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ASSISTANCE IN FORMULATING A DETAILED IMPLEMENTATION PLAN
FOR THE ESTABLISHMENT OF A SEMICONDUCTOR TECHNOLOGY CENTER

SI/MAL/88/801

MALAYSIA

Technical Report: A Study on Electronic Industry in Malaysia*

Prepared for the Government of Malaysia
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

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Vienna

*This report has not been edited.

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TABLE OF CONTENTS

	PAGE
Acknowledgements	III
List of Tables	IV
Purpose and scope of this project	V
Introduction	1
I. EXECUTIVE SUMMARY	2
II. ACTUAL SITUATION/STATUS REPORT ON THE ELECTRONIC INDUSTRIE IN MALAYSIA	
1. Manufacturers	4
1.1. Multinational Companies	7
1.2. Local Industry/Joint Venturers	8
1.3. Supporting Industry	9
1.4. Spin-offs	10
2. Technical Education	10
2.1. Engineering Level	
2.2. Technicians/Skilled Labour	
2.3. Unskilled Labour	
3. M I M O S	11
4. Singapore Status	12
III. CONCLUSIONS AND RECOMMENDATIONS	14

IV. APPENDICES

1. Revised Objectives MIMOS	18
2. List of Companies, Universities, Educational Institutes, Agencies and other Organizations visited	19
3. Other sources of Information	26
4. Ranking of Results	
4.1. Industrial Services	27
4.2. Educational Services	32
4.3. Other Subjects/Problems	37
5. Technology tree	42

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LIST OF TABLES

	PAGE
1. Trade Performance of the Electronic Industry against the IMP Targets, 1986	5
2. Output Structure of the Electronic Industry 1976, 1981 and 1986	6

PURPOSE AND SCOPE OF THE PROJECT

The initial briefing by the Malaysian Institute of Microelectronics Systems (MIMOS) at the beginning of the project showed that the expected scope of this mission should not cope with the planned Semiconductor Centre of MIMOS only but verify the 'Revised Objectives' of MIMOS (Appendix 1) being in line with actual industry demand and requirements as well as with the recommendations of the 'Sectorial Task Force Electronics and Electrical Industry' of the IMP.

MIMOS is expected not only spearheading the R & D activities in the electronic sector but also to offer a wide range of services to the industry including low cost R & D services for those companies wishing to translate product ideas into working prototypes.

By this MIMOS could become a real national focalpoint in Malaysia for the entire electronic industry and all other industrial sectors incorporating 'state-of-the-art-electronics' in their products.

Introduction

The assessment of the actual situation of the Electronic Industry, their technological capability as well as their needs and wants discussed in this report will be based mainly on a qualitative evaluation.

Top management personnel and engineering management in the electronic industry as well as technical educational bodies, government agencies, related organizations and authorities were interviewed, as obtaining quite confidential information on high-tech companies through a standard structured questionnaire survey would be problematic.

Even if this method of assessment may be less definitive than a more objective evaluation, it was used because of the shortage of time and resources as well as because of the nature of the subject matter. Furthermore there was no guarantee however that any other type of survey data could be more accurate than views and opinions from industry insiders and informed sources.

A review of the Electronics Industry status in Malaysia can best be approached by an analysis of the different types of manufacturing companies operating here:

- **Multinationals**
- **Local Industry**
- **Joint Ventures**
- **Supporting Industry**
- **Spin-Offs**

and by an analysis of the key subsectors.

- **Components**
- **Consumer Electronics**
- **Industrial Electronics**

It turned out that the findings and common patterns are independent of the product sub-sectors but could be related quite clearly to the different types of manufacturing companies. For this reason the three sub-sectors are not referred to separately, unless specifically needed.

I. EXECUTIVE SUMMARY

The revised objectives of MIMOS (Appendix 1) are in line with the recommendations of the 'Sectorial Task Force Electronics and Electrical Industry' as well as the actual industry demand and requirements.

Today's Electronics Industry is unbalanced with approx. 80 % of its output being in Electronic Components, practically all of these manufacturers operate out of Free Trade Zones. The added value is between 10-15 % only. There are practically no linkages between firms operating in FTZs and the local industry as FTZ companies do not dispose of 2 out of 3 major company - ingredients: R & D and Marketing. But these two missing activities are creating the spin-offs in high-tech industries. Therefore it is no wonder that in the past years really NO TECHNOLOGY - TRANSFER took place. It is recommended to redirect incentives-programs to promote high-tech entrepreneurs and to support them with a corresponding infrastructure best found in Technology and Science Parks.

There is an overwhelming interest among the entire Electronics Industry in a 'National Electronic Centre' which should offer services to the industry as listed in the appendices 4.1 and 4.2.

The high ranking interest in a Malaysian Wafer Fabrication within the industry shows the willingness and the understanding for the 'competitive edge' in a fast moving industry with product life cycles of 5 years and less.

The by now three years delay in 'MIMOS-Plans' to set up a wafer fabrication should serve as a valuable lesson that time means money and even more important - lost opportunities! The C-MOS-technology selected by MIMOS years ago, did become even more dominant. The chip density has increased approx. 3 times leading to a much higher circuit complexity at roughly tripled set-up-cost! Today the project costs will amount to M\$ 50-55 Million compared to the initial estimated pro-

ject costs of M\$ 17.33 Million. As for the next generation of product the start-up-investment will be close to M\$ 200 Million and as ELECTRONICS will be the major ingredient for future industry growth and competitiveness and 'semiconductor-technology', is the core-technology it is strongly RECOMMENDED:

To approve the acquisition of a state-of-the-art C-MOS-technology. To minimize costs, form a cooperation with a licensing partner and agree to a still to be defined 'joint-venture'.

Time will be the most crucial factor in the extremely rapid changing Semiconductor Technology. It is therefore RECOMMENDED:

To approve the establishment of a NATIONAL ELECTRONIC CENTRE with a wafer fabrication latest by the end of this year and have a wafer fabrication in operation by late 1991/early 1992.

The product strategy to be selected should be a 'NICHE-STRATEGY', high quality oriented and not high volume oriented (see appendix 5, technology tree).

This 'National Electronic Centre' should be partly self-supporting by offering its services to the industry.

II. ACTUAL SITUATION/STATUS REPORT ON THE ELECTRONIC INDUSTRY IN MALAYSIA.

1. Manufacturers

The Trade Performance of the Electronics Industry against the IMP-Target does look impressive on the first sight (Table 1).

The average sales value growth of 14.8 % p.a. between 1982 and 1987 for the sub-sector Electronic components and even 22.5 % for the consumer electronic group over the same period is as impressive, but Table 2 shows that the output structure is unbalanced in comparison to the actual market size of the correspondent sub-sectors.

To have 'all eggs in one basket' could be considered as somewhat risky but to have them there without any possibility of control or way of interaction has to be considered as dangerous. Above statement does by no means recommend to interfere with the existing multinational private enterprises mainly operating out of Free Trade Zones (FTZs) and generating more than 80 % of the Electronic Industry output but does strongly recommend to develop the national electronic industry.

A shortage of technicians and skilled labour is a common concern of all manufacturers operating here. Furthermore it is criticized that FTZ-manufacturers do not supply the local market directly but through Singapore or Hong Kong sales offices only.

So far the Electronic Industry is not represented with a sub-group in the 'Federation of Malaysian Manufacturers' (FMM) - but the FMM is staying in contact with international electronic manufacturers associations.

TABLE 1**TRADE PERFORMANCE OF THE ELECTRONIC-INDUSTRY
AGAINST THE IMP TARGETS, 1986 (MILLION RINGIT)**

Sub-Sector	Export		Import		% Difference	
	Target	Actual	Target	Actual	Export	Import
Electronic Components	4250	5391	3219	5563	39.6	72.8
Consumer Electronics	371	904	470	315	143.7	-33.0
Industrial Electronics	207	143	429	767	-30.9	78.8
TOTAL	4828	6438	4118	6645	33.3	61.4

Source: MIDA

TABLE 2**OUTPUT STRUCTURE OF THE ELECTRONIC INDUSTRY
1976, 1981 AND 1986**

Sub-sector	Year	As % of Total Output of Electronic Industry		
	1976	1981	1986	
Electronic Components	82.3 %	85.4 %	80.0 %	
Consumer Electronics	11.6 %	10.2 %	13.0 %	
Industrial Electronics	6.0 %	4.4 %	7.0 %	

Source: MIDA and Department of Statistics, Malaysia

1.1. Multinationals

All but 3 companies visited operate in Free Trade Zones (FTZ). They all started as strict assembly plants only, using the cheap labour rate and favourable investment terms offered by the Malaysian Government. Over the years more complex manufacturing steps were added. 'Cost improvements programs' run by all Multinationals as standard procedures created 'process-engineering groups' which are referred to quite commonly as "Research at Development Groups". It has to be stated very clearly that this is NO R & D - activity, even so tools, test - and automation equipment is designed.

Product - improvements done locally practically by all manufacturers can be considered as the 'low end' of R & D, leading eventually to a full R & D activity in the future.

Motorola Communication group is the only manufacturer having not only full R & D - facilities and capabilities but also R & D - responsibility for their product range. Several local developed and designed products are in full scale production for export around the world.

As far as specially semiconductor manufacturers are concerned no IC - design and no real wafer fabrication is taking place in Malaysia. National Semiconductors and Motorola have established wafer-fab-facilities but neither one is doing a complete wafer fabrication in this country.

National Semiconductors is just metallizing nearly completed wafers, whereas Motorola is starting with already Ion-implanted wafers, doing the most important wafer fabricating step outside the country. It furthermore has to be noted that the Motorola process set up is for a simple transistor function only (a VLSI - circuit contains 100.000 and plus transistor functions). Nevertheless these wafer-fabrication steps can be considered the first product Know-how-transfer taking place in Malaysia on the semiconductor side at all.

Failure analysis, another Know-how intensive step is being transferred slowly, but a complete failure analysis only can be done with a local wafer fab and a fast and direct feedback to it (appr. 50 % of the failures happen on the wafer level).

There is a complete lack of linkages between FTZ - companies and the rest of the Industry. As the marketing and sales function is missing too completely, quite often products produces 'next door' can be purchased thru a Singapore - or Hongkong sales office only.

1.2. Local Industry/Joint Ventures

Also most local companies started with an 'own designed' product, not too much emphasis is put on a continuous R & D activity. Product and marketing planning as well aren't the rule but the exception. Even Malaysian engineers have both the talent and the experiences to design and develop new products, improve manufacturing processes, if given the opportunity there seems to be a lack of overall management expertise.

To invest heavy in R & D as well as into product design still seems to be the exception as most successfully done by SAPURA with their S 2000 telephone series.

Among all local manufacturers is a solid interest in R & D - as well as in procurement assistance.

Also the request for a 'Central' Testequipment service, product simulation capabilities, PCB-design and prototyping as well as application assistance, customer specific IC Design and corresponding process-capabilities reflect a picture of an 'emerging industry' which needs a guiding hand. The still relatively small size of most local companies

and the too small home market base explains the need and interest for international marketing assistance, as the single companies can not afford own market presence in major export markets.

Also it certainly was the intention to share technology in executed joint venture set ups, it turned out that in one case also after many years of operation (commercially justified) only product adoptions are done locally and due to a softened telecom market planned product R & D activity was not yet started.

1.3. Supporting Industry

A lack of supporting industry is reported by all manufacturers. Particularly the need for precision parts and moulds as well as high quality printed circuit boards (PCB) can not be met by local suppliers.

The supporting industry itself complains about the lack of qualified personnel, not allowing them to meet the expected product standards, particularly of multinationals. The multinationals on the other side hold the low standard of manufacturing equipment of the supporting industry responsible for not meeting their product specifications.

Manufacturers engaged in Industrial Electronics claim that these ancillary firms do not meet their quality standards and they still have to import needed parts and services.

1.4. Spin-offs

An high-tech industry employing close to 100.000 people for sure should have the right entrepreneurial spirit!

The 'comfort-level' of Bumiputras with their actual employers respectively their unwillingness to take up the risk in starting their own business has been indicated as being the key reasons for the relatively low rate of business-start ups. During the last few years a number of ancillary firms started in the Penang area mainly supporting the Semiconductor-Industry.

Multinationals furthermore see in the missing overall management skill one of the 'real' reasons for so few spin-offs.

But in reality the missing R & D-activities and Marketing-functions can be seen as the key to so few spin-offs. The majority of spin-offs in highly industrialized countries is started by ex R & D- and Marketing personnel! Already today one local start-up can be seen as a MIMOS-spin-off!

2. Technical Education

The local Industry as well as multinational companies ask for an overall improvement of the technical education. The education is considered to be too theoretical and not to meet industrial requirements.

2.1. Engineering Level

The lack of any practical industry experiences during or before the university education is held responsible for the unwillingness of graduated engineers to do necessary 'hands on' work in the industry. Furthermore it was stated that there are practically no qualified Bumiputra engineers available to the industry as they seem to have a clear preference to start their business careers with the Civil Service.

2.2. Technicians/Skilled Labour

Industry wide there is a real shortage of technicians and skilled labour. The quality of certificates issued by various vocational institutes varies widely and is considered in many cases as being quite theoretical and not adequate. Some Institutes have established advisory boards including representatives from the surrounding industry.

2.3. Unskilled Labour

With the ongoing automation in the Electronic Industry the demand for unskilled labour will diminish continuously.

3. M I M O S

In line with the revised objectives (see Appendix 1) MIMOS is restructuring and redirecting itself.

Actually there are 4 operational R & D divisions:

- Computer Systems
- Computer Aided Design
- Industrial Projects
- Information Technology

A 5th group is being set up - Semiconductors.

The existing groups have been working in accordance with the R & D - status and approach MIMOS did take after its establishment in 1985.

It was realised by the MIMOS management that R & D for itself does not guarantee future growth and only R & D results in form of products are the base for a future industry growth.

As early as 1985 MIMOS did see the necessity of establishing a 'Semiconductor Technology Centre' in Malaysia to serve the Industry.

A complete project plan including the financial implication was produced. Detailed studies were carried out to determine the most feasible technology. The C-MOS-technology selected by MIMOS years ago, did become even more dominant and can be considered 'the right choice' also for the future. Only the chip-density increased manifold, making the 1.XX micron-process the standard compared to the 3 ... micron-process originally picked.

But not only technology has progressed tremendously in the meantime - so have the costs!

The original cost estimate of ~~RM~~ 17.33 Million adds now up to M\$ 50 - 55 Million for a 1.XX micron-process and will go up to close to M\$ 200 Million for a submicron-process.

4. Singapore Status

Even though MIMOS presented a complete project proposal for a C-MOS-Wafer-Fabrication as early as 1985 it still is only a project proposal!

The Singapore government has been much later to define the set-up of a C-MOS-Wafer-Fabrication as a strategic topic - but their wafer-fabrication went into production a few weeks ago!

Only late 1986 the decision was taken to establish a Singapore Wafer-Fabrication line. It took 10 months only in preparing and finalizing a government - private entity joint venture and a total of only 14 months to build a full operating wafer fab including the entire construction of the building after ground breaking. The actual monthly production capacity is:

- 5000 6" wafers per month (1.2 μ),
- expendable up to 12.000 wafers per month with the capability to process 0.7 μ .
- Total cost \$ 67 Million, thereof: \$ 32 Million for the building
- \$ 35 Million for state of the art large scale production equipment

'Chartered Semiconductor' will concentrate on a line of 'niche' products, using the Sierra-Semiconductor Know-how of combining analog and digital functions on one single chip.

The Economics Development Board (EDB) teamed up with the French, German and Japanese Government to set up vocational trainings for:

- Electronic -
- Automation -
- Mechanic -
- Metalworking - Technicians

The operating costs of these Technical Institutes are born by the EDB. There is a very close cooperation with the local industry and all three Institutes offer project-work to the industry which uses it quite widely. The graduates of above institutes are famed for their 'hands on' training.

The educational standards set by these Institutes are well accepted by the entire industry.

III. CONCLUSIONS AND RECOMMENDATIONS

The use and applications of Microelectronics in practically all manufacturing industries will determine the country's competitiveness and therefore its future growth. Having access to the core technology in microelectronics will be most advantageous in supporting the National Industry.

The technological advances in microelectronics became faster and faster - at multiple costs for the next generations of technology. The C-MOS technology selected years ago by MIMOS already did become the dominant one.

Tentative discussion with semiconductor manufacturers on their willingness to licence such a technology turned out to be quite positive. So far four possible licensors have been identified:

- Motorola
- National Semiconductors
- Philips
- Siemens

All four also indicated possible interest in a joint-venture, naturally depending on the form of the planned set-up.

The government, if it chooses to assign high priority to the development of an indigenous electronic industry must play a more aggressive role in acquiring such a core technology in the shortest possible time. As the time frame is the most crucial point it is strongly

RECOMMENDED:

To give MIMOS the Go-AHEAD within the next 6 months to acquire such a 1.2 ... 1.5 μ C-MOS-Technology.

(Recommendation 1)

After above approval MIMOS should select possible sources for the acquisition of such a technology, start corresponding licence negotiations and prepare a complete Business Plan according industry standards
It is RECOMMENDED:

That MIMOS uses the assistance of an expert with experience in technology transfers and licence negotiations as well as industrial planning methods.
(Recommendation 2)

For having a long lasting flow of Know-how and ongoing technology-transfer as well as to lower the project costs it is RECOMMENDED:

To form a partnership with the LICENSOR (eg. joint-venture).
(Recommendation 3)

To make practical use of the acquired technology the setting up of a wafer-fabrication within a 'Semiconductor Centre' becomes the next logical step. It is RECOMMENDED.

To use the expertise of the Licensor and outside industry resources available in Malaysia and neighbour countries to set up such a facility and get it started within 2 years.
(Recommendation 4)

As the only operating 'part'-wafer-fabrication (MOTOROLA) in this country can process discrete devices only, there will be no duplicating of activity, also not for the foreseeable future.

The Semiconductor Centre should be used for general R & D purposes with the emphasis on 'Applied Developments'. To meet the needs of and support the industry as well as the universities it is RECOMMENDED:

To give this Center 'Profit & Loss - Responsibility' and to operate it like an industrial company.
(Recommendation 5)

To serve the industry best no 'commodity products' should be processed. A 'niche' policy should be applied concentrating on semi-custom-specific-ICs and 'Customer specific-ICs' respectively. It is RECOMMENDED:

To concentrate within this group on the fastest growing subgroup 'PLD' (Programmable Logic Devices) and to sign a cooperation agreement with a technology leader in this field. See: Appendix 5 Technology tree.

(Recommendation 6)

To get all the product and process flexibility desirable it is RECOMMENDED:

To include a 'Silicon Compiler' in the equipment list for the Semiconductor Centre.

(Recommendation 7)

There is an overwhelming interest in a 'National Electronic Centre' in Malaysia. As this demand exists not only from the industry side but also from the Technical Educational side it is RECOMMENDED:

To establish a National Electronic Centre by restructuring MIMOS.

(Recommendation 8)

It is furthermore RECOMMENDED:

That the restructured MIMOS as a National Electronic Centre should be partly self-supporting by offering services and customer specific designs and products to the industry.

(Recommendation 9)

To control and measure the performance of the new MIMOS: It is RECOMMENDED:

That MIMOS introduces industrial type 'Business-Planning' and a regular Internal Reporting system in line with it.

(Recommendation 10)

To meet the industry demand and interest in continuous technical training and education, and promote the country's most valuable resource - it's people - it is RECOMMENDED:

To set up a Training Division at MIMOS offering dedicated training and seminars in electronics at a post-graduate level and organize vocational training together with existing institutes.

(Recommendation 11)

OBJECTIVES OF MIMOS

- **Promote microelectronics as a strategic technology for national development;**

- **Stimulate the coordinated development of an integrated electronics industry;**

- **Enhance the innovativeness and competitiveness of the Malaysian electronics industry;**

- **Support the development of effective and efficient processes in production, manufacture, commerce and services**

LIST OF COMPANIES AND ORGANIZATIONS VISITED

=====

- | | |
|--|---|
| <p>1. SAPURA
BANGUNAN SAPURA
JALAN ENGGANG
ULU KLANG
54200 KUALA LUMPUR
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Mr. Ramli Musa</p> <p>TEL: 4572033 (30 Lines)
TLX: MA 31152 PRECOM
FAX: 03-4575402</p> |
| <p>2. PERNAS NEC
KAWASAN PERINDUSTRIAN
AMPANG/ULU KLANG
PETI SURAT 11
54007 KUALA LUMPUR
MALAYSIA</p> | <p>Asst. Gen. Manager:
Mr. Shaharom Md Shariff</p> <p>TEL: 4560188/4560296
TLX: MA 30023
FAX: 4577659</p> |
| <p>3. SETRON
SETRON (MALAYSIA) BHD.
SUITE 502, 5TH. FLOOR
PERNAS INTERNATIONAL
JALAN SULTAN ISMAIL
50250 KUALA LUMPUR
MALAYSIA</p> | <p>Group Managing Director
Mr. Hj. Abdul Murad Ahmad</p> <p>TEL: 2613211
TLX: MA 21086 SMLBK
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NO. 23A-25A, JALAN JEJAKA 7
TAMAN MALURI
CERAS
55100 KUALA LUMPUR
MALAYSIA</p> | <p>Senior Research &
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Mr. Sin Hock Kian</p> <p>TEL: 9840119
FAX: 9845752</p> |
| <p>5. MELEWAR TECHNOLOGIES
SDN. BHD.
LOT 1, 1ST. FLOOR
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6. LOSHITA SDN. BHD.
12, LEBOH RAYA KAPAL
OFF CHAN FERRY ROAD
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12100 BUTTERWORTH
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8. POWER ELECTRONIC
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9. POWERMATIC SDN. BHD.
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12. ROBERT BOSCH (MALAYSIA)
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16. INTEL TECHNOLOGY
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17. MOTOROLA MALAYSIA SDN.BHD.
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13600 PERAI
PENANG
MALAYSIA
- General Manager:
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TLX: MA 47138 V DOMAL
FAX: 04-308194
19. LITRONIX MALAYSIA
SDN. BHD.
BAYAN LEPAS
FREE TRADE ZONE
11900 PENANG
MALAYSIA
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FAX: 04-834063
20. MOTOROLA MALAYSIA
SDN. BHD.
SEMICONDUCTOR PRODUCTS
SECTOR
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Affairs & Employment:
Mr. Hassim Hj. Abd. Majid
- TEL: 7761166
TLX: MOTMAY MA 37695
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21. PHILIPS
PHILIPS GROUP OF CO.
IN MALAYSIA
WISMA PHILIPS
NO. 3, JALAN SS 15/2A
SUBANG JAYA, PETALING JAYA
SELANGOR
- Chief Executive:
Mr. Atok Ilhan
- TEL: 4567077
TLX: MA 25111
22. TEXAS INSTRUMENTS
MALAYSIA SDN BHD
PETI SURAT 12221
50942 KUALA LUMPUR
MALAYSIA
- Managing Director:
Mr. Jerry W Lee
TEL: 4567077
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23. ERICSSON
MOBILE TELEPHONE
SYSTEMS DIVISION
JALAN SEPANA 15/3
P O BOX 28
SHAH ALAM
SELANGOR
MALAYSIA
- Marketing Manager:
Mr. Zamani Zakariah
- TEL: 03-5591821
TLX: ECM MA 38645
FAX: 03-5593084

24. MOTOROLA SEMICONDUCTOR
SDN. BHD.
SEMICONDUCTOR PRODUCT
SECTOR
P O BOX 465
70450 SEREMBAN
NEGERI SEMBILAN
MALAYSIA
- Manager:
Mr. Lee Chong Seng
- TEL: 06-773088
TLX: MOTSEN MA 63862
FAX: 06-771378
25. SIEMENS COMPONENTS
SDN. BHD.
FREE TRADE ZONE
BATU BERENDAM
P O BOX 177
75914 MELAKA
MALAYSIA
- Managing Director:
Mr. K. Obermeier
- TEL: 06-325266
TLX: SIEMAL MA 62844
FAX: 06-321539
26. WORKERS INSTITUTE
OF TECHNOLOGY
JALAN PANDAMARAN
42000 PORT KELANG
SELANGOR
MALAYSIA
- Advisor for Vocational
Training: Mr. Franz Maier
- TEL: 03-3688859
27. UNIVERSITI TEKNOLOGI
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ELECTRONIC FACULTY
JALAN SEMARAK
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MALAYSIA
28. UNIVERSITI MALAYA
PHYSICS DEPARTMENT
59100 KUALA LUMPUR
MALAYSIA
- TEL: 7555466
TLX: MA 39845
FAX: 7573661
29. UNIVERSITI KEBANGSAAN
MALAYSIA
ELECTRONIC FACULTY
43600 BANGI
SELANGOR
MALAYSIA

30. MEXPO
TINGKAT BAWAH & TINGKAT 2
BANGUNAN PKNS.
JALAN RAJA LAUT
50350 KUALA LUMPUR
MALAYSIA
Mr. Nik Rahmat
31. MALAYSIAN INDUSTRIAL
DEVELOPMENT AUTHORITY
(MIDA)
G.3, 4, 5 & 6 FLOORS
WISMA DAMANSARA
DAMANSARA HEIGHTS
P O BOX 10618
50720 KUALA LUMPUR
MALAYSIA
TEL: 2553633
TLX: MA 30752
FAX: 2557970
32. DEUTSCHE BANK
YEE SENG BUILDING
50200 KUALA LUMPUR
MALAYSIA
General Manager:
Mr. Heinz Pohlsen
TEL. 2329455
33. PENANG DEVELOPMENT
CORPORATION
NO. 1, JALAN SUNGEI NIBONG
11909 BAYAN LEPAS
PULAU PINANG
MALAYSIA
Manager:
Mr. Lim Pao Li
TEL: 04-832111
TLX: PESCOR MA 40630
FAX: 04-832405
34. FEDERATION OF MALAYSIAN
MANUFACTURERS
17TH. FLOOR, WISMA SIME DARBY
JALAN RAJA LAUT
50350 KUALA LUMPUR
MALAYSIA
Deputy Director:
Mr. Lee Cheng Suan
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35. BANK INDUSTRI
MALAYSIA BERHAD
LEVELS 14-18
BANGUNAN BANK INDUSTRI
JALAN SULTAN ISMAIL
50724 KUALA LUMPUR
MALAYSIA
Manager Credit II Dpt.
Mr. Ungku Mohd.Yusof Ahmad
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TLX: MA 31546
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36. CHARTERED SEMICONDUCTOR
PTE LTD
NO. 2 SCIENCE PARK DRIVE
SINGAPORE SCIENCE PARK
SINGAPORE 0511

General Manager:
Mr. John Hambidge

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37. FRENCH-SINGAPORE
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38. GERMAN-SINGAPORE
INSTITUTE
10, SCIENCE CENTRE ROAD
JURONG
SINGAPORE 2260

Director:
Mr. Klaus Krueger

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Other Sources of Information

- **Medium and Long Term Industrial Master Plan Malaysia**
 - **Volume II, Part 8: Electronics And Electrical Industry**
 - **Volume III, Part 6: R & D And Technology Policies**
 - **Executive Highlights**
 - **Annual Report 1986/1987 Sectorial Task Forces**
- **The Establishment of the Semiconductor Technology Centre (MIMOS)**
- **Report on the Study Tour of Semiconductor Technology Centres (MIMOS)**

RANKING OF INDUSTRIAL SERVICES REQUESTED (by Sample Groups)

	: Local : Industry	: Multi- : National : Companies	: Educational: : Institutional	: Government: : Agencies & : Others	: Total
Central information service: on microelectronics	8	6	4	4	22
-Technology monitoring	4	2	3	3	12
Test Equipment service	9	8	4	-	21
Product-simulation capabilities (digital/ analog/mechanic)	8	7	3	-	18
VLSI design	7	5	3	-	15
-ASIC/PLD design	7	2	2	-	11
VLSI-process capability	7	5	3	-	15
-Sampling/Prototyping	7	5	3	-	15
-Low volume production	6	4	-	-	10
CAD/CAM service	7	4	3	-	14
PCB design	7	2	3	-	12
-Multilayer	7	1	3	-	11
-Flexible	2	1	-	-	3
PCB prototyping/Low volume production	7	2	3	-	12
-Multilayer	7	1	3	-	11
-Flexible	2	1	-	-	3
Latest software tools and services	6	2	3	-	11
Optimising circuitry	8	2	-	-	10
Failure Analysis	6	5	-	-	11
Software support	5	2	3	-	10
Assistance in international: marketing	5	1	-	2	8
-Market feasibility studies:	-	2	-	4	6
Assistance in technical joint activities with other companies i.e. layouts, ASICs and PLD:	6	1	-	-	7
Central purchasing service	4	-	-	1	5

RANKING OF INDUSTRIAL SERVICES REQUESTED (by Sample Groups)

LOCAL MANUFACTURERS/ JOINT VENTURES	1	2	3	4	5	6	7	8	9	10	11	Sum Local	Total
Central information service: on microelectronics	-	X	X	-	X	X	-	X	X	X	X	8	22
-Technology monitoring	X	-	-	-	-	-	-	-	X	X	X	4	12
Test Equipment service	X	X	-	X	-	X	X	X	X	X	X	9	21
Product-simulation capabilities (digital/ analog/mechanic)	X	X	-	X	X	-	X	-	X	X	X	8	18
ULSI design	X	X	-	X	X	-	-	X	-	X	X	7	15
-ASIC/PLD design	X	X	-	X	X	-	-	X	-	X	X	7	11
ULSI-process capability	X	X	-	X	X	-	-	X	-	X	X	7	15
-Sampling/Prototyping	X	X	-	X	X	-	-	X	-	X	X	7	15
-Low volume production	-	X	-	X	X	-	-	X	-	X	X	6	10
CAD/CAM service	-	X	-	X	X	-	X	X	X	-	X	7	14
PCB design	-	X	-	X	X	-	X	X	-	X	X	7	12
-Multilayer	-	X	-	X	X	-	X	X	-	X	X	7	11
-Flexible	-	-	-	-	-	-	-	X	-	X	-	2	3
PCB prototyping/Low volume production	-	X	-	X	X	-	X	X	-	X	X	7	12
-Multilayer	-	X	-	X	X	-	X	X	-	X	X	7	11
-Flexible	-	-	-	-	-	-	-	X	-	X	-	2	3
Latest software tools and services	-	X	-	X	X	X	-	-	X	-	X	6	11
Optimising circuitry	X	X	X	X	X	-	-	-	X	X	X	8	10
Failure Analysis	-	X	-	X	-	-	-	X	X	X	X	6	11
Software support	-	-	-	X	-	X	-	-	X	X	X	5	10
Assistance in international marketing	X	-	-	-	-	-	-	X	X	X	X	5	8
-Market feasibility studies	-	-	-	-	-	-	-	-	-	-	-	-	6
Assistance in technical joint activities with other companies i.e. layouts, ASICs and PLD	-	-	-	X	-	X	X	X	X	-	X	6	7
Central purchasing service	-	-	X	X	X	-	-	-	-	-	X	4	5

RANKING OF INDUSTRIAL SERVICES REQUESTED (by Sample Groups)

MULTINATIONAL MANUFACTURERS	:12	:13	:14	:15	:16	:17	:18	:19	:20	:21	:22	:23	:24	:25	Sum	Total
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	Multi	:
Central information service: on microelectronics	-	-	X	-	X	-	X	-	-	X	-	X	X	-	6	22
-Technology monitoring	-	-	-	-	-	X	-	-	-	-	-	-	X	-	2	12
Test Equipment service	-	-	-	-	X	X	X	X	X	-	-	X	X	X	8	21
Product-simulation capabilities (digital/ analog/mechanic)	-	-	X	X	-	X	-	-	-	-	X	X	X	X	7	18
ULSI design	-	X	-	X	X	-	-	X	-	-	-	-	-	X	5	15
-ASIC/PLD design	-	-	-	X	X	-	-	-	-	-	-	-	-	-	2	11
ULSI-process capability	-	-	-	X	-	-	X	X	-	X	-	-	-	X	5	15
-Sampling/Prototyping	-	-	-	X	-	-	X	X	-	X	-	-	-	X	5	15
-Low volume production	-	-	-	X	-	-	X	X	-	X	-	-	-	-	4	10
CAD/CAM service	-	-	-	-	-	-	-	X	X	-	X	-	-	X	4	14
PCB design	-	-	-	-	X	-	-	X	-	-	-	-	-	-	2	12
-Multilayer	-	-	-	-	-	-	-	X	-	-	-	-	-	-	1	11
-Flexible	-	-	-	-	-	-	-	X	-	-	-	-	-	-	1	3
PCB prototyping/Low volume production	-	-	-	-	X	-	-	X	-	-	-	-	-	-	2	12
-Multilayer	-	-	-	-	-	-	-	X	-	-	-	-	-	-	1	11
-Flexible	-	-	-	-	-	-	-	X	-	-	-	-	-	-	1	3
Latest software tools and services	-	X	X	-	-	-	-	-	-	-	-	-	-	-	2	11
Optimising circuitry	-	-	-	-	X	-	-	-	-	-	X	-	-	-	2	10
Failure Analysis	-	X	-	-	X	-	-	-	X	-	-	X	-	X	5	11
Software support	-	X	-	-	X	-	-	-	-	-	-	-	-	-	2	10
Assistance in international marketing	-	-	-	-	X	-	-	-	-	-	-	-	-	-	1	8
-Market feasibility studies	-	-	-	X	-	-	-	-	-	-	X	-	-	-	2	6
Assistance in technical joint activities with other companies i.e. layouts, ASICs and PLD:	-	-	-	-	X	-	-	-	-	-	-	-	-	-	1	7
Central purchasing service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5

RANKING OF INDUSTRIAL SERVICES REQUESTED (by Sample Groups)

EDUCATIONAL INSTITUTIONS	:26	:27	:28	:29	Sum	Total
	:	:	:	:	:Edu'ion:	:
Central information service on microelectronics	X	X	X	X	4	22
-Technology monitoring	-	X	X	X	3	12
Test Equipment service	X	X	X	X	4	21
Product-simulation capabilities (digital/analog/mechanic)	-	X	X	X	3	18
VLSI design	-	X	X	X	3	15
-ASIC/PLD design	-	-	X	X	2	11
VLSI-process capability	-	X	X	X	3	15
-Sampling/Prototyping	-	X	X	X	3	15
-Low volume production	-	-	-	-	-	10
CAD/CAM service	-	X	X	X	3	14
PCB design	-	X	X	X	3	12
-Multilayer	-	X	X	X	3	11
-Flexible	-	-	-	-	-	3
PCB prototyping/Low volume production	-	X	X	X	3	12
-Multilayer	-	X	X	X	3	11
-Flexible	-	-	-	-	-	3
Latest software tools and services	-	X	X	X	3	11
Optimising circuitry	-	-	-	-	-	10
Failure Analysis	-	-	-	-	-	11
Software support	-	X	X	X	3	10
Assistance in international marketing	-	-	-	-	-	8
-Market feasibility studies	-	-	-	-	-	6
Assistance in technical joint activities with other companies i.e. layouts, ASICs and PLD	-	-	-	-	-	7
Central purchasing service	-	-	-	-	-	5

RANKING OF INDUSTRIAL SERVICES REQUESTED (by Sample Groups)

	:30	:31	:32	:33	:34	:35	Sum	Total
GOVERNMENT AGENCIES & OTHERS	:	:	:	:	:	:	Govt	:
Central information service: on microelectronics	X	-	-	X	X	X	4	22
-Technology monitoring	X	-	-	X	-	X	3	12
Test Equipment service	-	-	-	-	-	-	-	21
Product-simulation capabilities (digital/analog/mechanic)	-	-	-	-	-	-	-	18
VLSI design	-	-	-	-	-	-	-	15
-ASIC/PLD design	-	-	-	-	-	-	-	11
VLSI-process capability	-	-	-	-	-	-	-	15
-Sampling/Prototyping	-	-	-	-	-	-	-	15
-Low volume production	-	-	-	-	-	-	-	10
CAD/CAM service	-	-	-	-	-	-	-	14
PCB design	-	-	-	-	-	-	-	12
-Multilayer	-	-	-	-	-	-	-	11
-Flexible	-	-	-	-	-	-	-	3
PCB prototyping/Low volume production	-	-	-	-	-	-	-	12
-Multilayer	-	-	-	-	-	-	-	11
-Flexible	-	-	-	-	-	-	-	3
Latest software tools and services	-	-	-	-	-	-	-	11
Optimising circuitry	-	-	-	-	-	-	-	10
Failure Analysis	-	-	-	-	-	-	-	11
Software support	-	-	-	-	-	-	-	10
Assistance in international marketing	-	-	-	X	-	X	2	8
-Market feasibility studies	-	X	X	X	-	X	4	6
Assistance in technical joint activities with other companies i.e. layouts, ASICs and PLD	-	-	-	-	-	-	-	7
Central purchasing service	-	-	-	-	-	X	1	5

RANKING OF EDUCATIONAL SERVICES REQUESTED (by Sample Groups)

	Local Industry	Multi- National Companies	Educational Institution	Government Agencies & Others	Total
Post graduate training on various technical subjects	6	10	3	1	20
Shortage of technicians/ skilled labour	7	10	2	-	19
Training failure analysis	8	6	3	-	17
Seminars on latest IC technology	6	4	3	2	15
Supporting industry general	4	7	-	2	13
-too low quality	3	5	-	-	8
-precision parts and moulds	4	5	-	-	9
-on time delivery	2	4	-	-	6
General level of technical education is too low/ theoretical	4	7	1	1	13
Training SMT	6	1	1	-	8
Involvement in M.E. degree	-	1	3	-	4
English level of students/ workers is dropping	1	1	1	-	3

RANKING OF EDUCATIONAL SERVICES REQUESTED (by Sample Groups)

LOCAL INDUSTRY	1	2	3	4	5	6	7	8	9	10	11	Sum Local	Total
Post graduate training on various technical subjects	X	-	-	-	-	X	-	X	X	X	X	6	20
Shortage of technicians/ skilled labour	-	X	-	-	X	X	X	X	X	-	X	7	19
Training failure analysis	-	X	X	X	X	-	-	X	X	X	X	8	17
Seminar on latest IC technology	-	X	-	-	X	X	X	-	X	-	X	6	15
Supporting industry general	-	-	-	-	-	X	-	X	-	X	X	4	13
-too low quality	-	-	-	-	-	X	-	X	-	X	-	3	8
-precision parts and moulds	-	-	-	-	-	X	-	X	-	X	X	4	9
-on time delivery	-	-	-	-	-	X	-	X	-	-	-	2	6
General level of technical education is too low/ theoretical	-	-	-	-	-	X	X	X	-	-	X	4	13
Training SMT	-	X	X	-	-	-	-	X	X	X	X	6	8
Involvement in M.E. degree	-	-	-	-	-	-	-	-	-	-	-	-	4
English level of students/ workers is dropping	-	-	-	-	-	X	-	-	-	-	-	1	3

RANKING OF EDUCATIONAL SERVICES REQUESTED (by Sample Groups)

MULTINATIONAL COMPANIES	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum Multi	Total
Post graduate training on various technical subjects	-	X	X	-	X	X	X	X	X	X	-	-	X	X	10	20
Shortage of technicians/skilled labour	X	X	-	-	-	X	X	X	X	X	X	-	X	X	10	19
Training failure analysis	-	X	X	-	-	X	-	-	X	-	-	-	X	X	6	17
Seminar on latest IC technology	-	X	X	-	-	-	-	-	-	X	X	-	-	-	4	15
Supporting industry general	X	X	-	-	-	X	X	-	-	-	-	X	X	X	7	13
-too low quality	X	X	-	-	-	X	X	-	-	-	-	-	-	X	5	8
-precision parts and moulds	X	X	-	-	-	X	X	-	-	-	-	-	-	X	5	9
-on time delivery	X	X	-	-	-	X	X	-	-	-	-	-	-	-	4	6
General level of technical education is too low/theoretical	X	-	-	-	-	X	X	X	X	-	-	-	X	X	7	13
Training SMT	-	-	-	-	-	-	-	-	X	-	-	-	-	-	1	8
Involvement in M.E. degree	-	-	X	-	-	-	-	-	-	-	-	-	-	-	1	4
English level of students/workers is dropping	X	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3

RANKING OF EDUCATIONAL SERVICES REQUESTED (by Sample Groups)

EDUCATIONAL INSTITUTIONS	:26	:27	:28	:29	: Sum	: Total
	:	:	:	:	:Edu'ion:	:
Post graduate training on various technical subjects	-	X	X	X	3	20
Shortage of technicians/skilled labour	-	X	X	-	2	19
Training failure analysis	-	X	X	X	3	17
Seminar on latest IC technology	-	X	X	X	3	15
Supporting industry general	-	-	-	-	-	13
-too low quality	-	-	-	-	-	8
-precision parts and moulds	-	-	-	-	-	9
-on time delivery	-	-	-	-	-	6
General level of technical education is too low/theoretical	X	-	-	-	1	13
Training SMT	-	-	X	-	1	8
Involvement in M.E. degree	-	X	X	X	3	4
English level of students/workers is dropping	X	-	-	-	1	3

RANKING OF EDUCATIONAL SERVICES REQUESTED (by Sample Groups)

GOVERNMENT AGENCIES & OTHERS	:30	:31	:32	:33	:34	:35	: Sum Gov't	: Total
Post graduate training on various technical subjects	-	-	-	X	-	-	1	20
Shortage of technicians/skilled labour	-	-	-	-	-	-	-	19
Training failure analysis	-	-	-	-	-	-	-	17
Seminar on latest IC technology	-	-	X	X	-	-	2	15
Supporting industry general	-	-	X	X	-	-	2	13
-too low quality	-	-	-	-	-	-	-	8
-precision parts and moulds	-	-	-	-	-	-	-	9
-on time delivery	-	-	-	-	-	-	-	6
General level of technical education is too low/theoretical	-	-	X	-	-	-	1	13
Training SMT	-	-	-	-	-	-	-	8
Involvement in M.E. degree	-	-	-	-	-	-	-	4
English level of students/workers is dropping	-	-	-	-	-	-	-	3

RANKING OF OTHER SUBJECTS/PROBLEMS IDENTIFIED (by Sample Groups)

	: Local : Industry :	: Multi- : National : Companies	: Educational : Institution :	: Government : Agencies & : Others	: Total :
No local supply out of FTZ	: 7	: 9	: 1	: -	: 17
Incentives for use/ increasing local content	: 10	: 4	: -	: 1	: 15
No standardized technical exams	: 4	: 3	: 3	: 1	: 11
Technical product assesment	: 1	: 3	: 1	: 4	: 9
Approval procedures too long	: 5	: 1	: -	: 2	: 8
Free design sevice for local industry	: 6	: 1	: -	: 1	: 8
Technical entrepreneurial assesment	: 1	: 3	: 1	: 3	: 8
'Pioneer status' not given to vital supporting industry	: 2	: 2	: -	: 2	: 6
Advisory capacity on state of-the-art microelectronics	: -	: -	: 2	: 3	: 5
Added value in manufacturing is very low	: 1	: -	: -	: 3	: 4
Power failures	: 2	: 1	: -	: -	: 3
Toxic waste disposals	: -	: 3	: -	: -	: 3
Upcoming unionization	: -	: 2	: -	: 1	: 3
Industry leaves for MIMOS staff	: 1	: 2	: -	: -	: 3

RANKING OF OTHER SUBJECTS/PROBLEMS IDENTIFIED (by Sample Groups)

LOCAL INDUSTRY	1	2	3	4	5	6	7	8	9	10	11	Sum	Total
												Local	
No local supply out of FTZ	-	X	X	X	-	-	-	X	X	X	X	7	17
Incentives for use/ increasing local content	X	X	X	X	-	X	X	X	X	X	X	10	15
No standardized technical exams	-	-	-	-	X	X	-	X	-	X	-	4	11
Technical product assessment	-	-	-	-	-	-	X	-	-	-	-	1	9
Approval procedures too long	-	-	-	-	X	X	X	X	X	-	-	5	8
Free design service for local industry	-	-	X	-	-	X	-	X	X	X	X	6	8
Technical entrepreneurial assessment	-	-	-	-	-	X	-	-	-	-	-	1	8
'Pioneer status' not given to vital supporting industry	-	-	-	-	-	X	X	-	-	-	-	2	6
Advisory capacity on state of-the-art microelectronics	-	-	-	-	-	-	-	-	-	-	-	-	5
Added value in manufacturing is very low	-	-	-	-	-	-	X	-	-	-	-	1	4
Power failures	-	-	-	-	-	-	-	-	X	-	X	2	3
Toxic waste disposals	-	-	-	-	-	-	-	-	-	-	-	-	3
Upcoming unionization	-	-	-	-	-	-	-	-	-	-	-	-	3
Industry leaves for MIMOS staff	-	-	-	-	-	-	-	X	-	-	-	1	3

RANKING OF OTHER SUBJECTS/PROBLEMS IDENTIFIED (by Sample Groups)

MULTINATIONAL COMPANIES	:12	:13	:14	:15	:16	:17	:18	:19	:20	:21	:22	:23	:24	:25	Sum	Total
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	Multi	:
No local supply out of FTZ	-	-	X	X	-	X	X	X	X	-	X	X	-	X	9	17
Incentives for use/ increasing local content	-	-	-	-	X	-	X	-	-	X	X	-	-	-	4	15
No standardized technical exams	X	-	-	-	-	X	X	-	-	-	-	-	-	-	3	11
Technical product assessment	-	-	-	X	-	X	-	-	-	-	X	-	-	-	3	9
Approval procedures too long	-	-	-	-	-	X	-	-	-	-	-	-	-	-	1	8
Free design service for local industry	-	-	-	-	X	-	-	-	-	-	-	-	-	-	1	8
Technical entrepreneurial assessment	-	-	-	X	-	X	-	-	-	-	X	-	-	-	3	8
'Pioneer status' not given to vital supporting industry	X	X	-	-	-	-	-	-	-	-	-	-	-	-	2	6
Advisory capacity on state of-the-art microelectronics	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Added value in manufacturing is very low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Power failures	-	X	-	-	-	-	-	-	-	-	-	-	-	-	1	3
Toxic waste disposals	-	X	-	X	-	-	-	-	-	-	-	-	X	-	3	3
Upcoming unionization	X	X	-	-	-	-	-	-	-	-	-	-	-	-	2	3
Industry leaves for MIMOS staff	-	-	X	X	-	-	-	-	-	-	-	-	-	-	2	3

RANKING OF OTHER SUBJECTS/PROBLEMS IDENTIFIED (by Sample Groups)

EDUCATIONAL INSTITUTIONS	:26	:27	:28	:29	: Sum : Edu'ion:	: Total :
No local supply out of FTZ	-	-	X	-	1	17
Incentives for use/ increasing local content	-	-	-	-	-	15
No standardized technical exams	X	X	X	-	3	11
Technical product assesment	X	-	-	-	1	9
Approval procedures too long	-	-	-	-	-	8
Free design sevice for local industry	-	-	-	-	-	8
Technical entrepreneurial assesment	X	-	-	-	1	8
'Pioneer status' not given to vital supporting industry	-	-	-	-	-	6
Advisory capacity on state of-the-art microelectronics	-	-	X	X	2	5
Added value in manufacturing is very low	-	-	-	-	-	4
Power failures	-	-	-	-	-	3
Toxic waste disposals	-	-	-	-	-	3
Upcoming unionization	-	-	-	-	-	3
Industry leaves for MIMOS staff	-	-	-	-	-	3

RANKING OF OTHER SUBJECTS/PROBLEMS IDENTIFIED (by Sample Groups)

GOVERNMENT AGENCIES & OTHERS	:30	:31	:32	:33	:34	:35	Sum Gov't	Total
No local supply out of FTZ	-	-	-	-	-	-	-	17
Incentives for use/ increasing local content	-	-	-	-	-	X	1	15
No standardized technical exams	-	-	X	-	-	-	1	11
Technical product assesment:	-	X	X	X	-	X	4	9
Approval procedures too long	-	X	X	-	-	-	2	8
Free design sevice for local industry	-	-	-	-	-	X	1	8
Technical entrepreneural assesment	-	X	X	X	-	-	3	8
'Pioneer status' not given to vital supporting industry	-	X	X	-	-	-	2	6
Advisory capacity on state of-the-art microelectronics:	X	-	-	X	-	X	3	5
Added value in manufacturing is very low	-	X	X	X	-	-	3	4
Power failures	-	-	-	-	-	-	-	3
Toxic waste disposals	-	-	-	-	-	-	-	3
Upcoming unionization	-	-	X	-	-	-	1	3
Industry leaves for MIMOS staff	-	-	-	-	-	-	-	3

PRODUCT TREE OF SEMICONDUCTOR DEVICES



