial technology.
2) Standards that are needed for improvement of the certification systems.
   a) Those related to certification systems related to transport safety
   b) Those related to quality control system certification

There are two types in the first group of standards.

1) Standards that reflect the level of technological development of the country and seek to newly standardize technology.
2) Standards that are already recognized internationally and are being widely used to improve efficiency in industry, and which are needed to be introduced and diffused into the country.

The first type, in industrially advanced countries, has undergone many improvements in keeping with progress in technological development, but in Malaysia's automobile and automobile parts industries almost all the technology has been developed and brought in from overseas, and the country has not yet arrived at the stage at which it can undertake its own development predicated on domestic conditions. Further, at the stage where the percentage of imported parts is high and a start has just been made at exports, the quality and specifications that are required in the domestic market are the same as in the international market. Thus, in a situation where each individual automobile manufacturer not only applies its own standards what it assembles but also similarly exerts control over purchases, it is not perceived that there is need concerning the product to adopt international standards as Malaysian standards, or to develop new standards. Of course it is necessary to seek that attention be given on behalf of securing internationality. Therefore under present conditions, introduction of foreign and international standards and national standards in Malaysia, conforming to them, is needed, the independent development of standard raises the fear that disorder may be created in industry and the distributive sector. What is of course necessary in this field, although at the present time its necessity is not great, is to start to prepare the relevant systems so that it will be possible to cooperate with the industry for development of standards once it becomes necessary to undertake technological development in keeping with conditions specific to Malaysia.

The second type includes many that are already in use in industry, and it is desirable to facilitate the adoption in Malaysia of international and foreign standards (including in the latter sector standards) as Malaysian standards for use by the industry. The following are representative of this type.

1) Standards related to marks, glossary of terms, units, progressions, classifications, etc.
2) Basic technical standards for raw materials, processed materials, heat treatment, surface treatment, etc.
3) Standards related to basic engineering of design and production for standard parts, standard shapes, dimensional accuracy, etc.
4) Standards related to methods of testing, analysis, measurement and inspection of raw materials, products, intermediate products etc.
5) Standards related to production technology for quality, function, performance etc.

Regarding the second group there are the following: that have been discussed already.

1) Standards and regulations that are necessary as the basis for regulating or guiding determination of reference related to transport safety, consumer protection, environmental preservation, and so on.
2) Standards that reflect the quality control systems in use in the parts industry at present, but are somewhat modified from the standpoint of the ISO 9000 Series.

1.3.3.4 Dissemination of standards and the certification system

Standards related to necessary basic technology for elevating the technological level of industry, such as standards related to testing and analysis, not only make a contribution to the elevation of technological levels as they are put into practice over and over again, but also create the need to revise them. It will be effective to attain this to make materials for use at seminars, collecting in the materials various international standards and commonly-used standards in industrialized countries (including sector standards if frequently used) that are relevant to the automobile production industry (particularly, metal processing related industry), and to hold seminars as often as necessary to secure understanding of standards and methods of their use.

1.3.3.5 Improvement of quality management

As a measure for further effective implementation of Quality Management, in addition to promoting wider participation in quality control certification schemes in keeping with the actual situation in the small– and medium–scale business sector, as aforementioned, an important strategy for more effective quality control is promotion of diffusion of greater understanding of the concept of quality control.

In many small– and medium–scale industries there is a lack of comprehension of the difference between inspection work and quality control work. The former is work that separates passed and ejected products whereas the latter is woik with the purpose of enabling continuous, stable production of good products. What must be emphasized as being necessary is the Check and Action parts of the Deming Cycle, that is, to do the inspection and to feedback the results to the process. It is necessary to emphasize the creation of an organization or arrangement that makes the feedback process work well. Matters such as these are included in the ISO 9000 Series, and in order to have this concept understood even by companies that have not chosen the ISO 9000 Series, it would be necessary to mount a campaign that demonstrates this.

1.3.3.6 Necessity for improving testing and inspection systems

It is necessary to improve testing and inspection systems in order to be able to have a better motor vehicle inspection system. Together with expanding the scope of inspection, there is need to raise through–put capacity, so as to enable inspection of a larger number of vehicles, and to broaden the geographical range over which inspections are made. At present there are inspection centers in each state (13 centers in total), but inspections are perfunctory. The inspection system in use cannot contribute to improvement of the testing and inspection system. It is necessary at the same time to improve the repair shops.

What is needed next in regard to the testing and inspections system is support for acceptance inspection by parts makers, and their own product inspections, both of which are now insufficient. In general both assemblers and parts makers in principle have the responsibility to inspect their own products. Assemblers, however, often do not do acceptance inspections when parts are delivered. In turn, parts makers rely on their suppliers of materials and parts. As a result of these conditions, the parts vendors selected by assemblers, and materials and secondary parts vendors selected by primary parts makers, are confined to those companies in which trust can be placed.

The Malaysian automobile market being small, and there being a number of MNCs, besides Proton, costly equipment is fundamentally uneconomical, if it is installed only for own use. Because of this, it is necessary to have public inspection facilities for the common use to every firm in order to maintain the level of quality. Such facilities are not of the type that are properly a recipient of government subsidies. They should be self–supporting on the basis of charging suitable fees for inspection services.

For the inspection of parts, standard practice calls for the company that supplies the part in question to bear total responsibility for it. Therefore, each company must have its own inspection arrangements to insure that substandard parts do not leave the factory, or there must be a check function performed by a third party engaged to inspect products to ascertain if they meet specifications. Whether or not a complete inspection can be made on the premises of the parts makers depends on such factors as the materials used, and facilities available.

1) Regarding plastic parts, many manufacturers are wholly owned by Malaysian interests, and in general that use the inspection services available from SIRIM.
2) For rubber parts, RRIM has good facilities.
3) In the case of castings, there are some that maintain in–house control over the melting process, but they go to SIRIM, SISIR, universities or other places for mechanical tests or chemical analyses.
4) Most raw materials for machine–processed parts are imported, and for heat treatment reliance is made on the suppliers of those materials. Inspections done in–house are limited to the likes of hardness testers, micrometers, vernier calipers, height gauges, and surface plates, that is, measurements are not high in precision.

In addition, when the required kind of equipment is not found in the country, a parts maker can request its Technical Agreement (T/A) counterpart to have the work done. In the case of newly developed parts, automobile makers often ask for cooperation by their parent companies.

In addition to improvement of public testing and inspection facilities it is important to assist to those companies that are trying to improve their own in–house facilities. It will be effective to provide a credit scheme, special depreciation, double deduction of taxes and other incentives.

1.3.3.7 Necessity for development of human resources, and measures for development

Many parts makers have sought a transfer of technology by means of signing T/A with non-Malaysian companies, and are using OJT for the development of human resources. It can be said that technology transfer to this kind is highly efficient.

But the transfer of technology by means of a T/A is confined to the signators of the agreement (or to only one of them), and solely use of T/As would not have quick, widespread effects on the improvement of technological levels across the board in industry. For the diffusion of technology throughout industry, improvement of technical guidance institutions is necessary, and although some institutions are now functioning as contact points for the acquisition of technology from overseas, the transition to a guidance scheme wherein Malaysians have central roles has not been sufficient.

The following are conceivable as methods of providing transfer of technology by means of T/A.

1) Incentives to compensate higher costs related to fostering activity for linkage industries done by foreign-affiliated companies.
2) Compensation for participation in technological diffusion activities (seminars, etc.) given by technical personnel of foreign-affiliated companies.
3) Subsidies for use of non-Malaysian technical consultants.
4) Promotion and support measures for Technical Committee activities in industrial organizations.
   a) Technological information exchange with counterpart industrial organizations of other countries
   b) Dispatch of study missions to other countries
   c) Formation of joint-participation study groups
5) Support for renewal and expansion of equipment and facilities on the basis of T/As.
6) Provision of a facility for promotion of T/As and functioning as a point of contact for acquisition of technological information from overseas.
7) Certification of technical personnel's qualifications

Table A1-1-1 AUTOMOBILE PRODUCTION IN MALAYSIA (1987-1991)

	1987			1988			1989			1990			1991		
	P	C	T	P	C	T	P	C	T	P	C	T	P	C	T
Proton (Export)	25,200		25,200	44,670		44,670	65,551 (11,985)		65,551 (11,985)	85,460 (13,535)		85,460 (13,535)	101,000 (18,000)		101,000 (18,000)
Others	9,503	15,305	24,808	16,606	23,786	40,392	28,015	48,772	76,787	44,540	75,054	119,594	49,259	81,099	130,358
Total	34,703	15,305	50,008	61,276	23,786	85,062	93,566	48,772	142,338	130,000	75,054	205,054	150,259	81,099	231,358

Abbreviations: P=Passenger Car C=Commercial Car T=Total

Source: Proton

Table A1-1-2 REGIONAL DISTRIBUTION OF CAR ASSEMBLERS AND PARTS MANUFACTURERS

(Unit: Number of firms)

	Car Assemblers	Motorcycle Assemblers	Parts Manufacturers
Kedah			4
Penang		2	10
Perak			9
Selangor/KL	6	2	122
Negeri Sembilan			4
Melaka			4
Pahang	1		
Terengganu			1
Kelantan			1
Johor	1		14
Sabah	1		1
Sarawak			2
Total	9	4	172

Source: MIDA

Table A1-1-3 NUMBER OF CAR PARTS MANUFACTURERS BY KIND OF PARTS MANUFACTURED

Kind of Parts	No. of Firms
Engine, Clutch, Transmission Parts	35
Chassis, Suspension Component Parts	35
Body Parts	37
Electrical Equipment Parts	28
Automotive Airconditioner Parts	9
Plastics Parts	12
Rubber Parts	16
Total	172

Source: MIDA

Table A1-1-4 NUMBER OF CAR PARTS MANUFACTURERS BY MARKET

Market			Number of Firms
OEM	REM	Export	
x			55
x	x		42
x	x	x	23
x		x	4
	x		36
	x	x	11
		x	1
Total			172
Of which:			
	OEM related		124
	REM related		112
	Export related		39

Notes: OEM=Original Equipment Market
REM=Replacement Equipment Market

Table A1-1-5 CRITERIA FOR DIFFERENTIATION OF JIS AND JASO

1. In the automobile sector basic thinking follows the same lines as in our general model; standards are classified into in-house standards, group standards and national standards and to realize the most effective standardization results these must be closely linked and harmonized. The JIS and JASO work together in accordance with the above thinking.

   Naturally the Automobile Technical Association actively participates in the JIS standard drafting commissioned by the Industrial Technical Academy. Further those JASO developed independently by the Automobile Technical Association which are considered appropriate are made into JIS, and every opportunity is taken to propose such JIS creations which reinforce the JIS framework.

2. Criteria for Differentiation of JIS and JASO

2.1 Items suited as JIS, are items mentioned in (1) below which satisfy the conditions laid down in (2) below

(1) Standard aspects which require JIS definition

(a) The terminology, codes, labeling methods, installation details, operating direction of basic or fundamental chassis structures.

(b) Testing and measuring methods used to evaluate the performance of automobiles, their equipment and functional parts or products related to automobiles.

(c) The required quality parameters (including form and dimensions) of interchangeable automobile parts which need quality guarantees.

(d) The required quality parameters (including form and dimensions) of parts used widely in other sectors as well as in the automobile industry.

(e) The required quality parameters (not including form or dimensions) of parts required by automobile users or repair shops in order to assure the safety and public hygiene.

(f) Required quality parameters, testing methods and measuring methods for materials.

(2) Additional Conditions for JIS definition

(a) Standardization will be further promoted by the use of these standards outside of the automobile sector.

(b) It is expected that fundamental modifications will not be required in the immediate future.

(c) The standard details match the required conditions for JIS.

(d) The standard is close to international standards in terms of the levels established.

2.2 Items which can be Defined as JIS in some cases

These are parts which do not fall under any of the above groups but which can be considered for promotion JIS especially in the case of JASO meeting the following conditions,

(a) Promotion to JIS is highly likely in the case of items required by society at large or which are emphasized in national policies.

(b) Those items where it is judged appropriate for the sector to employ the JIS marking system.

(c) Items requiring the additional authority of JIS for the reasons of export overseas or internal legal regulations.

2.3 Items Appropriate for JASO Definition

Are items which do no meet with the conditions laid down in section 2 above, and in particular it is advisable for standards to be defined by JASO even if they meet with the conditions laid down in 2.1(1) above if the following conditions are also true.

(a) Standard aspects of the existing JIS specifically limited to use in the automobile sector which are to be even further limited to the automobile sector over and above the JIS limitation.

(b) Standard aspects which are to be limited, modified or added as particularly for automobile use over and above the existing JIS specifically limiting to use to the automobile sector.

(c) Those which are in the stages of technical development or which require a trial period, and for which JIS definition is considered premature.

(d) Those standards which do not have uniformity in present conditions and where implementation of standard definition will require a certain amount of time (this is also true in the case of the introduction into the country of international standards).

Source: JSAE

Table A1-1-6 (1) JIS STANDARDS FOR AUTOMOTIVE DIVISION

Subject	No.
General	42
Tests and Inspections	60
Common-use Parts	20
Engine	17
Chassis Frame	51
Electrical Equipment; Instruments	53
Commercial and Industrial Vehicles	55
Repairs, Test and Inspection Equipment	11
Total	309

Table A1-1-6 (2) JASO STANDARDS

Subject	No.
Body	26
Chassis, Brakes	99
Electrical Equipment	31
Engine	27
Elemental Parts	39
Materials and Surface Treatment	56
Two-wheeled Vehicles	20
Automobiles in General, etc.	34
Total	332

Figure A1-1-1 OEM CAR PARTS SUPPLY ROUTE IN MALAYSIA

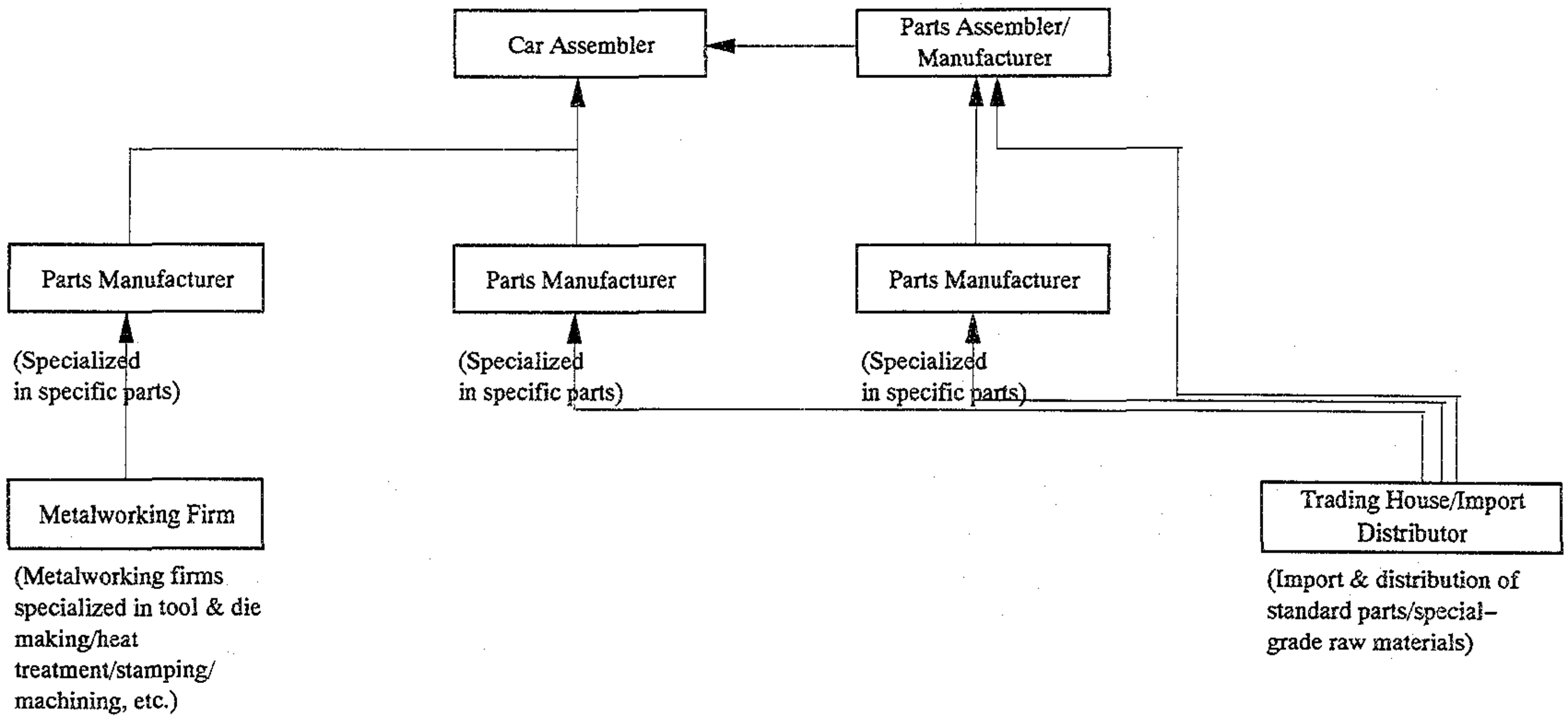
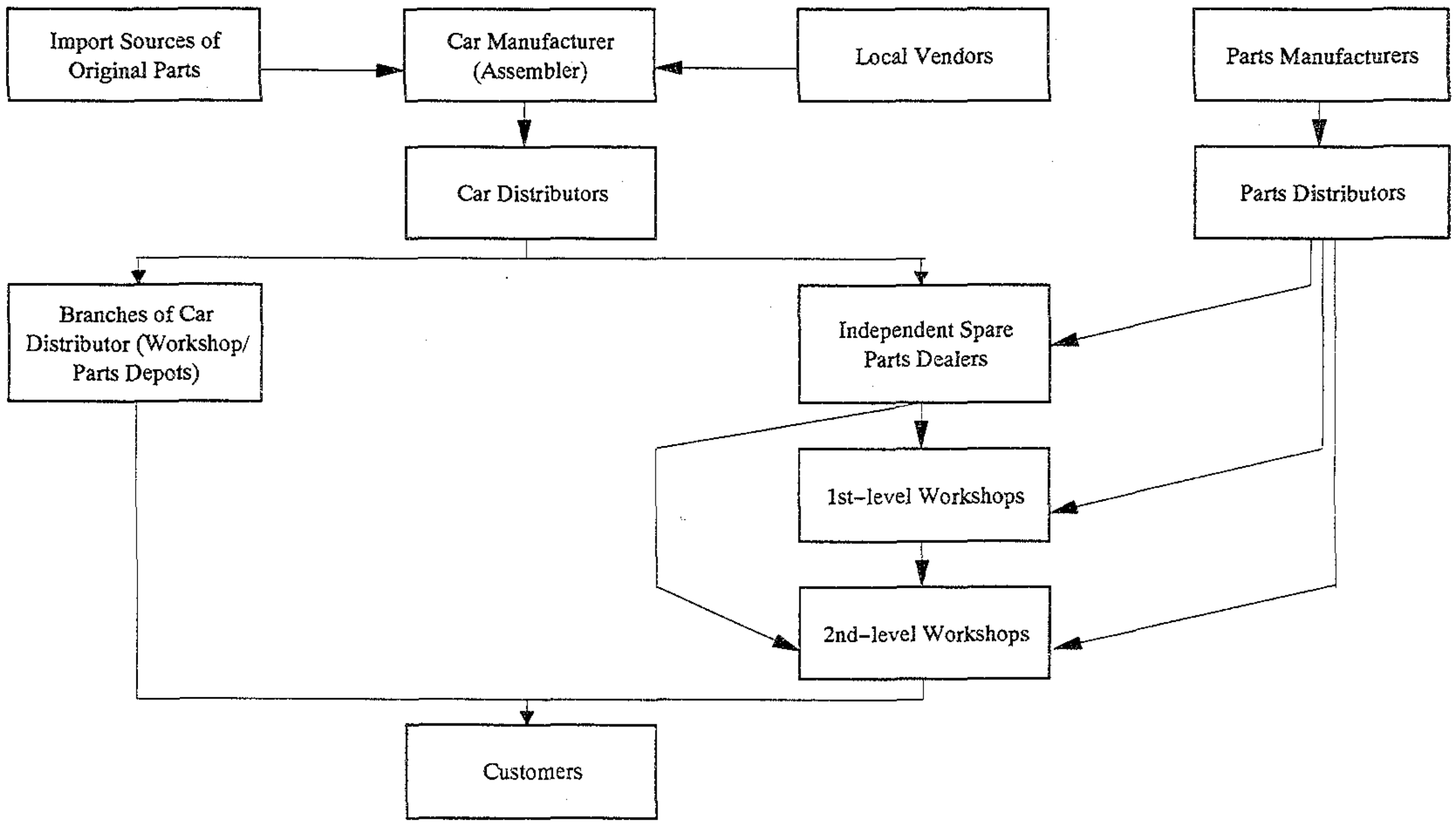


Figure A1-1-2 DISTRIBUTION CHANNEL OF REPLACEMENT OF CAR PARTS IN MALAYSIA



Chapter 2 Metal Engineering Industry

2.1 Present Conditions in the Industry

The metal engineering industry in Malaysia has been developed on the base of production of replacement parts for tin mining equipment. Production of high-manganese and hence wear-resistant steel castings thus has a history of 70 years and at present occupies an important position in the foundry industry in Malaysia. The composition of demand for products of the metal engineering industry has changed greatly in recent years, largely because of the expansion to Malaysia by foreign companies engaged in processing and assembly of automobiles, electric appliances and other kinds of products. Demand for castings has risen not only for Replacement Equipment Manufacturers (REM) but also for high-quality, mass-produced products for the Original Equipment Manufacturers (OEM) companies. Demand has also risen for metal presswork products and, in turn, for molds and dies to make them. Demand for molds has risen also in the plastics conversion industry. The range of the metal engineering industry therefore has been expanding rapidly. The entry to Malaysia of steel forging companies, according to MIDA, is said to be still in the planning stage but the range of the industry is being expanded by the inclusion of heat treatment, electroplating and other surface treatment, welding, and precision machining industries.

The following paragraphs describe foundry, metal presswork and molds and dies, as the three sub-sectors of Malaysia's metal engineering industry that are now important and are expected to grow in scale in the future.

2.1.1 Foundry Sub-sector

2.1.1.1 Outline

The foundry industry supplies castings that are important parts in the machinery, automobile (including motorcycles), electric and electronic, and other industries. As exemplified by rolls for rolling, ductile cast iron pipe, manhole covers, hydrants and malleable cast iron fittings, although in some instances castings are final products, for the most part they are incorporated in other products. The foundry industry therefore is, in general, considered to be oriented to the domestic market, since it is a sector that supports the nation's industries. In the case of the Malaysian foundry industry, because it has until recently produced equipment, machinery and replacement parts for Malaysia's traditional industries (tin mining, timber processing, rubber and palm oil processing), the technological levels are high in the special steel sector, where there are elevated quality requirements, for resistance to wear, corrosion and elevated temperatures. But there is not an adequate capability to supply the quantity or quality required, with regard to soundness, high accuracy, high reliability and high productivity that are needed in castings for the automobile and electric/electronic industries.

Thus, in order to make and supply large quantities of high-quality castings, it is necessary to acquire state of the art equipment that is high in price, and to acquire advanced foundry technology. As a means of responding to the demand for high-quality castings, local firms have; 1) developed the ability to make castings in-house, in the case of the foreign-affiliated processing and assembly firms, while 2) some foreign companies have established foundry subsidiaries in Malaysia, and 3) some local companies are now able to supply castings to foreign-affiliated processing and assembly companies.

2.1.1.2 Scale of the industry

(1) Value of production

Accurate statistics giving production of castings in Malaysia are not available, but the last study by JICA estimates that in 1988 production was 55,884 tons, valued at M$188 million.

(2) Number of companies

There were 220 companies as of 1976, and it is recorded that 64,400 tons were produced in 1975, but the number of companies is believed to have declined after that, because of the decline of tin mining. In 1986 (according to "Survey on Foundry Industry", in "Economic Report 1988/89"), there were 76 foundry companies and production had fallen to 29,100 tons. According to FOMFEIA, recently the number of companies has been:

Ferrous foundries	About 210
Non-ferrous foundries	20-30
Die casting firms	About 25

(3) Number of employees

According to the 1991 FMM Directory, 4,000 persons were employed in the foundry sub-sector in 1987/88.

2.1.1.3 Regional distribution

According to the last JICA study, 48.5% of Malaysia's foundry firms are in Selangor and Kuala Lumpur, 21.5% in Perak and 15.3% in Penang. This study also confirmed that there were more than 20 companies in Melaka. Thus, foundry companies are concentrated in certain areas.

2.1.1.4 Demand sectors and domestic supply conditions

According to the last JICA study, about 60% of castings made in Malaysia are of gray iron. The major users are agencies involved in public works, that buy municipal castings, the automobile industry, that needs replacement parts made by foundries, and makers of pumps and valves. There has been an increase recently in production of cast parts for room air conditioners, refrigerators, and automobile air conditioners. Next in importance is the 25% share of steel castings, that are supplied to tin mines and the gravel industry, that require wear-resistant alloy steel castings and cast gears, these being largely for Malaysia's traditional industries. Malleable iron castings have a 7.1% share; almost all are for water, gas and oil pipe fittings. Die cast products account for 5.7% of all castings, and are shipped to the automobile (including motorcycle) industry, as well as to the electric/electronic industry.

There are no instances of local independent companies producing high-quality, high-precision iron castings. These are made in-house by foreign-affiliated processing and assembling firms, or are imported as CKD components or fully-assembled products (for example, for automobile engines and suspension parts).

Production of steel castings developed in connection with growth of tin mining and the palm oil industry, and the level of production technology for wear-resistant steel castings, that is high-manganese steel or high-chromium steel, is quite high. Recently, these products have been exported to adjacent countries.

In the malleable iron castings field, there is one Japanese-affiliated company and one local company, each making its own brand of pipe fittings as the main product. Their products are intended for the domestic market.

Die cast products that must satisfy exacting requirements, such as for cylinder blocks of motorcycle engines, and therefore have to have high quality, are imported as KD parts from Japan. Almost all die cast toys are for the export market.

2.1.1.5 Raw materials

Pig iron, ferroalloy, aluminum alloy ingots for die casting, and zinc alloy ingots are imported. Some of the foundry sand for high-pressure molding is imported.

2.1.1.6 Production technology

The gray iron casting foundries, that produce about 60% of total output, are composed of 1) subsidiary foundries of some of the Japanese-affiliated appliance makers, and government owned companies, and 2) other local independent foundries.

Almost all of the local independent foundries are family-operated firms, and few of them produce their own brand of product; that is, most produce to meet orders, i.e., are jobbing foundries. The number of foundries using the pep-set process or the alpha-set process has increased recently, but the major molding methods used are the cement mold process and the CO_2 process. Regarding the green sand molds, with the exception of some of the larger foundries, many foundries use either small jolt-squeeze machines for molding or hand rammers. Little attention is given to control of molding sand, and many defects such as blow-holes occur. Foundries using cupolas for melting are common, and recently use of induction furnaces for melting has increased. Nevertheless, control of chemical composition and pouring temperature is not adequate at these foundries. It is thought to be necessary to establish strict quality control arrangements, in view of the expected start of domestic production of automotive casting and machine-tool castings, for which higher quality is needed.

2.1.2 Metal Presswork Sub-sector

2.1.2.1 Outline

Presswork products, together with cast products and forged products, are among the major structural materials used to make automobiles, motorcycles, electric and electronic equipment, and other goods. Many foreign-affiliated companies that have expanded to Malaysia in recent years are users of such products, and after using imported SKD and CKD parts while production volumes were still low, they began to buy parts in Malaysia once their own output reached a certain level. In the area of presswork products, the same as for cast products, major parts tend to be made in-house, or be bought from foreign-affiliated companies. Parts for which high precision is not required are in some cases bought from domestic companies. In the Malaysian presswork industry, the importance of Proton is very high. The local content of vehicles made by companies other than Proton is low, about 30%, but Proton, that makes more than 100,000 cars a year, has a high local content ratio, 60%. This ratio includes body parts made in-house, but there is a tendency for increased procurement from local companies that have acquired technology from Japanese vendors by means of technical assistance agreements. Similar to Proton, the Matsushita Electric Co., (M) Bhd. (MELCOM) group also has great influence on the Malaysian metal presswork industry. The group makes important parts in-house, but almost all of the major local independent presswork companies provide stamping parts to one or another, or both, of the Proton and MELCOM. Purchasing of Malaysian-made stamping parts is increasing from year to year at other companies also. But at any of the user-companies most of the important parts are made in-house. Further, there are many stamping companies that have expanded to Malaysia to supply their long-standing customers that are engaged in production there. An example of this would be makers of lead frames for semiconductors; these are products that must have high dimensional accuracy and high quality, and users often prefer to buy from companies they know well. Thus, the local stamping companies are supplying only parts of simple shape, that are not required to have high dimensional accuracy.

2.1.2.2 Scale of the industry

(1) Value of production

The value of production of the metal presswork industry is not known, as there are no statistics, but it may be assumed that it is the highest of all metallic materials-processing industries supporting the automobile, motorcycle, electric appliance, and electronic equipment industries, this observation being probable also on the basis of domestic content ratios.

(2) Number of companies and employees

According to the 1991 FMM Directory, 32 projects have received production licenses from MIDA. Sources in the industry, however, estimate that there are more than 300 companies. There are no statistics on the scale of employment in the industry but it may be presumed to be at least as great as that of the foundry industry.

2.1.2.3 Regional distribution

Because user industries are concentrated in Kuala Lumpur, Selangor, Penang and Johor, most presswork companies are there too.

2.1.2.4 Demand areas and conditions of domestic supply

(1) Automobiles

Only Proton, which produces more than 100,000 vehicles a year, is making body parts locally in its press work shop. Further, a press work company of the Proton group makes small press and stamping parts to supply to the parent company. Because the scale of assemblers other than Proton is small, they import body parts made by presswork, in the form of KD parts. Mandatorily deleted components are made in Malaysia; they would include air filters, seats, shock absorbers, radiators, fuel tanks, and exhaust systems, that are all made by presswork. Wheel rims, air receiver tanks and their cases, as well as bodies for commercial vehicles, are all being made in Malaysia.

(2) Motorcycle parts

There is domestic production of frames, fuel tanks, mufflers, oil cushion units and other presswork products but because of safety considerations they are made in-house or by companies that have followed motorcycle makers that had invested in production in Malaysia.

(3) Home electric appliance parts

Almost all press and stamping work parts for home electric appliances are being made in Malaysia. Major parts, however, are made in-house by the appliance manufacturing companies. When an order is placed with local vendors, it is for parts not required to have high precision, and dies are provided by the customer for their manufacture.

(4) Electronics parts

Lead frames for semiconductors, for which high-precision processing is required, are being made by Japanese- or American-affiliated companies specialized in this product. Malaysia also produces stamping parts for computer peripherals, bar code reading devices, TV sets, and other small parts. The number of local independent companies that have installed automatic high-speed presses has increased, and modernization of equipment is proceeding at a rapid pace.

2.1.2.5 Raw materials

All sheet steel and steel pipes or tubing used in metal presswork is imported. There are five steel centers established in Malaysia by large non-Malaysian trading companies, where cold-rolled sheets, hot coils, surface-finished steel and other products from Japan, South Korea, Taiwan, New Zealand, the U.S., Canada, Brazil and elsewhere are cut to specific dimensions and dispatched to users. Press and stamping equipment has been installed in these centers, and in some cases stamping parts are supplied to processing and assembly companies. In the case of Proton, that is a large user of steel plates, imports are made directly from foreign steelmakers, through a trading company.

2.1.2.6 Production technology

The metal presswork industry in Malaysia is characterized by a short history of domestic production of parts and in-house production of main parts by the large users, and a lag in local investment by press and stamping companies. Recently, however, the volume of work done by local independents has been increasing, in keeping with increases in production by major users, and attainment of higher rates of local content. From the viewpoint of user industries, however, problems of the quality control arrangements persist because these companies are family enterprises that operate in the old ways, using old equipment and not having been improved by rationalization, so there are few local companies that can be given contracts with the assurance that all will be well. The most advanced company in terms of local content is Proton that gives contracts to a company that has signed a technical assistance agreement with Mitsubishi Motor's venders in Japan to give technical guidance to them, and has done much to develop local independents.

Further, in the electric appliance industry, the MELCOM says that it has had good results from sending its own personnel to key vendors, to provide managerial and quality control guidance on a regular basis. In press and stamp working, it is vital that the dies have and retain precision, but because there is no local source of high-precision dies, in the case of large dies, either they are made in-house by the manufacturers and supplied to the local press working firms, or are imported from Japan, Singapore, Taiwan, Thailand or elsewhere and supplied to them.

2.1.3 Molds and Dies Sub-sector

2.1.3.1 Outline

The companies that make direct use of molds and dies are presswork and stamping processors, plastic conversion companies, die cast makers, forged product makers, rubber molding companies and the like, for which they are indispensable tools used in forming processes. Processed materials made using molds and dies are used in the automobile, motorcycle and electric and electronic equipment industries where they are important components. These processing and assembly industries in Malaysia have developed very rapidly, primarily by means of investment by multi-national companies. Further, in accordance with raising of local content ratios, the demand for molds and dies has increased. But in Malaysia at the present time the local independent mold and die manufacturers cannot satisfy demand either in terms of quality or quantity. That is, they cannot make high-precision and complicated, or large, molds and dies, and foreign-affiliated processing and assembly companies must make them in-house and procure them from multi-national mold and die manufacturing companies, or import them from Taiwan, Hong Kong, Singapore, Thailand or elsewhere. Recently, however, an increasing number of foreign mold and die manufacturers, especially from Japan, have been forming joint ventures with Malaysian companies so it is thought that hereafter there can be domestic manufacture of high-precision, large molds and dies. In particular, local independents specializing in molds and dies have acquired a degree of design and processing technology through their maintenance work on imported molds and dies, and it is thought that the increase in joint ventures will lead to improvement of molds and dies making technology in Malaysia through a transfer of technology from the foreign partners.

2.1.3.2 Scale of the industry

(1) Value of production

According to MIDA, the production of Malaysia's 60 independent molds and dies companies in 1987 was M$50 million. This amount has the following components:

For electrical/electronics sector	M$20 million
For plastic conversion sector	M$15 million
For metalworking sector	M$12 million
For rubber molding sector	M$3 million

It is also estimated that the value of production in 1988 was M$201 million. These estimates do not include the value of in-house production and because there recently has been a sharp increase in the number of mold and die makers, the total value of production is believed to be much higher than these amounts.

(2) Number of companies and employees

The exact number of companies in this sub-sector is not known. According to MIDA, the number of independents in 1987 was estimated at 60. Further, as of March 31, 1991, MIDA has given licenses for 113 projects, of which 31 are operating. According to information from the industry, there are about 200 companies in Kuala Lumpur and Petaling Jaya alone, and it is said that there are about 380 mold and die makers in Selangor. Accurate figures would be hard to obtain because many metal presswork companies and even plastic conversion companies make molds and dies in-house. The number of people employed is estimated as about 3,000, based on MIDA's M$201 million figure for 1988. This is probably lower than the actual number today because of the recent increase in the number of mold and die companies.

2.1.3.3 Regional distribution

As shown in Table A1-2-1 the regional distribution of companies in the 1990 FOMFEIA Directory shows a concentration of more than 95% in Selangor (including Kuala Lumpur), Penang and Johor. This concentration is likely to increase in keeping with growth of the industry, and would be higher if adjusted for in-house production.

2.1.3.4 Demand areas and conditions of domestic supply

The mold and die making industry, is in an important position for the materials processing industry, contributing to an increase in domestic production of parts that hitherto had to be imported; however according to MIDA the self-sufficiency rate for molds and dies is only 20-30%. The bulk of needs are met by imports, that were valued at M$255.6 million in 1989. In general, large and particularly heavy molds and dies, or molds and dies that are complicated and require a high degree of dimensional accuracy are imported from industrially advanced countries, Asian NIEs, Thailand or elsewhere.

(1) Molds for rubber molding

Demand is primarily from tire makers, and tire retreading companies, but a large part of demand is for reconditioning imported tire molds. Almost all of the rest of demand is for simple molds for rubber footwear makers.

(2) Molds for plastic conversion

The plastic conversion industry, producing plastic containers as well as various items for daily use, started relatively early in Malaysia. For this reason, domestic production by use of blow molds, compression molds, injection molds, and extrusion dies began before the start-up of metal processing by use of molds and dies, and the number of companies making molds for the plastics conversion industry, including the companies making their own molds in-house, is quite high. Recently, in accordance with the swift expansion of processing and assembly industries in Malaysia, domestic production has been begun of molds for forming the back covers of TV cabinets, molds for automobile wheel covers, molds for motorcycle front wheel covers, and molds for other purposes. In the case of molds of 5-10 tons or more, for forming large-size TV cabinets, automobile instrument panels, automobile bumpers and the like, however, it is necessary to get imports from industrially advanced countries, Singapore, Taiwan, or elsewhere. Further, molds that must have high precision are either made in-house by foreign-affiliated companies, or imported from industrialized nations or Asian NIEs, Japanese makers of molds for plastics recently have been setting up operations in Malaysia and they are expected to make large and high-precision molds.

(3) Dies for presswork and stamping

The history of dies for presswork and stamping is short in comparison to that of molds for plastic conversion. In the automotive industry, relatively low-precision, small dies for presswork, are being procured from local independent die makers, being motivated also by Proton's desire to promote more domestic production of presswork products. But large press dies, such as Proton uses for in-house production of body parts, must be imported from Japan or Japanese-affiliated die makers in Thailand. Electric appliance parts that are small and not required to have a high degree of precision are being purchased from local independent stamping companies that are expected to furnish their own dies. Among these independents there are some that make dies in-house, others buy them from local independent die makers. Progressive dies too are made by these companies. But here too, in the case of complicated dies or dies that must be highly precise, either they are made in–house at foreign–affiliated companies or imported from industrialized countries or Asian NIEs. Progressive dies used to make lead frames for semiconductors must have dimensional accuracy to micron order, so they must be made in–house by the foreign–affiliated lead frame makers in Malaysia, or be made by the foreign–affiliated die makers.

(4) Die casting molds

The history of production in Malaysia of aluminum alloy die cast products for automobiles, motorcycles, electric appliances or electronic equipment is new, and almost all molds are imported. Molds are usually borrowed from users of the products made by using them, and are not assets owned by die cast makers. There is a relatively old history of making zinc alloy die casts, but the products for the most part are simple, such as door levers, architectural hardware, or toys, and the precision of the molds is not very high. Molds for zinc alloy die casting are made by die cast makers in–house, but many are made by independent local firms.

2.1.3.5 Raw materials for making molds and dies; standard parts

The materials used to make molds and dies, carbon tool steel, alloy tool steel, high–speed tool steel, powdered high–speed tool steel, cemented carbide, etc., are imported from Sweden, Germany and Japan. Die sets, mold bases, guideposts, pins, bushings, coil springs, punches, ejector pins and other standard parts are imported, mostly from Germany and Japan, but recently a domestic, independent maker of standard parts has been established.

2.1.3.6 Production technology

The molds and dies industry in Malaysia is new and small in scale. Recently, however, there has been a strong tendency for more foreign processing and assembly companies to transfer production to Malaysia and for them to increase purchases of domestic parts. Some of the new entrants from overseas have set up in-house molds and dies production facilities, and there also are many cases of foreign molds and dies makers investing in Malaysia. Regarding these companies, and especially those from industrially advanced countries, no problems exist regarding the equipment used for die making and quality control, the source of technology, and the continuity of supply of new technology.

Other than these companies, there are a number of medium–standing companies that are independent, Malaysian–owned makers of molds and dies. These compa–

nies typically have molds and dies making and design technology that has been acquired and accumulated by the owner himself, have a degree of ability to raise capital, have bought up-to-date machining equipment, and directly or indirectly are supplying molds and dies to foreign-affiliated processing and assembly companies. These companies typically are equipped with the following for quality control use, namely a hardness tester, profile projector, height gauge, micrometers, calipers, granite surface plate, etc. But none of them have a 3D coordinate measuring machine, that can make measurements to micron order. Further, even though these companies are using air conditioned precision machining rooms and laboratories where dimensional and profile measurement work is done, there are frequent instances of careless temperature control in those air conditioned rooms. It is necessary for these companies to increase their efforts at maintaining dimensional accuracy in their processing work.

Another stratum of companies is made up of firms typically employing 5–20 persons; most of these companies have no ability of their own to design molds and dies, nor the ability to properly utilize high-precision die making equipment if they were to acquire it. The only dimensional measurement equipment they have is on the order of calipers, micrometers, height gauges, and dial gauges, and the dimensional accuracy of their work at best is several hundredths of a millimeter. Therefore, the molds and dies they can make are extremely simple, and dimensional accuracy is low. But from among these companies have appeared some that have obtained orders for molds and dies from local vendors that supply processed materials to foreign-affiliated processing and assembly companies, and by this process it is expected that they will be able to gradually up-grade the quality of their work.

Under present conditions, if two of the same kind of mold, one from a local, independent Malaysian company and one from overseas, are compared, it will be found that the former is more expensive and moreover users say that deliveries tend to be delayed. However, it will be increasingly necessary to make molds and dies in Malaysia, in keeping with progress of product development in Malaysia, and the increase in domestic production that will ensue. At present, the increase in demand is being satisfied by in-house production, and by entry of foreign mold and die makers, but it is absolutely necessary to improve the level of local, independent makers, who are far greater in number than the in-house or foreign makers of molds and dies. To achieve that, there are many problems that must be solved, such as those related to modernization of management organizations, modernization of die making facilities, improvement of equipment related to quality control, introduction of CAD and CAM in order to shorten the time between receipt of an order and delivery of the mold or die, and to accumulate and improve design and die making technology. Further, it is to be noted that in conjunction with the short history of mold and die manufacturing in Malaysia, the number of companies in peripheral areas to the industry, namely precision machining, heat treatment, and surface treatment (including electroplating) is few.

2.2 Needs in Promotion of Standardization

2.2.1 Standards in the Metal Engineering Industry in Malaysia

JIS standards related to the metal engineering industry as of the end of 1991 include 1,313 for mechanical engineering, 321 for ferrous metals and metallurgy, 393 for non-ferrous metals and metallurgy. In keeping with Japanese participation in the international standardization effort, and from the viewpoint of contributing to opening of the domestic market, JIS standards are being made to conform to international standards (ISO) to a higher degree than in the past.

In MS, however, the number of standards related to the metal engineering industry is less than 100. They concern, for the most part, steel wire, hot rolled bar steel, galvanized steel sheet and coils, steel for steel pipe and tubes, welding electrodes, cast iron products for water pipe, automobile and motorcycle parts, LPG cylinders, and pig iron products. Many standards include requirements for both products and testing method.

In relation to metals, 1) preparation of the basic standards for general castings and forged products, metal materials, heat treatment, and surface treatment, has lagged. Also, 2) standards related to "basic matter" such as drawing office practice, geometrical tolerance, glossary, surface roughness, and 3) standards related to "machine and parts" such as bolts and nuts, washers, keys, split pins, gears, couplings, rolling bearings, valves, flanges, springs and the like are not adequate. It is desirable that these be improved at the earliest possible date, not only because they are of great importance for the metal engineering industry but because they are of fundamental importance for the manufacturing industry.

2.2.2 Use of Standards in Individual Companies

Product specifications and testing of materials in the metal engineering industry make great use of standards. In Malaysia, MS exist for steel bars, deformed steel bars, steel fabric for civil work, galvanized steel sheets (including corrugated gal vanized steel sheets), gate valves, malleable iron fittings and other cast products, as well as fire extinguishers, door locks, valves for LPG cylinders and other metal products, and these standards are used in the manufacturing process. For other products, such as high-grade steel, ductile iron manhole covers, ductile iron fittings, and zinc alloy die cast products, foreign standards (BS, JIS, DIN, ANSI, ASTM, etc.) are used.

The major user companies in Malaysia are foreign-affiliated companies, and because of the high dependency on imports of raw materials, foreign standards are used for those materials. An additional reason for this is that there are not many MS related to metal materials.

In the case of replacement parts, it is common for production to be made in accordance with standards used in the country that supplied the original machinery. DIN and JIS are among the commonly used standards for molds and dies. For metal presswork and die casting, almost all production is based on the specifications that basically conform to JIS, because most of the users are Japanese-affiliated processing and assembly companies.

2.2.3 State of Preparation of Inspection and Testing Systems

(1) In-house systems

Inspection and testing systems at foreign-affiliated processing and assembly companies, or at companies that are primarily engaged in export business, in general are in good order. In comparison to this, when the user company is a local company, adequate inspections are not performed. Moreover, the arrangements (in terms of both staffing and equipment) for quality checks of raw materials, quality control during the production process, and out-going quality checks are insufficient.

It is necessary to use 3D coordinate measuring machines, profile projectors, surface roughness tester and other sophisticated equipment in production of molds and dies because of the high standards of dimensional accuracy required, but with the exception of foreign-affiliated companies and some governmental entities there are few places where such equipment has been installed. Progress has been made in installation of machining centers, jig boring machines, jig grinders, surface grinding machines, electric discharging machines (EDM), wire cut EDM, capable of high-precision machining, and the like, but introduction of sophisticated measurement equipment is lagging. In the area of foundry, foreign-affiliated and governmental companies as well as large steel foundries have installed spectrometers and can conduct chemical composition analyses but at the small- and medium-scale foundries there are few that have even a CE meter and there is cause to doubt the quality of their products.

(2) Outside systems

SIRIM is equipped with facilities for chemical composition analysis and tests of mechanical properties of metals, but in addition to its being inconveniently located, because of a shortage of staff and a low level of staff skills, the work cannot be performed quickly. Whereas results can be obtained in about 2 days from privately-owned institutions, about 2 weeks are needed at SIRIM, so its services are not being actively sought. In addition to domestic private institutions, of which Malaysia does not possess many, mention may be made of Nusantara Technologies, based in Singapore. In addition to this company, use is being made of SISIR, SEEL, STS in Singapore and others.

It is desirable that the private inspection and testing institutions increase in number, and expand in a way effective from the viewpoint of geographical distribution of user companies. It is also desirable that SIRIM promote accreditation of those institutions. Regarding calibration of measuring equipment, foreign-affiliated equipment makers have been providing such services to their customers, and it is desirable that SIRIM give them accreditation for their activities.

2.2.4 Use of Certification Systems

In relation to the metal engineering industrial sub-sector under consideration here, there are almost 50 companies producing goods that conform to MS, or foreign standards such as JIS, BS, etc., and are authorized to use the MS mark. Most of them are in the business of making steel bars, steel pipe, steel wire, steel fabric or other materials of steel, or secondary steel products. Many others are castings as final products, such as malleable iron fittings, ductile iron manhole covers or zinc alloy die castings. Others are certified for production of goods such as fire extinguishers which are mandatorily certified, valves for LPG cylinders, or door locks.

Public agencies such as Telekom, National Railways, and JKR give high importance to the cost of goods they procure, and make light of MS.

There are yet few companies in this industry that possess certification of ISO 9000 Series systems based on ARQS. There are about 10, that are certified for manufacture of welding rods, steel roofing, steel drums and other secondary steel products, and automobile parts such as leaf springs, hub nuts, hub bolts and U bolts. But there are almost no other companies which are interested in such systems.

Regarding Quality System Consultants Registration Scheme (SAMM) system only one laboratory in the metal engineering field has been certified.

For the metal engineering industry, where there are many small- and medium-scale enterprises, QIP is an important program whereby their quality control can be brought up to international levels. But in general, none of them know about this system in this field.

2.2.5 Quality Control

(1) Quality control

Quality control at the level of TQC (CWQC) or SQC is adopted only at some of the foreign-affiliated processing and assembly companies. QC circles are an on-going activity at very few companies. At best, there are a few staff members assigned to quality control, and they undertake Incoming Quality Control (IQC), In-process Quality Control (IPQC) and Outgoing Quality Control (OQC). Most small businesses do not have a specialized quality control person, and the entrepreneur himself inspects goods prior to shipment.

(2) Education of personnel

At the foreign-affiliated companies, education of personnel is highly important, and many have programs whereby education and training is conducted at the parent company or a related company in their home country for periods of six months to one year. Further, many of them undertake training within the company in Malaysia, and send their staff to seminars at the NPC or elsewhere. However, small local companies show great divergence in educational activities, the difference being based on the attitude of top management. At companies that sell their products to foreign-affiliated processing and assembling companies, and are eager to expand their business, there is a tendency to be convinced of the value of educating the staff. They send employees to open seminars held by NPC, ITI and other institutions, and some, send their staff to seminars to carry out programs as an instructor within the company. Small businesses, in comparison to that, are not interested in the use of outside programs because of reasons including the low level of educational attainment of employees, and language problems, that would prevent employees from fully understanding the contents of a seminar. These companies are also not interested in conducting training within the company.

(3) In–house standards

Because most of the production in this industry is done as jobbing work, manufacturers follow the specifications provided by the customers. In the presswork industry, there are many women working as operators, and men who are non–skilled, and the operation standards prepared by the company on the basis of the customer's specifications are hung up next to the press. These are simple sheets that show a sketch of the product and dimensions, being drawn in such a way as to facilitate understanding by someone who has not received much of an education. Further, some companies provide an inspection data sheet, and have a system whereby periodic checks are made and recorded. Regarding molds and dies, few companies with the exception of some affiliated with Japanese companies have in–house standards, but there is a tendency for companies to adopt such sets of standards in keeping with the use of standard parts, or introduction of CAD. In the foundry sub–sector, manufacturing technology is specialized by whether it relates to metal materials or the manufacturing process. However, in relation to the methods of testing of the qualities of metal materials, or their mechanical properties, there are many foreign and international standards available, and they are widely used in Malaysia. Therefore, except for special cases, there is no need for in–house standards. However, because the body of manufacturing processes is complicated and diverse, it is desirable that each company prepare, in detail, in–house standards and especially operating standards. The foreign–affiliated companies, and companies that have been certified by a national body, have in–house standards.

(4) Other issues

Whether or not a company succeeds in quality control activities depends on the attitudes of the top management towards management of their company. Small businesses in Malaysia are often family–owned businesses, and in them in general a short–term perspective is common. At some of these companies, however, the owner–managers have acquired an understanding of the value of a long–term view, after having been in contact with Japanese–affiliated companies have succeeded in introducing QC systems. At the worker level there is an irregularity in the level of education and where there is a lack of ability to comprehend quality control, at times it hampers efforts to promote quality control activities.

Although it greatly depends on the attitude of top management, in general there is keen interest in introduction of production–related facilities, but insufficient interest in introduction of the equipment used for quality control. In keeping with greater demands for higher quality of the products manufactured in the industry, introduction of quality control equipments besides manufacturing facilities will become important. For the foundries, for instance, it will be needed to prepare CE meters to analyze the carbon equivalent value of molten iron, optical pyrometer to check the temperature of molten iron and various testing equipment used for quality control of molding sand, etc. For the machine shops such as die making companies or precision machining companies, it is also needed to prepare high grade measuring equipment such as 3D coordinate measuring machines, profile projectors, surface roughness testers and gauge blocks, etc., to cope with demands for higher dimensional accuracy and surface roughness, besides preparation of such simple measuring instruments as micrometers, calipers, dial gauges, and height gauges, etc. Although air conditioning is prepared in some machine shops to make precision works or in some laboratories to do accurate measurement, their control of room temperature or cleanliness is not strict. They do not seem to understand the reason and importance of air-conditioning.

Owing to the fact that the majority of enterprises in the industry are SMIs, the basic concept of quality control, that the quality of products should be monitored in the manufacturing process, is not prevailing among them. The companies in which exclusive QC staff check the products quality in each step of the manufacturing process are still better than the majority of those companies in which only outgoing inspection is done. Moreover, due to the fact that the role of workers is single function in most of the factories, there is no thought for them to take care of a former process or succeeding process, and there is also no thought that a succeeding process is a customer for the former process. The word of SQC (Statistic Quality Control to detect the cause of product defects) is well known among the people in the industry, but only a few companies actually have adopted it. The present business environment in the industry is not ready for prevailing TQC or CWQC. In the business environment in which end users prefer cheaper price rather than higher quality, QC activities will not take root in the industry. Malaysian governmental institutions should take the initiative in procuring higher quality products rather than cheaper price products with inferior quality.

Table A1-2-1 NUMBER OF COMPANIES IN METAL ENGINEERING INDUSTRY BY FIELD AND REGION

	Foundry and Pattern Maker	Steel Fabrication and Welding Works	Machine Shop	Machinery & Parts Manufacturer	Mold & Die	Electro-plating	Heat Treatment	Total
Selangor	58 (6)	46	60	69	43	2	2	280 (6)
Perak	26	16	49	17	2	–	–	110
Negeri Sembilan	1	22	24	8	1	–	–	56
Melaka	1	18	19	7	–	2	–	47
Kedah	–	30	44	5	–	–	–	79
Pahang	–	21	36	–	–	–	–	57
Penang	16 (2)	9	36	33	13	–	–	107 (2)
Kelantan	–	20	21	7	–	–	–	48
Johor	6	98	150	52	8	4	–	318
Total	108 (8)	280	439	198	67	8	2	1,102 (8)

Note: Figures in the parentheses show number of pattern makers.

Chapter 3 *Electrical Machinery and Appliance Industry*

3.1 Present Status of Electrical Machinery and Appliance Industry

3.1.1 Overview

The Malaysian electrical engineering industry began in the early 1960s, with production of dry cell batteries, automotive batteries, electric wire and cable and electric lamps, as well as through import substitution efforts based on assembly of imported components and parts by foreign-owned companies, that produced radios and black-and-white TVs.

Thereafter, because of environmental changes related to production, primarily consisting of appreciation of the currencies of industrialized nations or of NIEs, and increases in labor costs in those countries, electric engineering manufacturers began to shift their production bases from those countries to the ASEAN countries. In keeping with that, the number of foreign companies that expanded in Malaysia, not to supply the domestic market but to export, increased, and the diversification of products progressed.

Among those new products, the growth of production of air conditioners in particular has been rapid, and Malaysia can boast of being second only to Japan in world production standings. In 1990, 980,000 sets were made, and exports of them were worth M$542 million. In addition to this product, exports of electric appliances were valued at M$123 million, and exports of wire and cable at M$302 million. Imports related to the electrical engineering industry, on the other hand, were M$5 billion in 1990 and exceeded the value of exports. About half of the imports were electric machinery and equipment for industrial use.

3.1.2 Scale and Regional Distribution of the Industry

The electrical engineering industry in Malaysia is divided into five sub-sectors as shown below. The number of companies[1], based on registrations with MIDA, by sub-sector is shown in Table A1-3-1.

a) Electric appliances
b) Electric industrial machinery and equipment
c) Dry cells and batteries
d) Incandescent and fluorescent lamps
e) Wire and cable

According to MIDA, the value of production of the Malaysian electrical engineering industry in 1990 was about M$3 billion, of which about three–quarters was accounted for by the home appliance and the wire and cable sub–sectors combined. Further, according to MIDA, the wire and cable sub–sector in 1990 had a production value of M$1.075 billion.

There are no statistics on employment in the industry, but nearly two–thirds of the electric product output (about M$2 billion in 1991) is accounted for by four Japanese–owned companies that have a total number of employees of 8,500.

Note: 1) According to the Directory of Existing Electrical Product Manufacturers as of March 1991, issued by MIDA, 125 companies are registered as makers of electrical products, some of them being registered in more than one category. Multiple–entry companies have been counted in the most appropriate category. There are 14 companies that cannot be classified and are not included in Table A1–3–1.

Further, the 1989 Industrial Survey, as reported by the Malaysian Department of Statistics, has 3,925 employees in the wire and cable section, 1,514 in the dry cell and battery section, 598 in the electric lamp section, and 6,919 in the electric appliance section, for a total of 12,956 persons. On the basis of this information, the scale of employment in the industry is estimated to be about 20,000.

The regional distribution of the industry, according to the above classification in the MIDA Directory, shows a concentration of 84% in the three states of Selangor/Kuala Lumpur, Johor and Penang, as shown in Table A1–3–2.

3.1.3 Conditions of Demand Sectors, and Domestic Supply

3.1.3.1 Electric appliances sub–sector

This is the most important sub–sector in the industry. Major export products are room air conditioners, vacuum cleaners, immersion heaters, electric irons, rice cookers and microwave ovens. Major products for the domestic market are refrigerators, electric fans, washing machines, gas cookers, mixers, home showers, electric kettles, hair driers and the like.

The local content ratio of products differs depending on each manufacturer, but at the major companies it is 90% or higher. For example, at a certain Japanese–

owned company, the only parts that are imported are electrical contacts, fuses, and cords for electric irons, and covers for vacuum cleaners, that are imported from Japan; all the other parts the company needs are made in Malaysia. About 80% of the parts of domestic-made products are bought from local vendors, including Japanese-owned companies, and the remainder are made by this company itself.

At another Japanese manufacturer, the local content ratio of fans and rice cookers is very high, at 80% and 99% respectively, and for room air conditioners and refrigerators the rate is 50%. This company has motor, compressor and electronic parts production facilities in Thailand and Singapore, and imports those parts from there. Similarly, with regard to air conditioners, such Japanese manufacturer has a very large scale of production, that enables its compressor and motor production to be economically done in-country, and it has within its own group a company that makes compressors and motors for air conditioners. This has enabled it to have a 90% local content ratio; however 80% is produced within the company's group and only 10% is purchased from local vendors. Moreover, at one of the group's companies, production of cast parts for the rotary compressors for air conditioners was recently begun.

3.1.3.2 Electric industrial machinery and equipment sub-sector

This sub-sector is primarily oriented to the domestic market, and produces distribution transformers (25 KVA to 2 MVA), general-use motors, switch gears, etc. At a Taiwanese-owned manufacturer of general-use motors, the casings, brackets and other cast parts are made by an in-house foundry.

3.1.3.3 Dry cells and batteries sub-sector

Both dry cells and automotive batteries are made by foreign-owned companies for the domestic market. It is required of domestic assemblers of automobiles that they use domestically-made batteries only.

3.1.3.4 Incandescent and fluorescent lamps sub-sector

The sub-sector, primarily oriented to the domestic market, produces incandescent lamps, fluorescent tubes, ballasts and reflector fittings for fluorescent tubes.

3.1.3.5 Wire and cable sub-sector

Bare conductor and insulated wire and cable of copper and aluminum are produced. The uses of these products include power transmission, ACSR, telecommunications cable, electric and electronic industrial devices wiring, wire harnesses and the like. The sub-sector has been domestically oriented but recently production for the export market has increased.

3.1.4 Imports and Exports

3.1.4.1 Raw materials

Magnetic steel sheets, cold-rolled steel sheets, structural steel, hot-rolled steel sheets, copper billets, aluminum ingot, plastic resins and other major raw materials sourcing is entirely from overseas. Recently, production of some plastic resins was begun in Malaysia.

3.1.4.2 Exports

According to MIDA information, the value of exports of the electric machinery and equipment, by type of product, is shown in Table A1-3-3.

3.1.4.3 Imports

Malaysia's imports of electrical machinery and equipment in 1990 totaled M$5 billion (exports totaled M$2.4 billion). Half of imports was accounted for by transformers, motors, switch gears and other industrial-use products.

In keeping with diversification of consumer needs, considerable imports of vacuum cleaners, grinders, mixers, juice extractors, washing machines, ovens, floor polishers, shavers, hair driers, dehumidifiers, clock-pots, and other items are evident.

3.1.5 Production Technology and Relevant Issues

The home appliance sub-sector is a typical processing and assembly industry, with complicated manufacturing processes that are classified into several stages. Further, it requires a number of supporting industries such as metal processing and plastics processing industries. The electric industrial machinery and equipment sub-sector too is processing and assembly industry, but its scale of output is small and production essentially is done entirely in-house by each company. The electric lamps sub–sector essentially is a parts industry. In the dry cells and batteries sub–sector, and the wire and cable sub–sector, production processes are integrated, automated, and virtually the entire production process is accomplished in–house by each company.

In view of this situation, the following sections discuss technology and related issues of the sector with focusing on electric appliances sub–sector. According to information from sources in the industry, 80–90% of production is by Japanese–owned companies. The expansion in Malaysia by these companies has been in two stages, wherein the manner of expansion has been different. In the first stage, during the latter half of the 1960s, expansion was motivated by a desire to protect markets which had been secured through exports from Japan, but came to be characterized as "import substitution" industries. Thereafter, however, the yen appreciated, wages in Japan rose, and labor came to be in short supply; these domestic changes in the business environment led companies to shift production to bases in Malaysia. Further, the Malaysian Government adopted an investment–promotion policy and starting in 1987 expansion based on these conditions became evident. This comprises the second stage. The structure of production in Malaysia's home appliance industry has been greatly influenced by this process of Japanese expansion.

During the first stage of expansion, production begun by assembly of all kit parts imported from the parent company, because the scale of the Malaysian domestic market was small. Thereafter, the domestic production of parts and materials was increased in keeping with increases in demand, including export demand. But because supporting industries were undeveloped in Malaysia, major parts had to be made in–house, and the only parts purchased from domestic makers were metal parts that were small and were not required to have a high degree of precision or dimensional accuracy, and low–grade plastic parts.

In the second stage, a transfer of production from Japan, the scale of production was high from the outset, and the production equipment used was the latest available. Even at this stage, however, because supporting industries such as the metal processing industry were not developed, emphasis had to be placed on in–house production by the company or companies belonging to the group. During this stage, further, it came to be that foreign parts manufacturers were among the companies that expanded to Malaysia. For example, companies making copper tubes or refrigerant circuit parts for air conditioners, expanded to Malaysia, and supported the production of air conditioners there. Further, recently some companies have expanded to Malaysia not only to engage in production there but also to