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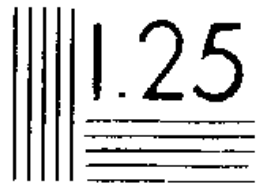
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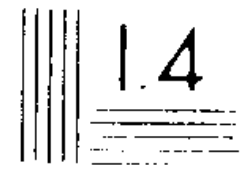
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A STUDY ON MICROELECTRONICS INDUSTRY IN BANGLADESH

REPORT

BY

TAFAZZAL HUSSAIN

United Nations Industrial Development Organisation

Vienna, Austria (Contract No. ID/SER-335)

January 31, 1984.

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P R E F A C E

This study on microelectronics industry in Bangladesh was undertaken by the Consultant at the instance of United Nations Industrial Development Organisation in response to a cable received from Mr. M. Venkataraman, Special Technical Adviser, UNIDO Technology Programme, Vienna International Centre, Austria.

The study was to commence from December 1 and expire on December 31, 1983. But as the detailed terms of reference were not received by the Consultant in full until December 25, a request was made for extension of time till January 31, 1984 for completing the study, which was agreed to by UNIDO. In the meantime, the Consultant started his preliminary enquiries.

The study was commenced in full swing on receipt of the complete terms of reference on December 25, 1983. The terms of reference will be found in Annexure-I. The Consultant was able to complete his studies and draft report by January 31, 1984. The final report, however, took a few days to be refined and fair-typed before it was despatched to UNIDO, Vienna.

In drawing up his findings and report, the Consultant has been largely benefited by the interviews held with various personages concerned with national policy and strategy, R & D, manpower development and other matters related to microelectronics industry in Bangladesh. He has also gained by useful information available through visits to related industrial units in the county. In this regard, the Consultant is particularly grateful to Dr. Abdus Sattar Syed, Ph.D, who was lately Chief of R & D centre in the Telephone Shilpa Sangstha Limited, an enterprise of Telegraph & Telecommunication Division of the Government of the People's Republic of Bangladesh. Dr. Sattar Syed's assistance in making a few industry visits and taking some of the interviews himself and offering useful suggestions to make the study meaningful is thankfully acknowledged. The Consultant's thanks are also due to the field investigators who undertook enquiries in related industrial units and to Mr. Nibaran Chandra Dey, a Research Economist whose expert help

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in analysing and tabulating the results of the industry visits proved to be very interesting.

The Consultant has tried to direct his studies to the pattern indicated in the terms of reference and bring out as much information as possible on the main issues involved at the national level and on the potentialities of international and regional co-operation. He is conscious of the inadequacies of existing infrastructure and indigenous sources for proper assessment of the state-of-the-art in microelectronics and identification of the areas of regional and international co-operation. Nevertheless, the Consultant has, undoubtedly, received unstinted co-operation, encouragement and valuable information from all quarters, beginning from the Hon'ble Ministers, heads of relevant Ministries, Departments and autonomous agencies of the Government of the People's Republic of Bangladesh down to the top-level management authorities of the industries visited in all matters relating to the development of microelectronics industry in the country.

In preparing the memorandum of interviews, reasonable care was taken to make the reproduction of the substance thereof as correctly as possible; yet errors or omissions may have unwittingly crept in, for which, the Consultant is offering his sincere apologies.

Lastly, the Consultant has to acknowledge his deep appreciation of the efforts initiated by UNIDO in having proper studies made in the area of microelectronics development in the selected countries of the Asian region, including Bangladesh. The Consultant, however, would like to impress that his individual activities for technology transfer are based upon and linked with the Members of the Asia Electronics Union.

T. Hussain,
CONSULTANT

SUMMARY OF CONCLUDING REMARKS OF THE REPORT

1. Bangladesh is now at the assembly base of consumer electronic products for domestic market. It is felt that steps for the setting up of microelectronics industry be taken up in the country as early as possible. This should be a joint-venture industry with reputed foreign companies willing to invest and transfer technology.

2. A feasibility study should be undertaken first to identify areas or processes for which such joint-venture projects should be launched. To start with, any such joint-venture project should be export-oriented.

3. Adequate incentives are to be offered to attract foreign investment:

(a) by treating this sub-sector of industry on priority basis on the part of development financing institutions;

(b) by establishing an air-based export processing zone in Dhaka; and

(c) by offering large tax and fiscal concessions and other facilities.

4. A National Institute of Electronics should be set up by expanding the role and scope of the existing Institute of Electronics and Material Science of the Atomic Energy Commission for gearing up and co-ordinating R & D activities at national level.

5. A multi-disciplinary approach is essential for the development of microelectronics industry.

6. Early formulation of a national policy and plan for the development of electronics industry and manpower training is essential. Existing facilities in the country for manpower training have to be strengthened and expanded.

7. For maintenance and servicing of electronic equipments existing facilities are inadequate to meet the needs of the country. These facilities should be made more comprehensive.

8. For development of software, existing facilities are insufficient for the national need. Special attention is required to develop software for export to countries where computer software expertise is in great demand.

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9. Transfer of technology to Bangladesh, which is one of the least developed countries, may take place in various ways. One of these ways is to have an institute or centre for electronics technology established in the country through international co-operation on the lines proposed at the 8th General Assembly of the Asia Electronics Union in Jakarta, October 21, 1983.

10. Regional and international co-operation is essential for expansion of manpower training and R & D facilities through sharing of the available facilities in Japan and India under bilateral Science and Technology Agreements entered into with these countries. Assistance of UN agencies will go a long way in promotion of manpower training and technology transfer.

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A STUDY ON MICROELECTRONICS INDUSTRY IN BANGLADESH

CHAPTER - 1

INTRODUCTION

1. The nature of study :

1.1 The United Nations Industrial Development Organisation (UNIDO) co-sponsored an International Symposium on "Electronics for Productivity" along with the Asia Electronics Union (AEU), Japan in New Delhi on April 21-23, 1983. The symposium was organised by the Electronics Commission (IPAG) of the Government of India. Apart from the central theme of the seminar as stated above, two special sessions were earmarked for deliberations on technology transfer. One such session was chaired by the Consultant in his capacity as Chairman of the Working Group for Technology Transfer (WGTT) formed in the 7th General Assembly of the AEU in December, 1981 in Bangkok.

1.2 Background :

One of the recommendations of the Symposium was related to the setting up on an "Asian Centre for Electronics", and to requesting UNIDO to take appropriate action in this regard. In this context, UNIDO observed as follows in the cable addressed to the Consultant inviting him to undertake a national study for Bangladesh.

> "Having considered alternative proposals for moving in this matter and in view of request to UNIDO also for setting up the international centre for microprocessor applications, we have come to the conclusion that the starting point towards the implementation of the New Delhi recommendations will be to study the State of the Art in electronics, particularly microelectronics in selected developing countries, including some in the Asian region. These studies besides focussing on the actual situation will be required to highlight the areas in which the country needs regional and international co-operation and the areas in which it could contribute its own facilities and expertise to such co-operation".

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The Consultant accepted the UNIDO's invitation to make the required national study in Bangladesh in his personal capacity.

1.3 Terms of Reference :

A summary of the points highlighted in the terms of reference (Annexure-I) is given below:

(i) (a) Government's technology strategy and policies in microelectronics i.e. manufacture and application of integrated circuits (ICs) in consumer electronics, industrial controls and applications, telecommunications and special techniques, such as, computer-aided-design (CAD), computer-aided-manufacture (CAM) and computer-integrated-manufacture (CIM) ;

(b) Need for national policies and strategies and the scope of assistance that UNIDO could render in this regard, with special reference to promotion of regional/international mechanisms and programmes ;

(c) National policies to cover a wide area e.g. public awareness compaign, concentrated programme for education and training, support for manufacture of electronic components, public procurement policies, research and development ;

(d) International/Regional co-operation possible in early identification and assessment of technological advances in microelectronics; establishment of plants for the design and production of microelectronic components and interface elements; identification of application possibilities in critical and priority sectors relating to domestic and external markets; specialized centres of excellence to promote and carry out R & D and applications; conduct of feasibility studies; exchange of information and co-operation in regard to public purchases; socio-economic assessment of the

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impact of the technology ;

(ii) National R & D;

(iii) Acquisition of microelectronics technology;

(iv) Main foreign suppliers of this technology and equipments ;

(v) Raw-materials and existing infrastructure for microelectronics development;

(vi) Manpower problems in microelectronics industry and training efforts; Reversal of brain drain ;

(vii) Scope of introduction of different stages of manufacture of silicon chips ;

(viii) Availability of facilities for maintenance and repair of equipments and spares;

(ix) Main fields of application of microelectronics equipment, including computers;

(x) Acquisition and development of computer software.

1.4 The scope :

The scope of the study is obviously related to development of microelectronics industry and application of ICs. But in course of the study, one has to cover areas extending to development of electronics as a whole. The socio-economic aspects of the study is also quite significant in the wake of rapid technology advances in electronics.

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CHAPTER - 2

APPROACH AND METHODOLOGY

2. Approach :

2.1 In the absence of any reliable national statistics on the growth of microelectronics industry and related issues as per terms of reference, it was considered appropriate to undertake field investigations in selected industrial units where application of microelectronics exists and for this purpose, a proforma was designed (Annexure-II) to get the required information incorporated therein. It was also felt necessary to interview heads of Government ministries and departments, semi-Government or autonomous corporations or agencies, educational institutions, training institutes, etc. to elicit the requisite information to make the study comprehensive.

2.2.1 Methodology and design :

The industry study proposed to generate, among other things, data/information on the following items:

(i) the different types of electronic products of the industrial units using ICs and year-wise production of these products;

(ii) whether the company is in public or private sector or a foreign-owned or joint-venture unit;

(iii) future plan of expansion and R & D ;

(iv) availability of servicing facilities and spares.

2.2.2 Interviews of two Hon'ble Ministers and the heads or persons designated by the heads of relevant ministries, departments, educational institutions, autonomous or semi-autonomous corporations, specialized institutes or offices concerned with electronics/microelectronics in someway or other were taken covering the points mentioned below:

(a) Govt's technology strategy and respective policies in the field;

(b) National R & D in the field: Prospects of regional co-operations;

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(c) National approach towards acquisition of micro-electronics technology;

(d) Main foreign suppliers of micro-electronics technology and equipment, with special attention to regional resources;

(e) Main fields of application of microelectronic equipments purchased locally and bought from within as well as outside the region;

(f) Raw materials and existing infrastructure for microelectronics development;

(g) Manpower problems in microelectronics industry and training efforts undertaken (e.g. by suppliers of technology and by local institutions and enterprises) ;

(h) Main areas in which the country needs co-operation and can offer co-operation at the regional and international level;

(i) Scope of introduction of different stages of manufacture of components including custom-designed chips and applications thereof;

(j) Availability of facilities for maintenance and replacement of spare parts.

2.3 Field study :

In Bangladesh 39 units are engaged in manufacturing television, radio-receivers and radio-cassette-recorders, etc. Of them 33 units are manufacturing only radio-receivers or radio-cassette recorders or both. Besides, another joint-venture company is manufacturing products using ICs. Of these companies, seven units using ICs were selected for in-depth on-the-spot study for the present purpose.These units are listed in Annexure-III.

2.4 Interviews :

In all 30 persons representing a cross-section of the people involved in one way or the other with the development of electronics in Bangladesh were interviewed to elicit a variety of information and views indicated in paragraph 2.2.2. A complete list of such persons or/and the organisations they represent along with a memorandum of their statements/views will be found in Annexures - IV and IVA.

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CHAPTER - 3

REVIEW OF PRESENT SITUATION

3. The State of the Art :

The electronic industry made a start in Bangladesh in the early 1950's with the setting up of a few assembly plants for producing a limited range of radio sets. In the 1960's more assembly units were added. With the introduction of television station in Dhaka in December 1964, some of these units also started manufacturing television sets. At present i.e. upto the end of the year 1983, six companies including one TNC and two public sector enterprises are manufacturing Black & White television sets of different sizes ranging from 24" screen size to 12" screen size and only two of these companies including one in the private sector are making colour television sets also.

3.1 In addition to the companies mentioned above, 13 other companies have also received Government sanction for the manufacture of B/W and colour television, but they are not in production. As regards units sanctioned for manufacture of radio-receivers and radio-cassette-recorders, it appears that as many as 40 companies received sanction of the Government for manufacture of these products. But actually all of these units are not in production. One local company, however, has entered into a joint-venture with a Swedish firm manufacturing automatic electronic fences and battery chargers, exclusively for export on a sub-contracting basis. This company is also manufacturing Printed Circuit Boards and dry-type transformers for use in their electronic circuits.

3.2 Existing application of microelectronics:

The use of microelectronics in Bangladesh has been growing steadily in consumer electronics manufactures in the country, such as, radio receivers, television, radio-cassette-recorders, etc. The electronic industries in Bangladesh is now mostly limited to assembly Operation on the basis of import of basic components in CKD condition from abroad.

contd..../11

3.2.1 As yet there is no manufacture of any of the basic components in the country in the public or private sector, including the trans-national company which is operating here for a long time past. The companies which are making the above mentioned consumer electronic goods in the country using imported microelectronics are six in number. In course of field enquiries, it transpired that one of the seven companies visited was not using microelectronics in its manufacturing process, while another furnished incomplete information about its IC use.

3.2.2 Of the units which are actually using ICs at the moment, three are functioning with technical collaboration agreement with reputed foreign companies and two of them are Japan-based. Another company which has recently started manufacturing television and radio-receivers is in technical collaboration with a Thai company. Table 1 below shows sectorwise distribution of these companies. The annual figures for the production of television, radio and other items and the use of ICs in their manufacturing process are given in Table 2 (page 13).

Table 1 : Type of company (ownership)

Ownership	Public	Private	Total
Bangladeshi	2	3	5
Joint-venture	-	2	2
Total	2	5	7

Remarks : All the three companies in private sector have technical collaboration with foreign companies.

3.2.3 The professional equipments used in public telecommunication, communication and navigation equipments of aircrafts, civil aviation facilities of Dhaka International Airport and domestic airports, meteorological departments, armed forces, television station, research institutes, etc. have a wide range of IC application.

The main professional equipments using ICs in a number of selected organisations are listed in Table 3 as under.

Table 3

Name of organisation.	Equipments using ICs
Bangladesh Telegraph and Telephone Board	Trunk Automatic Exchanges for Nationwide Dialling, International Subscriber Dialling Exchange, Telex Exchange, Carrier Multiplex.

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Civil Aviation Authority	Radio chain communication, Teleprinter, Instrument Landing System Localiser, TV Monitor, Microcomputer.
Biman (Bangladesh Airlines)	All communications and navigation equipments used in F-28 and DC 10-30C aircrafts.
Meteorological Department	Weather Rader, Automatic Weather Observing System, Rawinsonde, Communication Equipment.
Bangladesh Television	Production Video Switches, Transmission Control Circuits.

3.3 Allocation of funds :

The Revised Industrial Investment Schedule published by the Department of Industries of the Bangladesh Government for the last 3 years of the Second Five-Year Plan period (July, 1982-June, 1985) for private sector indicates an allocation of Tk. 45 million (inclusive of 50% foreign exchange) in respect of radio-receivers and Tk. 60 million (inclusive of 30% foreign exchange) in respect of B/W and colour television sets. So far as the utilisation of this allocation is concerned 98% (approx.) of the fund allocated for the television sector has been sanctioned, whereas a sizeable amount allocated for radio-receivers has been reported to be exhausted. It is, however, to be noted that quite a few of the sanctioned units, both in the television and radio sectors, have not yet gone into production (vide Table 4 below)

Table - 4

Electronic industrial units and total investment sanctioned in Industrial Investment Schedule (1982-85)

Name of product	Sanctioned units		Total allocation (1982-85)
	Total No.	No. in production	
Television	13	6	60 million(local currency: 42.0 million plus foreign exchange: 18.0 million)
Radio-receivers, radio-cassette recorders, etc.	40	33	45 million(local currency: 22.25 million plus foreign exchange: 22.25 million)
Computer servicing and maintenance	1	Recently sanctioned	3.16 million(local currency: .93 million plus foreign exchange: 2.23 million)

Source: Interview of officers of the Industries Department, Government of Bangladesh. (Appendix - IVA)

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Table- 2

Companywise annual production of TV, Radio & others and use of IC by the Companies.

No. of Companies using ICs : 5

Year	Television								Radio	Fancy	Total use of IC	Annual rate of increase of IC used (%) (1)
	B/W					Colour						
	Company A	Company B	Company C	Company D	Total	Company B	Company C	Total	Company C	Company E		
1977	6,000	-	-	-	6,000	-	-	-	-	-	12,000	
1978	7,500	480	-	-	7,980	-	-	-	-	-	16,920	41
1979	7,000	502	3,000	-	10, 502	-	-	-	-	-	19,008	12
1980	8,000	761	3,000	12,000	23,761	-	-	-	-	-	70,044	269
1981	10,000	1,737	3,000	15,000	29,737	-	-	-	-	-	89,948	28
1982	8,500	1,460	3,000	15,000	27,960	107	500	607	10,000	10,000	125,982	40
1983	8,500	1,612	3,000	18,000	31,112	145	-	145	10,000	30,000	156,318	24
Total	55,500	6,552	15,000	60,000	137,052	252	500	752	20,000	40,000	490,220	38 (2)

N.B: (1) The annual rate of increase has been determined taking the preceding year as base.

(2) Overall annual rate of increase.

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3.4 Future plan of expansion :

3.4.1 It is evident that there is a trend of increasing growth in the use of microelectronics by way of expansion of electronic industries now manufacturing television, radio-receivers, etc. (Vide Table 1). Another thrust in this growth is likely to come when the Government implements its policy of switching over its local telephone exchanges to digital and manufacturing the same in phases in the country.

3.4.2 Further expansion in the use of microelectronics is expected with increasing computerisation in the Government departments/ agencies and commercial offices, including banks and insurance companies, in pursuance of a recent policy decision taken in this regard.

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CHAPTER - 4

MANPOWER TRAINING AND R & D

4. Existing facilities :

4.1 Bangladesh has a large labour force consisting of about 27 million workers (1980), with a net addition of about 0.9 million workers to this labour force every year. (vide 1982 statistical yearbook of Bangladesh, page 163). Annual manpower output of educational and training institutions in the country was 340 engineers (including 45 in electronics) and 4140 technicians in 1978 and 4148 trade and craft workers (including 46 in electronics) in 1980. (Source:Table III, page 170 of the Report on Regional Study of the Electronics Industry, ESCAP (RCTT), August, 1981.

4.1.1 The existing training facilities in manpower development are briefly described below:

(a) At the technician and supervisor's level, one can get admitted in any of the two Polytechnic Institutes (at Dhaka & Chittagong) where a Diploma course on electronics upto a certain level is offered. For admission in any such Institute, a Secondary School Examination Certificate is the requisite qualification;

(b) Under the auspices of the Organisation of Islamic Conference (OIC), an Islamic Centre for Technical and Vocational Training and Research is being set up in Dhaka for imparting technician-level training in various trade crafts, including electronics, to students of Islamic countries. The centre has also a programme of imparting training to teachers. The intake of trainees is expected to start within a year or so.

(c) Two training centres, one at Dhaka and another at Khulna on telecommunication, including basic electronics course, are functioning for giving one-year training to departmental personnel upto technician and supervisor level. About 600 departmental technicians and supervisors are being trained

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in these centres annually. Around 50 graduate engineers are also being trained every year in these centres. From 1985, a Telecommunication Staff College for providing training to about 300 graduate engineers is being contemplated.

(d) Short-term trade-courses for one year or so in the two Polytechnic Institutes mentioned above and a Government Technical Training Centre at Dhaka are also available to qualify students to work merely as a semi-skilled worker in TV or radio assembly plants or repair-cum-servicing workshops for electronic appliances.

(e) Training at the professional level are being conducted through the different Degree courses at all the four general universities, including the three engineering Degree colleges in the country and in the Bangladesh University of Engineering & Technology (BUET), Dhaka. Microelectronics is included both in the lecture and laboratory courses leading to the B.Sc.(Engineering), B.Sc.(Hons.) and M.Sc.in Applied Physics and Electronics. In addition, post-graduate courses on computer science and soft are are offered in the new Department of Computer Science and Engineering under BUET.

(f) An one-year certificate course on service and maintenance of scientific instruments, including microelectronics, is conducted by the Institute of Scientific Instrumentation under the University Grants Commission (UGC) at Dhaka. In addition, general and on-the-job training of the personnel specific to the requirement of equipments are provided by the Civil Aviation Authority, Biman (Bangladesh Airlines), etc.

(g) Besides regular training programmes, special short courses related to microelectronics are given at the Computer Centre of the Bangladesh University of Engineering and Technology (BUET), Department of Applied Physics and Electronics, University of Dhaka, Institute of Scientific Instrumentation and the Telecommunication Training Centres referred to above. Some training in computer

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software is also provided at the above mentioned Computer Centre and special courses on computer software are undertaken by the Institute of Business Administration (IBA), Dhaka.

(h) In addition, a number of private companies claim to have arrangements for providing technician level training in electronics and also training courses in high level computer languages. However, it is generally felt that due to rapid technological development in professional equipments, continuous refresher training at supervisor's level is definitely required in order to keep the knowledge of these personnel updated.

4.2 Research and development :

4.2.1 Some research and development in the use of microelectronics are being carried out at the Department of Electrical and Electronic Engineering, and Department of Computer Science and Engineering of the Bangladesh University of Engineering and Technology (BUET), Department of Physics and Department of Applied Physics and Electronics of the University of Dhaka, Institute of Electronics and Material Science and Electronics Division of the Atomic Energy Centre of Bangladesh Atomic Energy Commission, Dhaka.

4.2.2 The ambitions programmes of the Institute of Electronics and Material Science, located in the outskirts of Dhaka, needs special mention. Its broad objectives are :

(1) Promotion of R & D in electronics;

(2) Providing electronic installation, testing, servicing, quality assurance (QA) and quality centre(QC) needs;

(3) Training of electronic personnel; and

(4) Small-scale fabrication of electronic equipments.

4.2.3 In addition to activities of the Institute of Electronics and Material Science, the Electronics Laboratory of the Bangladesh Atomic Energy Centre has completed quite a few R & D projects in material science, while some more are in progress.

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4.2.4 Detailed picture of existing R & D activities will be found in the relevant portions of the memorandum of interviews. (Annexure - IVA) .

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CHAPTER - 5

FINDINGS

5. Points emerging from the study :

5.1 It was clear in course of the study that the present status of electronics industry in Bangladesh is related mainly to assembly operations in television, radio receivers, radio-cassette-recorders, etc. for domestic consumption only.

5.1.1 At the same time, it was found that the use of IC application is steadily growing in the above assembly operations. But uptil now, no positive effort has been made for local manufacture of microelectronics, partly because the domestic market is limited and partly because of want of technology.

5.1.2 No project has yet been undertaken either in the public or private sector for manufacture of any basic electronic component. However, there is a general awareness about the need for making a start in the matter of manufacture of basic components for import substitution and acquisition of technology. This will be apparent from the step taken by the Government of Bangladesh about a year back in forming a Working Committee under the Industries Division for studying the existing situation and recommending appropriate action to be taken in this regard. The Consultant served on this Committee and its report is now under active consideration of the Government.

5.1.3 Existing facilities available on national basis for manpower training is not obviously enough at technician or supervisory level. The engineers and scientists who are coming out of the general universities and the University of Engineering & Technology are not getting attractive employment at home and the net result is that there is a constant brain-drain from the country.

5.1.4 Activities in Research and Development are also limited. The existing Institute of Electronics and Material Science set up under the Bangladesh Atomic Energy Commission is not equipped to meet the national

contd..../20

needs. Nor are the scope of R & D facilities existing in the general universities and the Bangladesh University of Engineering and Technology (BUET) sufficient enough for the country as a whole. It is, however, noteworthy here that a scheme has been initiated by the University of Dhaka for the creation of an Institute of Silicon Technology, which is obviously a step in the right direction.

5.1.5 The Government of Bangladesh has not yet defined its technology strategy and policies in the development of electronics industry. Uptil now, the practice of technology import is being followed in the projects so far implemented with wide application of microelectronics e.g. International Subscriber Dialing (ISD) and Nation-Wide Dialing (NWD) manufactured by NEC, Japan. They are the main foreign suppliers of microelectronics technology and equipment in the country.

5.2 National policy and strategy : steps already taken.

In the absence of any national policy or a sense of direction, the development of microelectronics industry has not naturally made any headway. In 1981, a National Symposium on Electronics was held at Dhaka. This symposium made useful recommendations in the matter of development of electronics, including microelectronics, manpower training and R & D in the country. Government of Bangladesh has recently constituted a National Committee on Science & Technology at the highest level with well-defined guidelines for framing a national policy and strategy in different technological fields. There is a recommendation of the Science & Technology Division for the formation of a sub-Committee or task force to draw up national policy guidelines and strategy in the field of electronics development for consideration by the National Committee on Science and Technology (NCST). In addition to this, a National Computer Committee (NCC) has also been constituted by the Government to formulate appropriate strategy and policy guidelines for development of computer technology, identification of application areas and fixation of priorities and frame an action plan for developing necessary trained manpower. The NCC is now engaged in collecting necessary information and data.

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5.3 Potentialities for regional/international co-operation :

5.3.1 The scope of seeking assistance from international agencies or co-operation of /any developed country in or outside the Asian region to make a feasibility study as to how to make a start in promoting microelectronics industry is undeniable. This is a very important /step for which international or regional co-operation is essential. The establishment of a plant for manufacturing microelectronic component will come next for asking for such co-operation.

5.3.2 In regard to manpower training and sharing of R & D facilities at regional level, need for inter-country or bilateral co-operation is also being keenly felt.

5.3.3 The favourable response noticeable in different quarters e.g. University of Dhaka, Atomic Energy Commission and elsewhere to the question of establishing a regional centre or institute for electronics technology in Bangladesh has demonstrated the interest shown by concerned authorities to have an institute of this nature for the promotion of R & D, higher training and technology transfer.

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CHAPTER - 6

CONCLUDING REMARKS

6. Promotion of microelectronics industry :

6.1 Electronics industry in Bangladesh is now, as aforesaid, related to assembly operations in some consumer electronic products for domestic market. There was a consensus among the persons interviewed in this study that steps should be taken as early as possible for the setting up of microelectronics industry in the country. It was also generally agreed that this has to be done in the private sector with arrangements for a joint-venture with reputed foreign companies. The objective will be not only import substitution and technology acquisition, but also export to other countries, which will provide the advantage of economies of scale.

6.1.1 A feasibility study should, of course, precede this step to identify the specific areas or processes for which such joint-venture projects should be desirable to satisfy the national objectives and priorities. To start with, an export-oriented undertaking on joint-venture basis could be launched to manufacture, for example, chips separation or I.C.-bonding, packaging and testing.

6.1.2 The above step is also sure to accelerate the transfer of technology. But a joint-venture effort will have meagre chance of success unless adequate incentives are provided for in the shape of:

(a) directing development financing institutions to accord top-priority to this sub-sector of industry;

(b) establishing an air-based export processing zone in the proximity of Dhaka Airport to attract export-oriented foreign investment in Bangladesh; and

(c) providing attractive tax and fiscal concessions and other facilities.

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6.2 National R & D :

6.2.1 The study has revealed the absence of sufficient R & D activities in the country. The first step which needs careful consideration in this context is to establish a National Institute of Electronics, by expanding the role and scope of the existing Institute of Electronics and Material Science now working under the Atomic Energy Commission, to gear up and co-ordinate R & D activities at national level, besides increasing the infra-structural capability.

6.2.2 In order to develop I.C. manufacturing technology, a multi-disciplinary approach will be useful involving chemists and metallurgists to develop raw-material, solid state physicists and electronic engineers to develop IC-design technology and applications. Sufficient fiscal incentives and appropriate foreign trade policy measures shall also be needed to develop microelectronics industry.

6.2.3 The Science and Technology Division of the Government is rightly considering a pragmatic step to set up a task force under the newly formed National Committee on Science & Technology to formulate a national policy and plan and identify the areas of R & D and other programme for development of electronic industry, including microelectronics.

6.3 Manpower training :

6.3.1 The need for intensifying efforts for manpower training in the framework of a national plan is a pressing one. It has been acknowledged that the existing facilities of Dhaka University, University of Engineering and Technology (BUET), Dhaka Polytechnic Institutes, departmental training centres of T & T Board, Biman, Bangladesh Television, etc. are not enough. With more emphasis being laid in future on the development of electronic industry as a whole, there will be even greater need for more professional scientists and engineers in this field. The present facilities in the Universities and other

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educational institutes will then have to be strengthened and expanded. Moreover, an integrated approach for imparting intensive training at technicians and supervisors level is urgently necessary.

6.3.2 This is also true of training needs for maintenance and servicing of electronic equipments. Two sources have mentioned that there are contracts with suppliers of the equipments for training, maintenance and supply of spares. These adhoc facilities are not considered sufficient. Of course, in the Institute of Scientific Instrumentation of UGC and the Electronics Division of the Dhaka Atomic Energy Centre (AEC), there are some facilities for maintenance of electronics equipments and it is reported that during 1981 to 1983, a large number of equipments were repaired in the Electronics Division of BAEC. In the private sector, an allocation of Tk. 3.16 million (including foreign exchange of Tk. 2.23 million) has been provided for computer servicing and maintenance industry (cf: Table contained in the interview/~~sketch~~ summary of Deputy Director-General and Director, Planning of the Industries Department, page 49) Nevertheless, it is obvious that these facilities need expansion to meet the future needs of the country as a whole.

6.4 Development of software :

6.4.1 As regards development of software, there is much to be desired. In the Computer Centre and the Department of Computer Science & Engineering of BUET, software has been developed for the following programmes:

(i) 3-dimensional finite element analysis (linear and non-linear) in FORTRAN,

(ii) ground water modelling in FORTRAN,

(iii) analysis of transmission towers in FORTRAN, and

(iv) load flow studies for the national power grid in FORTRAN.

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6.4.2 The Institute of Business Administration (IBA), University of Dhaka also conducts occasional courses in the same line. However, one can safely conclude that these facilities for software development are insufficient not only to meet the demand at home but also for export to countries abroad where the requirement is already great and increasing fast in the wake of rapidly advancing computer technology.

6.5 Technology Transfer and Regional and International co-operation:

6.5.1 Technology transfer is a vast area for discussion. In the first place, it depends largely on the national strategy and priorities fixed for a country. The Consultant was associated with in-depth studies on the subject so far as it related to Asian region as Chairman of a Working Group for Technology Transfer formed by the Asian Electronics Union in its 7th General Assembly meeting in Bangkok in December, 1981. A report was prepared by him on the basis of presentations made by the delegates who participated in the International Symposium held in New Delhi in April, 1983. This report was presented at the 8th General Assembly of the Asia Electronics Union in Jakarta, October 21, 1983. It is worthwhile to quote the relevant portion from the proceedings of the 8th General Assembly, as follows :

"Five projects were proposed and elaborated in the report :

(1) Establishment of the Asian Institute of Electronics Technology,

(2) Promotion of sub-contracting from developed to developing countries,

(3) Promotion of license agreements and joint venture projects,

(4) Short country courses in developing countries,

(5) Video training materials.

The assembly accepted the report of the WGTT as a starting point towards the achievement of the objectives of the Union to be firmed up with further actions by the Union".

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The idea of an Asian Institute for Electronics Technology to be set up in a developing country like Bangladesh evoked keen interest from responsible quarters in the country.

6.5.2 Bangladesh needs international and regional co-operation in various ways. Even a National Institute of Electronics might need international support in the supply of equipments and necessary funding. Apart from this, for expansion and strengthening of manpower training and R & D facilities, regional or international co-operation is essential. To cite an example, the Institute of Scientific Instrumentation has provisions for having instructors and equipments from U.K. through the good offices of the British Council. Such efforts should be made more comprehensive and sustained.

6.5.3 In the sphere of R & D, there is scope for Bangladesh to share the facilities available in India and Japan under the terms of the Scientific & Technological Agreements entered into between these countries and Bangladesh. In computer software technology, Japan International Co-operation Agency (JICA) acting on behalf of the Government of Japan is arranging a 3-month programme once or twice a year in collaboration with Asia Electronics Union for Asian member countries. Bangladesh should avail of these programmes every year.

6.5.4 In the field of education and training, assistance of UN agencies like UNESCO, UNIDO, ILO and ESCAP will go a long way in the promotion of manpower training and transfer of technology.

6.6 Brain-drain :

6.6.1 It is undeniable that there is a constant brain drain from the country, even though our professionally qualified scientists and engineers are not yet considered surplus. This phenomenon can perhaps be reversed if facilities exist in the country for proper application of the technology acquired by them and reasonably attractive salary

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is offered to them. At the sametime, it is felt that Bangladesh should become an active member of all regional and international forums devoted to the cause of microelectronics development and send competent representatives to participate in such forums.

Annexure - I

TERMS OF REFERENCE OF STUDIES OF THE MICROELECTRONICS INDUSTRY AT THE NATIONAL LEVEL AND THE POTENTIALITIES FOR INTERNATIONAL CO-OPERATION

1. Terms of Reference

1. The study should review the state-of-the-art and anticipated future developments of the country's microelectronics industry as well as research undertaken; applications of microelectronics products both nationally developed and imported; and existing as well as possible co-operation at regional and international levels in this field. The study should cover in particular:

A. - Government technology strategy and respective policies in the field;
- Main subsectors of microelectronic industry developed in the country;
- National R+D in the field; prospects of regional co-operation;
- National approach towards the acquisition of microelectronic technology;
- Main foreign suppliers of microelectronics technology and equipment, with special attention to regional resources;
- Main fields of application of microelectronic equipment purchases locally and bought from within as well as outside the region;
- Raw materials and existing infrastructure for microelectronics development;
- Manpower problems in microelectronic industry and training efforts undertaken (e.g. by suppliers of technology, and by local institutions and enterprises)

B. - Main areas in which the country needs co-operation and can offer co-operation at the regional and international levels.

2. The study should be based on technical and economic data and should be policy-oriented. It should be prepared in accordance with the rules and regulations described in the UNIDO document

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UNIDO/EX/CPE/GS. 14, "Notes for authors of UNIDO studies". It is also expected that the study will be supplemented by relevant national policy or legislative documents.

3. The term microelectronics will be used essentially to mean integrated circuits. A wide rather than narrow treatment is preferred. The field could cover e.g. 1. manufacture of components, including custom-designed chips, 2. applications, 3. computers, and 4. software. Applications could deal e.g. with consumer electronics, industrial controls and applications, telecommunications-applications and special techniques such as computer-aided design, computer-aided manufacture and computer-integrated manufacture. Areas in which there are no existing or planned activities in the country need not be covered.

4. The background to the study is given below.

II. Background

5. UNIDO's activities in microelectronics have highlighted the need for national policies and strategies in this field and the scope of the assistance that UNIDO could render in this regard. Equally, UNIDO has been requested to promote regional mechanisms and programmes as well as explore the possibility of a specific international mechanism to help developing countries. National level studies are being undertaken in a number of countries in different regions to eventually help national efforts and to provide a basis for formulating proposals for regional and international actions and mechanisms.

6. The national policies and strategies in this area are getting increasingly complex. They have to cover a wide area, such as public awareness compaigns; concentrated programmes for education and training; support for the manufacture of electronic components and the application of microelectronics in production and services; public procurement policies; R+D promotion; and promotion of software capabilities.

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Related elements of telecommunications policies have to be considered. The "make or buy alternative" is getting more complex. With the growing integration of chips, the dividing line between components, systems and software is becoming increasingly blurred.

7. International co-operation is possible in a variety of respects. These include co-operation in areas such as early identification and assessment of technological advances in microelectronics; the establishment or expansion of plants for the design and production of microelectronic components and interface elements; identification of application possibilities in critical and priority sectors relating to domestic and external markets; specialized centres of excellence to promote and carry out research and development and applications; conduct of feasibility studies; training of manpower reversal of braindrain; exchange of information and co-operation in regard to public purchases; and socio-economic assessments of the impact of the technology. Regional and/or international centres in this field could thus deal with: manufacture; R+D; training; advisory services; information; and promotion of special applications appropriate to developing countries.

Annexure - II

QUESTIONNAIRE FOR UNIDO SURVEY IN CONNECTION WITH MICROELECTRONICS INDUSTRY IN BANGLADESH

1. Name and address of the Company :

2. Type of Company : (a) Public sector/Private sector

(b) Bangladeshi/Joint venture/

Foreign owned.

3. Name of product :

	1	2	3	4
Year of commercial production :				
Quantity sanctioned/ produced (annually)				
Quantity and type of IC Used :				

4. Immediate plans involving further use of IC :

5. Availability f facilities for repair/maintenance and replacement of spare parts :

6. R & D facilities :

7. Remarks :

Date:

Signature of Investigator

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Annexure - III

NAMES OF INDUSTRIES VISITED

1. Bangladesh Electrical Industries Ltd. (Philips), Mahakhali, Dhaka.

2. Fecto-Yamagan Electronics Ltd., 218-C, Tejgaon Industrial Area, Dhaka.

3. Mehar Industries Ltd., Airport Road, Dhaka.

4. Kallol Electronics Ltd, 10/C, Dhanmandi R.A., Road No. 6, Dhaka.

5. Pacific Industries Ltd., Chamber Bldg., 122/123, Motijheel C.A., Dhaka

6. Legic East Corporation, 36-A, Indira Road, First Floor, Dhaka.

7. Yamin Bangladesh Co. Ltd., 43, Rankin Street, Dhaka

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LIST OF PERSONS INTERVIEWED

1. Mr. S. M. Shafiul Azam,
   Minister for Commerce & Industries,
   Government of the People's Republic of Bangladesh.

2. Major Genl. M. J. Choudhury,
   Minister for Establishment & Reorganisation,
   Government of the People's Republic of Bangladesh &
   Chairman, National Computer Committee (NCC)

3. Dr. Abdullah Al-Muti Sharfuddin,
   Addl. Secretary-in-Charge, Science & Technology Division,
   Government of the People's Republic of Bangladesh.

4. Dr. Anwar Hussain,
   Chairman,
   Bangladesh Atomic Energy Commission (BAEC)

5. Mr. K. A. Rauf,
   Chief of Planning, Post & Telecommunication Division,
   Government of the People's Republic of Bangladesh.

6. Mr. A. H. M. Nurul Huda,
   Chairman,
   Telegraph & Telephone Board, Bangladesh.

7. Prof. M. S. Huq,
   Vice-Chancellor,
   Dhaka University.

8. Prof. A. M. Patwari,
   Vice-Chancellor,
   Bangladesh University of Engineering & Technology (BUET).

9. Dr. Jamilur Reza Choudhury, Director, Computer Centre, and
   Dean of the Faculty of Civil Engineering, BUET.

10. Dr. Jalalur Rahman,
    Chairman,
    Department of Applied Physics & Electronics, Dhaka University.

11. Prof. Mahfuzur Rahman Khan,
    Head,
    Department of Computer Science & Engineering, BUET.

12. Prof. Shamsuddin Ahmed,
    Head,
    Department of Electrical & Electronics Engineering, BUET.

13. Dr. A. R. Khan,
    Acting Director, Institute of Scientific Instrumentation,
    University Grants Commission.

14. Mr. Emdad Hussain,
    Director,
    Institute of Electronics (BAEC).

15. Mr. S. A. Mutaleb,
    Chief of Communication, Civil Aviation,
    Government of the People's Republic of Bangladesh.

16. Dr. M. I. Talukder,
    Joint Chief, Energy & Industries Division, Planning Commission,
    Government of the People's Republic of Bangladesh.

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17. Mr. M. A. Khaleque,
Senior Electronics Engineer, Meteorological Department,
Government of the People's Republic of Bangladesh.

18. Dr. Sultan Ahmed,
Associate Professor, Department of Physics,
Dhaka University.

19. Mr. Saaduddin Ahmed,
Chief Engineer,
Bangladesh Television.

20. Director,
Inspection & Technical Development,
Bangladesh Army.

21. Mr. T. Hussain,
Chairman,
Bangladesh Electronic Manufacturers Association.

22. Lt. Col. (Retd.) M. M. Rahman,
Director of Engineering,
Biman (Bangladesh Airlines).

23. Mr. A.K.M. Nurul Huda,
Engineer Officer in-charge,
Radio & Radar Workshop, Biman (Bangladesh Airlines).

24. Mr. H. Miah,
Chief Scientific Officer, Institute of Computer Science,
Bangladesh Atomic Energy Centre, Dhaka.

25. Mr. Mahfuzul Islam,
Deputy Director-General (Policy & Planning) Department of
Industries, Government of the People's Republic of Bangladesh.

26. Mr. A. S. M. Enayetullah, Director (Planning)
Department of Industries,
Government of the People's Republic of Bangladesh.

27. Mr. Zahur Ali,
Head of Electronics Division,
Atomic Energy Centre, Dhaka

28. Mr. Shamsul Islam,
General Manager, Long Distance, T & T Department,
Government of the People's Republic of Bangladesh.

29. Mr. A. Mannan Choudhury,
Director, Telecommunication Training Centre,
Bangladesh Telegraph & Telephone Board, Dhaka.

30. Mr. A.K.M. Amjad Ali Khan,
Head of the Department of Electronics,
Dhaka Polytechnic Institute.

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Annexure - IVA

MEMORANDUM OF INTERVIEWS

Hon'ble Ministers
Government of Bangladesh.

Mr. S. M. Shafiul Azam,
Minister for Commerce and Industries.

The government has not yet any definite policy or strategy in respect of microelectronics industry. However, the government is ready to give all possible support to suitable proposals for the development of microelectronics industry, including training facilities, etc. in the country.

Major Genl. M. J. Choudhury,
Minister for Establishment & Reorganisation and
Chairman, National Computer Committee (NCC).

A national computer policy will be adopted by the Government on the basis of information and data which are now being collected by the National Computer Committee (NCC).

Science & Technology Division,
Government of Bangladesh.

Dr. Abdullah Al-Muti Sharfuddin,
Additional Secretary-in-charge and
Member-Secretary of National Committee on
Science & Technology (NCST).

National policy and strategy:

There is as yet no well-defined policy or strategy on electronics industry or R & D. The government is considering to have a task-force formed under the newly constituted National Committee on Science & Technology (NCST) to formulate a national policy and plan, identify the areas of R & D and other programme for the development of electronics industry, including microelectronics.

The NCST has been formed with the Head of the Government as Chairman and Secretary, Science and Technology Division as Member-Secretary, with the following essential terms of reference :

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(a) Recommend national policies on science and technology;

(b) Recommend priorities to specific research programmes, evaluate the quality and effectiveness of research programmes undertaken by various agencies and the extent to which results are put to actual use;

(c) Suggest measures for co-ordination of scientific research and development activities ;

(d) Recommend approval to research plans and programmes;

An Executive Committee of the NCST has been formed with the Minister for Energy and Natural Resources as Chairman to oversee the implementation of its directives and decisions.

R & D :

The question of establishing a National Institute of Electronics for promotion of R & D activities will be considered by NCST.

Post & Telecommunication Division,
Government of Bangladesh.

Mr. K. A. Rauf,
Chief of Planning.

Digital telephone :

The question as to whether Bangladesh should adopt the digital telephone system replacing the existing EMD has been duly considered by the Government and it has been decided to go for the digital system.

For implementation of the decision, outright import of the digital technology will not do. Manufacture of ICs is a must for effecting transfer of technology. The foreign company selected to introduce the digital technology should be prepared to come in a joint-venture for the IC-manufacture, provided financial aid is available.

The Post & Telecommunication Division is thinking in terms of an overall change-over to the digital system and not merely of Greater Dhaka telephone network renovation. However, a world tender will be floated in due time to select a suitable system.

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Training:

Two Training Centres, one at Dhaka and another at Khulna on telecommunication, including electronics applicable to telecommunication, are now functioning. About 600 departmental technicians and supervisors (Sub-Asstt. Engineer's level) are being trained at the above centres every year. Besides, around 50 graduate engineers are being trained annually in Dhaka. From next year onwards, a project of Telecommunication Staff College is scheduled to be taken up at Joydevpur. This Staff College will cater to the needs of graduate engineers for initial orientation and in-service training. The annual intake is expected to be about 300. ITU has already committed funds for procuring equipments. Government will construct the buildings, etc. and run the Staff College at their cost.

Regional institute :

There is enough land in possession of the Post & Telecommunication Division at Joydevpur where it is possible to accommodate a regional institute of electronics technology, should such a decision is taken in appropriate quarters.

Bangladesh Telegraph & Telephone Board,
Government of Bangladesh.

Mr. A.H.M. Nurul Huda,
Chairman.

Government of Bangladesh has taken a policy decision on changing over to digital switching and transmission technology and for introduction of digital system in phases.

World Bank experts (Consultants) have been commissioned to submit a report as to which system will be suitable for adoption in Bangladesh.

There is a separate Directorate under T & T Board for R & D work; but funds available for this work is inadequate.

Already, electronic exchanges have been installed and they have gone into operation for ISD (International Subscriber's Dialing) and NWD (Nation Wide Dialing), which are now restricted to 4 trunk automatic

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exchanges, viz at Dhaka, Chittagong, Khulna and Bogra. Besides, telex/teleprinter electronics exchanges came into operation about two years back i.e. 1981.

For the entire countrywide telephone exchanges to be converted from existing EMD to digital, it might take another 15 years or more to be completed.

Regarding manufacturing policy of digital exchanges, this will depend on the recommendation of the World Bank Consultants.

The main foreign suppliers of microelectronics technology in Bangladesh are NEC, Japan.

Mr. Shamsul Islam,
General Manager, Long Distance,Dhaka.

Two important projects already completed are :

International Trunk Exchange, Dhaka and Nation Wide Dialing(NWD) with exchanges at Dhaka, Chittagong, Khulna and Bogra. All these five are digital exchanges, besides the existing telex/teleprinter services.

About 1200 number of public coin-telephone-boxes are already functioning throughout the country. In these coin boxes, 3 or 4 ICs are being applied in each box. ICs are also being used in Carrier Multiplied Channels in the Micro-wave, Coaxial, UHF and VHF systems.

In addition to the above 5 newly installed digital exchanges, local digital exchanges will also be introduced throughout the country in phases.

SCPC (Single Channel Per Carrier) at Talibabad Satellite Station (Intelsat B) is having the use of ICs in its control section. The same is true in the channelling equipments in both Talibabad and Bethunia (Intelsat A) Satellite Stations.

At present, EMD exchanges are being manufactured by Bangladesh Telephone Shilpa Sangstha (TSS). When digital exchanges are introduced on a large scale in the country, TSS may take up the manufacture of such exchanges which may involve the manufacture of PCB's.

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There is a contemplation of taking up the Greater Dhaka Telephone Project in the near future, which will have the main objective of renovation and expansion of Dhaka telephone net-work. It is expected that this project, for which feasibilities are being studied, will be implemented as soon as fund giving agency is determined.

Mr. A. Mannan Choudhury,
Director,
Telecommunication Training Centre, Dhaka.

The project for this training centre is being executed by the International Telecommunication Union (ITU) with UNDP assistance. Proper counterpart staffing and training schedule for advanced training are yet to be formulated.

Microelectronics is included in the different electronics courses offered for the training of technical staff of the Bangladesh Telegraph and Telephone Board. In addition, the following special courses involving microelectronics have been conducted since 1981:

Table	Number of courses
Basic Digital Technique	3
Advanced Digital Technique	1
Stored Programme Control Electronic Exchange	1
Data Transmission and Pulse Code Modulation	1
Computer Applications and Microprocessor	1
Computer Language	1

contd..../40

Bangladesh Atomic Energy Commission

Dr. M. Anwar Hossain
Chairman
and
Mr. Sadad Hossain,
Chief Scientific Officer,
Institute of Electronics and Materials Science.

R & D :

Activities of this Institute as per project objectives shall be: applied research in electronics, design and development of electronic products, laboratory scale production of electronics equipment, repair and maintenance, development of basic raw-materials to support the above activities, fabrication of silicon surface barrier detectors, etc.

Initial application is in the area of nucleonics. Research projects in advanced stage of development using microelectronics are, inter alia, beta-gamma survey meter, radiation monitor, high voltage power supply, etc. Present strength of personnel is about 40 scientists.

Regional/International Co-operation :

At present international collaboration is available through the International Atomic Energy Agency for training and provision of some equipment supply. The Commission is ready to provide land and some other infrastructural facilities for a regional institute for electronics technology if set up in Bangladesh.

Raw Materials :

Raw materials for microelectronics development are available.

Brain-drain :

The present brain drain can only be checked by providing proper and adequate incentives.

contd..../41

Mr. H. Miah,
Chief Scientific Officer,
Institute of Computer Science.

National policy :

On 29.8.1983, the government has constituted a National Computer Committee under the Chairmanship of Major Genl. M. J. Chaudhury, Minister for Establishment and Reorganisation to formulate the strategy and policy guidelines for the development of computer technology in the country with the following essential terms of reference :

(a) Formulation of strategy and policy guidelines for the promotion and systematic transfer and development of computer technology in the country ;

(b) Identification and selection of application areas and fixation of priorities ;

(c) Formulation of action plan for developing necessary trained manpower.

Three sub-committees have been set up to deal with the following areas :

(1) Hardware, software service, maintenance and their standardization;

(2) Identification of application areas and fixing of priorities;

(3) Manpower training and research.

Mr. M. Zahur Ali,
Principal Scientific Officer,
Electronics Division.

Function:

This division is responsible for research into the design and development of nucleonic equipments required for the Centre as well as repair and maintenance of electronic equipments.

R & D :

The following equipments using microelectronics are in the advanced stages of development :

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Pre-programmed relay, liquid flow-time counter, transistor curve tracer, digital voltmeter, public address amplifier, PH meter, digital clock, nuclear pulse simulator, high frequency signal generator, I.C. power supply, IC scaler timer.

Maintenance :

During the past 3 years, a large number of electronic equipments involving microelectronics have been repaired in this division. A good supply of spare ICs are stocked for this purpose and not much difficulty has been faced for their procurement.

University of Dhaka.

Professor M.S. Huq
Vice-Chancellor.

National R & D, International/Regional Co-operation:

In view of the importance and use of semiconductor grade silicon in the manufacture of IC chips and photovoltaic solar cells, the University of Dhaka has prepared a project for the establishment of an Institute of Silicon Technology. If ultimately approved, this project may be integrated with a regional institute for electronics technology if established in Dhaka. In such a case, the University of Dhaka shall be ready to provide the necessary land and some other infrastructural facilities for the proposed Institute.

Manpower training:

The said Institute may fulfill the professional higher manpower training needs.

Raw materials :

Raw materials for microelectronics development are available. Purification plant is only necessary.

Brain drain :

The brain drain is occuring due to absence of technology application in the country and low salary offered.

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Acquisition of electronics technology:

There is no concerted approach yet towards development of microelectronics industry.

Dr. Jalalur Rahman,
Chairman,
Department of Applied Physics and Electronics.

Manpower training :

Microelectronics has been included in the department courses in the following manner :

B.Sc. Lectures :

II Year B.Sc.(Honours); Physics of solid devices,

III Year B.Sc.(Hons.) : Device characteristics, plus techniques, digital electronics, computer technology.

B.Sc. Laboratory : Logic gates, operational amplifiers and applications, such as, filter, difference amplifier, escillator, etc; Digital electronics.

M.Sc : Lectures : I.C. fabrication technology, computer architecture, programming principles, electronic instrumentation. Use of I.C. in different electronics applications are included throughout the course.

M.Sc. Laboratory : IC circuits gates, arithmetic circuits, frequency counters, registers, multiplex-demultiplexer codec, divider, timer, microprocessor. Linear ICs, operational amplifier, feedback. Programming languages, BASIC, FORTRAN

R & D :

Thesis programme in advanced stages:

Analog to digital converter, Digital multimeter, FM receiver using ICs, Software for Computer Aided Design (CAD) for amplifier design, etc.

A number of 3 weeks' special courses with lectures and laboratory work on IC electronics have been conducted.

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Dr. Sultan Ahmed,
Associate Professor.
Department of Physics.

Manpower training :

Semiconductor devices including microelectronics are covered in M.Sc. final degree course.

R & D :

The following research projects using microelectronics are in the advanced stages of completion: remote controlled public address system for use in theatre stage, solar radiation integrator, bone healing stimulator for animal experiments, digital nuclear radiation counter.

Bangladesh University of Engineering & Technology (BUET), Dhaka.

Professor A. M. Patwari,
Vice-Chancellor, BUET.

Manpower training :

Microelectronics has been included in different courses of the Department of Electrical and Electronic Engineering and the new post-graduate Department of Computer Science and Engineering.

National Policy :

IC manufacturing should be in private sector having joint-venture with foreign companies for technology transfer and marketing. In order to develop IC manufacturing technology, a multi-disciplinary approach will be useful involving chemists and metallurgists to develop raw-material, solid state physicists and electronic engineers to develop IC design technology and applications. Sufficient fiscal incentives and appropriate import/export policy measures shall also be needed to develop microelectronics industry.

contd...../45

Professor Shamsuddin Ahmed,
Chairman,
Department of Electrical and Electronic Engineering.

Manpower training :

70 percent of the courses offered in the department consist of electronics, microelectonics and computer engineering, of which 30 percent consists of semi-conductor technology and microelectronics. In the near future, this will be raised to 50 percent.

Dr. Mahfuzur Rahman Khan,
Chairman,
Department of Computer Science and Engineering.

Manpower training :

This Department has been started in 1983.

This is a post-graduate department of inter-disciplinary character. Course contents are as follows :

Computer hardware:

Computer design, microcomputer.

Computer software:

Basic system management, data management, operating system, compiler, assembly language.

R & D :

In advanced stages : Micro-computer development, general purpose and custom designed (8085 based), EPROM programmer, Bangla alphanumeric system.

Software in FORTRAN : Load flow studies for the national power grid.

International/Regional co-operation:

Joint post-graduate programme with the Asian Institute of Technology, Bangkok is being started.

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Dr. J. R. Choudhury
Director,
Computer Centre, Dhaka.

Software has been developed for the following programmes:

(i) 3 dimensional finite element analysis (Linear and non linear) in FORTRAN

(ii) Analysis of transmision towers in FORTRAN

(iii) Ground water modelling in FORTRAN

Training programmes for software are being conducted in the centre.

Institute of Scientific Instrumentation,
University Grants Commission, Dhaka.

Dr. A. R. Khan,
Acting Director (Associate Professor,
Department of Applied Physics & Electronics, Dhaka University).

Manpower training :

This institute has been conducting an one-year certificate course on scientific instrumentation for the last 3 years for science graduates with Physics. The course includes lectures and laboratory work on linear and digital ICs, control instrumentation and introduction to micro-computer. In addition, a number of 2 to 4 weeks' courses have been conducted on digital systems and micro-processors with support from Microelectronics Development Centre(U.K.) Such courses are being further planned.

Regional/International Co-operation:

There is some provision for having instructors and equipments from the United Kingdom through the British Council.

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Planning Commission

Dr. M. I. Talukder
Joint Chief.

National policy and strategy :

A proposal for the fast development of export-oriented electronics inudstry in Bangladesh is being examined by the Bangladesh Planning Commission.

Electronics industry in Bangladesh is, by and large, still limited to the low value-adding assembly operations.

Although expanding, the market for electronics in Bangladesh is still too small to allow for extensive vertical integration in the manufacture of electronics equipment and appliances. Bangladesh, therefore, shall have to choose between the options of (a) staying happy with the domestic market and confining to assembly operations based on imported components and (b) locating export markets for integration and manufacture of selected range of component and equipment. Both for the purpose of technology acquisition and increasing export earnings, the second option merits careful consideration.

The growth of the industry beyond assembly operations is intimately linked with the growth of the components industry, which in turn is linked with the development of sustained R & D efforts. Any decision to enter into this high technology industry must be preceded by careful selection of equipment and components to be assembled/ manufactured.

Training/ R & D :

Training of manpower in electronics is important, not only because such is required for the acquisition, adaptation, innovation and handling of this high technology, but also because such manpower has the potential of earning foreign exchange through export to countries which are endowed with relatively more expensive manpower, but otherwise have resources and are expanding into the field of electronics at a very fast rate.

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In this context, immediate efforts need to be initiated, keeping in view the following objectives:

(a) to produce well-trained electronic software and hardware personnel to meet the demand at home and abroad;

(b) to direct research and development institutions to launch research programmes in electronics and solid state physics with special emphasis on development and fabrication of suitable materials, develop prototype electronic devices, instrumentation, testing, etc.

(c) to take necessary measures at national, regional and international levels for promoting electronics development and trade.

The following courses of action have been recommended:

(i) commissioning study to establish domestic and potential export market and to identify equipment and components in which Bangladesh may (i) limit itself to assembly operation based on CKD imports, (ii) engage, through subcontracting arrangement, in the sub-assembly of distinctly functioning sections of selected equipment through operation like IC-bonding, packaging, testing, etc. (iii) carry out higher value-added manufacturing activities, based on local R & D ;

(ii) strengthening of the Institute of Electronics and Materials Science of the Bangladesh Atomic Energy Commission,

(iii) establishing an Export Processing Zone in the proximity of Dhaka Airport to attract export-oriented investment in Bangladesh;

(iv) direct development financing institutions to accord top priority to this sub-sector of industry;

(v) Bangladesh should become an active member of all regional and international forums devoted to the cause of electronics and send competent representatives to participate. For this

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purpose, the External Resources Division may be advised to line up necessary technical assistance;

(vi) the government may sound selected foreign companies for development of electronics industry in Bangladesh on joint venture basis.

Department of Industries, Government of Bangladesh.

Mr. Mahfuzul Islam,
Deputy Director-General(Policy & Planning)

and

Mr. A.S.H. Enayetullah,
Director, Planning.

Electronics is included in the Revised Industrial Investment Schedule for 1980-85 Plan period of the Department of Industries, Government of Bangladesh. The details of sectorwise investment and number of sanctioned industrial units in this period are given in a tabular form below :

Name of product	Sanctioned unit		Total allocation(1982-85)
	Total	In production	
Television	13	6	60 million(local currency: 42.0 million plus foreign exchange: 18.0 million)
Radio-receivers	40	33	45 million (local currency: 22.25 million plus foreign exchange:22.25 million)
Computer servicing and maintenance	1	(Recently sanctioned	3.16 million(local currency: .93 million plus foreign exchange: 2.23 million)

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Director of Inspection and Technical Development,
Bangladesh Army.

The Directorate have equipments using microelectronics. There are contracts with the suppliers of these equipments for training, maintenance and supply of spare.

Department of Civil Aviation

Mr. S.A. Motalib,
Chief of Communications.

This department is responsible for the maintenance of all ground communication and navigation facilities in airports. All new equipments contain microelectronics, e.g. building intercom, radio-chain communication, digital clock, teleprinter, ILS localiser, TV monitor, microcomputers, etc. The department has well-trained manpower for maintenance of the above.

However, serious dislocations are sometimes caused due to the non-availability of some very inexpensive spares. Procurement takes a long time due to red-tape.

At present, international co-operation in training needs are continuing through the International Civil Aviation Organisation through UNDP assistance. Most of airport communication and navigation equipments are of French origin.

BIMAN (Bangladesh Airlines)

Lt. Col. (retd.) M.M. Rahman,
Director of Engineering.

Service/Maintenance:

At present, there is a service and maintenance contract for DC 10 with Singapore Airlines. An electrical and instrument maintenance course for DC 10 is now being conducted by the Singapore Airlines.

A long-term maintenance and training contract is now being worked out.

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Mr. A.M.M. Nurul Huda,
Engineer Officer -in-charge,
Radio and Radar Workshop, Dhaka.

Maintenance/Training needs:

Workshop

The Radio and Radar has the responsibility of the maintenance of all the aircraft communication and navigation equipments of Bangladesh Biman. They are carrying out the same quite satisfactorily except for the F 28 and DC 10-30C aircrafts.

The communication and navigation equipment of F 28 and DC 10-30C aircrafts contain microelectronic components for which the workshop personnel have not yet been adequately trained.

At present the maintenance work is being done at Sinagpore which charges US $ 45.00 per man hour for this job. This heavy expenditure can be curtailed if adequate training can be provided to the workshop personnel.

Bangladesh Meteorological Department.

Mr. M. A. Khaleque,
Senior Electronics Engineer.

Equipments using microelectronics are :

Weather rader - for precipitation measurement, cyclone tracking, flood forecast, etc;

Rawindosonde - for upper air temperature, pressure, humidity measurement, wind spped and direction;

Automatic Weather Observing System (AWOS); and

Communication Equipment.

Training of personnel for servicing and maintenance of equipments using microelectronics is insufficient. All procurement processes of spares are very slow, even for local purchases.

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Bangladesh Television

Mr. Saaduddin Ahmed,
Chief Engineer.

Most TV studio equipments and control circuits in T.V. transmission are using microelectronics and the production video switches are micro-computer controlled.

All trouble shooting and repairs are done by the Departmental personnel. Spares are suitably stocked.

Continuous training facilities are required for the personnel for keeping pace with the rapid development of technology.

Bangladesh Electronic Manufacturers Association (BEMA)

Mr. T. Hussain,
Chairman.

National Policy :

In the context of recommendations of the National Electronic Symposium, 1981, Science & Technology Division of the Government of Bangladesh held a meeting recently, which was attended by the Chairman, BEMA. It was decided to request National Committee on Science and Technology (NCST) to form a subcommittee with the task of formulating a national policy and a plan for development of electronics in the country and to survey the present capability in this field, including manpower. It was also decided that a National Institute of Electronics should be formed with two component divisions, viz; manpower training division and R & D division.

About a year back, the Industries Division of the Govt. of Bangladesh formed a Working Committee for studing the existing situation of electronics industry and recommending appropriate action for

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progressive manufacturer of electronic components in the country. The Committee report is in active consideration of the Government.

Manpower training :

Training at the technician-level is not adequate at all and, in many cases, is being conducted by incapable private agencies. On the whole, higher academic training facilities in Universities are not bad. Need for higher professional training may be met by the creation of a centre of " excellence " at regional level through international co-operation.

Transfer of technology :

This is only possible by inducing reputed foreign companies of developed countries to set up export-oriented microelectronics industry in Bangladesh on joint-venture basis. Different stages of manufacture of microchips should be possible through such ventures.

Brain Drain :

For the reversal of brain drain, proper utilization of existing trained manpower, sufficient appreciation and attractive salary for our scientists and engineers are necessary to motivate them to work at home.

Dhaka Polytechnic Institute

Mr. A.K.M. Amjad Ali Khan,
Head, Department of Electronics,

This Institute offers a 3-year Diploma courses, besides short trade courses.

The Diploma course has been updated in 1983 to include Digital Technique and Process Control (III year's course).

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Microelectronics is involved in the courses on :

Industrial Electronics (III year's courses),

Solid State Electronics (III year's courses),

Semiconductor Devices (II year's course),

Electronics Circuits (II year's course), and also in

project work, e.g. stabilizer power supply, wave-shaping, etc.

Microelectronics is also covered to some extent in vocational trade courses.

There is a necessity for arranging appropriate refresher courses for the Instructors in microelectronics. Further augmentation of laboratory facilities is also needed.