II-1-3. Trends in the Procurement of T.V. Components and the Significance of the Domestic Production of CRTs

(1) Parts Able to be Procured Locally

Table II.1-6 shows the possibility of local procurement of key components required for the T.V.set production based on the result of field interview survey. For the unit prices of the components, reference was made to MIDA's "A Study on the Promotion of the Supporting Services Industry in the Manufacturing of TV".

As for the possibilities of the local Procurement of T.V.set parts, there were some differences in view depending on the company. Counting all of the parts for which some companies consider that domestic components are available, the maximum procurement rate of local T.V.set parts in Malaysia is estimated at 38.7%. However, the actual local procurement rates of various manufacturers show a range from a lowest 5% to a highest 33%. This is due in part to the differences in the manner of counting local procurement rates by companies. By comparison, the following trends were observed:

1) In most cases, the local procurement rates of OEM manufacturers are relatively low due to the materials and parts being generally supplied by the brand owners.
2) The highest local content rates were shown by domestic market oriented manufacturers. This is believed to be due to the fact that the import duty on TV components is a high 50%, so these companies, which do not enjoy tariff exemption, try to use domestic products as much as possible.
3) Even in the case that some local manufacturers of certain parts exist, the specifications of individual companies differ and thus some of these parts may often not be usable. In particular, such cases are observed in tuners, ICs and the like.
4) Similarly, while domestic parts manufacturers exist, some export-oriented T.V. set manufacturers consider that procurement from them is not possible due to the insufficient amount of supply. These items include PCB, speakers, etc.
5) Parts for which future domestic production is desired from T.V. set manufacturers are given as CRTs, ICs, PCB, capacitors, resistors, and the like. The shares of these in the total price of parts are, respectively, a high 34.6%, 7.3%, 10.4%, 6.9%, and 3.3 percent. In particular, if CRTs are

produced domestically, the percentage of parts which could be possibly procured locally would soar from the current 38.7% to 73.3%.

Table II. 1-6 Components Required in Manufacturing TV Sets

Item	Price (M$/Set)	Local (M$/Set)	Main Supplying Countries
1. CRT	120.90	0	S'pore, Taiwan, Japan, Korea
2. PCB	36.24	30.00	S'pore
3. IC	25.57	2.55	Japan
4. Capacitor	24.29	2.50	Japan
5. P.W. Cabinet	20.25	20.25	--
6. Tuner	20.00	20.00	--
7. Resister	11.49	2.28	Japan
8. Deflection Yoke	9.43	9.43	--
9. Pear Cover	8.35	8.35	--
10. Coils	8.08	6.79	Korea, Taiwan
11. Diode	5.83	0	Japan
12. Antenna, Antenna Connector	4.66	4.66	--
13. Transistor	4.63	0.56	Japan
14. Filmer	3.89	0	Japan
15. Delay Line	3.50	0	Japan
16. Switch	3.15	1.58	
17. High-Drive Chopper Transformer	3.14	3.14	--
18. Connector/Asseasly	2.84	2.84	--
19. PVC Alu. Punching Pannel	2.60	2.60	--
20. Speaker	2.58	2.58	--
21. Carton	2.55	2.55	--
22. Bead Care	1.67	0	--
23. Power Cord	1.62	0	--
24. Cushion	1.55	1.55	--
25. Oscillator	1.39	0.69	--
26. CRT Socket	1.43	0	--
27. Tape/Printing	1.33	0	--
28. Clamper/Mountain Bracket	1.21	1.21	--
29. CRT Rubber Washer	1.17	1.17	--
30. Lid Body	1.16	1.16	--
31. Others	13.66	6.85	--
Total	349.86	135.29	--

Local Contents 38.67%

(2) Merits of Local Procurement

1) Price Competitiveness

At present, the materials cost accounts for over 70% of the total product cost of T.V. sets. To increase the competitiveness of the products, the point is how cheaply parts can be purchased.

In particular, export-oriented T.V.set manufacturers have newly begun or expanded production in Malaysia in order to cope with the drop of competitiveness due to the yen appreciation. However, under the condition that a relatively large portion of the parts are still being procured from Japan their aim is not achieved, and replacement of the same is urgent.

Some companies expressed their desire that some Japanese investors would start the production of components either in Malaysia or in neighboring countries, but the prevalent opinion was that it would be the best way to rear local manufacturers by providing assistance and guidance.

Further, the following points were pointed out by many T.V. set manufacturers that a considerable number of Japanese affiliated parts manufacturers are already engaged in production in Malaysia or in Singapore and purchases from these firms account for a substantial share of the local content. Because these manufacturers purchase their metal, plastic, and other materials from Japan, their products do not necessary have enough price competitiveness. The necessity to promote the investment of material manufacturers has often been stressed.

2) Inventories

T.V. set manufacturers, according to the results of a questionnaire survey, usually have inventories of as short as five days to as long as 1.5 months worth of production. In general, companies with smaller scales of production had greater inventories. In particular, due to the tightness of supplies of CRTs, the companies are maintaining larger inventories of the same. From the view of the operation with smaller inventories, too, the local production of CRTs would be welcomed from T.V.set manufacturers.

At present, CRTs are transported from Port Klang or overland from Singapore. It is said that South Korean makes, due to the shipping, tends to be late in delivery.

3) General System of Preferences (GSP)

The tariffs in the main export destination of Malaysian T.V. sets, the U.S. and the EC, are 5% and 14%, respectively. In the U.S., T.V.sets are not covered by the GSP. Although they are covered in the EC, it is not applied in practice.

The conditions for the application of the GSP in the EC are:

a) local procurement of transistors
("local": in this case meaning ASEAN as a whole), and

b) a local content of 50% or more.

There are no companies meeting these requirements at present. Many export market oriented companies have the desire to raise the local content rate so as to strengthen their product competitiveness through use of the GSP.

II-2. Present Status of the Industry Related to the Domestic Production of CRTs in Malaysia

II-2-1. Outline of the Production Process for CRTs

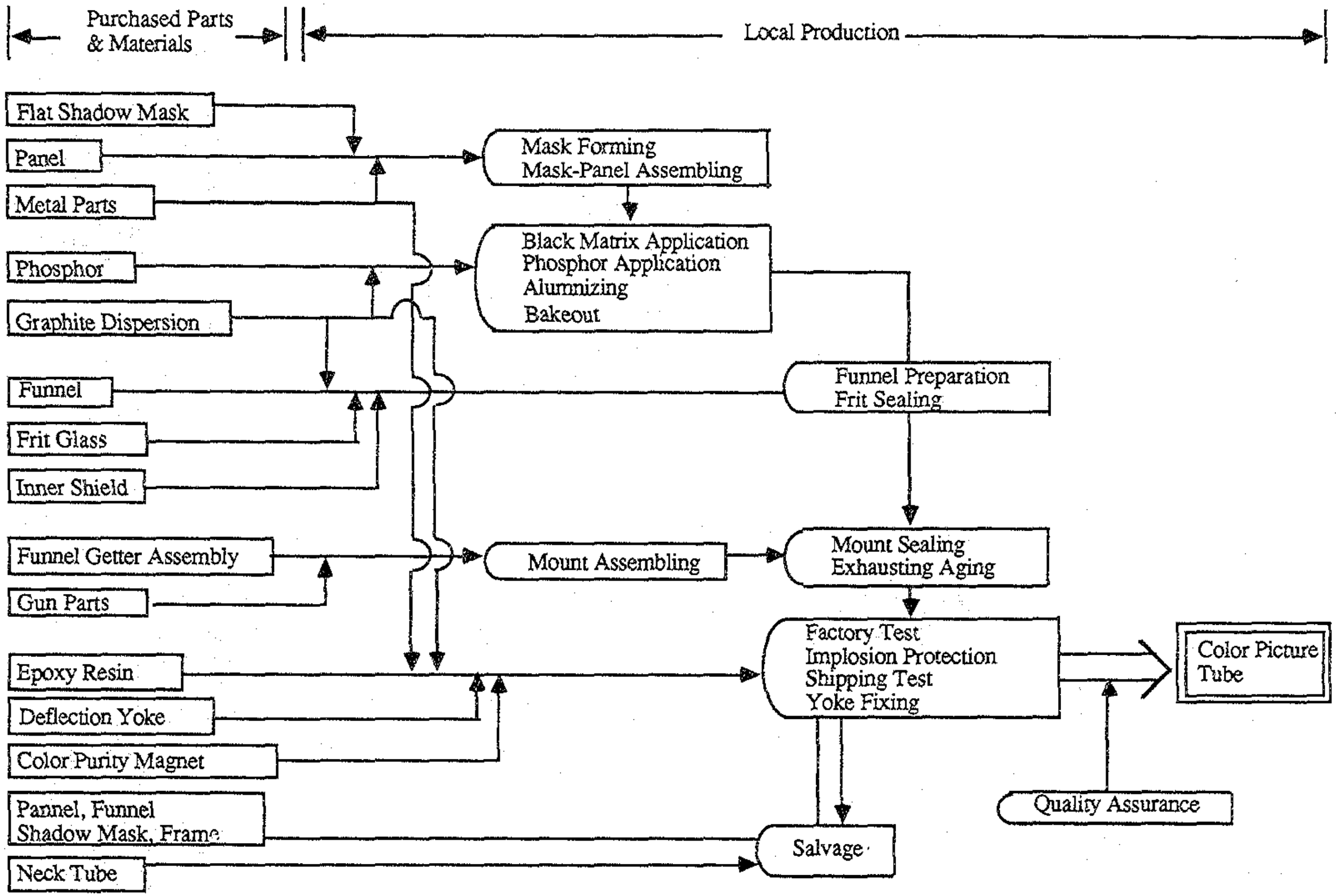
(1) Production Process

For the production of Colour CRTs very lengthy and complicated chemical treatment, assembling, and testing processes are needed. They are briefly summarized as follows:-

1. Shadow Mask Assembly
   - Mask Forming
   - Mask-Panel Assembling
2. Screening
   - Black Matrix Application
   - Phosphor Application
   - Aluminizing
   - Bakeout
3. Funnel Preparation and Bulb Assembly
4. Flit Sealing & Exhausting
   - Panel Funnel Sealing
   - Mount Sealing
   - Exhausting
   - Aging
5. Electron Gun Assembly
6. Finishing
   - Factory Test
   - Implosion Protection
   - Shipping Test
   - Yoke Fixing

The details of the process flow chart of C-CRT are shown in Fig. II.2-1.

Fig. II. 2-1 Process Flow Chart for CKD Production



(2) Types of Local Assembly of C-CRTs

Because of the nature of C-CRT production consisting of a large number of processing steps, the local production of C-CRT could be started either from partial assembly or adjusting work or from an integrated assembly operation.

The major possible types of local assembly of C-CRT are as follows:-

A. Partial Work of Deflection Yoke Adjusting & Fixing

After the completion of C-CRT assembly, deflection yoke adjusting and fixing processes are needed. Yoke adjusting provides precise motions of electron beams while an operator observes the tube's screen so that a clear picture is reproduced by correcting the position of each beam. Yoke fixing, testing, finishing and labelling procedures would follow yoke adjusting before the shipment of final products.

B. Simple Assembly after Mount Sealing

Local assembly could be started from the process of electron gun mount sealing. In this case, the CRT tubes in the form of sealed panels and funnels and assembled electron guns are supplied as imported parts.

C. SKD (Semi-Knock Down) Assembly after Panel Baking

In SKD assembly, the processed panels, in which the most difficult process of screening has been completed, would be supplied as imported parts.

D. Integrated Assembly except for Electron Gun

In an integrated assembly, all the processes of C-CRT assembly could be made except for the process of electron gun assembly. Assembled electron guns are supplied as imported parts.

E. Integrated Assembly

All the assembling processes would be done domestically including electron gun assembly.

Table II.2-1 shows the relationship between the type of local assembly of C-CRT and the processing work covered

Table II. 2-1 Relationship Between the Type of Local Assembly of C-CRTs and the Processing Work Covered

	A	B	C	D'	D
1. Shadow Mask Assembly					
Mask Forming				X	X
Mask-Panel Assembly					
2. Screening					
Black Matrix Application				X	X
Phosphor Application				X	X
Alumnising				X	X
Bakeout			X	X	X
3. Funnel Preparation and Bulb Assembly					
Funnel Preparation			X	X	X
Bulb Assembly			X	X	X
4. Flit Sealing & Exhausting					
Panel-Funnel Sealing			X	X	X
Mount Sealing		X	X	X	X
Exhausting		X	X	X	X
Aging		X	X	X	X
5. Electron Gun Assembly					
Electron Gun Assembly		(X)	(X)		X
6. Finishing					
Factory Test		X	X	X	X
Implosion Protection		X	X	X	X
Shipping Test		X	X	X	X
Yoke Fixing	X	X	X	X	X

A Partial Work of Deflection Yoke Adjusting & Fixing.
B Simple Assembly After Mount Sealing.
C SKD Assembly After Panel Baking.
D' Integrated Assembly Except for Electron Gun.
D Integrated Assembly.

II-2-2. Possibility of Raw Material and Parts Procurement

(1) Major Raw Materials and Parts Required for C-CRT Production

Table II.2-2 shows the major raw materials and parts required for C-CRT production and their approximate weights in the total material costs. The weight would very largely according to the types of CRTs or to the sourcing measures:

Table II. 2-2 Major Raw Material and Parts Required for C-CRT Production and Their Weights in Material Cost

(Unit: %)

Major Items	Weight in Material Costs
1. Panel	26.6
2. Funnel	19.7
3. Gun Parts	11.9
4. Deflection Yoke	11.6
5. Frame	5.7
6. Shadow Mask	5.1
7. Clip-Spring	2.8
8. Phospher (Green, Blue, Red)	1.9
9. Inner Shield	1.8
10. Colour Purity Magnet	1.8
11. Getter/Support	0.9
12. Wedge	0.9
13. Flit Glass	0.7
14. Others	8.6
Total	100.0

(2) Possibility of Procurement

1) Panel and Funnel

The glass products of panels and funnels occupy a very large portion of over 45% of the total material cost of C-CRT.

At present, the local procurement of panels and funnels is not possible, and they would have to be imported from Japan or Korea. In Singapore, Asahi TV-Glass is supplying panels and funnels to Hitachi Electronic Devices (S), but their operation in Singapore is presently limited to finishing work. At the end of 1988, Asahi Techno Vision (Singapore) is reported to start the production of panels from raw materials in Singapore, and to start production of both funnels and panels in Thailand in 1991.

2) Gun Parts

Gun parts consist of various kinds of metal working products, for the production of which highly elaborate mould are needed. Both from the present skill level of mould manufacturers in Malaysia and the lack of merits of scale, the local procurement of these parts would be difficult at the early stages of the production.

3) Deflection Yoke

The deflection yoke occupies around 12% of the total material costs, and is one of the items which could be procured locally in Malaysia. At present, there are two manufacturers which could supply deflection yokes.

4) Frame

The frame is a metal punched product. The production of moulds would become the key factor for local procurement.

5) Shadow Mask

The shadow mask is an etching processed metal sheet. Both from the present skill level and lack of merits of scale, the imports of shadow masks from such countries as Japan, the U.S., Korea or W. Germany would be needed for the time being.

6) Clip-Spring

For the production of clip-springs the import of special stainless steel would be needed. With this imported material the local processing of clip-springs would be possible.

7) Phosphor (Green, Blue, Red)

Phosphors are the major chemical materials used for mask screening. They would have to be imported from Japan, the U.S. or Korea. From Korea, only red phosphor could be obtained.

8) Inner Shield

The local processing of inner shield is expected to become possible in the near future. The sheet metal would have to be imported.

9) Colour Purity Magnet

Colour purity magnets would have to be imported from Japan. There is presently no other country that can supply the products.

10) Getter/Support

The local processing of getters and getter supports is rather difficult at the early stage of the CRT production mainly due to the lack of scale merits.

11) Wedge

Wedges are the plastic moulding product. With the capability of production of moulds, the local production of wedges would be possible.

12) Flit Glass

Flit glass would have to be imported either from Japan or Korea.

The possibility of recruitment of major raw materials and parts is summarised and shown in Table II.2-3.

Table II. 2-3 Procurement Possibility of Major Raw Materials and Parts for CRT Production

Major Raw Materials and Parts	Procurement Level		
	A	B	C
1. Panel			X
2. Funnel			X
3. Gun Parts			X
4. Deflection Yoke	X	X	X
5. Frame		X	X
6. Shadow Mask			
7. Slop-Spring		X	X
8. Phosphor			
9. Inner Shield			X
10. Colour Purity Magnet			
11. Getter/Support			X
12. Wedge			X
13. Flit Glass			
Local Procurement Ratio (%)	11.6	21.9	89.6

Note: A. Locally procured from the start of production.

B. Locally assembled or procured at early stage of the production.

C. Local assembly or procurement is expected in the near future.

II-2-3. Possibility of the Procurement of Major Auxiliary Facilities Related to CRT Factory Construction

(1) General

For the production of C-CRTs, various kins of auxiliary facilities such as a waste water treatment system, deionized water supply system, special gas supply system or clean room are needed. In the case that the local technical level is not sufficient to supply these facilities, the initial investment costs would increase largely. Further, the annual maintenance would also become a heavy burden on the manufacturer of C-CRTs.

With accumulated experience both of construction and maintenance in such industries as semiconductors, chemicals, food processing and timber processing, a relatively large number of Malaysian local contractors are judged to have enough capability to construct most of these facilities needed at C-CRT factories.

(2) Waste Water Treatment System

In the waste water discharged from C-CRT factories, hazardous substances such as fluoride, lead, zinc, iron, chromium or mercury are inevitably involved. For the elimination of these substances from the waste water, a large-scale waste water treatment system has to be installed along with the factory.

In Malaysia, industrial waste water discharge is regulated by the Environmental Quality (Sewage & Industrial Effluent) Regulations under the Environmental Quality Act 1974. The Standards of effluent set in Malaysia for waste water are compared, with those of Japan. They are shown in Table II.2-4.

Although there are no governmental regulations at present in Malaysia, the elimination treatment of the following substances is considered to be essentially needed.

1) Fluorine and its compounds (F)
   In both the process of washing and cleaning of glass bulbs and the process of salvage, hydrofluoric acid solution is used, which discharges fluoric ions into the waste water.
2) Chromium (Cr^6)
   In both the black stripe screening process and phosphor screening process, hexavalent chromium compounds are added as sensitizers into polyvinyl alcohol liquid, which discharges Cr^6 into the waste water.

3) Mercury

In the process of photo-printing, ultra-high pressure mercury lamps are applied as the exposer of ultraviolet ray for photo-resist layer. In case this lamp is broken and liquid mercury is spread, there is a slight possibility that mercury would be discharged into the waste water.

Table II. 2-4 Comparison of Government Standards for Effluent

Parameter (Unit)	Malaysia A	Malaysia B	Japan
Temperature	40	40	-
pH value (pH) (Mg/l)	6.0-9.0	5.5-9.0	5.8-8.6
Suspended solids (SS) (")	50	100	300
			MO 5
N-hexane Extracts (")	Not Detectable	10.0	A & VO 30
Phenols (")	0.001	1.0	0.5
Chemicals Oxygen Demands (COD) (")	50	100	(60)
Biochemical Oxygen Demands (BOD) (")	(at 20° c	5 days)	
	20	50	300
Dissolved Oxygen (DO) (")	-	-	-
Free chlorine	1.0	2.0	
Cyanides (CN) (")	0.005	0.05	1
Fluorine (F) (")	-	-	15
Cadmium and its Compounds (Cd) (")	0.01	0.02	0.1
Lead and its Compounds (Pb) (")	0.10	0.5	1
Zinc (Zn) (")	1.0	1.0	3
Copper (Cu) (")	0.20	1.0	3
Iron and its Compounds (Fe) (")	1.0	5.0	10
Manganese and its Compounds (Mn)	0.20	1.0	1
Nickel (Ni) (")	0.20	1.0	1
Total Chromium (Cr) (")	-	-	2
Chromium (VI) (Cr6+) (")	0.05	0.05	0.5
Arsenic and its Compounds (As) (")	0.05	0.10	0.5
Mercury, Alkylmercury and Other Mercury Compounds (Hg) (")	-	-	0.005
Sulphide (S) (")	0.50	0.20	-

Notes: (1) Malaysian Parameter Limits of effluents of standard A and B are based on the Regulations 1978 - (Regulation 8(1), 8(2), 8(3))
(2) Japanese Standard Values are applied only to effluents discharged into the public waste water treatment system.

As for the above waste water treatment system, Malaysian subcontractors are judged to have enough capability to construct the facility in accordance with the specifications proposed from CRT manufacturers.

(3) Deionised Water Supply System

Deionised water is commonly used in semiconductor factories in Malaysia. The requirement level for deionised water in the C-CRT industry is not usually so high as that in the semiconductor industry and the permissible sizes of foreign particles would be less than 5 microns at the point of use.

From the view of financial viability, however, the facility cost for deionised water would have to be much cheaper in CRT factories than in semiconductor factories. Thus, there is a possibility to use the ion exchanging resin column system in CRT factories rather than to use the reverse osanosis system conventionally used in semiconductor factories, taking into consideration the good quality of water in Malaysia.

Although key components have to be imported, Malaysian local contractors are considered to have enough capability to design, to assemble, to install and to maintain the facilities needed at CRT factories.

(4) Gas Supply Systems

1) LPG (Liquid Petroleum Gas)
   In the processing of glass for C-CRTs, the fluctuation of combustion calories in LPG largely affects the yield ratio and quality of the products. Accordingly, the stabilisation system of combustion calorie would have to be imported. However, all of the other necessary facilities related to the LPG supply system could be installed by local LPG suppliers.
2) Hydrogen, Nitrogen and Oxygen Gas
   Both hydrogen gas and nitrogen gas are supplied from local manufacturers to existing semiconductor manufacturers without any reported problem. Further, some local manufacturers can also supply oxygen gas. Accordingly, there would be no problem for the supply of these special gases to C-CRT manufacturers.
3) Compressed Oil Free Air
   The semiconductor manufacturers in Malaysia produce compressed oil free air inhouse by installing both oil free air compressors and dryers. Oil free air compressors would have to be imported.

(5) Clean Room

The requirement level for the clean rooms in C-CRT factories is not so high as compared with that in semiconductor factories. Accordingly, the Malaysian local contractors are judged to have enough capability to design, assemble, install and maintain the clean rooms required by C-CRT manufacturers. One special requirement from C-CRT factories would be the avoidance of copper parts in the system. This is because of the fact that blue phosphor used in the screening process is easily affected by copper ions, which cause the luminescent colour to change into a yellowish colour. All of the copper parts would have to be replaced by stainless steel parts in order to avoid the deterioration of blue phosphor.

II-3. Feasibility Analysis of Investment

II-3-1. Introduction

In order to develop the CRT industry or to invite the investment of overseas CRT manufacturers successfully in Malaysia, the basic requirement would be the fact that the CRT factories established in Malaysia could produce products competitive in the international market both in quality and price, and the operation of the factory be financially viable. For this reason, a rough financial feasibility analysis has been conducted based on the assumption that a new CRT plant would be established in Malaysia. The outline of the assumed model factory is as follows.

Outline of the Model C-CRT Factory

Total Land Area		:	60,000m^2
Total Building Area;	Production Area	:	25,300m^2
	Office & Auxiliary Area	:	5,000m^2
Total Initial Investment Costs		:	M$445 Million
Number of Employees		:	811
Production Item		:	Colour-CRT
Production Capacity		:	1.4 Million Pcs/Year

The major assumptions used for the analysis were as follows:

Basic Assumptions for the Analysis

Project Life	:	15 years
Construction Period	:	1 year
Prices	:	1988 Constant price
Investment Incentives	:	- Exemption from import tax for equipment and materials
	:	- 10 year exemption from corporation tax (pioneer status) or the corporation tax exemption based on Investment Tax Allowance (ITA:100%)
Exchange Rates	:	M$1.00=¥46, US$1.00=M$2.64

II-3-2. Production Item and Production Capacity

(1) Production Item

As the kind of CRT to be produced in Malaysia, the following sizes of colour CRT would be recommended.

Product	:	Colour CRT for T.V. set assembly
Size	:	14" (13" V), 16" (15" V), 20" (19" V) and 21" (20" V)
Neck Size	:	Conventional neck (Ø 29.1 mm)

1) Product

From the recent trend of colour T.V. set assembling in Malaysia the domestic production of colour CRTs (C-CRT) would be desired. At present, there is no production of black and white T.V. sets in Malaysia, and the demand in nearby countries is also not large. In the future, the demand for colour display tubes for computer use is expected to grow. With the accumulated production know-how of C-CRTs for T.V. sets, it would be possible to change to the production of colour display tubes in the future.

2) Tube Size

The distribution of tube sizes demanded in Malaysia in 1988 was estimated as follows:

6" & 10"	:	1.0%
14"	:	62.8%
16"	:	5.8%
20"	:	17.8%
21"	:	12.1%
29"	:	0.5%

From the above distribution, the sizes to be produced in Malaysia would be 14", 16", 20" and 21". In particular, the major weight would be placed on 14" and 20" in the initial stage. According to shift in market demand, the sizes of CRTs produced in the model factory would change. However, the production of many sizes of CRTs at one time, or the frequent change of sizes would create a large productivity loss.

3) Neck Size

As to the neck size of C-CRTs, there are presently three types applied, narrow neck (Ø 22.5 mm), conventional neck (Ø 29.1 mm) and wide neck (Ø 36.5 mm). The wide neck type is used only for large size T.V. sets such as over 21". While the narrow neck has an advantage in lower power consumption, the conventional type has an advantage in the ease of production. Further, the conventional neck could cover a wider range of tube sizes from 14" to 26", while the narrow neck is applied usually only for small sizes such as 14". From the expected tube sizes produced in Malaysia, the conventional neck is considered to be preferable at least at the initial stages of local production.

(2) Production Capacity

1) Minimum Economic Scale of Production

The actual production volume of a factory would vary largely according to the skill level and efficiency of workers and other relevant conditions. However, the minimum economic production scale of one line would be decided by the production capacity of critical machines, such as the Black Matrik Machine.

3,600 sec / 18 sec	x 0.95 (Actual operating rate) x 21 hrs / day
	x 0.9 (Yield ratio in black matrix coating process)
	x 0.85 (Yield phopher screen coating process)
	x 0.90 (Yield in flit sealing)
	x 0.95 (Yield in shipping test)
	x 270 days / year
	= 704,634 tubes / year / line
	= 700,000 tubes / year / line

In the above calculation, the following plant working conditions are supposed:

Working hours	: 7 hours / day / shift
Working days	: 270 days / year
Working shifts	: 3 shifts
Machine operating ratio	: 95%

2) Production Capacity of a Proposed Factory

From both the growing demand for C-CRT in Malaysia and the economy of scale for CRT production, the production capacity of a factory to be examined is set as 1.4 million tubes / year.

II-3-3. Initial Investment

(1) Initial Investment Cost

Initial investment cost for the planned construction of the colour CRT plant is assumed to be about M$445 million.

Table II. 3-1 Breakdown of Initial Investment Costs

(Unit: M$1,000)

Item	Investment Amount
1. Land	5,167
2. Building Construction	31,570
3. Auxiliary Facilities	54,316
4. Production Facilities	312,469
5. Vehicles & Stationeries	400
6. Contingency	41,478
Total	445,400
(Local Procurement)	(219,129)

(2) Land

As to the site conditions for the colour CRT manufacturing plant, a location convenient for transportation is desired because transportation plays such an important role for both products and raw materials. Presently, colour CRT assembly manufacturers are concentrated in the suburbs of Kuala Lumpur or in the state of Johor. For the site of the new plant, the outskirts of Kuala Lumpur would be more advantageous than the state of Johor because of its nearness to the products' market and to the main port for the convenience of raw material import. The state of Johor, on the other hand, is in the vicinity of the biggest suppliers market, at present, Singapore.

It is impossible to decide on a specific site for the plant since a detailed site selection survey was not conducted this time. However, the Shah Alum Industrial Complex in the suburbs of Kuala Lumpur is examined as an assumed candidate plant site for the purpose of cost calculation.

Purchase Method	: 99 year lease
Land Price	: M$8.00 / ft^2
Fixed Asset Tax	: M$0.14 / ft^2
Administration	: M$100.00 / block
Sewage	: M$0.50 / ft2
Terms of payment	: Within one month after permit of purchase : 20%

Within six months after permit of purchase: 80%

The land space required of about 60,000m^2 (6ha), would be valued at about M$5.17 million.

(3) Construction Costs

The outline of the building required is as follows:

Plant (production) space	:	25,300m^2 Flat Bldg., Height; 6m^2 Anti-Weightpressure; 500kg / m^2 Air-conditioned
Office & auxiliary facilities space	:	2,500m^2 x 2 Floors 2 Floor Bldg. Partially air-conditioned
Outline of auxiliary facilities	:	Guard House, Power Station, Bin Center, Pump House Shed, External Works, Pumping, Water Mains Shed & Fire Fighting

Construction would be conducted by local contractors. Construction cost is estimated to be M$31.57 million.

(4) Costs of Auxiliary Facilities

The cost breakdown of anxiliary facilities is as folows:

Electric wiring	M$ 4,800 thousand
Air-conditioning system	M$43,688 thousand
Waste water disposal system	M$ 2,068 thousand
Pure water supply equipment	M$ 3,760 thousand
Total	M$54,316 thousand

(5) Production Facilities

As to production facilities, 2 production lines (Production capacity: 0.7 million units / line) would be installed. Considering the period of employee training, one line would be installed in the 1st year and the other would be added in the 2nd year.

The procurement cost is as follows.

Table II. 3-2 Procurement Costs of Production Facilities

(Unit: M$1,000)

Item	Procurement Costs
(Imports)	
Imported Machineries (FOB)	161,622
(1st Stage)	(90,939)
(2nd Stage)	(70,683)
Transportation Cost (FOB x 5%)	8,081
Installment Cost (FOB x 35%)	56,568
Total Imported Machineries	226,271
(Local Procurement)	
Locally Procured Facilities	71,832
(1st Stage)	(40,417)
(2nd Stage)	(31,415)
Installment Cost (20%)	14,366
Total Local Procurement Cost	86,198
Total	312,469

(6) Vehicles and Stationery

As other equipment cost, the procurement cost of 3 vehicles and one set of stationery is assumed as follows.

Table II. 3-3 Procurement Costs of Vehicles & Stationery

(Unit: M$1,000)

Item	Procurement Costs
Vehicles, M$100,000 x 3 Vehicles	300
A Set of Stationery	100
Total	400

(7) Contingency

The amount of 10% of total investment cost is assumed as contingency.

(8) Depreciation Cost

Method of depreciation to be taken is as follows:

Building : 30 year straightline depreciation

Auxiliary Facilities : 20 year straightline depreciation

Production Facilities : 15 year straightline depreciation

Vehicles & Stationery : 5 year straightline depreciation

II-3-4. Production and Sales

(1) Production Plan

The flow of annual production volume of the model factory is projected based both on the maximum production capacity and on the assumed operating rate of the model factory, the results of which are shown in Table II.3-4.

Table II. 3-4 Flow of Production Volume

(Unit: 1,000 Pcs)

Line	1st Year	2nd Year	3rd Year	4th Year	5th Year	After 6th Year
1st	126	378	553	665	700	700
2nd	-	126	378	553	665	700
Total	126	504	931	1,218	1,365	1,400
(Operating Rate)	(18%)	(36%)	(67%)	(87%)	(98%)	(100%)

The CRT sizes produced in the model factory would be changed according to shifts of market demand. For the purposes of calculation, however, it was assumed that 60% of the production would be the 14" size of CRTs and 40% of 20" size of CRTs.

Table II. 3-5 Flow of Production Volume by Size

(Unit: 1,000 Pcs)

Line	1st Year	2nd Year	3rd Year	4th Year	5th Year	After 6th Year
14"	75.6	302.4	558.6	730.8	819.0	840.0
20"	50.4	201.6	372.4	487.2	546.0	560.0
Total	126.0	504.0	931.0	1,218.0	1,365.0	1,400.0

(2) Unit Sales Prices

The following unit sales prices by size shown in Table II.3-6 were set for the products of the model factory. The unit sales prices were set taking into consideration (1) international transaction terms of colour CRTs at present, (2) present transaction prices in Malaysia and (3) the export prices of Korean-made colour CRTs which would be one of the major competing products.

Table II. 3-6 Assumed Unit Sales Prices

Size	International Prices (US$)			Unit Sales Prices
	CRT without Deflection Yoke	Deflection Yoke	Total	(M$)
14"	47-50	3-4	50-54	138.84
20"	69-74	6	75-80	206.92

The present major supply sources of colour CRTs to Malaysia are Singapore, Japan, Taiwan and Korea. It is said that the prices of Singapore-made products are slightly higher than those of Taiwan or Korean-made ones, and that those of Japanese products are still higher than the Singaporean ones.

(3) Projection of Annual Sales Flow

Based on the above assumed production volume and unit sales prices, the flow of annual sales of the model factory was projected as shown in Table II.3-7.

Table II. 3-7 Projection of Annual Sales Flow Value

(Unit: M$1,000)

Size	1st Year	2nd Year	3rd Year	4th Year	5th Year	After 6th Year
14"	10,496	41,985	77,556	101,464	113,710	116,626
20"	10,429	41,715	77,057	100,811	112,978	115,875
Total	20,925	83,700	154,613	202,275	226,688	232,501

II-3-5. Material Cost Projection

(1) Unit Material Cost

For the production of colour CRTs a very large number of parts and components have to be procured. Because it requires a very high level of technical knowledge to procure these parts directly from various parts suppliers, most of the parts and components would have to be procured from an overseas manufacturer giving technical assistance to the model factory in Malaysia at the initial stage.

The estimated unit material cost is M$ 94.22 for 14" and M$ 144.90 for 20", at the initial stage of production. Only the deflection yokes could be procured at the initial stage, and the local procurement rate is 10% and 8% for 14" and 20", respectively.

Table II.3-8 Unit Material Costs

(Unit: US$/Pc)

	14" (Convention Neck)	20" (Convention Neck)
Imported CKD Parts		
1 Panel Assembly Parts	8.13	14.93
2 Funnel Assembly Parts	0.52	0.69
3 Electron Gun Parts	5.02	5.85
4 ITC Parts	1.36	1.49
5 Other Parts	1.19	2.44
6 Packing & Transportation	0.57	0.89
Sub-Total	16.79	26.29
	(M$44.83)	(M$70.19)
Direct Procurement, Imports		
1 Panel	8.29	13.84
2 Funnel	6.14	9.21
3 Packing & Transportation	0.51	0.81
Sub-Total	14.94	23.86
	(M$39.89)	(M$63.71)
Total Imports	31.73	50.15
	(M$84.72)	(M$133.90)
Direct Domestic Procurement		
1 Diflection Yoke	M$9.50	M$11.00
Total Material	M$94.22	M$144.90

(2) Flow of Unit Material Costs

In order to decrease the material costs and increase the financial viability of the investment project., it is necessary to raise the direct procurement rate. The possibility of direct procurement is mainly dependent on the development of the technical capability of parts suppliers mainly in Malaysia and partly in other neighbouring countries such as Singapore. For the financial analysis, it was assumed that 15% of imported CKD parts from an original licensor would be changed into direct procurement, the cost merit of direct procurement would be 35%. The flow of unit material cost thus estimated is as shown in Table II.3-9.

Table II. 3-9 Flow of Unit Material Costs

(Unit: M$/pcs)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
14"							
Import							
CKD	44.83	38.11	32.38	27.53	23.40	19.89	16.91
Direct	39.89	39.89	39.89	39.89	39.89	39.89	39.89
Domestic	9.50	13.87	17.59	20.74	23.42	25.70	22.64
Total	94.22	91.87	89.86	88.16	86.71	85.48	84.44
20"							
Import							
CKD	70.19	59.66	50.71	43.11	36.64	31.14	26.47
Direct	63.71	63.71	63.71	63.71	63.71	63.71	63.71
Domestic	11.00	17.84	23.66	28.60	32.81	36.39	39.43
Total	144.90	141.21	138.08	135.42	133.16	131.24	129.61

(3) Projection of Material Cost Flow

The flow of material cost projected based on the assumed production schedule by size and on the unit material cost is as shown in Table II.3-10.

Table II. 3-10 Projection of Raw Material Cost Flow

(Unit: M$1,000)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
14"	7,123	27,781	50,196	64,427	71,015	71,803	70,930
20"	7,303	28,468	51,421	65,977	72,705	73,494	72,582
Total	14,426	56,249	101,617	130,404	143,720	145,297	143,512

II-3-6. Costs for Indirect Materials, Repair, Facility Leasing and Utilities

(1) Indirect Material Cost and Repair Cost

The costs for indirect materials and for repair were estimated at M$ 3.00 and M$ 0.60 per piece of product based on the experience both in Japan and in other countries. From these unit prices and the production volume assumed, the flows of indirect material cost and repair cost were projected as shown in Table II.3-11.

Table II. 3-11 Projected Indirect Material and Repair Cost Flow

(Unit: M$1,000)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
Indirect Materials	378	1,512	2,793	3,654	4,095	4,200	4,200
Repair Cost	76	302	559	731	819	840	840

(2) Facility Leasing Cost

As for the supply facilities of liquid nitrogen, liquid hydrogen, or LPG gas, they could be leased from domestic gas supply companies in Malaysia. The leasing costs of these facilities are estimated as shown in Table II.3-12.

Table II. 3-12 Leasing Fees for Facilities

(Unit: M$1,000)

	Monthly Costs	Annual Costs
Liquid Nitrogen	1.5	18
Liquid Hydrogen	1.1	13
Trailer Hydrogen	0.9	11
LPG	4.5	54
Total	8.0	96

(3) Utility Cost

In the C-CRT factory, a large volume of special gas such as nitrogen, oxygen or hydrogen is used in addition to those utilities such as electric power, LPG gas or water. The consumption volume and costs of these utilities in the factory with an annual production capacity of 1.4 million pieces are estimated and shown in Table II.3-13.

Table II. 3-13 Costs for Utilities

(Unit: M$1,000)

	Consumption Per Hour	Unit Cost	Annual Costs
Power	4,124 Kwh	M$0.12 /Kwh	2,806
Water	29 ton	M$0.88 /$m^3$	145
LPG Gas	671 kg	M$0.88 /kg	3,348
Oil-free Dry Air	520 m^3	M$0.08 /$m^3$	235
N_2 Gas	39 m^3	M$0.70 /$m^3$	155
O_2 Gas	32.5 m^3	M$0.80 /$m^3$	147
H_2 Gas	7.6 m^3	M$3.00 /$m^3$	129
Total	-	-	6,965

Annual Operation Hours = 7 Hours x 3 Shifts x270 Days

II-3-7. Personnel Costs

(1) General

For the operation of a C-CRT factory, a large number of engineers and technicians covering various fields would be needed. In the model factory assumed, around 50 engineers and technicians are needed. The availability of these employees is one of the key factors for the site selection of the factory. In addition to engineers and technicians, around 60 foremen and 360 skilled workers would be needed in the model factory.

(2) Estimated Number of Employees and Labour Costs

The number of workers needed for the operation of the model factory was calculated. The average personnel cost by each job category is examined based on the various statistics available in Malaysia and the results of a field interview survey. In these personnel costs, not only the basic salary but also all of the various fringe benefits are included. The number of workers and total annual personnel expenses thus calculated are as shown in Table II.3-14.

Table II. 3-14 Projection of Annual Labour Costs

(Unit: M$1,000)

	Average Wages (M$/Month)	1st Year No.	1st Year Annual Costs	After 2nd Year No.	After 2nd Year Annual Costs
(Manufacturing)					
Plant Manager	3,500	1	42	1	42
Section Manager	2,800	3	101	3	101
Section Chief	1,500	8	144	8	144
Engineers	1,500	15	270	25	450
Asst. Engineers	1,000	5	60	10	120
Foremen	650	30	234	60	468
Skilled Workers	500	200	1,200	360	2,160
Unskilled Workers	250	200	600	360	1,080
Sub-total	-	462	2,651	827	4,565
(Administration)					
General Manager	4,000	1	48	1	48
Section Manager	2,500	3	90	3	90
Office Clerk	1,500	20	360	20	360
Sales Staff	1,500	10	180	10	180
Typist	500	2	12	2	12
Driver	550	3	20	3	20
Others	300	15	54	15	54
Sub-Total	-	54	764	54	764
Total	-	516	3,415	881	5,329

II-3-8. Financing Plan

For the establishment of a colour CRT factory, a large amount of initial investment cost is required. Because of the very competitive international market condition of colour CRTs, the profitability would not be very high, and it is anticipated that there would be a relatively long period to recover the investment. For this reason, the availability of a financing scheme with favorable terms would be one of the key factors for success of the investment project.

For the purpose of a financial evaluation of the model factory, the following financing plan was assumed.

Outline of Financing Plan

Item	Amount (M$) million)	Terms
Paid-in Capital	200	-
Long-term Loans	245	10 years Equal Repayment, with 2 Years of Grace Period, Interest 6.0% /Year
Short-term Loans	Operating Funds	Repayment within One Year, Interest 8.0% /Year

Of the total investment cost of M$ 445 million, M$ 200 million was assumed to be procured as paid-in capital, and the remaining cost of M$ 245 million would be financed by long-term borrowing. From the nature of the project in which a large amount of stable (long-term) financing is required, the use of some institutional financing schemes either in Malaysia or in other overseas countries would be needed. From this point of view, an interest rate of 6.0% per annum which is a little lower than the usual market rate is assumed for long-term loans. The requirement of operating funds is assumed as approximately one month of the sales of the model factory, and all of these operating funds are assumed to be financed from bank borrowing. The interest rate is posed as 8.0% per annum, which is the current market rate in Malaysia.

II-3-9. Long-term Profit and Loss Projection and the Result of Financial Viability Analysis

Based on the results of the projections for both the sales and major cost items, the long-term profit and loss projection of the model factory has been conducted. For some cost items, they were roughly measured by the percentage rates of the sales, based on the experiences both in Japan or in other countries.

The results of the profit and loss projection thus conducted are summarized and shown in Table II-3-15.

Table II. 3-15 Projection of Long-Term Profit and Loss Flow

(Unit: M$1,000)

	1st Year	%	2nd Year	%	3rd Year	%	4th Year	%	5th Year	%	6th Year	%	7th Year	%
Annual Sales	20,925	100.0	83,700	100.0	154,613	100.0	202,275	100.0	226,688	100.0	232,501	100.0	232,501	100.0
Production Costs														
Material	14,426	68.9	56,249	67.2	101,617	65.7	130,404	64.5	143,720	63.4	145,297	62.5	143,512	61.7
Indirect Material	378	1.8	1,512	1.8	2,793	1.8	3,654	1.8	4,095	1.8	4,200	1.8	4,200	1.8
Utility	4,179	20.0	6,965	8.3	6,965	4.5	6,965	3.4	6,965	3.1	6,965	3.0	6,965	3.0
Leasing Fee	96	0.5	96	0.1	96	0.1	96	0.1	96	0.1	96	0.1	96	0.1
Repairement	76	0.4	302	0.4	559	0.4	731	0.4	819	0.4	840	0.4	840	0.4
Depreciation	15,569	74.4	24,679	29.5	24,679	16.0	24,679	12.2	24,679	10.9	24,679	10.6	24,679	10.6
Labour	2,651	12.7	4,565	5.5	4,565	3.0	4,565	2.3	4,565	2.0	4,565	2.0	4,565	2.0
(1) Others	628	3.0	2,511	3.0	4,638	3.0	6,068	3.0	6,801	3.0	6,975	3.0	6,975	3.0
Sub-total	38,003	181.6	96,879	115.7	145,912	94.4	177,162	87.6	191,740	84.6	193,617	83.3	191,832	82.5
Administration Costs														
Labour	764	3.7	764	0.9	764	0.5	764	0.4	764	0.3	764	0.3	764	0.3
(2) Packing & Transportation	504	2.4	2,016	2.4	3,724	2.4	4,872	2.4	5,460	2.4	5,600	2.4	5,600	2.4
(3) Others	419	2.0	1,674	2.0	3,092	2.0	4,046	2.0	4,534	2.0	4,650	2.0	4,650	2.0
Sub-total	1,687	8.1	4,454	5.3	7,580	4.9	9,632	4.8	10,758	4.7	11,014	4.7	11,014	4.7
Operating Profit	-18,765	-89.7	-17,633	-21.1	1,121	0.7	15,481	7.6	24,190	10.7	27,870	12.0	29,655	12.8
Non-trade Expenses	15,860	75.8	17,660	21.1	18,485	12.0	18,215	9.0	16,785	7.4	14,555	6.3	11,845	5.1
Net Profit	-34,625	-165.5	-35,293	-42.2	-17,364	-11.2	-2,734	-1.4	7,405	3.3	13,315	5.7	17,810	7.7

(1) 3.0% of Annual Sales
(2) M$4,00/Unit
(3) 2.0% of Annual Sales

III. Ceramic IC Packages/Substrates Industry

III. Ceramic IC Packages/Substrates

III-1 Overview of the Industry

III-1-1 Product Description

(1) Outline of IC Packages/Substrates

1) IC Packages

It is a well known fact that the IC is extremely small in size and very fragile. Therefore, in its handling by humans, even a slight touch of the finger tip might damage its circuit lines due to stains or dust. Once stained by handling, the whole function of the IC might be ruined, making it unusable.

There is a limit to direct human manipulation of the object. In short, the chip should be put in a certain size of container in order to make the chip easier to handle. Furthermore, the chip has to be electrically connected with the outer world by very thin bonding wires (one-quarter the thickness of a human hair) which are re-connected by brazing to a little bit thicker internal leads and external leads.

In order to meet the requirements as above, the IC chip is put in a container called an IC package. So to speak, the IC chip puts on its clothes. The IC package has, mainly, the following important functions.

1. To shut the chip out from the outer-world to protect it from stains and moisture which might cause damage.
2. To make it easier for humans to handle the chip owing to the adequate size of container into which the chip is put.
3. To keep mechanically the position of internal leads or external leads stable.
4. To discharge the heat generated from the IC.

The electric function and quality of the IC depends on the design and manufacturing technology of the IC chip itself, however, manufacturing technology of packages should be considered as a decisive factor in order to ensure various quality requirements of the IC such as long time usage without trouble, easy fitting on PCB (Printing Circuit Board), good heat discharge, and so on.

Therefore, manufacturing technology of IC packages plays a very important role, because a bad quality package might affect the functions of IC as a whole, leading to quality deterioration which might cause big problems.

A small IC chip of 5 mm^2 is composed of several hundred thousands of discrete devices such as transistors, diodes, rectifiers, and so on. In order to provide the ICs the full capacity of reliable and stable operation, IC packages should be protected from all types of bad effects such as the changes of temperature and moisture, dust and stains, while at the same time, conveying input and output electrical signals and discharging the heat generated from the ICs.

2) Ceramic Substrates

A ceramic substrate is a kind of ceramic board on which high density electrical circuit lines are formed by either the thick film method or thin film method. It is ordinarily used for various discrete semiconductors such as ICs, transistors, diodes and resistors, etc., to be mounted on the surface. Both surfaces of the ceramic substrate would be usable for mounting if small through-holes are punched on it.

A ceramic substrate with electrical circuit lines serves as a small circuit board. The size of a ceramic substrate ranges generally from 10mm x 10 mm to 100 mm x 100 mm.

(2) Kinds of IC Packages

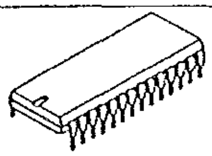
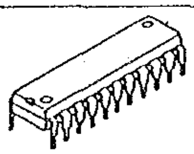
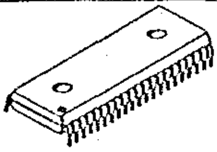
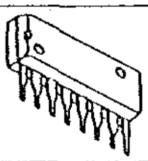
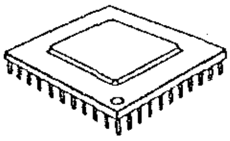
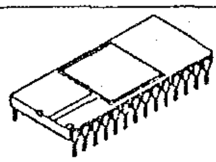
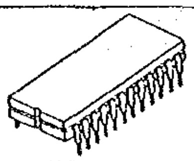
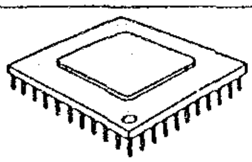
The IC packages categorised by usage of material are two types, i.e. plastic packages and ceramic packages.

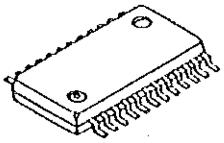
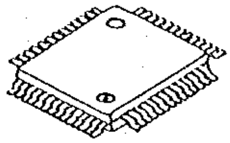
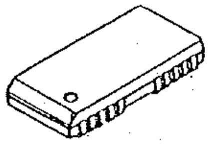
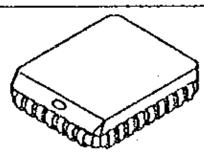
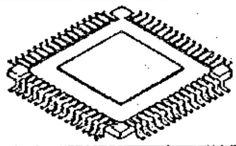
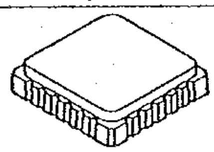
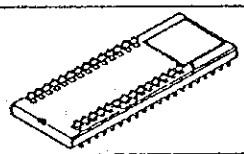
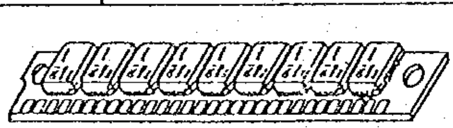
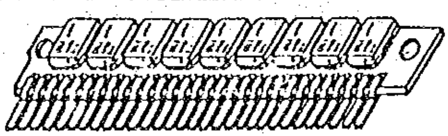
Plastic packages have been said to be inferior to ceramic packages in some characteristics of packaging such as airtightness, endurance and heat resistance. However, due to the recent progress of IC surface protection techniques and general amelioration of plastic material quality, plastic packages have expanded their share of applied usage. They have rapidly taken the place of the relatively expensive ceramic packages. Nowadays, the share of plastic packages in the total of IC packages reached about 90%. A tendency is seen among users of IC packages (IC assembly manufacturers) that they prefer to use the ceramic packages for the start of new products but soon after the stage of mass production of the product comes, they would change the package used from ceramic to plastic. At present, the usage of ceramic packages is mainly for the use for computers, satellite communications, space rockets and military use, etc., where various severe characteristics of IC packages such as airtightness, endurance, etc., are required.

Ceramic packages are categorised in general into two types i.e., cerdip packages produced by relatively simple production processes and having no printed circuit lines on them, and laminate packages. On the other hand, laminate packages are composed of multi-layers of ceramic sheets with printed electric circuit lines. As for the present market share of IC ceramic packages on a quantity basis, the cerdip type has a share of about 90% and the laminate type has 10%. As for the compared average price, the cerdip type is priced at twice that of the plastic packages and the laminate type is about eight times that of the plastic package.

The IC packages could also be categorised in two types by the method of mounting, i.e., insertion type and surface mount type.

Fig. VI.1-1 Kinds of IC Packages

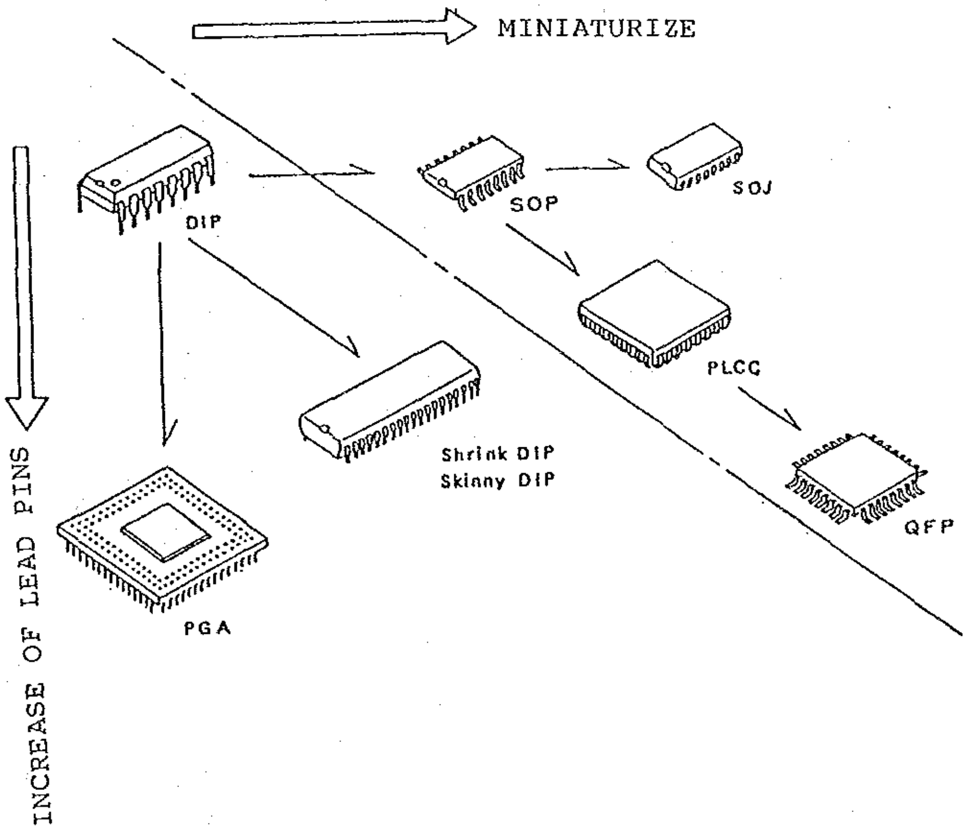
	KINDS OF PACKAGES				REPRESENTATIVE NUMBER OF LEAD PINS
INSERT TYPE	PLASTIC	DIP	STANDARD		8,14,16,18,22,24, 28,40,42,48
			SKINNY		20,22
			SHRINK		42,64
		SIP			8
		PGA			1 88,120,132,176, 208
	CERAMIC	STANDARD DIP			14,16,18,22,24,28 40,42,48
		CERDIP			8,14,16,18,22,24, 28,40
		PGA			72,88,120,132, 176,208

	KINDS OF PACKAGES				REPRESENTATIVE NUMBER OF LEAD PINS
SURFACE MOUNT TYPE	PLASTIC	FP	SOP		8,16
			QFP		2 3 24,32,44,56(S),56(L), 60, 64, 80, 88, 100
		PLCC	SOJ		26
			PLCC		18,20,22,28,32, 44,68,84
	CERAMIC	QFP			42,60,64,80
		CC			14,24,28,44
PARTICULAR PACKAGES	PIGGY BACK				40,42
	SIMM				30
	SIMP				30

(3) Trends of IC Packages

The conventional basic functions of IC packages have been the protection of IC chips from the outer-world and convenience of handling. The standard DIP type packages (Dual Inline Package) which satisfy these basic functions have been utilised for a long time in a wide range of electronic devices and equipment. However, because of the recent high integration and ultrarapidity of ICs in addition to the trend of miniaturisation of size and weight of electronic devices, the higher density mounting method for IC packages has been increasingly required.

Fig. VI.1-2 Trend of IC Packages



III-1-2 Outline of the Semiconductor Industry in Malaysia

(1) Trends of Production

In the Malaysian statistics, the production of semiconductors in Malaysia is categorised as MIC 38329 including semiconductors, other electronics parts and communications equipment. Therefore, the statistical figures related to the semiconductor industry itself are not shown clearly. The trend concerned with the MIC 38329 for the past five years (January-August in 1988) is shown in Table III.1-1. The sales value of the category MIC 38329 occupies about 78.5% of total sales value of MIC 383 (Electric Electronics Industry) in 1988. The employees in the category MIC 38329 are 77,2% of the total employees in MIC 383. These figures indicate that the category MIC 38329 has a very important position in the Malaysian electric and electronics industry.

In the semiconductor industry, there is a peculiar worldwide trend of demand and supply, the so called "Silicone Cycle." The year 1985 was a period of stagnation in the cycle of worldwide scale. In Malaysia, too, the sales value of the year 1985 was down by 12.5% compared to the previous year. In the year 1986, however, the sales value surpassed the level of the year 1984, the highest level at that time. Afterwards, steady increases' of 31.8% (1987) and 46.2% (1988, Jan-Aug) have been achieved and productions continue to expand.

The production volume of semiconductors in three categorises i.e., transistors, ICs, and another semiconductors,is shown in Table III.1-2.

Table III. 1-1 Principal Statistics of Semiconductors and Other Electronic Components and Communications Equipment and Apparatus (MIC 38329) in Malaysia

	1984	1985	1986	1987	1988 (Jan.-Aug.)
Number of Companies	56	54	55	63	66
Sales Value (M$1,000)	5,369,512	4,771,037	5,694,325	7,506,916	6,536,220
Total Persons Engaged	68,717	53,354	57,459	71,344	80,562

Source: Monthly Industrial Statistics

Table III. 1-2 Production of Semiconductors in Malaysia

(Unit: Million Pcs.)

	1984	1985	1986	1987	1988 (Jan.-Aug.)
Transistors	3,831	3,450	3,719	4,714	3,640
(%)	(47.5)	(Δ9.9)	(7.8)	(26.8)	(21.7)
IC	3,874	2,561	3,278	3,911	3,105
(%)	(44.1)	(Δ33.9)	(28.0)	(19.3)	(23.9)
Other Semi-Conductors	2,011	1,468	1,554	1,953	1,468
(%)	(26.2)	(Δ27.0)	(5.9)	(25.6)	(19.1)
Total	9,716	7,479	8,551	10,579	8,213
(%)	(12.0)	(Δ23.0)	(14.3)	(23.7)	(22.0)

Figures in brackets are annual percentage changes.
Source: Monthly Industrial Statistics

(2) Export Trend

The export trend of semiconductors is shown in Table III.1-3. It is noticeable that the export of discretes, especially diodes, has decreased while that of ICs has increased. The ratio of ICs in the export share of semiconductors went up from 48.1% in 1983 to 84.2% in 1987.

Table III. 1-3 Exports of Semiconductors in Malaysia

(Unit: M$1,000)

	1983	1984	1985	1986	1987
Transistors (SITC 776 310)	364,197	429,310	377,702	379,081	533,617
Diodes & Similar (SITC 776 390)	1,265,441	1,023,810	371,310	553,457	395,773
Electronic Micro-circuits (SITC 776 400)	1,526,224	2,599,782	3,158,799	4,066,732	4,956,511

Source: Malaysia Annual Statistics of External Trade.

Export destination for each product in 1987 is as follows.

Transistors:	1.	U.S.	(30.2%)
	2.	Singapore	(26.2%)
	3.	W.Germany	(14.9%)
	4.	Others	(28.7%)

Diode & similar semiconductor devices:	1.	U.S.	(49.9%)
	2.	Singapore	(25.8%)
	3.	W.Germany	(8.9%)
	4.	Others	(15.4%)
Electronic microcircuits:	1.	U.S.	(57.9%)
	2.	Singapore	(10.8%)
	3.	W.Germany	(9.1%)
	4.	Others	(22.2%)

For all the products, the U.S. is the largest export destination country. The fact is that Malaysian semiconductor manufacturers do not have their own sales companies in Malaysia and they export most of the products to their parent companies in the U.S.

(3) Present Status of Procurement of Raw Materials

The survey was conducted on the manufacturers who are assumed to use ceramic IC packages and/or ceramic substrates. MIDA had already conducted a survey on the domestic demand for ceramic IC packages in 1981 which was followed by another general survey in 1986 concerned with the Malaysian semiconductor industry. A survey on the procurement of raw materials was also included in the MIDA survey in 1986.

In order to select the manufacturers to visit for the field survey this time, the data obtained from MIDA's two previous surveys, information provided from NGK Singapore office, and other public information from PDC (Penang Development Corporation), etc., were used for reference. As the result, 12 companies are identified as users' of ceramic IC packages. However, the information on their use of ceramic IC packages was provided by 10 of the companies out of the 12, the names of which are listed in Table III.1-4 with the description of their business outlines.

The contents of the survey were concerned mainly with volume of demand for ceramic IC packages and substrates, supply sources, purchasing methods, and desires for local procurement etc. The information on these matters shown in this report, accordingly, is the summary of the present status of the selected semiconductor manufacturers covered by the field interview survey, and not of the whole semiconductor manufacturers in Malaysia.

The rate of local procurement of materials at the IC manufacturers is generally at a very low level. (The lowest is 0.1% and the highest is 20%). Locally procurable items are ralatively minor consumables such as shipping tubes and carton boxes etc.

Table III. 1-4 Outline of Semiconductor Manufacturers in Malaysia

	Company	Year of Establish-ment	Location	No. of Employees	Annual Sales Value (87)	Parent Company Nation-ality	Main Products Manufactured	Production Volume (million pcs)	Usage of Ceramic Packages/Substrates	
									Packages	Substrates
1	Intel Technology	1972	Penang	2,600	M$140m	U.S.A.	IC (Memory, MPU)	90	YES	—
2	Harris Semiconductor	1974	KL	874	—	U.S.A.	IC (Telecom, Lines, Memory, MPU)	16.1	YES	—
3	SGS-Thomson	1974	Johor	2,250	US$150m (88)	Italy	IC (Bipolars, Logic Memory)	700	YES	—
4	Motorola	1974	Penang	1,800	—	U.S.A.	IC (Hybrids)	—	YES	YES
5	Carsem	1972	Ipoh	2,400	—	Malaysia	IC, Transistors	9.6	YES	—
6	Motorola	1972	Petaling Jaya	4,000	M$500m	U.S.A.	IC (Memory, Digital, Analog Gate Array)	—	YES	—
7	Integrated Device Technology	1988	Penang	200	US$200m	U.S.A.	IC	6-8	YES	—
8	Advanced Micro Devices Export	1972	Penang	4,800	US$250m	U.S.A.	IC (Digital, Memory, MPU)	783.4	YES	—
9	Siemens Litornix	1972	Penang	732	US$18.8m	U.S.A.	Opto Isolation Processed Dies	49.3	YES	—
10	Motorola		Senawang	500	—	U.S.A.	Components for RF, IC	—	YES	—

Meanwhile, the IC chips as a major material are all imported because the wafer printing process (so called "first half process") is not yet available in Malaysia at present. Import sources are mostly from their parent companies situated near the final users of the assembled ICs (the final products). Except for lead frames, other major components and materials such as bonding wires, moulding compound, ceramic packages/substrates are not locally produced and all of them are imported.

Present status of material procurement is shown briefly in Table III.1-5.

Table III. 1-5 Main Suppliers of Materials and Components

Items*	Local Product	Name of Main Suppliers
Leadframes	Yes	DCI, KITAKO (Malaysia) Mitui Hitech (S'pore) Sumitomo Metal (Japan) SPT (US), QPL Holdings (HK)
Bonding Wires	No	Tanaka Electronics (S'pore) American Fine Wire (S'pore)
Moulding Compound	"	NITTO (Japan) NIHON DENKO (Japan) Plaskon (S'pore) Sumitomo Bakelite (Japan)
Combo Lids	"	Simi Alloys (US) Advanced Material Technology (US) Richard Metal (US)
Preforms	"	Cominco (US) Advanced Material Technology (US)
Metal Cane & Headers	"	Oro Electronics (HK) Shinko Electric (Japan)
Tin Anode	Yes	Emis (Malaysia), Multicore (Malaysia)
Solder Bar	"	Multicore (Malaysia)
Shipping Tubes	"	PPM (S'pore) Ampang, Kamejuam, Meritex (Malaysia)

*Excluding Ceramic IC Packages/Substrates and IC Chips

III-1-3. Supply and Demand of Ceramic IC Packages/Substrates in Malaysia

(1) Demand for Ceramic IC Packages in Malaysia

The total annual volume of ceramic IC packages used by the 10 companies in 1987 was about 142.8 million pieces. (cerdip type; about 108.0 million pieces, laminate packages: about 34.8 million pieces). Total annual value is assumed to be about M$193.2 million (cerdip type; about M$54.0 million, laminated packages; about M$139.2 million). As for demand in value, most of the companies surveyed could give the demand in volume basis, and the total demand in value was estimated assuming unit price for each product. The average unit price of the cerdip type is assumed to be M$0.50/piece and laminate packages to be M$4.00/piece in Malaysia.

Among ceramic packages, cerdip packages occupy a higher share of 75.8% in total volume, however, the demand for laminate packages is said to be increasing more rapidly than that of the cerdip type in Malaysia. As for the volume used by each company surveyed, AMD, INTEL, MOTOROLA (Selangore) and HARRIS were the top 4 users in that order. The volume used by the other companies surveyed was limited.

IC products which use ceramic packages occupy about 3.7% of the total quantity of IC products in Malaysia in 1987.

(2) Demand for Ceramic Substrates in Malaysia

Only one company was identified as the user of ceramic substrates in Malaysia.

The usage of ceramic substrates covers extensive fields such as home electric apparatus, communication equipment, audio equipment, etc. In Malaysia, the ceramic substrate which is actually used or purchased is the circuit printed substrate. Furthermore, in many cases the users purchase the ceramic substrate as an electronic component with various types of discrete devices such as resistors, capacitors, ICs, etc., mounted on it.

There are only a few companies in Malaysia who are undertaking the mounting process of discrete devices on the ceramic substrates. In the case of PCBs (Printed Circuit Boards), too, companies in Malaysia import all of the PCBs and just assemble them.

As a result of this field survey, one company (MOTOROLA in Penang) is identified as the only manufacturer who possesses the process of printing circuit lines on ceramic substrates in Malaysia. They produce hybrid ICs for use in pocket-bells, walkitalkies and 2 way radios. The ceramic substrates used by the company in 1988 amounted to 375,000 sheets (4x4 inches/sheet). The annual value of the substrates ceramic used by the company went up steadily from M$325,000 in 1986, to M$360,000 in 1987 and M$460,000 in 1988.

Table III. 1-6 Domestic Demand for Ceramic IC Packages/Substrates in Malaysia (1987)

	Quantity (Million Pcs.)	Value (M$ Million)
Ceramic IC Package	142.8	193.2
Cerdip Type	(108.0)	(54.0)
Laminate Type	(34.8)	(139.2)
Substrate	0.375	0.36
Total	-	193.56

(3) Major Suppliers

As there are no manufacturers who produce ceramic IC packages and or substrates, all the products are imported.

Major supply sources are shown as follows:

Kyosera	(Japan)
NTK	(Japan)
Narumi	(Japan)
General Electric	(U.S.A.)
Shinko	(Japan)
MPI	(Singapore)

The market share for each company is not clear but the shares of Kyosera and NTK are said to be larger among others.

Each semiconductor manufacturer chooses more than two supply sources for the advantage in price negotiations as well as to avoid risk. All the companies interviewed replied that supply sources once chosen would not be changed so easily or frequently.

(4) Method of Purchase

All the companies selected for the field survey this time, except CARSEM, are 100% foreign capitalised. For those companies, their parent companies in principle make the decisions as to supply sources and the purchase quantity of raw materials as well as on product items and volume. However, there are some companies among them who can decide on product items to be purchased up to 50% of the total purchase volume. There are also some companies who are negotiating at present so as to obtain from their parent companies the right of purchase decision making. It seems to be a general trend for each of the Malaysian semiconductor manufacturers to possess the self-decision of the purchase.

In order to decide on the purchase of products from a new supply source, a fairly complicated and long experimental process is necessary. In such a case, the approval of the qualifications shall be conducted by the parent companies. However, each Malaysian semiconductor manufacturer interviewed, does, at least, its proposals for the next purchase order. They said in the interviews that they thought in that sense, they already shared a "co-decision right" with their parent companies.

(5) Demand Trend for the Future

Many of the companies interviewed predicted that the demand for ceramic IC packages would be stable for years to come and immune to the effects of the adverse economical cycles owing to the peculiarity of the fields where they are used.

The volume of demand for ceramic IC packages in Malaysia identified in section III-1-3(1), compared with those of MIDA survey in 1981 and 1986, is shown in Table III.1-7.

Table III. 1-7 Domestic Consumption of Ceramic IC Packages

	1978	1979	1980	1986	1987
Volume (Million Units)	69.3	92.2	145.6	147.4	142.8
Value (M$ Million)	102.6	128.8	156.8	120.7	193.2

Although direct comparison of the values used in each year is impossible because of the assumption made in the year 1987, as far as volume is concerned, it can be said that the rate of increase of the ceramic IC packages on a quantity basis has continued to go down from the beginning of the 1980s. The main reasons are as follows.

- They are more expensive than plastic IC packages
- Automation in the manufacturing process is more difficult than that of plastic packages.

- Owing to the rapid quality amelioration of plastic materials, the characteristics such as heat resistance and endurance have been improved to the level of ceramic packages.

It is also noticeable that the share of the cerdip type in the market of ceramic packages in gradually shrinking, partly because of the alternative of plastic to ceramic in the cerdip types of packages. In addition, the higher density integration of the IC itself requires increasingly the types of laminate ceramic packages with many lead pins such as PGA, FLAT type, and so on.

III-1-4 . Advantages of Local Production of Ceramic IC Packages/Substrates

Each company surveyed shows keen interest in the local procurement of raw materials. The locally procurable items are minor materials such as solder bar and shipping tubes, etc. The highest rate of local procurement given by the companies surveyed is 20%. All of them desire an increase in local procurement including the ceramic IC packages for which all of them expressed their intentions to purchase when domestic production is realised.

Most companies surveyed consider quality as the most important factor among the three factors, quality, price and delivery, itemised for the selection of supply sources. However, the advantage of the nearness of supply sources seems to be highly recognised by most of them judging from the replies given by some companies who regard also delivery, location and various services as important factors in addition to quality and price. The wording "just in time" seems the most proper expression of their preference for the nearer supply sources. Many companies interviewed expressed their efforts to achieve "just in time" supply. Their ordinary duration of the stock ranges from 2-3 months at the longest to 2 weeks at the shortest. Because of the irregular orders from the parent companies and the many varieties and frequent changes of specifications, their desires to have the parts suppliers in the vicinity were strongly expressed for the sake of "just in time".

The necessity of supporting industries, mainly such as the parts suppliers, is widely recognised. There are many companies who are providing advisory assistance to their vendors concerning the managerial and/or technical areas. As the most typical case, MOTOROLA has adopted a so called "SPC Method" (Statistical Process Control). The method is for the purpose of achieving the realisation of standard manufacturing processes. MOTOROLA applies the method not only for in-house execution but also to each supplier, demanding the amelioration of the production process under their inspective guidance. According to MOTOROLA, the SPC method is based on the concept that good quality leads to mutual development. The semiconductor manufacturers in Malaysia expressed good-will feelings of welcome for local production of IC ceramic packages not only from the delivery and /or quality point of view but also from the point that cost competitiveness and quicker services could be expected.

The domestic demand for ceramic IC packages was about 142.8 million pieces in 1987. This volume is 2.4 times the size required for minimum economical production (i.e. 60 million pieces per year) for a single ceramic IC package manufacturer. Therefore, there will be no problem as to the market size for the local production of ceramic IC packages in Malaysia. However, as far as ceramic substrates are concerned, the local market in Malaysia is extremely small because the number of local users is limited. The largest market in the world for ceramic substrates is Japan. Export to the Japanese market is almost impossible when the extremely hard competition and the extra transportation costs are taken into consideration. Therefore, there would be small advantage to local production of ceramic substrates in Malaysia.

III-2. Present Status of the Industries Related to the Domestic Production of Ceramic IC Packages/Substrates in Malaysia.

III-2-1. Outline of the Production Process of Ceramic IC Packages and Substrates

(1) Ceramic Substrates

The outline of the manufacturing process and the raw materials & consumables required for ceramic substrate production are shown in Fig. III.2-1.

Fig. III. 2-1 Process Flow & Raw Materials Used for Substrate Production

PROCESS		MATERIALS & CONSUMABLES
Material inspection ↓	Material inspection ↓	Al_2O_3, Glass Powder Binder, etc.
Blending ↓	Glass blending (↓ joins before Glass printing)	Organic solvent
Sheet casting ↓		
Punching ↓		Punching die
Pre-baking ↓		
Firing ↓		Setter & Platform car
Grinding ↓		Diamond grinding wheel
Snap-lining ↓ ←		
Glass printing ↓		Screen mask, Organic solvent, etc.
Glass firing ↓		
Inspection ↓		
Delivery		Tray

A. Material Inspection and Blending of Raw Materials

The main materials such as Al_2O_3 or organic solvents after having passed the material inspection proceed forward to the milling and blending stage.

Except for ordinary organic solvents such as toluene, mathyle-ethyle-ketone, etc., it is difficult to change the composition of such main materials as Al_2O_3or other materials of extremely small quantity such as $Fe_2O_3$and molybdenum because the change has a great affect on the ceramic characteristics such as anti-shock, bending moment, thermal conductivity, electric insulation, etc. For the change of composition, it would take several months for testing, and acquiring the qualification approval from users would take a further several months.

At this stage of blending, the raw material is in liquid form and is called "slurry".

B. Sheet Casting

The slurry is developed by doctor blade onto the carrier film in equal thickness and dried and cut off into the required size. This cut-off portion is called a "sheet". The sheet could either be white or green in colour. Normally the thickness is about 0.2-1 mm. White sheet is used for white-coloured substrate and green sheet for black-coloured substrate.

C. Punching

The next process is the punching of holes in the sheet by a punching die. In some cases, snaplines are punched on the sheet at the same time by using the same punching die. Generally speaking, ceramic shrinks by about 20% after firing. The shrunken size is the actual size of the final ceramic product.

In order to maintain the exact size of the product after firing, the design of the punching die is a very important factor.

As to the punching die, the permissible tolerance of diameters of holes, widths of snaplines, relative positions and pitch distances between holes and/or snaplines is only ±0.02 mm.

The punching die can be manufactured in two different ways. One way is in-house production and the other is the use of sub-contractors. In both cases, equipment such as EDM (Electric Discharge Machine), wire-cut EDM, etc., is used.

The punching die is a very important tool because its precision directly affects the product quality.

D. Pre-Baking & Firing

Before firing, a pre-baking process is undergone in order to remove the organic solvents and binders from the ceramic sheet by using the method of heat resolution.. Then the sheet is fired at about 1,500°C in an oxidisation atmosphere. (Firing temperature may be different according to various materials.) The interior of the firing furnace is generally tunnel-shaped with a wall of many fire bricks.

All through the firing process, platform cars and various sizes of setters (a kind of weight for pressing) made of firestones are used as auxiliary materials. Fire bricks once placed in the wall would be changed very rarely but those firestones used for platform cars or setters are consumables because of the damage and wear and tear caused by repeated exposure to the frequent and extreme changes of temperature.

E. Grinding

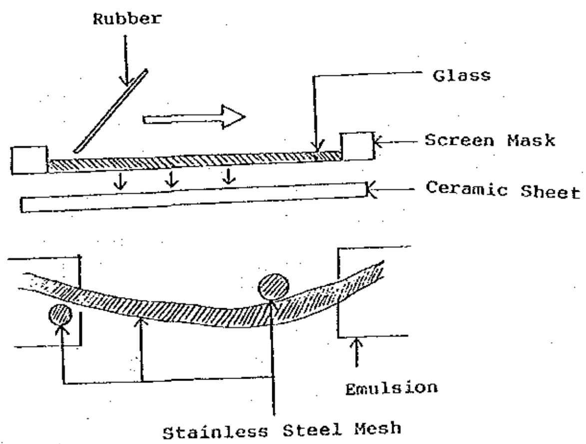
Depending on the specification of each product, the grinding process requires a very severe dimension control capability. Therefore, according to the specifications for outer dimension, thickness, surface roughness, etc., a plain grinding machine equipped with a diamond wheel is used. The diamond grinding wheels are also deemed consumable materials.

F. Snap-lining

The snap-lining process is for the purpose of easy-separation of each sheet in the later process. They look like squares in a bar of chocolate. The snap lining of the ceramic substrate is done by either the substrate makers themselves or at the users side.

G. Glass Printing

In many cases, ceramic substrates are also used without glass printing. The process of glass printing is similar to those for cerdip or laminate packages. In the case of laminate packages, the printing paste mainly consists of tungsten ink compared to the glass paste used for substrate or cerdip packages. A common characteristic of printing in those three types of ceramics (i.e. substrate, cerdip, laminate package) is the usage of a screen mask as shown in the drawing.



The screen mask is of stainless steel mesh tightly set in an aluminium frame. The stainless steel mesh is painted by emulsion with mesh holes corresponding to various patterns to be printed on the surface of the ceramic substrate. For the screen mask printing, a red film must be very accurately cut according to the required pattern to be printed. The red film is of about ten magnifications which has to be reduced by very accurately controlled camera-work to the actual size of each substrate. The reduced film is for the use of the repeater machine in order to make the original film. And an original film which contains many of the same patterns is produced so that a ralatively large number of substrates are to be printed at the same time on the same sheet. These original films or screen masks would be either in-house production or ordered from sub-contractors.

H. Glass Firing, Inspection and Delivery

The final manufacturing process is glass firing, and after inspection, the product is delivered to the users.

(2) Cerdip Type of Ceramic IC Package

The outline of the manufacturing process and raw materials and consumables required for cerdip type ceramic package production are shown in Fig. III.2-2.

Fig. III. 2-2 Process Flow & Raw Materials Used for Cerdip-type IC Packages

PROCESS		MATERIALS & CONSUMABLES
Material inspection ↓	Material inspection ↓	Al_2O_3, Glass powder Binder Organic solvent
Blending ↓	Glass blending (→ Grinding)	
Making powder ↓		
Powder press ↓		Press mould
Firing ↓		Setter & Platform car
Dotting of D/A material ↓		D/A (Au, Ag-Pd, Ag-Pt, etc.)
Grinding ↓		
Glass printing ↓		Screen mask, Organic solvent
Glass firing ↓		
Inspection ↓		
Delivery		Tray

A. Material Inspection, Blending & Making Powder

Until the slurry stage, all the manufacturing processes are the same as those of ceramic substrate. The slurry is made into powder by a spray dryer and is pressed by a powder press machines into the required form. The powder press mould requires extremely accurate precision in the fit of the male and female moulds. Even a tiny chink between them may invite an unwelcome intrusion of the powder causing the product to be unusable. Therefore, the required fit tolerance of the moulds is on the micron order.

B. Firing

Ceramic plate formed by the powder press is fired in an oxidisable atmosphere.

Unlike the case of ceramic substrates or laminate ceramic packages, no special process of heat resolution is required for cerdip type packages. However, as in the case of the ceramic substrate, platform cars and setters are required as consumable materials. The edges of the pressed ceramic are very sharp and have a kind of stingers so small in size as to be on the micron order, which are often caused in the moulding process,, For prevention, fired ceramic plates are put in a barrel grinding process in many cases.

C. Dotting of D/A Material

The process of dotting the die attach material shall be applied only to the lower base of the cerdip and not to the upper cap of the cerdip. The place of dotting is where the die (IC chip) shall be attached later on. The materials for attaching the die are Au, Ag-Pt, Ag-Pd, Glass, Ag-Glass, etc., which also serve as bonding agents.

D. Glass Printing and Glass Firing

The processes of both glass printing and glass firing in ceramic packages are the same as in the case of ceramic substrates. A screen mask is also required as in the case of the ceramic substrate. However, the tolerance of precision required is not so severe (±0.03 mm). Glass printing must be repeated several times until the required thickness is attained. Normally repetition about 2 to 4 times would be enough for this purpose. As the glass printing serves the purpose of sealing the IC chip, the control of the thickness (i.e. volume of sealing glass) must be conducted with careful attention. For this purpose, the thickness control of the emulsion to be painted on the screen mask is an important factor.

As to the lower base of the cerdip package (base ceramic), the process of leadframe attachment could be conducted either by the ceramic package makers or the IC assemblers. Generally speaking, IC assemblers conduct the process in many cases.

Thus, the finished cerdip product (upper cap and base ceramic) could be shipped out to the users after inspection.

(3) Laminated Ceramic Packages

The outline of the manufacturing process and raw materials and consumables required for production of laminate ceramic packages (DIP type) are shown in Fig. III.2-3.

Fig. III. 2-3 Laminated Package Process Flow & Raw Materials

Process		Materials & Consumables
Material Inspection ↓	Material Inspection	Al_2O_3, Binder
Blending ↓	Paste Blending (→ to Circuit Printing)	Tungsten, Organic Solvent
Sheet Casting ↓		
Punching ↓		Punching Die
Circuit Printing ↓		Screen Mask, Organic Solvent
Laminating ↓		Organic Solvent
Cutting ↓		
Chamfering ↓		
Side Printing ↓		Screen Mask, Organic Solvent
Firing ↓		Setter, Platform Car, H^2, N^2
Ni Plating ↓		Acid, Alkali, $NiSO^4$, $NiCl^2$
Brazing ↓		Leadframe (Ag-Brazing)
Ni, Au Plating ↓		Acid, Alkali, $NiSO^4$, etc.
Inspcetion ↓		
Delivery		

A. Material Inspection, Blending, Ink Blending and Sheet Casting

The process from material inspection to sheet casting is almost the same as that substrates.

B. Punching

Cavity portions and vertical holes are made by using a punching die. The holes in the sheet are called "Via Holes" or "Through Holes." The purpose of these holes is for electric conduction between the layers of the package.

The diameter of holes differs according to the usage, the size and density of circuit lines of the package, and is so small as to range from 0.1 mm to 0.4 mm.

The punching pin is for punching out a small hole and is very difficult to manufacture to ensure frequent usage. The punching pin is easily broken due to its smallness. Furthermore, the punching die with such a large number (several hundreds to several thousand pieces) of pins with a small diameter is also difficult to manufacture.

C. Circuit Printing (Metallisation)

Each layer of the laminate package shall be provided with circuit printing (metallisation). The layers are laminated in the later process for integration into a whole circuit line. It is not similar to the case of the PCB (Printed Circuited Board), which is a single-layer, because the laminate package is multi-layered, composed of a 3- dimensional circuit.

The paste for circuit printing is mainly composed of tungsten. The circuits serve to connect the electric terminals of the IC chip and the external lead of the package. Careful attention should be given in the circuit printing because the width and the thickness of the circuit affect greatly the electric characteristics such as resistance, capacitance, inductance, etc. The process of circuit printing requires the usage of a screen mask. The screen mask is produced in the same way as in the case of the substrate and cerdip package but a more severe precision of the screen mask is required for the laminate package. It is absolutely required that the tolerance of line width should be ±0.01 mm and that of relative position should be ±0.02 mm. In addition, the sharpness of the sectional edges of the emulsion is a very important factor.

D. Laminating

The printed circuit layer shall be laminated. Mixed oil, mainly composed of organic solvents, shall be used as an adhesive agent. The surface of each layer shall be melted shallowly and laminated by heat and pressure. As with the process of screen printing as stated in the case of substrates, a sheet contains many pieces of packages. Generally, each layer of the sheet could be laminated at the same time to produce a large quantity of laminate packages at one time.

E. Cutting and Chamfering

The process of cutting is to cut off many pieces of packages from the laminated sheet. At this stage, the laminated sheet is still soft enough to be cut off easily by an ordinary kind of blade.

The soft ceramic package after the cutting has very sharp sectional faces and edges which would cause chipping and cracking in the later process. To prevent this, chamfering shall be done at this stage in the same way as cutting.

F. Side Printing

The side printing serves the role of connector between internal leads and external leads.

G. Firing

The furnace is a combination pre-baking furnace and firing furnace. As explained in the case of ceramic substrates, the pre-baking furnace is of an oxidisable atmosphere type and a relatively lower temperature can be used. Meanwhile, the firing furnace is of a high temperature deoxidisable atmosphere type and saturated with H_2 and N_2 gases which prevent the printed paste of the circuits (Tungsten)from oxidising.

H. Ni plating

Ni plating is done as a preparation process for the later process of Au plating. The flow of brazing material in the brazing process is promoted by the Ni plating. As is the general case of plating, degreasing and acid dip for pre-treatment solution is required in this stage.

I. Brazing

The process of connection between the ceramic and the lead frame which has passed inspections, Ag. Cu alloy is most often used. Eutectic brazing material (Ag 72%) with lowest melting point could be used as well as brazing material (Ag 85%) with a relatively higher melting point, according to usages.
Lead frames (KOVAR or 42 Alloy) used for plastic packages and cerdip packages could also be used for laminate DIP packages.

J. Au plating

The final process is that of Au plating. Au is chemically a very stable material and has excellent electric characteristics, therefore, it is frequently used for laminate packages. There are other plating materials such as Cu, Sn, solder, etc., for special usages such as mother board but the quantity used is very small. The composition of the Au plating solution is very delicate and requires extreme purity. The thickness of Au plating requires very strict control because Au is very expensive and the thickness itself greatly affects the yield of wire bonding.

K. Cutting, Inspection and Delivery

The connected portions of the package which are unnecessary are cut off by a diamond cutter. The connection has served an electrical purpose in the Au plating process. The connection becomes unnecessary after the plating has been conducted.

The laminate packages which have completed all the processes are forwarded to the final inspections and are delivered to the IC assemblers.

III-2-2. Overview of the Related Industries in Malaysia

(1) General

In order to manufacture ceramic packages and substrates, many production processes are required as has been seen in the preceding paragraphs. For the manufacturing of punching dies and/or powder press moulds and the process of glass printing, Japanese ceramic package manufacturers utilise sub-contractors in many cases. Of course, if such sub-contractors are not available, they would have no choice but in-house manufacturing, in which case, there would be problems such as a big investment burden and time-consuming personnel development. Therefore, the survey in Malaysia was conducted from the view point of the availability of such mould and die manufacturers and glass printing companies.

As a result of the survey, the mould and die manufacturers who are capable of making the punching dies and the powder press moulds with enough precision to support the manufacturing of ceramic packages and substrates were found to exist. However, printing companies with the required capacity for glass printing could not be found at present in Malaysia.

(2) The Mould and Die Industry

The mould and die industry in Malaysia is rapidly developing as a peripheral industry of the semiconductor industry. The plastic moulding for plastic IC packages and the punching dies for lead frames could be taken as examples.

As stated in the preceding paragraphs, the precision punching dies and powder press moulds are necessary tools for the ceramic IC package production. With these, the production processes of ceramics before the firing stage are relatively easy because at those stages the ceramic sheets are soft and the ceramic powders are not difficult to form.

The survey conducted this time is limited to those technically top-level mould and die manufacturers located in the Free Trade Zones because they are considered as the manufacturers who are capable to meet the requirements of ceramic package production, judging from the survey results of last year on the mould and die industry in Malaysia.

The present situations of the mould and die manufacturers surveyed in the FTZ are as follows:

1) Designing

Except for one case which is a company technically joined with a local company, the other manufacturers (fully foreign capitalised) have been equipped with CAD systems for designing and have accumulated comprehensive know-how of technical applications in designing.

2) Machinery and Equipment

Much machinery and equipment such as NC EDM (Electric Discharging Machine), NC lathe and dimensional measurement equipment, rooms for measurement and calibration, CAD systems for designing, etc., are satisfactorily available at the manufacturers surveyed at this time. Satisfactory manners of usage of the equipment was also indentified.

3) Drawing and Working Standards

The range of tolerance for the parts and the moulds and dies of the manufacturers surveyed at this time is from 0.002-0.005 mm which could be considered as the tolerance of precision high enough for the manufacturer of punching dies for the laminate packages and/or the substrates.

Judging from the above 1), 2), 3), most of the mould and die manufacturers surveyed in the FTZ could be said to be capable enough for the manufacturing of moulds and dies for IC ceramic packages.

Findings of specific problems could be summarised as follows:

a) They have no actual experience in manufacturing powder press moulds.

As mentioned in the preceding paragraphs which explain the production process of the cerdip packages, powder press moulds are required for them.

In the case of punching dies to be used for substrates or laminate packages, the tolerance of fitness would be not so severe (about ±0.01mm). On the contrary, in the case of powder press moulds, the tolerance of precision in the fitness between female and male moulds is extremely severe because even the smallest misfit might invite the powders in the slit between the moulds and cause the cerdip packages to be unusable.

b) They have no experience in manufacturing the extremely small punching pins.

As mentioned in the preceding paragraphs, in the case of laminate packages, for the purpose of electric conduction, very small holes (0.1-0.4 mm of diameter) must be punched through the sheet by a punching die with many punching pins.

Therefore, extreme difficulties for the makers who have experience in manufacturing only punching pins of more than 0.6 mm in diameter could be assumed.

Such specific problems as the above a) and b) could be resolved by technology transfer, technical training and technological guidance, etc.

(3) The Printing Industry

As stated in the preceding paragraphs as to the processes of laminate package production, there is a process of circuit printing called "metallisation". For the process, a screen mask is required. The circuits serve the electric conduction between the electric terminals of the IC chip and the external leads through the area where the terminals are wire-bonded with aluminum wires. The conduction is composed mainly of tungsten and is in the state of paste. At this stage the connection is not electrically conductive but after being fired in the later process, it becomes electrically conductive.

Further, the glass to be printed on the surface of substrates or used as sealing glass for the cerdip packages should also be printed with the use of a screen mask. The printing glass is made by mixing powdered glass and organic solvents into the state of paste. For the laminate packages, a screen mask is also used. The required precision for the screen mask for the use of laminate packages is ±0.01 mm in line width and ±0.02 mm in both the relative pitch and the total pitch. Meanwhile, for the cases of substrates and cerdip packages, the required precision is ±0.03mm.

When the required precision for the screen printing mentioned above is taken into consideration, no Malaysian printing company could be said to be adequate at present to serve as a supporting industry in the production of ceramic IC packages and substrates.

In Malaysia, there are some printing companies which are conducting printing with the use of screen masks called "silk screen mask." As a result of the field survey this time, the silk screen masks which they use are found to be inadequate from such view points as precision or volume control of paste, etc. There are also some film companies to produce original films for the use of off-set printing but these companies are not available as the suppliers of original films for the screen masks to be used for the production of IC ceramic packages and substrates because they lack the required precision of the micron order.

The measures of solution of the specific problems as above stated are listed as follows in the order of possibility.

1) To procure from Singapore (Screen masks for the use of circuit printing for substrates are available in Singapore).
2) Manufacturers of IC ceramic packages themselves would produce the original films and the screen masks.

3) To introduce the required equipment to Malaysia and technically tie-up with the original film companies and/or the silk screen printing companies in Malaysia in order to develop the supply sources.

4) Film companies and/or screen mask manufacturers of USA and/or Japan should be established in Malaysia.

III-2-3. Feasibility of Procurement of Raw Materials and Consumables

(1) General

Many kinds of raw materials and consumables are required in the manufacturing process of ceramic packages and substrates.

The results of the field surveys which was conducted regarding the availability of local procurement of raw materials and consumables in Malaysia are as shown in Table III. 2-1 and Table III. 2-2.

Table III. 2-1 Raw Materials and Consumables Available in Malaysia.

Raw materials & consumables		Remarks
Moulds & Dies	Punching die	Small punching pins
	Powder press mould	Fitness
Organic solvents	Acetone Toluene Xylene M.E.K. 1.1.1. Trichlor-ethylene Trichlor-ethylene N. butanol	Other ordinary organic solvents are available
Gases	H_2 N_2 NH_3	
Firestone	Platform car Setter	
Inorganic substance	$NiSo_4$ $NiCl_2$ $CoSo_4$ Boric acid	
Lead frame		

Table III. 2-2 Raw Materials and Consumables not Procured in Malaysia

Raw materials and Consumables		Remarks
Materials for composition of ceramic packages & substrates	Al_2O_3 Fe_2O_3 Mo Au Tungsten Binder Glass	
Printing	Original Film Screen Mask	Available in Singapore

It is difficult to change the composition of the main materials of ceramic packages and substrates because the change greatly affects the ceramic characteristics and the approval from the users is required as mentioned in the preceding paragraphs. Even if the main materials are available in Malaysia, they would not be locally procured for the production of ceramic packages and/or substrates unless the following conditions are satisfied.

a) Cheaper than imported materials.
b) Delivery must be done within the desired period.
c) Conditions of production would not be much affected by the change of materials.
d) The ceramic characteristics would not be deteriorated at all.
e) The approval of the users could be received.
f) Technology required for the change of materials should be obtained.

The conditions as above listed are all indispensable factors for the change of materials. Therefore, if all the conditions could be satisfied, the materials which are available in Malaysia could be used for the ceramic packages and/or substrates. However, it is assumed that it would take at least 2-3 years after the actual production of the ceramic package and/or substrates in Malaysia is begun, before the local procurement of the materials and consumables listed in Table III. 2-2 is possible.

III-3. Feasibility Analysis of Investment

III-3-1. Study of Production Size

In this section, in order to evaluate the adaptability of Malaysia for an industry site of ceramic IC packages/substrates, a quite rough analysis of investment feasibility was conducted,on the assumption that the following three types of plants are to be newly constructed in Malaysia.

Table III. 3-1 Type of Plants and Production Size

Type	Production Capacity (Monthly)	
1. Ceramic Substrate Plant I	Blank Substrate	800,000 Pcs
2. Ceramic Substrate Plant II	Blank Substrate	370,000 Pcs
	Glazed Substrate	30,000 Pcs
3. Ceramic IC Package Plant	Cerdip Type IC Package	5,700,000 Pcs

Production items and production size are assumed from the following considerations.

(1) The size of the domestic market in Malaysia for the ceramic substrates is quite limited (about 400k pieces/month). It is not economically feasible to construct a plant if it is destined only to cover the domestic market. Therefore, the plant should be an export oriented factory. There are two big overseas markets, Japan and the U.S., for the products. Japan is taken up here as the assumed export market because of its nearness to Malaysia. The feasibility of adaptability of Malaysia for a substrate manufacturing plant of minimum economic size was conducted on the assumption that the product could be exported to Japan.

Two types of substrate factories are studied. One is a factory to produce only blank substrates and the other is that to produce both blank and glazed substrates.

Concerning the comparison of the two types of substrates, glazed substrate requires relatively higher manufacturing technology and is a more value-added product than the blank substrate. However, the demand for the blank substrate is bigger than for the glazed one in the general market.

(2) The size of the domestic market in Malaysia for ceramic IC packages of cerdip type is about 9 million pieces per month.

A feasibility study of plant construction for the cerdip type was conducted on the assumption of monthly production size of 5.7 million pieces calculated from the market size and the production capacity of one firing furnace.

(3) As to the laminate package, which is a more value added type than the cerdip type, the production is far more difficult and complicated than those of cerdip packages and substrates due to the sophisticated production processes. However, the production technology used for cerdip packages and substrates could also be applied to the laminate packages.

It would be more recommendable that the feasibility of the production of laminate packages should be re-studied after the experience of cerdip/substrate plant operation in accordance with the need plant size at that time and the extent of the accumurated manufacturing know-how of cerdip packages and substrates.

Thus, the feasibility analysis of investment as to laminate packages was not conducted in this survey.

For reference, the monthly size of the Malaysian domestic market for laminate packages is about 2.9 million pieces.

III-3-2. Investment Environment

It is said that the most important problem in the construction and operation of a plant is the constant supply of electricity. Electricity as the energy source for ceramic firing must be indispensably secured. If the installation of an in-house power plant for use in the case of outage of electricity is prohibited or if it is insufficient, the products would actually be damaged and the operation would be forced to stop. Cooperation as to constant supply of electricity from the government or the state is absolutely necessary. As to other kinds of utilities and industrial disposal, though there remain some problems, they are said to be solvable problems.

The advantageous aspect in Malaysia regarding plant construction is that the incentive measure of pioneer status can be utilised for the maximum period of 10 years. This fact is the evidence that the Malaysian government considers the ceramic IC packages/substrate industry to be an important high-tech industry in Malaysia. This represents, indeed, a very favourable incentive to induce any investor companies.

III-3-3. Outline of the Plants and Initial Investment Costs

(1) Outline of the Plant

Outline of the plants assumed for the purpose of feasibility of investment is as follows.

1) Ceramic substrate plant I

Product item	:	Ceramic blank substrate
Production capacity	:	800,000 pcs/month
Employees	:	153
Land	:	15,000 m^2
Building	:	4,825 m^2
Initial Investment	:	M$25.5 million

2) Ceramic substrate plant II

Product item	:	Ceramic blank substrate & ceramic glazed substrate
Production capacity	:	Blank substrate 370,000 pcs/Month Glazed substrate 30,000 pcs/Month
Employees	:	166
Land	:	15,000m^2
Building	:	4,100m^2
Initial investment	:	M$36.6 million

3) Ceramic IC package plant

Production item	:	Cerdip type IC package
Production capacity	:	5,700,000 pcs month
Employees	:	111
Land	:	16,500 m^2
Building	:	5,500 m^2
Initial investment	:	M$39.7 million

(2) Initial Investment Value

1) Premises

In order to evaluate the funds necessary for initial investment, the following premises were assumed.

- The plants would be located in the Prai Industrial Complex in the state of Penang, considering the access to the market. Not based on strict survey, the selection of this site was made just for the purpose of the assumption in cost calculation
- The factories were assumed to be partially air conditioned and steel frame block type with a clean room portion.
- Most of the major equipment and materials would be imported from Japan. Procurement of materials available in Malaysia and neighbouring countries would also be considered.

2) Ceramic substrate plant I

Initial investment value for the plant of blank substrates only is assumed to be about M$ 25.5 million.

III. 3-2 Initial Investment Value for Ceramic Substrate Plant I

(Unit: M$1,000)

Item	Calculation Base	Value
a. Land	15,000m2XM$43.06/m^2	646
b. Factory Construction		11,319
Factory Building	4,825m2XM$750/m^2	(3,619)
Utilities Supply Equipment		(7,600)
Guarantee for Outside Gutter and Water Supply, etc.		(100)
c. Machinery and Equipment		9,082
Mixing Sheet Making		(2,384)
Before Firing Process		(286)
Pre-Baking		(780)
Firing		(5,392)
Quality Guarantee		(200)
Packing		(40)
d. Vehicles, Stationery		220
Two Trucks	M$100,000/Truck	(200)
Stationery 1 Set		(20)
e. Contingency	((1)+(2)+(3)+(4)) x 20%	4,253
Total		25,520

3) Ceramic substrate plant II

Initial investment value for the plant of blank substrates and glazed substrates is assumed to be about M$ 36.6 million.

Table III. 3-3 Initial Investment Value for Ceramic Substrate Plant II

(Unit: M$1,000)

Item	Calculation Base	Value
a. Land	15,000m^{2}XM$43.06/m^2	646
b. Factory Construction		14,670
Factory Building	4,100m^{2}XM$1,700/m^2	(6,970)
Utilities Supply Equipment		(7,600)
Guarantee for Outside Gutter and Water Supply, etc.		(100)
c. Machinery and Equipment		14,994
Mixing Sheet Making		(2,384)
Before Firing Process		(226)
Pre-Baking		(780)
Firing		(5,312)
Glass Mixing		(312)
Secondary Process		(5,440)
Quality Guarantee		(40)
Packing		
d. Vehicles, Stationery		220
Two Trucks	M$100,000/Truck	(200)
Stationery 1 Set		(20)
e. Contingency	((1)+(2)+(3)+(4)) x 20%	6,106
Total		36,636

4) Ceramic IC package plant

Initial investment value for the plant of cerdip type IC packages is assumed to be about M$ 39.7 million.

Table III. 3-4 Initial Investment Value for Ceramic IC Package Plant

(Unit: M$1,000)

Item	Calculation Base	Value
a. Land	16,500m^{2}XM$43.06/m^2	710
b. Factory Construction		18,383
Factory Building	5,500m^{2}XM$1,700/m^2	(9,350)
Utilities Supply Equipment		(8,933)
Guarantee for Outside Gutter and Water Supply, etc.		(100)
c. Machinery and Equipment		18,100
Raw Material		(2,320)
Press		(3,080)
Firing		(930)
Au Dotting		(1,320)
Glass Printing		(6,870)
EP•ROM Sealing		(1,270)
Attaching of Leadframe		(750)
Quality Guarantee		(260)
Packing		(100)
Others		(1,200)
d. Vehicles, Stationery		220
Two Trucks	M$100,000/Truck	(200)
Stationery 1 Set		(20)
e. Contingency	((1)+(2)+(3)+(4)) x 20%	7,483
Total		39,671

5) Depreciation

The Method of figuring depreciation for the above investment is assumed as follows.

Building	.....20Years Straightline Depreciation
Utilities Supply Equipment	.....10Years Straightline Depreciation
Machinery/Equipment	.....10Years Straightline Depreciation
Vehicles/Stationery	..... 5Years Straightline Depreciation

III-3-4. Production and Sales

(1) Production

Annual volumes of production are assumed as follows based on the production capacity and initial operation ratio of each plant.

Table III. 3-5 Production Programme for Ceramic Substrate Plant I

(Unit: 1,000 Pcs)

		1st Yr.	2nd Yr.	After 3rd Yr.
Production Capacity	: Blank Substrate	9,600	9,600	9,600
Annual Production	: Blank Substrate	5,760	9,600	9,600
Operation Rate		60%	100%	100%

Table III. 3-6 Production Programme for Ceramic Substrate Plant II

(Unit: 1,000 Pcs)

		1st Yr.	2nd Yr.	After 3rd Yr.
Production Capacity	: Blank Substrate	4,440	4,440	4,440
	Glazed Substrate	360	360	360
Annual Production	: Blank Substrate	2,664	4,440	4,440
	Glazed Substrate	216	360	360
Operation Rate		60%	100%	100%

Table III. 3-7 Production Programme for Ceramic IC Package Plant

(Unit: 1,000 Pcs)

		1st Yr.	2nd Yr.	After 3rd Yr.
Production Capacity	: 14 Lead Cerdip	39,600	39,600	39,600
	EP•ROM28 Lead Cerdip	19,440	19,440	19,440
	EP•ROM28 Lead Cerdip with Leadframe	9,360	9,360	9,360
Annual Production	: 14 Lead Cerdip	19,800	27,720	39,600
	EP•ROM28 Lead Cerdip	9,720	13,608	19,440
	EP•ROM28 Lead Cerdip with Leadframe	4,680	6,552	9,360
Operation Rate		50%	70%	100%

(2) Unit Sales Price

Average unit sales prices of each product are assumed as follows, based on Malaysian market prices and Japanese manufacturing costs of each product. As to substrates, the unit sales prices are assumed to be equal to assumed Japanese market prices in order to be competitive when they are exported to Japan, because there is very limited domestic market in Malaysia. On the other hand, the unit sales prices of IC packages (cerdit type) for which there is an enough size of domestic market in Malaysia, are assumed to be equal to assumed imported prices from Japan.

Table III. 3-8 Unit Sales Prices of Substrates

(M$1=¥46)
(Unit: M$/Pc)

Production Item	Unit Sales Price	Ocean Freight & Insurance	Duty	Japanese Market Price
Blank Substrate	0.80	0.01	0	0.81
Glazed Substrate	8.00	0.04	0	8.04

Table III. 3-9 Unit Sales Prices of IC Package

(Unit: M$/Pc)

Production Item	Japanese Market Price	Air Freight & Ins.	Duty	Unit Sales Price
14 Lead Cerdip	0.115	0.025	0	0.14
EP•ROM28 Lead Cerdip	0.768	0.082	0	0.85
EP•ROM28 Lead Cerdip with Leadframe	0.915	0.085	0	1.00

(3) Sales Forecast

Sales forecast for each plant was made taking into consideration the production volume and the unit sales prices.

Table III. 3-10 Flow Forecast of Annual Sales Value of Each Plant

(Unit: M$1,000)

		1st Yr.	2nd Yr.	After 3rd Yr.
Ceramic	Substrate Plant I	4,608	7,680	7,680
	Blank Substrate	(4,608)	(7,680)	(7,680)
Ceramic	Substrate Plant II	6,163	10,272	10,272
	Blank Substrate	(4,435)	(7,392)	(7,392)
	Glazed Substrate	(1,728)	(2,880)	(2,880)
Ceramic	IC Package Plant	15,714	22,000	31,428
	14 Lead Cerdip	(2,772)	(3,881)	(5,544)
	EP•ROM28 Lead Cerdip	(8,262)	(11,567)	(16,524)
	EP•ROM28 Lead Cerdip with Leadframe	(4,680)	(6,552)	(9,360)

III-3-5. Raw Materials and Utilities

(1) Raw Materials to be Imported

As already stated in the preceding paragraph, the very important material, Al_2O_3, is to be imported from Japan at least for the first 5 years. Lenses for EP.ROM cerdip and gold are also to be imported from Japan.

Table III. 3-11 Flow of Annual Import Cost of Raw Material (Al_2O_3)

	1st Yr.	2nd Yr.	After 3rd Yr.
(Ceramic Substrate Plant I)			
Blank Substrate Production Volume (1,000 Pcs)	5,760	9,600	9,600
Product Weight (g/Pcs)	6.03	6.03	6.03
Material Input (Kg/Weight)	2.0	2.0	2.0
Annual Consumption (Ton)	69.5	115.8	115.8
FOB Unit Price (M$/Kg)	5.52	5.52	5.52
Cost of Raw Material (M$1,000)	384	639	639
Annual Import Cost (M$1,000)	422	703	703
(Ceramic Substrate Plant II)			
Blank Substrate Production Volume (1,000 Pcs)	2,664	4,440	4,440
Glazed Substrate Production Volume (1,000 Pcs)	216	360	360
Product Weight of Blank Substrate (g/Pcs)	6.03	6.03	6.03
Product Weight of Glazed Substrate (g/Pcs)	6.69	6.69	6.69
Material Input (Kg/Weight)	2.0	2.0	2.0
Annual Consumption (Ton)	35.0	58.4	58.4
FOB Unit Price (M$/Kg)	5.52	5.52	5.52
Cost of Raw Material (M$1,000)	193	322	322
Annual Import Cost (M$1,000)	212	354	354
(Ceramic IC Package Plant)			
14 Lead Cerdip (1,000 Pcs)	19,800	27,720	39,600
28 Lead Cerdip (1,000 Pcs)	9,720	13,608	19,440
28 Lead Cerdip with Leadframe (1,000 Pcs)	4,680	6,552	9,360
Product Weight (14 Lead, g/Pcs)	0.95	0.95	0.95
Product Weight (28 Lead, 28 Lead with Leadframe, g/Pcs)	3.25	3.25	3.25
Material Input (Kg/Weight)	1.25	1.25	1.25
Annual Consumption (Ton)	82.0	114.8	164.0
FOB Unit Price (M$/Kg)	6.74	6.74	6.74
Cost of Material (M$1,000)	553	774	1,105
Annual Import Cost (M$1,000)	608	851	1,216

Table III. 3-12 Flow of Annual Import Cost of EP•ROM Lens and Gold

	1st Yr.	2nd Yr.	After 3rd Yr.
(Ceramic IC Package Plant)			
EP•ROM Lenz (1,000 Pcs)	7,200	10,080	14,400
28 Lead Cerdip (Volume x 1/2)	(4,860)	(6,804)	(9,720)
28 Lead w/Leadframe (Volume x 1/2)	(2,340)	(3,276)	(4,680)
FOB Unit Price (M$/Pcs)	0.12	0.12	0.12
Cost of Material (M$1,000)	864	1,210	1,728
Annual Import Cost (M$1,000)	951	1,331	1,900
Gold			
14 Lead (Volume x 1/2, 1,000 Pcs)	9,900	13,860	19,800
28 Lead •28 Lead w/Leadframe (Volume x 1/2, 1,000 Pcs)	7,200	10,080	14,400
FOB Unit Price (14 Lead, M$/Pcs)	0.06	0.06	0.06
FOB Unit Price (28 Lead, 28 Lead w/Leadframe, M$/Pcs)	0.25	0.25	0.25
Cost of Material (14 Lead, M$1,000)	594	832	1,188
Cost of Material (28 Lead, 28 Lead w/Leadframe, M$1,000)	1,800	2,520	3,600
Annual Import Cost (M$1,000)	2,419	3,386	4,836

(2) Raw Materials Domestically Procured

1) Minor consumable materials

Minor cosumable materials such as organic solvents are domestically available and are less expensive than in Japan.

Table III. 3-13 Local Unit Prices of Minor Consumable Materials

Item	(Unit)	Local Prices (M$)	Prices in Japan (M$)	Prices in Japan (Yen)
Toluene	(kg)	1.31	1.04	52
M.E.K.	(kg)	4.00	2.96	148
Acetone	(kg)	2.30	3.08	154
Xylene	(kg)	1.24	2.32	116
Tricholo-Ethylene	(kg)	1.90	2.50	125
N-Butanol	(kg)	2.75	8.20	410
1.1.1.Tricholo-Ethane	(kg)	2.30	2.60	130

Table III. 3-14 Consumable Volume Rate of Representative Minor Consumable Materials

Unit: Kg Per Product Weight Ton of Ceramic Substrate

Item	Rate
Toluene	88.05
M.E.K.	415.09

Table III. 3-15 Flow of Annual Cost of Minor Consumable Materials

(Unit: M$1,000)

	1st Yr.	2nd Yr.	After 3rd Yr.
(Ceramic Substrate Plant I)			
Toluene	3	6	6
M.E.K.	58	96	96
Others	61	102	102
Total	122	204	204
(Ceramic Substrate Plant II)			
Toluene	2	3	3
M.E.K.	29	48	48
Others	31	51	51
Total	62	102	102

2) Screen Mask (consumables)

The screen masks to be used for glass printing occupy a major portion of the consumable materials. There is a problem that there is no existing industry in Malaysia to supply the screen masks. The counter-measures to the problem are shown as follows in the order of possibility.

i) To procure from Singapore

ii) The ceramic package/substrate manufacturers themselves would manufacture them.

iii) Technical tie-ups with similar Malaysian companies having similar technology such as silk screen printing companies which would introduce the necessary manufacturing equipment for screen masks.

iv) To realise the investment of foreign original film manufacturers and mask film manufacturers in Malaysia.

If the above counter measures are not available, the screen masks are to be imported from Japan or the U.S.

In this survey, the screen masks are assumed to be procured from Singapore with the following assumed unit prices.

Table III. 3-16 Assumed Unit Prices of Screen Masks

(Unit: M$/1,000 Pcs)

Products	Unit Price
Glazed Substrate	220
Cerdip Type IC Package	
14 Lead	1.81
28 Lead	6.02
28 Lead with Leadframe	6.02

Table III-3-17 Flow of Annual Cost of Screen Masks

(Unit: M$1,000)

Plant	1st Yr.	2nd Yr.	After 3rd Yr.
Ceramic Substrate Plant I	-	-	-
Ceramic Substrate Plant II	48	79	79
Ceramic IC Package Plant	123	172	245

3) Utilities

Electricity is the most important utility for the plants assumed in this survey. As to other utilities such as water supply and fuel, etc., they are considered to be at a negligibly low level.

Table III. 3-18 Electricity Consumption and Costs

Plant	Monthly Consumption (1,000 Kwh/Month)	Unit Price (M$/Kwh)	Annual Cost (M$1,000)
Ceramic Substrate Plant I	750	0.21	1,890
Ceramic Substrate Plant II	750	0.21	1,890
Ceramic IC Package Plant	700	0.21	1,764

III-3-6. Personnel Programme

(1) General

From the view point of labour force procurement, Malaysia can be said to be in a very favourable environment for the following reasons:

i) Labour cost is cheaper than Japan and there would be not such an abrupt increase of wages as in Korea, Taiwan, Hong Kong or Singapore.

ii) Most of the people at the general workers' level can speak English not like in Thailand and Indonesia.

iii) Job hopping is not frequent.

iv) Workers are generally diligent and persevering (Especially female workers)

v) Overall quality level of worker is increasing owing to the increasing number of university and technical school graduates.

(2) Personnel Costs

According to each job category, the number of personnel necessary for the operation of the assumed plants is investigated. Average personnel costs in each job category are assumed based on the results of field interviews or various statistical materials available in Malaysia. In this calculation of personnel cost, not only the basic salary but also various fringe benefits and bonuses were included to assume an aggregate unit cost of personnel.

Thus, annual costs of personnel in each plant are assumed as follows.

(3) Education Level and Required Skills for Engineers and Technicians in Ceramic IC Package/Substrate Plant Operation

Certain numbers of engineers and technicians are required in Ceramic IC Package/Substrate plant operation. Skills in actual operation could be obtained through on-the-job training, however, it would be better if the engineers and technicians in each job category had completed basic education in their various fields and at the level shown generally in Table III. 3-20.

Table III. 3-19 Flow of Annual Personnel Costs

Job Category	Number	Monthly Cost (M$)	Annual Personnel Cost (M$1,000)
Ceramic Substrate Plant I			
(Manufacturing)			
Factory Manager	1	2,800	34
Production Manager	2	2,000	48
Engineers	4	1,500	72
Skilled Workers	74	500	444
Unskilled Workers	52	250	156
Sub Total	133	-	754
(Administration)			
President	1	3,500	42
Administration Manager	3	2,000	72
Clerical Workers	6	1,500	108
Drivers, Typists, etc./	10	500	60
Sub Total	20	-	282
Grand Total	153	-	1,036
Ceramic Substrate Plant II			
(Manufacturing)			
Factory Manager	1	2,800	34
Production Manager	3	2,000	72
Engineers	6	1,500	108
Skilled Workers	95	500	570
Unskilled Workers	41	250	123
Sub Total	146	-	685
(Administration)			
President	1	3,500	42
Administration Manager	3	2,000	72
Clerical Workers	6	1,500	108
Drivers. Typists. etc./	10	500	60
Sub Total	20	-	282
Grand Total	166	-	967
Ceramic IC Package Plant			
(Manufacturing)			
Factory Manager	1	2,800	34
Production Manager	2	2,000	48
Engineers	4	1,500	72
Skilled Workers	50	500	300
Unskilled Workers	34	250	102
Sub Total	91	-	556
(Administration)			
President	1	3,500	42
Administration Manager	3	2,000	72
Clerical Workers	6	1,500	108
Drivers, Typists, etc./	10	500	60
Sub Total	20	-	282
Grand Total	111	-	838

III-3-7. Fund Recruitment Programme

The initial investment value necessary for the plants was assumed to be procured from paid-up capital (1/3), long-term borrowing (2/3) and short-term borrowing which covers other working capital requirement.

Table III. 3-20 Fund Recruitment Programme

Plant	Value (M$ 1,000)	Conditions
(Ceramic Substrate Plant I)		
Paid-Up Capital	8,500	-
Long-Term Borrowing	18,000	10 Year Average Reimbursement, Interest 8.0%
Short-Term Borrowing	Working Cost	Within One Year Reimbursement, Interest 8.0%
(Ceramic Substrate Plant II)		
Paid-Up Capital	12,200	-
Long-Term Borrowing	26,000	10 Year Average Reimbursement, Interest 8.0%
Short-Term Borrowing	Working Cost	Within One Year Reimbursement, Interest 8.0%
(Ceramic IC Package Plant)		
Paid-Up Capital	13,200	-
Long-Term Borrowing	28,000	10 Year Average Reimbursement, Interest 8.0%
Short-Term Borrowing	Working Cost	Within One Year Reimbursement, Interest 8.0%

III-3-8. Projection of Long Term Profit and Loss

Projection of long term profit and loss for the plants based on the estimated sales volume and other various costs was assumed as shown in Table III.3-21, Table III.3-22 and Table III.3-23. Costs not specified in the production cost were assumed to be a certain rate of sales value according to the production unit cost index of similar Japanese plants.

Table III. 3-21 Long-term Flow of Profit and Loss Projection - Ceramic Substrate Plant I

(Unit: M$1,000)

	Ist Year		2nd Year		3rd Year		4th Year		5th Year		6th Year	
		%		%		%		%		%		%
Sales Value	4,608	100.0	7,680	100.0	7,680	100.0	7,680	100.0	7,680	100.0	7,680	100.0
Production costs												
Materials	422	9.2	703	9.2	703	9.2	703	9.2	703	9.2	703	9.2
Minor consumables and materials	122	2.6	204	2.6	204	2.6	204	2.6	204	2.6	204	2.6
Utilities	1,890	41.0	1,890	24.6	1,890	24.6	1,890	24.6	1,890	24.6	1,890	24.6
Depreciation	1,893	41.0	1,893	24.6	1,893	24.6	1,893	24.6	1,893	24.6	1,893	24.6
Labour	754	16.4	754	9.8	754	9.8	754	9.8	754	9.8	754	9.8
Other expenses (1)	230	5.0	384	5.0	384	5.0	384	5.0	384	5.0	384	5.0
Sub total	5,311	115.3	5,828	75.9	5,828	75.9	5,828	75.9	5,828	75.9	5,828	75.9
Sales & General Adminstration												
Personnel	282	6.1	282	3.7	282	3.7	282	3.7	282	3.7	282	3.7
Transportation (2)	83	1.8	138	1.8	138	1.8	138	1.8	138	1.8	138	1.8
Others expenses (3)	230	5.8	384	5.0	384	5.0	384	5.0	384	5.0	384	5.0
Sub total	595	12.9	804	10.5	804	10.5	804	10.5	804	10.5	804	10.5
Operation profit	-1,298	28.2	1,048	13.6	1,048	13.6	1,048	13.6	1,048	13.6	1,048	13.6
Non-business expenses (4)	1,508	32.7	1,536	20.0	1,432	18.6	1,304	17.0	1,172	15.3	1,024	13.3
Ordinary profit	-2,806	60.9	-488	6.4	-384	9.0	-256	3.3	-124	1.6	+24	0.3

(1) 5.0% of average sales cost in similar Japanese industry is assumed.
(2) M$240/ton is assumed for transportation.
(3) 5.0% of average sales cost in similar Japanese industry is assumed.
(4) Borrowing interest.

Table III. 3-22 Long-term Flow of Profit and Loss Projection - Ceramic Substrate Plant II

(Unit: M$1,000)

	Ist Year		2nd Year		3rd Year		4th Year		5th Year	
		%		%		%		%		%
Sales Value	3,859	100.0	6,432	100.0	6,432	100.0	6,432	100.0	6,432	100.0
Production costs										
Materials	212	5.5	354	5.5	354	5.5	354	5.5	354	5.5
Minor consumables and materials	110	2.6	181	2.6	181	2.6	181	2.6	181	2.6
Utilities	1,890	49.0	1,890	29.4	1,890	29.4	1,890	29.4	1,890	29.4
Depreciation	2,465	63.9	2,465	38.3	2,465	38.3	2,465	38.3	2,465	38.3
Labour	685	17.8	685	10.6	685	10.6	685	10.6	685	10.6
Other expenses (1)	193	5.0	322	5.0	322	5.0	322	5.0	322	5.0
Sub total	5,555	143.9	5,897	91.7	5,897	91.7	5,897	91.7	5,897	91.7
Sales & General Adminstration										
Personnel	282	7.3	282	4.4	282	4.4	282	4.4	282	4.4
Transportation (2)	41	1.1	69	1.1	69	1.1	69	1.1	69	1.1
Others expenses (3)	193	5.0	322	5.0	322	5.0	322	5.0	322	5.0
Sub total	516	13.4	673	10.5	673	10.5	673	10.5	673	10.5
Operation profit	-2,212	57.3	-138	21.5	-138	21.5	-138	21.5	-138	21.5
Non-business expenses (4)	-2,168	56.2	-2,280	35.4	-2,320	35.4	-2,352	36.6	-2,344	36.4
Ordinary profit	-4,380	113.5	-2,418	37.6	-2,458	37.6	-2,490	38.7	-2,482	38.6

(1) 5.0% of average sales cost in similar Japanese industry is assumed.
(2) M$240/ton is assumed for transportation.
(3) 5.0% of average sales cost in similar Japanese industry is assumed.
(4) Borrowing interest.

Table III. 3-23 Long-term Flow of Profit and Loss Projection - Ceramic IC Package Plant

(Unit: M$1,000)

	Ist Year		2nd Year		3rd Year		4th Year		5th Year	
		%		%		%		%		%
Sales Value	15,714	100.0	22,000	100.0	31,428	100.0	31,428	100.0	31,428	100.0
Production costs										
Materials	3,978	25.3	5,568	25.3	7,952	25.3	7,952	25.3	7,952	25.3
Minor consumables and materials	123	0.8	172	0.8	245	0.8	245	0.8	245	0.8
Utilities	1,764	11.2	1,764	8.0	1,764	5.6	1,764	5.6	1,764	5.6
Depreciation	3,214	20.5	3,214	14.6	3,214	10.2	3,214	10.2	3,214	10.2
Labour	556	3.5	556	2.5	556	1.8	556	1.8	556	1.8
Other expenses (1)	2,514	16.0	3,520	16.0	5,028	16.0	5,028	16.0	5,028	16.0
Sub total	12,149	77.3	14,794	67.2	18,755	59.7	18,755	59.7	18,755	59.7
Sales & General Adminstration										
Personnel	282	1.8	282	1.3	282	0.9	282	0.9	282	0.9
Transportation (2)	656	4.2	918	4.2	1,312	4.2	1,312	4.2	1,312	4.2
Others expenses (3)	2,357	15.0	3,300	15.0	4,714	15.0	4,714	15.0	4,714	15.0
Sub total	3,295	21.0	4,500	20.5	6,308	20.1	6,308	20.1	6,308	20.1
Operation profit	270	1.7	2,706	12.3	6,365	20.3	6,365	20.3	6,365	20.3
Non-business expenses (4)	-2,288	14.6	-2,224	10.1	-1,880	6.0	1,496	4.8	-1,232	3.9
Ordinary profit	-2,018	12.8	482	2.2	4,485	14.3	4,865	15.5	5,133	16.3

(1) 16% of average sales cost in similar Japanese industry is assumed.
(2) M$10/kg is assumed for packing and transportation.
(3) 15% of average sales cost in similar Japanese industry is assumed.
(4) Borrowing interest.

IV. Rubber Footwear Industry

IV. THE RUBBER FOOTWEAR INDUSTRY

IV-1. Overview of the Industry

IV-1-1. Position of the Rubber Footwear Industry

(1) The Industry's Position

According to the Industrial Survey of 1986 by the Department of Statistics, the total production of rubber footwear in Malaysia was worth M$159.2 million. The share it holds in all manufactures is 0.4%; value added amounted to M$71.1 million and the share was 0.6%.

There are 5,291 employees, which is 1.1% of total employment. It is noted that the employee share is high, considering total production value and value added.

Looking at the ratio of rubber footwear in the rubber industry as a whole, it is apparent that the employment share is high as seen against the total share of the production amount and the value added amount (Refer to Table IV.1-1).

These statistics on the rubber footwear industry were taken from a total of 15 industries with companies employing more than 30 workers in Peninsular Malaysia and companies in East Malaysia.

Exports of rubber footwear among the industrial products of Malaysia for 1987 total 0.4% (customs base) (Refer to Table IV.1-2).

(2) Production Trends

According to the Rubber Statistics Handbook, the production scale of rubber footwear (including slippers, sandals and materials) in Malaysia for 1987 was M$120.5 million and the quantity produced was 20.1 million pairs (Refer to Table IV.1-3). From these statistics the following points can be mentioned as to the recent production trends:

a) Until 1985, production value was declining. But in 1986, it recovered to a slightly higher level than that of 1983. In 1987, it decreased again.

b) The statistics include items such as shoes, boots, slippers, sandals, heels and soles. The unit values are increasing year by year. But they have sharply decreased in 1987.

Table IV. 1-1 Size of the Malaysian Rubber Footwear Industry (1986)

	Number of Firms	Share (%)		Output M$ Million	Share (%)		Value Added M$ Million	Share (%)		Employment (person)	Share (%)	
Whole Manufacturing	5,814	100	--	40,427	100	--	12,154	100	--	478,920	100	--
Rubber Products Industry (MIC 355)	274	4.7	100	3,504	8.3	100	809	6.7	100	32,358	6.8	100
Rubber Footwear Industry (MIC 35593)	15	0.26	5.5	159	0.4	4.5	71	0.6	8.8	5,291	1.1	16.4

Source : Department of Statistics, "Industrial Survey 1986"

Table IV. 1-2 Share of Malaysian Rubber Footwear Exports in All Industrial Product Exports

Unit : M$ Million

	1985	1986	1987
Whole Industrial Product Export SECT 5~8	11,973.2	13,991.9	18,768.1
Rubber Footwear Export	45.2	51.6	75.3
Share(%)	0.4%	0.4%	0.4%

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade 1985" "Malaysia External Trade Statistics 1986,1987"

Table IV. 1-3 Production of Rubber Footwear in Malaysia

Unit: M$1,000
1,000 Pairs

Year	Production (MIC Code 35593) Value A	i	Volume B	i	Unit Price A/B
1983	157,891	100	28,845	100	5.47
1984	143,204	91	23,943	83	5.98
1985	134,368	85	20,642	72	6.51
1986	162,457	103	20,501	71	7.92
1987	120,489	76	20,089	70	6.00

Source: Department of Statistics, "Rubber Statistics Handbook" 1985, 1986, 1987
Note: i) Index (1983 = 100)

(3) Domestic Consumption

a) There are no statistics relating to the stock of rubber footwear and domestic consumption trends. It is possible to calculate domestic consumption (M$70.9 million) from 1987 production and trade statistics. Quantity was 12.9 million pairs (Refer to Table IV.1-4). The drop in domestic demand in terms of value in 1984 and 1985 was thought to be influenced by the recession.

Imports for 1985 and 1986 were held off because of the domestic recession. On the other hand, the annual production quantity has decreased and exports increased in 1987.

Table IV. 1-4 Trend of Demand and Supply of Rubber Footwear in Malaysia

Unit: M$ Million
Million Pairs

		Output	Import	Export	Domestic Consumption
1983	Value	157.9	19.5	37.7	139.7
	Volume	(28.8)	(2.8)	(9.1)	(22.5)
1984	Value	143.2	25.4	41.7	126.9
	Volume	(23.9)	(4.4)	(7.1)	(21.2)
1985	Value	134.4	24.4	45.2	113.6
	Volume	(20.6)	(3.6)	(7.4)	(16.8)
1986	Value	162.5	18.8	51.6	129.7
	Volume	(20.5)	(3.4)	(8.7)	(15.2)
1987	Value	120.5	25.7	75.3	70.9
	Volume	(20.1)	(4.1)	(11.3)	(12.9)

Source: "Rubber Statistics Handbook" 1985, 1986, 1987
"Malaysian Annual Statistics of External Trade" 1983, 1984, 1985
"Malaysian External Trade Statistics" 1986, 1987

Note: (1) Coverings and Items of Production and Export & Import Statistics are Different.
(2) Domestic Consumption = Production + Import - Export

(4) Industry Development Policy

The rubber products industry is listed among the 12 priority industries mentioned in the Industrial Master Plan (IMP), Malaysia's middle and long-term development strategy for industry which started in 1986 runs through to 1995. The future development of the rubber products industry, as seen by the IMP, includes the expanding of exports of rubber products such as tyres, latex products for medical use and industrial rubber products that consume a great deal of natural rubber.

Also, the plan calls for exports of "fashion footwear" to expand. "Fashion footwear" consists of middle and high class footwear with high value added. However, the definition of "fashion footwear" remains unclear. On the 'Promoted Products' list under the Promotion of Investment Act 1986, it is defined as "footwear, all types" in accordance with the recommendation of the IMP Task Force.

The IMP estimates concerning the supply and demand trends of rubber footwear from 1986 to 1995 indicate that exports will increase 13% per year and that domestic consumption will increase 6.1% per year. The production growth rate is expected to be 8% a year; imports will increase 6% per year. The MIDA sets this prediction as one of its targets. The nominal value for 1986 will be : production amount, M$193.4 million; exports: M$48.8; imports: M$16.3 million; and domestic consumption: M$16.09 million.

(5) Groups in the Industry

1) MRPMA

There is an organisation called Malaysia Rubber Products Manufacturers' Association (MRPMA). The Association was established in 1977 and involves itself with the manufacture of rubber products. The antecedent to this group was the Malaysia Rubber Goods Manufacturers' Association (MRGMA), established in the 1950s.

Companies which are affiliated members of this Association include manufacturers of overall rubber products such as tyre tubes, latex products, rubber footwear, rubber products for industrial use and general rubber products. As of July 1988, there were 65 companies with full membership and 13 companies with associate membership for a total of 78 companies. Among the nine manufacturers visited, five are manufacturers with full membership. A parent company of one of those nine was a full member.

The activities of this Association include holding seminars,supplying information, the circulation of relevant data to members, sending missions overseas, participating in overseas exhibitions and arranging connections with overseas industry groups. Activities by this Association can act as a window for the government and it is very important. This Association representing the industry is a member of a task force of an IMP follow-up.

Only two staff are currently involved in the operation of this Association. Although small in number, they are involved in many activities. In fact, when these staff were called upon, they were so busy that they hardly had time to give information. Also, their working space was extremely small. They are in the same building as the Malaysian Rubber Research and Development Board (MRRDB).

Recent issues involving the rubber industry are the government policy for the tyre industry, too many manufacturers of rubber gloves for medical use (AIDS related), and the mass production of inferior goods. The Association is concerned about these problems and is busily involved in solving them.

2) FMM

The Federation of Malaysian Manufacturers (FMM) is a group representing all manufacturers in Malaysia. The 1988 FMM Directory reports that four of the nine companies visited are members of this Federation and the parent companies of two companies visited are also members.

(6) Supplementary Explanation of Statistics

1) Production Statistics

[1] The coverings and items of rubber footwear are different and not unified in different kinds of statistics.

Included in the Malaysia Industrial Classification (MIC) issued by the Department of Statistics is a section (Industry 35593--Manufacture of Rubber Footwear) under (Major Group 355 --Manufacture of Rubber Products). This section deals mainly with the manufacture of footwear made primarily of vulcanised or moulded rubber and rubber shoe bindings. Rubber-soled leather footwear is not included.

As stated later, the definition of "rubber footwear" used by the Malaysian government and rubber footwear association in the case of exports or imports is "footwear with soles or upper of rubber or both." Accordingly, footwear with rubber soles and leather upper is regarded as rubber footwear.

In the Rubber Statistics Handbook 1987, published by the Department of Statistics, rubber footwear (MIC 35593) includes:

- Canvas shoes and boots
- Slippers and sandals
- Other footwear
- Soles and heels

But, the official statistics is not classifing rubber footwear like this. There is only one classification - MIC code 35593. Classified statistics such as shoes, boots, slippers and soles are not officially published.

[2] On the other hand, the classification of footwear in the rubber industry by the Rubber Research Institute of Malaysia (RRIM) lists the following items.

-Industrial boots
-Wellington boots
-Rubber-soled footwear
-Sports/canvas shoes
-Slippers and sandals
-Soles and heels

Among rubber-soled footwear, there are types of casual footwear which do not come under canvas shoes or sports shoes - such as women's dress shoes. The difference between sandals and slippers is described by some traders as footwear with a back band (sandals) and without a back band (slippers).

Footwear called Thongs or Japanese slippers are called beach sandals or rubber slippers in Japan.

[3] According to the Monthly Industrial Statistics, Peninsular Malaysia, and the Monthly Statistical Bulletin, Peninsular Malaysia, also issued by the Department of Statistics, statistics classifications until 1983 are as follows: "canvas boots and shoes with rubber soles", "slippers and sandals wholly or partially of rubber", "other footwear, entirely or partly of rubber" and "soles and hwwls." They were listed separately.

However, after 1984, official values were listed on "rubber footwear (all types).". These statistics mention only production values in Peninsular malaysia.

2) Export and Import Statistics

When referring to exports and imports of rubber footwear in Malaysia, the MIDA and MRPMA use the classification mentioned in IMP, which is slightly different from the Malaysia Industrial Classification in the section. According to MIDA and MRPMA, that is footwear in which rubber is used in the soles or upper part, or both. Leather footwear with rubber sole is also included in that classification.

The trade statistics conform to the Standard International Trade Classification (S.I.T.C.). The rubber footwear products are in the footwear section, Code No. 851, and parts and materials of rubber footwear are included in Code No. 612. Looking at the SITC 851 classified by materials used, it is as shown on Table IV.1-5.

Since the statistics code relates to the possible materials in the upper and outer sole, the slippers and sandals classifications are not clear.

Boots will mainly be classified in SITC 851-014 and the shoes in 851-024. Men's and women's shoes, which are not objects of the survey, are included in SITC 851-023. Leather sports shoes with rubber soles are also included.

The import duty rate of Malaysia is based on the Customs Cooperation Council Nomenclature (CCCN). However, beginning in 1988 it was changed to The Harmonised Commodity Description and Coding System (HS). SITC classifications in the customs tariff schedule and the trade statistics have changed as well.

Table IV. 1-5 SITC Classification (SITC 851) by Combination of Uppers and Outer Soles

Upper / Outer Sole	Rubber	Artificial Plastic Materials	Leather or Composition Leather	Textile Materials	Wood or Cork	Other Material
Rubber	851-014	-013	-023	-024	-	-025
Artificial plastic materials	851-012	-011	-	-062	-	-027
Leather or Composition leather	851-022	-	-	-	-	-021
Textile materials	-	-	-	-	-	-
Wood or cork	851-031	-	-	-	-	-032
Other material	851-041	-	-	-	-	-042

Source: Department of Statistics, "Malaysian External Statistics"

IV-1-2 Production Trend

(1) General Trend

The rubber footwear industry in Malaysia was greatly influenced in the 1980s by the world recession and intensified competition from Korean, Taiwanese and Chinese products. Taking this competition into consideration, the Malaysian government took steps to permit two companies to sell 50% and 90% of their production domestically, from June 27, 1983, to a designated period of time. These two companies previously had production licence to export 100% and 80% of their production.

However, a rapid increase in imports was seen in the domestic market and supplies became surplus. Bankruptcies increased and companies had to decrease production. In addition, in 1985 and 1986 Malaysia suffered from a serious recession and demand dropped.

Market conditions recovered rapidly after 1987. A 2% growth rate was expected for 1987. But according to the annual report of the Bank Negara published in March 1988, the growth rate was 4.7%. Furthermore, in October 1988, the Finance Ministry's economic report for 1988-1989 reported a growth rate of 5.2% for 1987. For 1988 they estimated a growth rate of 7.4%.

The recovery in business conditions was a result of rising prices and expanded exports of primary products. Exports of rubber footwear, increased sharply in 1987.

(2) Details of the Establishment and History of Companies

1) It has been reported that it was in the last half of the 1930s that the rubber footwear industry was developed in Malaysia.

The "Annual Companies Handbook, Volume XIII," issued by the Kuala Lumpur Stock Exchange, reported that in 1931 the Bata Co., a multi-national company, established the Bata Shoe Co., Ltd., in what is now Singapore, for the purpose of using it as a manufacturing, delivery and marketing base. In 1936, their plant No. 1 was set up in Klang. The present Bata (Malaysia) Berhad was established in 1957. This company took over the Klang plant.

This company is at present the largest manufacturer producing rubber footwear in Malaysia. Many managers of other companies at one time worked for this company, which has greatly influenced the rubber industry in Malaysia.

2) The Fung Keong Rubber Manufactory (Malaysia) Sdn. Bhd. was established in 1939 and has been producing rubber footwear. It was purchased by the General Corporation Berhad that developed from tile manufacturing in 1983. At present this company produces mainly tyre tubes and rubber products for industrial use. It does not produce footwear.

According to the 1985 MRPMA Directory, the Shum Yip Leong Rubber Works Sdn. Bhd. formerly produced boots for industrial use and Wellington boots. At present they have begun to concentrate on producing tyres and tubes and rubber products for industrial use. Their boot production has now been stopped.

3) The International Footwear (S) Pte. Ltd., in Singapore, established production sites in Penang, Kedah and Malacca, in the 1970s. The Kedah plant is operated by the State Government Institutions, as a Malaysian investor. The Malacca plant came under the Sime Darby group and the Sime Darby Footwear Sbn. Bhd. was established. The company, based on this group's strategy, is presently positioned under the DMIB(Dunlop Malaysian Industries Berhad).

There are many examples wherein a company continues its operations after it becomes part of another company. The Ozly Sdn. Bhd., in Johore State, came under Heavenco Industries Bhd. in 1972. Because of problems with exports, this plant halted operations in 1982. The Ozly Sdn. Bhd. bought the plant and resumed operations in 1983. However, this company had financial problems and the Lion Group, a manufacturer of steel and metal products, came in to reinforce the plant. Now it is under this group.

4) In the 1970s, the Viking Askim (M) Sdn. Bhd. and Marco Shoe Sdn. Bhd. started operations. The latter company is operated by MARDEC, a government institution and an Australian company. Its investment conforms to the NEP. Viking Askim is a joint venture company manufacturing mainly boots and consisting of a Norwegian company and a Malaysian company of foreign capital with plantation.

5) In Sabah State, the Kosan Shoe Industry opened a plant in 1980 to produce canvas shoes, with state government cooperation. This plant is in a town about one hour by car from the Kota Kinabalu. It was set up under the government's employment and social plan, and is run as a government facility, producing mainly footwear for children and government use. It is the only plant in the state that produces canvas shoes.

(3) Production Trend of Manufacturers Visited

1) Products Surveyed in Malaysia

The following steps were taken to set up the kinds of products to be surveyed after discussion with the Malaysian Industrial Development Authority (MIDA).

- Men's and women's leather shoes with rubber soles are excluded.
- Components such as soles and heels are excluded.
- Slippers and sandals are excluded.

As a result, products to be surveyed include such shoes and boots as canvas shoes, school shoes, sports shoes and casual shoes.

2) Places Visited During Survey

In addition to manufacturers mentioned previously, a part of material manufacturers, tool manufacturers, retailers, slipper and sandal manufacturers that supply soles and some related institutions were also surveyed (Refer to Table IV.1-6).

The selection of candidates for visitation was done using the following method:

a) Listing candidates to visit by using materials in Japan.
b) The list of candidates is adjusted according to information gathered during the survey.

The number of manufacturers producing shoes and boots to be selected for survey according to materials and informations in Malaysia is only 9 out of which one manufacturer is in East Malaysia.

A questionnaire was distributed to manufacturers that might possibly be subjects of the survey.

According to the Industrial Survey Report of 1986, there were 12 companies in Peninsular Malaysia that had more than 30 employees and three in East Malaysia. The names of these companies have not been announced officially.

The numbers of manufacturers have been decreased, as total number of them surveyed was nine.

Table IV. 1-6 List of Field Survey Sources Visited

A. Rubber Footwear (Shoes, Boots) Manufacturers
1. Bata (Malaysia) Berhad.
2. Cougar Industries (M) Sdn. Bhd.
3. International Footwear (Penang) Sdn. Bhd.
4. International Foodwear (Kedah) Sdn. Bhd.
5. Kosan Shoes Industry
6. Marco Shoe Sdn. Bhd.
7. Ozly Sdn. Bhd.
8. Sime Darby Footwear Sdn. Bhd.
9. Viking Askim Sdn. Bhd.

B. Peripheral Industries

- Materials

1. J & P. Coats (Mfg) Sdn. Bhd.	(Thread)
2. Kam Yoong Shoe Manufacturer (M) Sdn. Bhd.	(Sole, Slipper)
3. Kamunting Industries Berhad	(PVC Canvas)
4. New Engineering Sdn. Bhd.	(Sole)
5. Nylex (Malaysia) Sdn. Bhd.	(PVC Leather)
6. Tong Fatt Shoes Mrts. Sdn. Bhd.	(Sole, Slipper)
7. Winson Industries Sdn. Bhd.	(Shoe Lace)

- Last and Mould & Die
1. Fee Kee Sdn. Bhd.
2. Nya Seng Co.
3. Sum Hing Engineering Works Sdn. Bhd.
4. Wong Brothers Engraving & Engineering Sdn. Bhd.

- Rubber Industries
1. Central Elastic Corporation Sdn. Berhad
2. LYL Rubber Sdn. Bhd.

C. Trading Firms, Retail Shops and Financial Institutions
1. Sumitomo Corporation
2. Marubeni Corporation
3. Yaohan (M) Sdn. Bhd.
4. The Sumitomo Bank Ltd.

D. Related Organizations
1. Malaysia Export Trade Centre (MEXPO)
2. Rubber Research Institute of Malaysia (RRIM)
3. Standard and Industrial Research Institute of Malaysia (SIRIM)
4. Department of Industrial Development & Research, Sabah
5. Malaysian Industrial Development Authority, Kota Kinbalu Office

E. Business Association
1. Malaysian Rubber Products Manufacturer's Association (MRPMA)

3) Production Trends of Companies Visited

a) Among the companies visited, eight produced mainly shoes with one company producing mainly boots. Questionnaires were also sent to these companies. The production quantity of canvas shoes and sports shoes for 1987 for seven out of eight companies mentioned above is 10,461,000 pairs, an 7.4% increase over the previous year. Concerning boots, the one company mentioned above produced 1,384,000 pairs. (Refer to Table IV.1-7)

Among these companies there was only one which produced slippers, sandals and other rubber-soled footwear.

Table IV. 1-7 Production of Rubber Footwear (Shoes, Boots) of 9 Major Manufacturers

Unit: Pairs

	1986	1987	1986/1987 (%)
Shoes	9,743	10,461	7.4
Boots	1,495	1,384	Δ7.4

Source: Survey Questionnaires

Five out of seven companies that produce shoes increased production compared to the previous year. One of the two companies whose output had decreased reduced its production because of financial problems. However, at the time of the visit, production seemed to have recovered due to reinforcement by a larger company. The other company showed a production decrease of 0.5% compared to the previous year.

b) Under these circumstances, the management of many companies became more aggressive toward production increases. Activity at many of the plants was very brisk. New buildings were constructed, new equipment was installed or planned and new production plans were reported.

A big shoe manufacturer in Malaysia added a building on its site in order to expand exports and a new assembly line was set up.

At a plant in Johore, computerised sewing machines were introduced. At another plant, a plan was underway to use a belt conveyor for vulcanisation, processing, testing and packing. A company in which the government of Kedah has invested recently, purchased a used banbury mixer. Another company is building another plant near its present location in order to expand production.

As for new products, a company that produces mainly canvas shoes would like to handle sports shoes. Another company that produces slippers and parts, such as soles, would like to manufacture shoes.

c) Companies have become aggressive in their exports. Only one company out of nine is not exporting at present.

Among the nine companies, three have aimed for 100% exports since their establishment and two companies have aimed for 80% exports. As previously mentioned, there were drastic changes in the 1980s.

According to the questionnaire, the company having the highest export ratio in 1987 was Viking Askim Sdn. Bhd., a company with foreign capital and producing mainly boots. Its ratio was more than 98%.

Among companies producing mostly shoes, Marco Shoe Sdn. Bhd., with Australian capital, rated about 80%.

At present, the largest manufacturer of rubber footwear in Malaysia is Bata (M) Berhad. It has been making products mainly for domestic use. People at the company said it was not getting tax incentives, but recently they have concentrated more on exports. The company's export ratio for 1987 was only 15%. Its total export value compared with the previous year showed a 66% increase. The current plan to expand exports is to establish a wholly-owned subsidiary company, Bata (Kapar) Sdn. Bhd., in the present factory area and to introduce new equipment. This new company was granted pioneer status.

Present export products consist of OEM brands. From the questionnaire, six of nine companies responded on their OEM export ratio and four companies said their ratio was more than 85%.

One company out of two had an OEM brand export ratio of as low as 13%. It is natural that this foreign capital company entered Malaysia with its own brands.

Two-thirds of the other companies' exports consist of its own brand. This company also exports its own brand to Japan.

Among those with OEM brand exports, this company's export of its own brand is impressive.

4) Peripheral Industries Trend

a) Components Manufacturers

[1] Manufacturers needing rubber soles for their products usually make their own. The rubber sole supplier visited also manufactures slippers and sandals, etc. Sime Darby Footwear Sdn. Bhd. has transferred its manufacturing know-how to the Kasut Kurim Sdn. Bhd., which they bought recently. Kasut Kurim Sdn. Bhd. will act as a tributary to Sime Darby.

[2] It is believed that there are two main manufacturers that supply canvas. One of the companies visited is a company with foreign capital. In the past there was a foreigner employed there. However, at present, it is operated by Malaysians. Forty percent of this company's production is exported and 40% of the products produced for the domestic market go to supply shoe manufacturers. Along with the canvas for shoes, it also supplies thread to manufacturers producing shoe laces.

There are two manufacturers of PVC leather, and they are also involved with foreign companies. The one company visited supplied only a limited amount to domestic shoe manufacturers.

The main supplier of uppers is a foreign company and it is considered a large company in Malaysia.

[3] There are two or three main companies manufacturing shoe laces. One of the companies visited is a member of the FMM. This company was working to introduce new equipment in order to produce the same kinds of shoe laces it is presently importing.

[4] There are few domestic companies that manufacture thread for machine use. The shoe manufacturers that were visited used the products of the foreign capital company in Penang which is located in the Free Trade Zone (FTZ).

b) Tool Manufacturers

[1] Moulds for shoe soles are dependent on imports from Taiwan, Korea, etc. The domestic companies in this field are very small; also, delivery time is a problem among the manufacturers of rubber footwear.

[2] The supply of lasts is provided mostly from imports. There is only one company that provides lasts. So it follows that without imports there would be domestic supply problems with lasts.

IV-1-3. Export and Import Trends

(1) Summary of Export and Import of Rubber Footwear

1) Looking at the exports and imports of rubber footwear in Malaysia basically, there are far more exports than imports.

The export/import gap decreased in the first half of the 1980s when exports fell off quickly. However, exports recovered quickly beginning in 1983. Since imports fell in 1985 and 1986, the ratio of exports to imports has been expanding since 1984. In 1987 it increased sharply (Refer to Table IV.1-8).

2) Concerning exports of rubber footwear, the percentage of completed products is high. Among these, there are many export products with rubber outer soles. The export value of these items totals 80-90% of the total export value.

3) As mentioned, imports of rubber footwear fell for two consecutive years, in 1984 and 1985.

Imports were held back due to the domestic recession. However, in the middle and long term, imports are on an increasing trend.

Of the imported items, two are being imported rapidly. They are footwear with rubber outer soles and textile uppers and footwear with rubber outer soles and leather or synthetic leather uppers.

4) The export ratio of completed rubber footwear against the export value of all footwear (SITC 851) is about 80% and the import ratio is about 80 - 85%.

Table IV. 1-8 Export & Import of Malaysian Rubber Footwear

Unit: M$1,000

	Export (Over the Previous Year)	Import (Over the Previous Year)	Export-Import [Export/Import]
1980	72,925.8	11,138.1	61,787.7 655%
1981	59,470.7 Δ18.5%	16,660.4 49.6%	42,810.3 357%
1982	45,177.2 Δ24.0%	18,375.8 10.3%	26,801.4 246%
1983	37,660.0 Δ16.5%	19,534.9 6.3%	18,125.1 193%
1984	41,713.9 10.8%	25,396.6 30.0%	16,317.3 164%
1985	45,206.3 8.4%	24,418.5 Δ3.9%	20,787.8 185%
1986	51,600.5 14.1%	18,825.6 Δ22.9%	32,774.9 274%
1987	75,305.9 49.9%	25,054.4 36.3%	49,651.5 301%

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade, 1980, 81, 82, 83, 84, 85" "Malaysia External Trade Statistics, 1986, 87"

(2) Export Trends

1) Exports of Malaysian rubber footwear in 1987 (defined by IMP) were worth M$75.3 million, a 45.9% increase over the previous year. The export value from 1980 to 1983 declined drastically from M$72.9 million to M$37.7 million. IMP mentions the reasons for this were firstly the world recession and secondly the competition from NIES, mainly Korea and Taiwan, and other developing countries, mainly China.

However, after 1984, exports recovered and in 1987 they recovered to around the 1980 level (Refer to Table IV.1-8).

2) The biggest export item of rubber footwear from Malaysia for 1987, as far as price was concerned, was "footwear with rubber outer soles and rubber uppers" (SITC 851-014). Exports of these amounted to M$24.6 million and 1.8 million pairs. This was 32.7% of all rubber footwear, 50% of which was exported to Norway and other countries including Sweden, West Germany, the U.S. and the U.K.

Most of export products are manufactured by one joint venture boot manufacturer in Penang (Refer to Table IV.1-9).

3) The second biggest export item was "footwear with rubber outer soles and textile material uppers" (SITC 851-024), including canvas shoes.

The export value for 1987 was M$21.1 million and 3.6 million pairs, which was 28.0% of the whole rubber footwear value. In quantity it was 31.9%, the largest among all the items.

This export item was worth M$34.1 million and 7.8 million pairs for 1981, and was the No. 1 export item, more than footwear with rubber outer soles and uppers. However, in 1982 and 1983 it fell rapidly and in 1984 dropped to M$6.3 million and 1 million pairs.

In and after 1985, rapid recovery could be seen. For 1985, there was a 66.9% increase over the previous year; in 1986 a 16.2% increase; and in 1987 a 72.9% increase. Yet in 1987 it had not recovered to its peak point.

The top nations importing these products in 1987 were Italy with M$6.6 million and 0.7 million pairs and the U.S. with M$3.4 million and 1.2 million pairs followed by Canada, Australia and Ireland.

At the peak in 1981, the U.K. was No. 1 with M$15.3 million and 3.8 million pairs and No. 2 was Australia, M$5.9 million and 1.3 million pairs, followed by the U.S., Singapore and West Germany.

In 1982, when the export value of the same items dropped 50.2% compared to the previous year, England was ranked the No. 1 customer. The export value then totaled M$5.4 million and 1.2 million pairs. Exports to England kept declining and in 1985 they amounted to only M$27,400 and 4,000 pairs. In 1987 the figures were M$177,200 and 33,900 pairs, ranking No. 12.

Thus the rapid fall in the item's exports in the first half of the 1980s was caused in part by the drop in exports to the U.K (Refer to Table IV.1-10).

4) The rubber footwear export ranked third for 1987 was footwear with rubber outer soles and uppers with any other material (SITC 851-025). The export value was M$12.5 million and 1 million pairs. It differs with the export of the previously mentioned item, footwear with rubber outer soles and textile uppers, in that the trend shows that exports are rising.

Formerly, exports were mainly to the Philippines. However, after 1983 exports were mainly to Australia. For 1987, 60% of exports of the same item were to Australia (Refer to Table IV.1-11).

5) In exports of rubber footwear, the ratio shared by completed items was high. And in the first half of the 1980s the ratio of components quickly rose from 1% to the

10% range. This was the result of favourable increase of component exports in spite of the rapid decrease of completed product exports in the same period. Among the exports of components, exports of parts of rubber outer, middle and inner soles are increasing.

(3) Import Trends

1) Import Trends of Main Items

a) Malaysia's imports of rubber footwear in 1987 were worth M$25.7 million, an increase of 36.3% over the previous year. This was a great increase.

For 1984 and 1985, imports fell 3.9% and 22.9% respectively. This, as mentioned before, was due to the domestic recession.

Imports in 1987 recovered to their 1985 levels, and tendencies indicate further increases (Refer to Table IV.1-8).

b) Malaysia's main imports of rubber footwear are footwear with rubber outer soles and leather or synthetic leather uppers (851-023), and footwear with rubber outer soles and textile uppers (851-024).

The import value for 1987 was M$10.5 million for the former item and M$9.4 million for the latter. These two items held a 77.7% share of the whole import value of rubber footwear in 1987. As for quantity, the former item totaled 300,000 pairs and the latter totaled 2.2 million pairs. The latter item totaled 68.4% of the import quantity of completed rubber footwear for the year.

c) Footwear with rubber outer soles and textile uppers are being imported continuously, mainly from China and Taiwan. In 1987, of all imports, the imports from China totaled 77% in value and 86.3% in quantity. Imports from Taiwan amounted to 16.6% in value and 11% in quantity.

The No. 3 nation has usually been Korea. In 1985 its imports were valued at M$1.5 million with 194,300 pairs. Since then Korea's figures have not gone over M$1 million or 100,000 pairs (Refer to Table IV.1-12).

d) Of Malaysia's imports of footwear with rubber outer soles and leather or synthetic leather uppers, for 1987, the greatest volume came from Taiwan, followed by West Germany, Korea and Singapore. In 1980, England was No. 1, followed by France, Singapore, West Germany and China. In 1981, West Germany was first, followed by France, China and Singapore.

The trend of the 1980s has been imports changing from European products to products from Korea and Taiwan. Imports from China are on a declining trend (Refer to Table IV.1-13).

e) The third import item of rubber footwear is "footwear with rubber outer soles and uppers with any other material" (851-025). The import value of this item for 1987 was 4.3 times greater than the previous year, amounting to M$4.1 million. This was due to rising imports from Korea, Taiwan and Thailand.

2) Import Tax Rate

a) To protect the domestic industry, a high customs tax is levied on imported products that are the same as those produced domestically. A comparatively high customs tax is imposed on imported rubber footwear. The import tax rate on completed rubber footwear differs according to item, but 30% or M$50, whichever is higher, for 10 pairs, or 40% or M$10, whichever is higher, for 10 pairs, is imposed.

b) During investigations, we have visited some shoe stores. Many imported brand-name products were seen at sports shops. They were also seen in the sporting goods sections of large retail stores. The retail prices for these imported brand-name products were about two or three times higher than the prices for domestic products. Many people were seen wearing famous imported brand-name products while jogging or walking in town. It is believed that demand for these foreign brand-name products is firmly established.

Table IV. 1-9 Export of "Footwear with Outer Soles and Uppers of Rubber" (SITC 851-014)

Unit: M$1,000, Q'ty 1,000 Pairs

Export to		1980	1981	1982	1983	1984	1985	1986	1987
Total	Value	29,618.8	16,196.4	19,059.3	17,721.2	19,093.7	17,298.2	21,741.2	24,627.9
	(Q'ty)	(3,814.3)	(3,987.3)	(2,083.9)	(1,925.3)	(2,001.9)	(1,777.8)	(1,739.0)	(1,834.3)
Norway	Value	1) 20,259.1	1) 8,851.1	1) 12,829.8	1) 10,799.8	1) 12,617.4	1) 10,738.4	1) 13,122.4	1) 13,222.4
	(Q'ty)	(1,590.7)	(1,693.9)	(899.2)	(728.7)	(901.0)	(720.8)	(902.1)	(872.7)
Sweden	Value	2) 3,882.8	2) 2,191.4	2) 1,626.1	4) 1,075.8	3) 727.2	2) 2,310.4	2) 3,231.0	2) 2,968.7
	(Q'ty)	(560.3)	(498.2)	(143.5)	(80.6)	(62.1)	(279.9)	(270.2)	(219.9)
W. Germany	Value	5) 218.8	159.0	0.7	187.6	4) 608.5	4) 599.8	3) 1,204.9	3) 2,078.3
	(Q'ty)	(21.7)	(17.0)	(0.1)	(11.9)	(26.1)	(86.5)	(64.9)	(144.9)
U.S.A.	Value	4) 385.6	4) 818.9	5) 246.9	2) 2,087.5	2) 2,525.9	3) 922.8	4) 734.1	4) 1,432.6
	(Q'ty)	(225.7)	(482.2)	(99.3)	(384.6)	(472.1)	(215.1)	(50.1)	(135.2)
U.K.	Value	121.7	5) 301.9	4) 574.2	5) 757.5	5) 438.1	5) 254.6	5) 501.7	5) 775.0
	(Q'ty)	(9.7)	(56.0)	(40.2)	(38.3)	(26.8)	(13.8)	(30.1)	(35.1)
Canada	Value	3) 1,271.5	3) 1,895.0	3) 1,158.7	3) 1,095.6	389.5	154.8	321.6	266.6
	(Q'ty)	(198.6)	(208.0)	(119.1)	(108.4)	(29.8)	(11.4)	(11.9)	(14.4)
....									
....									

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade, 1980, 81, 82, 83, 84, 85"
"Malaysia External Trade Statistics, 1986, 87"

Note: Only Major or Specific Countries
1), --, 5) = The Major Countries in Order.

Table IV. 1-10 Export of "Footwear with Outer Soles of Rubber and Uppers of Textile Material" (SITC 851-024)

Unit: M$1,000, Q'ty 1,000 Pairs

Export to		1980	1981	1982	1983	1984	1985	1986	1987
Total	Value	30,906.3	34,053.0	16,953.4	8,211.1	6,260.1	10,451.1	12,212.9	21,111.3
	(Q'ty)	(7,826.1)	(7,786.6)	(3,020.6)	(1,734.0)	(1,020.9)	(1,991.5)	(2,563.7)	(3,589.1)
Italy	Value	593.5	959.7	380.2	230.8	3) 656.2	1) 3,667.8	1) 4,495.1	1) 6,649.7
	(Q'ty)	(129.1)	(201.0)	(83.1)	(43.7)	(107.0)	(728.8)	(630.2)	(673.0)
U.S.A.	Value	4) 2,380.7	3) 2,596.1	3) 3,099.5	4) 889.7	9.9	4) 710.7	3) 2,099.8	2) 3,361.1
	(Q'ty)	(598.1)	(435.9)	(265.0)	(92.6)	(1.2)	(258.5)	(812.2)	(1,178.8)
Canada	Value	14.3	-	-	2.1	-	15.2	278.0	3) 2,613.3
	(Q'ty)	(10.6)			(0.2)		(9.2)	(44.2)	(319.9)
Australia	Value	2) 4,561.8	2) 5,897.7	2) 3,948.7	1) 3,308.1	1) 3,127.2	2) 3,345.6	2) 2,505.2	4) 2,251.1
	(Q'ty)	(1,149.7)	(1,285.1)	(691.8)	(577.4)	(440.5)	(356.8)	(460.8)	(476.1)
Ireland	Value	281.3	485.9	445.6	5) 254.4	5) 153.8	25.6	5) 312.5	5) 1,716.4
	(Q'ty)	(73.9)	(86.9)	(87.6)	(49.3)	(31.8)	(4.9)	(50.1)	(232.1)
U.K.	Value	1) 11,222.7	1) 15,324.3	1) 5,416.6	3) 1,018.7	4) 171.1	27.4	98.7	177.2
	(Q'ty)	(2,969.5)	(3,750.9)	(1,154.4)	(321.0)	(29.1)	(4.0)	(18.4)	(33.9)
W. Germany	Value	3) 3,057.3	5) 1,288.0	394.4	27.8	-	5) 193.8	-	414.6
	(Q'ty)	(598.5)	(306.2)	(91.0)	(3.8)		(41.4)		(60.0)
Singapore	Value	5) 1,845.9	4) 1,374.3	4) 1,257.7	2) 1,562.1	2) 1,611.3	3) 1,768.9	4) 1,606.8	953.2
	(Q'ty)	(525.2)	(306.0)	(284.9)	(479.1)	(310.3)	(379.8)	(375.9)	(220.6)
....									
....									

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade, 1980, 81, 82, 83, 84, 85"
"Malaysia External Trade Statistics, 1986, 87"

Note: Only Major or Specific Countries
1), --, 5) = The Major Countries in Order.

Table IV. 1-11 Export of "Footwear with Outer Soles of Rubber and Uppers of Any Other Material" (SITC 851-025)

Unit: M$1,000, Q'ty 1,000 Pairs

Export to		1980	1981	1982	1983	1984	1985	1986	1987
Total	Value	1,692.4	2,175.4	1,554.8	2,489.1	6,319.2	6,314.2	8,664.8	12,541.6
	(Q'ty)	(369.5)	(397.7)	(268.8)	(376.1)	(785.7)	(510.1)	(833.2)	(1,049.5)
Australia	Value	-	0.02	43.0	1) 1,855.6	1) 6,004.7	1) 6,095.6	1) 7,035.1	1) 7,751.5
	(Q'ty)		(0.001)	(6.0)	(254.1)	(731.6)	(480.1)	(639.9)	(686.3)
Singapore	Value	2) 66.4	2) 266.9	2) 206.8	3) 140.6	3) 61.6	3) 18.8	3) 299.8	2) 1,890.4
	(Q'ty)	(13.8)	(32.9)	(39.1)	(24.0)	(15.7)	(1.6)	(28.5)	(130.2)
Japan	Value	-	-	-	30.3	0.6	7.7	2) 626.7	3) 1,173.8
	(Q'ty)				(0.9)	(0.1)	(0.2)	(80.0)	(62.1)
Philippines	Value	1) 816.5	1) 855.9	1) 523.5	2) 242.5	2) 86.8	2) 42.9	36.5	39.2
	(Q'ty)	(4.8)	(255.2)	(151.9)	(79.1)	(23.3)	(14.8)	(13.9)	(13.2)
....									
....									

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade, 1980, 81, 82, 83, 84, 85"
"Malaysia External Trade Statistics, 1986, 87"

Note: Only Major or Specific Countries
1), --, 5) = The Major Countries in Order.

Table IV 1-12 Import of "Footwear with Outer Soles of Rubber and Uppers of Textile Material" (SITC 851-024)

Unit: M$1,000, Q'ty 1,000 Pairs

Import from		1980	1981	1982	1983	1984	1985	1986	1987
Total	Value	3,653.3	6,283.3	5,951.1	6,563.2	11,098.1	10,621.9	9,690.1	9,437.5
	(Q'ty)	(974.4)	(1,478.9)	(1,397.6)	(1,729.6)	(2,523.4)	(2,054.9)	(2,100.6)	(2,222.5)
China	Value	1) 3,050.7	1) 5,114.1	1) 5,084.8	1) 4,692.3	1) 6,872.9	1) 5,595.8	1) 6,700.7	1) 7,271.3
	(Q'ty)	(896.7)	(1,357.7)	(1,301.2)	(1,492.4)	(1,863.9)	(1,245.4)	(1,649.6)	(1,918.6)
Taiwan	Value	3) 145.5	2) 428.1	2) 358.9	2) 761.7	2) 2,881.5	2) 2,130.5	2) 1,890.1	2) 1,568.4
	(Q'ty)	(20.3)	(41.0)	(54.2)	(134.6)	(520.7)	(434.0)	(350.6)	(244.3)
Korea	Value	4) 114.7	3) 211.0	3) 240.3	3) 237.4	3) 726.0	3) 1,517.1	3) 663.8	3) 279.3
	(Q'ty)	(11.8)	(13.8)	(16.8)	(12.5)	(40.0)	(194.3)	(31.6)	(23.6)
Singapore	Value	5) 62.6	4) 104.5	4) 57.5	95.1	91.6	4) 762.0	4) 90.9	4) 145.1
	(Q'ty)	(6.5)	(12.7)	(5.1)	(12.5)	(11.2)	(101.7)	(9.3)	(8.7)
U.S.A.	Value	1.4	12.3	31.0	88.0	59.0	33.0	20.2	5) 47.4
	(Q'ty)	(0.04)	(0.6)	(1.3)	(2.3)	(1.5)	(3.0)	(0.7)	(0.9)
Thailand	Value	-	4.5	8.1	4.3	35.2	6.8	5) 80.1	36.8
	(Q'ty)		(0.6)	(0.4)	(0.3)	(1.9)	(1.6)	(32.8)	(13.0)
W. Germany	Value	16.6	5) 101.6	5) 51.3	5) 150.8	5) 157.4	81.2	78.3	31.1
	(Q'ty)	(3.0)	(2.0)	(1.8)	(4.4)	(22.4)	(1.8)	(1.3)	(0.5)
H.K.	Value	17.3	96.7	35.6	85.2	141.1	85.3	67.7	30.7
	(Q'ty)	(3.5)	(36.8)	(9.6)	(27.1)	(30.9)	(20.5)	(19.2)	(9.2)
Japan	Value	2) 154.6	45.8	42.5	4) 233.6	4) 174.6	5) 193.0	30.9	15.1
	(Q'ty)	(23.3)	(6.5)	(5.2)	(28.0)	(20.7)	(20.0)	(2.0)	(1.8)
Indonesia	Value	7.4	-	-	0.1	17.7	28.8	5.6	4.8
	(Q'ty)	(0.5)			(0.01)	(2.1)	(0.8)	(1.3)	(0.6)
....									
....									

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade, 1980, 81, 82, 83, 84, 85"
"Malaysia External Trade Statistics, 1986, 87"

Note: Only Major or Specific Countries
1), --, 5) = The Major Countries in Order.

Table IV. 1-13 Import of "Footwear with Outer Soles of Rubber and Uppers of Leather or Composition Leather" (SITC 851-023)

Unit: M$1,000, Q'ty 1,000 Pairs

Import from		1980	1981	1982	1983	1984	1985	1986	1987
Total	Value	3,691.0	6,329.0	9,487.8	9,687.9	10,658.0	10,210.9	6,730.3	10,492.9
	(Q'ty)	(137.6)	(237.5)	(332.2)	(427.1)	(527.0)	(446.9)	(211.0)	(347.4)
Taiwan	Value	86.3	236.0	484.8	2) 933.3	2) 1,323.7	2) 1,544.5	2) 1,109.2	1) 2,540.6
	(Q'ty)	(5.9)	(11.5)	(22.2)	(68.2)	(122.1)	(88.4)	(45.3)	(101.1)
W. Germany	Value	4) 392.1	1) 1,481.7	1) 3,232.5	1) 2,622.8	1) 2,715.3	1) 1,935.6	1) 1,507.0	2) 1,786.3
	(Q'ty)	(9.5)	(54.9)	(98.9)	(82.3)	(137.6)	(54.0)	(29.8)	(56.3)
Korea	Value	13.3	120.7	242.5	278.1	283.7	5) 779.5	156.1	3) 1,616.6
	(Q'ty)	(0.4)	(2.7)	(6.6)	(11.1)	(8.4)	(57.6)	(6.0)	(53.3)
Singapore	Value	3) 601.6	3) 712.9	3) 815.0	5) 726.0	619.0	558.7	4) 526.6	4) 729.0
	(Q'ty)	(31.1)	(35.8)	(33.3)	(45.0)	(28.5)	(25.5)	(22.5)	(27.0)
U.K.	Value	1) 860.7	4) 498.0	5) 571.8	576.5	5) 817.1	4) 838.6	5) 418.5	362.2
	(Q'ty)	(25.2)	(11.0)	(12.6)	(18.9)	(41.6)	(41.6)	(9.2)	(8.7)
France	Value	2) 629.9	2) 848.8	2) 819.1	693.7	751.7	3) 876.3	320.6	301.6
	(Q'ty)	(15.0)	(21.3)	(22.1)	(23.9)	(23.5)	(31.0)	(9.0)	(5.8)
Italy	Value	75.0	194.9	4) 584.0	3) 829.1	4) 846.4	696.7	3) 590.4	303.9
	(Q'ty)	(2.2)	(6.0)	(16.7)	(24.1)	(26.0)	(21.4)	(15.4)	(7.4)
Japan	Value	5) 179.3	5) 343.5	499.7	4) 788.7	3) 978.4	618.2	202.3	133.7
	(Q'ty)	(9.1)	(11.5)	(21.6)	(39.8)	(35.7)	(25.7)	(6.4)	(4.8)
....									
....									

Source: Department of Statistics, "Malaysia Annual Statistics of External Trade, 1980, 81, 82, 83, 84, 85"
"Malaysia External Trade Statistics, 1986, 87"

Note: Only Major or Specific Countries
1), --, 5) = The Major Countries in Order.