E. C. No. 465

ESTIMATES COMMITTEE (1965-66)

HUNDRED AND FOURTH REPORT

(THIRD LOK SABHA)

MINISTRY OF EDUCATION
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE, PILANI

LOK SABHA SECRETARIAT
NEW DELHI

April, 1966/Chaitra, 1888 (Saka)

Price : Rs. 1·30

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CORRIGENDA

To

Hundred and Fourth Report of Estimates Committee on the Ministry of Education C.S.I.R. - C.E.E.R.I., Pilani.

Page 10, para 16, line 1, for 'E.E.R.I.' read 'C.E.E.R.I.'.
Page 18, line 10, for '1954' read '1964'.
Page 18, line 16, for 'rastor' read 'raster'.
Page 19, line 1, for 'this' read 'This'.
Page 23, line 5 from bottom, for 'transmiting' read 'transmitting'.
Page 24, line 11, for 'in that' read 'in the'.
Page 36, para 46, line 11, for 'on' read 'one'.
Page 38, line 1, for 'sepcial' read 'special'.
Page 40, para 49, line 15, for 'Regulation' read 'Regulations'.
Page 54, para 59, line 15, for 'in an' read 'is an'.
Page 59, line 10, for 'state' read 'stated'.
Page 59, line 13, for 'out that' read 'out the'.
Page 91, col.3, line 10, for 'purcase' read 'purchase'.
Page 99, col. 3, line 2 from bottom, for 'Plani' read 'Pilani'.

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INTRODUCTION

I, the Chairman, Estimates Committee, having been authorised by the Committee to submit the Report on their behalf, present this Hundred and Fourth Report on the Ministry of Education—Council of Scientific and Industrial Research—Central Electronics Engineering Research Institute, Pilani.

2. The Committee took evidence of the representatives of the Council of Scientific and Industrial Research and Central Electronics Engineering Research Institute on the 21st, 22nd and 25th January, 1966. The representatives of the Ministries of Education, Industry, Supply and Technical Development, Defence (Department of Defence Supplies), and Information & Broadcasting and Planning Commission appeared before the Committee during the course of the above sittings. The Committee wish to express their thanks to the Director General, Scientific and Industrial Research, Director, Central Electronics Engineering Research Institute, Secretaries of the Ministries of Education, Industry, Supply and Technical Development, Defence (Department of Defence Supplies) and other Officers of the above Ministries including the Ministry of Information & Broadcasting and Planning Commission for placing before them the material and information they wanted in connection with the examination of the estimates.

3. The Committee wish to extend their thanks to Shri Y. A. Fazalbhoy, Managing Director, General Radio & Appliances Ltd., Bombay for giving evidence and making valuable suggestions to the Committee.

4. The Report was considered and adopted by the Committee on the 7th April, 1966.

5. A statement showing the analysis of recommendations contained in the Report is also appended to the Report (Appendix VI).

NEW DELHI—1;
April 15, 1966.
Chaitra 25, 1888 (*Saka*).

ARUN CHANDRA GUHA,
Chairman,
Estimates Committee.

I

INTRDUCTORY

Electronics has aptly been described as nervous system of modern technology. It has made a phenomenal impact on technology used in industry, atomic energy and communications. It has assumed an important role in the monitoring and control of production processes in the engineering, chemical and metallurgical industries. The practical applications of electronics began with the transmission of wireless signals early this century. The Second World War gave an enormous impetus to the subject and the scientists who had been using it in their research were put on to developing it for the urgent needs of defence, resulting in the microwave techniques and the birth of electronics as it is known today.

2. Research work on electronics is being carried out at present in about twenty institutions in the country including Central Electronics Engineering Research Institute; Electronics Division of National Physical Laboratory; Electronics Division of Atomic Energy Commission; All India Radio Research Department; Tata Institute of Fundamental Research, etc. Government appointed Electronics Committee in 1963 to review the position regarding electronics industry and to indicate measures for the planned development of electronics. The terms of reference of the Electronics Committee were as follows:—

"(a) to assess the total requirements of the country in respect of various items of electronic components and equipment;

(b) to survey the existing and potential sources of supply and to recommend how best these sources can be tapped and capacity expanded; and

(c) to recommend measures for the planned development of electronics, so that the country as a whole may become self-sufficient in this field in the shortest possible time and in the most economical manner."

3. The Electronics Committee submitted 21 interim reports to Government, which covered *inter-alia* the following aspects:

(a) Microwave systems including Radar and Radio Navigational Aids.

(b) Industrial and Process Control Instruments.

(c) Transistors, Semi Conductor Diodes etc.

The final report was submitted by the Electronics Committee to Government in February, 1966.

4. The Electronics Committee has assessed the requirements of electronic equipment for the next 10 years as Rs. 1650 crores compared to the existing capacity of the industry to produce Rs. 265 crores. The position is summed up in the table below:—

	Item	Requirements over ten years	Extent of available supply from the existing industry
		(in crores of Rupees)	
1.	Radio receivers and other consumer products	450	170
2.	Low power radio communication equipment	310	37
3.	Microwave systems and associated equipment including radar and radio navigational aids	290	17
4.	High power radio transmitters, industrial heating equipment, railway signalling and process control installations and other major industrial equipment	250	3
5.	Electronic equipment for line communication systems	150	34
6.	Computing, data processing and nuclear, medical and industrial equipment	165	4
7.	Test instruments	35	..
	TOTAL	1,650	265

The Committee would like in particular, to draw attention to paragraph 2 on page 3 of the Electronics Committee Report wherein it has been stated that "electronic equipment of a total value of Rs. 1.650 crores at present day prices will be required in India during the next ten years, and that the total demand is not in general the result of an independent assessment by the Committee, but a sum total of the requirements of all the users, public and private as originally estimated by the ministries and departments of Government concerned, and as they finally emerged after discussions in the Committee."

The Electronics Committee has, however, gone on to record (para 5, page 4) that "it is satisfied that the estimated cost of the electronic equipment required during the next ten years which, as mentioned earlier, comes to Rs. 1,650 crores at today's prices is of the correct order of magnitude, and it is unlikely to be either as low as Rs. 1,000 crores or as high as Rs. 2,000 crores. In any case, an attempt at a more accurate estimation of the requirements over a ten year period in a developing economy and in the context of scientific developments in the world would not be very meaningful. The important point is that the report envisages the laying of the foundations of a self-sufficient and self-supporting industry with a built-in capacity for growth and development which will enable it to adjust its production to the needs of the country."

5. The Electronics Committee envisages an investment of Rs. 170 crores to achieve the estimated annual turn over of Rs. 300 crores by 1975. The details are given in the table below:—

Item	Estimated annual turnover in 1975		Maximum estimated capital investment upto and including 1975	
1	2	3	4	5
		(In crores of Rupees)		
1. Primary materials	28·0*	..	..	12·0
2. Components				
2·1 Resistors	7·5	..	3·5	..
2·2 Capacitors	7·5	..	3·5	..
2·3 Connectors, relays and switches	9·0	..	4·0	..
2·4 Transistors and semi-conductor diodes	17·0	..	8·5	..
2·5 Electron tubes	13·0	..	6·5	..
2·6 Panel instruments, hardware and other components	30·0	..	15·0	..
Total of Components :	84·0*	..	..	41·0
3. Radio receivers and other consumer products	..	73·0	..	20·0

*The value of primary materials and components (Items 1 and 2) has been taken into account in the final cost of equipment in Items 3 to 9.

1	2	3	4	5
4. Low Power radio communication equipment	..	59·0	..	24·0
5. Microwave systems and associated equipment including radar and radio navigational aids . .	..	57·0	..	24·0
6. High power radio transmitters, industrial heating equipment, railway signalling and process control installations and other major industrial equipment .	..	50·0	..	20·0
7. Electronic equipment for line .	..	26·0	..	12·0
8. Computing, data processing and nuclear medical and industrial equipment	..	33·0	..	15·0
9. Test instruments . . .	..	7·0	..	3·0
TOTAL . .	..	305·0	..	171·0
	Say :	300·0	..	170·0

6. The Electronics Committee has pointed out that "the annual production of Rs. 300 crores envisaged would represent less than 1 per cent of the estimated gross national product in 1975. At present electronics production barely accounts for a mere 0.15 per cent of the gross national product. As against this, present production of electronic equipment in Japan, where electronics is used almost exclusively for non-defence purposes, is 3.5 per cent of the gross national product. In the United States of America and France this figure is higher."

The Electronics Committee has estimated that "the total number of persons who will be employed directly or indirectly in an electronics industry of the size envisaged for 1975 will be about 400,000 in round figures, of which over 300,000 will be engineers, scientists and skilled workers."

It has also pointed out that "an investment of some Rs. 170 crores is expected to provide employment in the industry for some 400,000 scientists, engineers, skilled workers and supporting staff, from which it follows that the investment per man is approximately Rs. 4,000 to 5,000."

The Committee commend for implementation the comprehensive report on the subject of development of electronics during the next ten years which has been produced by the Electronics Committee

(1966) under the distinguished Chairmanship of late Dr. H. J. Bhabha.

The Committee would like Government to take integrated action to develop the electronics industry. In particular, they would like that the research programme should be intensified and related to the production programme as set out by the Electronics Committee. The Committee share the faith of the Electronics Committee that "the very backwardness of the country in electronics and smallness in size of the present electronics industry could be turned into an asset, if early stages in the development of the industry in other countries are by-passed and the industry planned on the basis of the latest ideas and techniques."

The Committee also agree with the recommendations of the Electronics Committee that "the industry should be planned and organised from the very beginning in such a way as to build into it the capacity to keep abreast of progress in the rest of the world without continuing dependence on foreign assistance. India should indeed be able to make its own contribution to the rapid advance of electronics. Thus, the importance of building into the industry from the very beginning powerful design and development groups and of supporting fundamental and applied research cannot be over-emphasised. This will not only save large sums of foreign exchange in the course of the next ten years, but is the only method of establishing a self-sufficient and self-reliant electronics industry capable of keeping pace with development in the rest of the world."

The Committee would like the research in the country to be forward looking so as to design, develop and produce the next generation of equipment indigenously.

The Committee note that the Electronics Committee has assessed the requirement of 3,00,000 engineers. scientists and skilled workers for electronics industry by 1975. The Committee would like Government to draw up and implement an integrated programme for training adequate number of personnel to meet the requirements of the electronics industry.

II

ORGANISATION AND FUNCTIONS OF CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE

A. Historical Background

7. The Governing Body of the Council of Scientific and Industrial Research decided at a meeting held in April, 1953 to establish the Central Electronics Engineering Research Institute (CEERI) at Pilani. The construction of the Institute building was started in September, 1954.

During the early part of the Second Five Year Plan, the building of the Institute was completed with most of the basic services, *viz* water supply, electricity, etc.

The main building provides 32,000 sq. ft. of floor space for the laboratories, library and ancillary facilities. There is 21,000 sq. ft. of floor space for the technological block (consisting of workshops, central stores, drawing office, maintenance facilities, etc.) The auditorium—seminar room block covers 7,500 sq. ft.

Laboratory equipment and workshop machine tools were installed during the Second Plan period. Work was started in three major fields, namely Special Purpose Vacuum Tubes, Audio Engineering & Acoustics, and Electronic Instrumentation. During the Third Plan period, research on communication systems and solid state devices got under way.

B. Objectives

8. The primary objective of CEERI has been to clear the way for industry for entering newer avenues of electronics. It has been stated by the Institute that "no need has been felt to modify this objective as it is already stated in comprehensive terms."

C. Organisation

Research and Development

9. Research and development at the Institute are project oriented and are carried out in the following five areas:

(a) Audio Engineering and Acoustics;

(b) Communication Systems;

(c) Electronic Instruments;

(d) Semiconductor Devices; and

(e) Special Purpose Vacuum Tubes.

Information and Liaison

10. Information and Liaison group conducts surveys of user needs and helps the Director and the technical staff in identification of problems and allocation of priorities. They also bring out a quarterly Newsletter in which the work being done at the Institute, and the current trends in electronics are brought to the notice of users, industry, universities and research organisations. The Information & Liaison Group is also the channel through which the transfer of know-how is negotiated with the participation of the CSIR and the National Research Development Corporation.

Industrial Engineering

11. Industrial Engineering group is primarily responsible for taking the laboratory models of different products developed in the different laboratories of the Institute to the stage of engineering prototypes. This group also tries out these prototypes in batch production. If necessary, pilot scale production is undertaken. In this manner, the know-how is brought to a stage where industry can readily take it for commercial exploitation.

This group also assists the research and development groups in fabrication of special equipment, and maintenance and calibration of the existing equipment.

Supporting Technical Services

12. Supporting technical services consist of library, workshop, stores and purchase, construction and maintenance, etc. Among some of the special features, it may be mentioned that the library has a well-set procedure by which the bibliography of all subjects relating to electronics is being constantly kept up-to-date through a card-index system which also contains abstracts of articles classified under different headings.

Administration and Housekeeping

13. This activity feeds all the other ones by performing all the functions of housekeeping, accounting, secretarial help, etc.

The Study Group of the Estimates Committee which visited CEERI in December, 1965, were impressed with the organisational set-up of the Institute and close cooperation and coordination between various divisions in furthering research on projects.

The Committee realise that in spite of the fact that Pilani is situated far away from the centres of research and manufacture of electronic equipment and suffers from lack of rail connection, the Research Institute has been located there because of its proximity to the Birla Institute of Technology and Science and the munificent donation given by a Trust. The Committee hope that the drawbacks of location as mentioned above will be compensated by the quiet and calm atmosphere of the place which should make for concentrated research. They also hope that Government would try to improve the rail and road communications to Pilani.

III

PLANNING OF RESEARCH IN CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE

A. Planning of Research

14. The procedure followed by the Central Electronics Engineering Research Institute, for the selection of research problems, has been stated to be as follows:—

> "The first phase of selection of a new research programme is the identification of the need of either the industry or Government Departments, etc. Requirements in areas allied to the work being undertaken at the Institute are received either through reports of committees like the Electronics Committee or at meetings with representatives of the user departments, industry, etc.
>
> The Institute representatives then discuss it with their other colleagues on return to the Institute. Detailed reports are prepared in respect of those projects which seem to be of a promising nature. These reports are discussed again with the user departments who suggest modifications in the time-schedule or the specifications, if necessary. In certain cases, they undertake special steps to obtain release of foreign exchange for urgent requirements.
>
> Various projects collectively form the programme of work of the Institute which is placed before the Executive Council for their approval. Although the final decision rests with the Vice-President, CSIR, the recommendations of the Executive Council in respect of research programme are normally accepted."

The Committee are glad to note that research projects at C.E.E.R.I. are selected with reference to the needs of the industry and Government departments and that discussions are also held with user departments regarding modifications in time schedules, specifications, etc. In this connection the Committee would, however, like to refer to the recommendation made by them in para 24 of their Hundred and Third Report on National Physical Laboratory regarding the principles to be observed in the selection of individual projects.

B. Costing of Projects

15. The Committee have been informed that after it has been decided to take up a research project at the institute, a project proforma is drawn up. This gives a survey of potential users, the technical approach to be followed, the main requirements, the major steps and the estimated time of completion of each of the major steps as well as the entire project. This proforma is used at the time of scientific staff meetings at which progress of all the projects is collectively reviewed. It is also used for allocation of priorities for the use of resources available to the Institute. It has been stated that C.E.E.R.I. was among the first institutions to introduce the project concept and a proforma for planning the projects as well as executing them.

Asked whether costs of individual projects are also estimated, it has been stated during evidence that 'Costing is not at present done on project-wise basis".

While the Committee appreciate the initiative taken by the C.E.E.R.I. to introduce the project concept and a proforma for planning the projects, they feel that full benefits from this scientific approach would accrue only if estimated expenditure on individual projects is also assessed in the very beginning and the progress is also watched with reference thereto. They hope that this would be done forthwith.

C. Expenditure during the three Plan Periods

16. The financial provision made for E.E.R.I. and the actual expenditure incurred during the First, Second and Third Five Year Plan periods is given below:

(in lakh rupees)

Plan Period	Head of Account	Provision	Expenditure
1	2	3	4
Ist Five Year Plan (1951-52 to 1955-56)	Recurring	..	1·817
	Capital	50·000	10·180
	Pilot Plant	..	..
	Provision for T.C.A. Equipment	11·880	1·185
	TOTAL	61·880	13·182

1	2	3	4
IInd Five Year Plan (1956-57 to 1960-61) . . .	Recurring . .	28·150	22·771
	Capital including provision for T.C.A.		
	Equipment . .	58·515	44·528
	Pilot Plant . .	..	..
	TOTAL .	86·665	67·299
IIIrd Five Year Plan (1961-62 to 1965-66) . . .	Recurring . .	55·277	34·165*
	Capital & Pilot Plant	30·000	12·870*
			0·483*
			26·370†
	TOTAL	85·277	83·888
Budget forecast for the year 1965-66, *i.e.* the last year of the current Plan Period.	Recurring . .		14·620
	Capital . .		4·000
	Pilot Plant . .		7·750
	TOTAL .		26·370

D. **Fourth Plan proposals**

17. The financial outlay proposal by C.E.E.R.I. for the Fourth Five Year Plan is given below:

(Rupees in Millions)

	1966-67	1967-68	1968-69	1969-70	1970-71	Total 1966—71
Capital . .	0·75	2·00	2·40	2·40	1·45	9·00
Recurring . .	1·94	2·42	2·91	3·38	3·86	14·51
TOTAL .	2·69	4·42	5·31	5·78	5·31	23·51

*1961-62 to 1964-65.

†1965-66 (based on provision for the year)

18. The list of the projects (current as well as new) is given below. Further details of the proposals are given at Appendix I.

(i) *List of current projects to be continued:*

Area	*Project*
(*a*) Audio Engineering . . .	Public address systems. Acoustic materials and design of auditoria. Speech communication Special microphones and loudspeakers.
(*b*) Communication Systems . .	Television receiver (Valve version. TV pattern generator. Pulse code modulation. V.H.F. trans-receivers.
c) Electronic Instrumentation. . .	Pen recorder. TV camera remote control. Non-linear servo systems. Printed circuit development.
(*d*) Semiconductor Devices . .	Silicon transistor for V.H.F. operation Varactor diodes.
(*e*) Vacuum Tubes . . .	Magnetrons (S-band) Travelling wave tube (S-band) Power triode (5 KW) Backward wave oscillator (S-band) Millimetre wave generation Microwave components.
(*f*) Industrial Engineering	Vacuum systems.
(*g*) Information and Liaison . .	Publication and symposia Library & documentation Industrial Liaison Public relations.

(ii) *List of new projects*:

19. Many of the new projects represent the next step after completion of certain projects in the Third Five Year Plan period. In some of them preliminary and exploratory studies have been undertaken towards the close of the Third Five Year Plan.

Area	*Project*
(*a*) Audio Engineering . . .	Tape recorders and recording heads High fidelity record players Ultrasonic transducers and cleaners. Audio measurements.

Area	*Project*
(*b*) Communication Systems. . .	Transistorised multichannel T.V. receivers. Vidicon camera & industrial T.V. T.V. sync wave form generator Transistorised FM receiver (for export). Antennas. Vehicular communications.
(*c*) Electronic Instrumentation . .	V.H.F. signal generator (H F. signal generator completed) 10 Mc digital frequency meter. Digital voltmeter. Desk computer. Instruments for special users like textile industry. Machine tool control.
(*d*) Solid State Devices . . .	Silicon transistors for U.H.F. operation. Power transistors Integrated circuits.
(*e*) Vacuum Tubes	T. V. picture tubes Magnetrons (X-band) Backward wave oscillator (X-band) Power triode (10 KW) Microwave circuits. Navigational aids.
(*f*) Industrial Engineering . . .	High frequency heating systems Environmental and durability tests.
(*g*) Information and Liaison . .	Operational research as applied to planning of research and development.

(iii) *Pilot Plant projects*:

20. The Committee are informed that "the year 1965-66 will be marked by a spurt of activity in respect of large-scale utilisation of products for which the laboratory work has been completed. Prominent amongst them is the Television Receiver Project. The Batch Production Unit will make television receivers, printed circuits and specialised components. Batch production is a stage intermediate between laboratory models and pilot plant. The activity thus started in the last year of the Third Five Year Plan period would be carried over into Pilot Plant Projects listed under item (i) below. It is also expected that current developments in the field of vacuum tube devices and semi-conductor devices would bring forth a need for establishment of pilot plants in those areas also. These are listed under item (ii).

(i) *Current Batch Production to be extended to Pilot Plant scale:*

(a) TV receivers and other electronic equipment;
(b) Printed circuits; and
(c) Micro-wave components.

(ii) *New Items for Batch Production:*

(a) Specialised vacuum tubes; and
(b) Semi-conductor devices."

It has been stated that in drawing up the programme for the Fourth Five Year Plan, the requirements of users, which had already been collected and collated by the Electronics Committee and its Working Group were taken into account as the Director of C.E.E.R.I. was a member of both.

The Committee note that the Fourth Five Year Plan proposals of C.E.E.R.I. give a broad idea of the projects and their importance but does not indicate even the rough estimates of expenditure involved in each project and the time schedule for their completion. It appears that such data has not been prepared by C.E.E.R.I. as it was not supplied to the Committee even when specifically called for*.

21. Asked about the publicity given to the programme, it has been stated that, "Fourth Plan programme was presented not only to the scientists in the Executive Council but also to the Working Group which has reviewed the plans of C.S.I.R. It consisted of a large number of eminent scientists. After the financial allocations of the Fourth Plan have been formally communicated, the plan programme can be given wider publicity".

The Committee consider that in addition to indicating the importance of the proposed research projects, the national laboratories and research institutes should also show in each of their Plan proposals, a broad estimate of the money any time required for completion of individual project so as to enable the Central planners to assess the requirements with reference to outlays and time factor and to take decisions accordingly. The Committee recommend that C.E.E.R.I. should incorporate the necessary data in respect of all research projects included in the Fourth Plan proposals.

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*At the time of factual verification of the Report, the CEERI has stated as follows:—

"it may be mentioned that in the Fourth Five Year Plan Proposals of the Institute, major items of expenditure on equipment, works and services have been given project-wise. Foreign exchange requirements also have been given priority-wise for different Projects in the proforma of the Fourth Five Year Plan Proposals of the Institute."

The Committee would further suggest that Fourth Plan proposals of C.E.E.R.I. should be given wide publicity among the scientists, user industries/Government departments, universities and related institutions so as to invite their suggestions.

E. Perspective Plan

22. It has been stated that C.E.E.R.I. has prepared a tentative Fifteen Year Perspective Plan indicating the broad fields of research etc. The major fields of activity during this period would be (a) High Fidelity/Engineering, etc., (b) Broadcast receivers, (c) Communication System, (d) Electronics instruments, (e) Semi-Conductor devices and (f) Special purpose vacuum tubes. Certain projects like development of integrated circuits, industrial controls, and lasers, etc., will receive increasing emphasis. It has, however, been stated that in a field as dynamic as research, a rigid formulation of a fifteen year programme of work can be self-defeating. For instance the current fields of interest of electronics, such as integrated circuits and lasers, could not have been visualised by anybody ten years ago. It has been added that the perspective plan of C.E.E.R.I. concentrates on indigenous development of designs and knowhow to meet the requirements of the country as brought out by the Electronics Committee.

The Committee are glad to note that C.E.E.R.I has formulted a tentative Fifteen Year Perspective Plan. They agree that such a long term plan in the field of research, particularly in a subject like electronics—which is a fast developing subject, should be flexible. The Committee recommend that the perspective plan of C.E.E.R.I. should be given wide publicity among the scientists, industry, user departments, universities and research institutions for inviting their suggestions so as to make improvements in the proposals and avoid unnecessary duplication. The Committee would further suggest that the perspective plan should be reviewed periodically in the light of developments and advances made in electronics research within the country and abroad.

IV

RESEARCH ON TELEVISION SYSTEM

A. Research on television receiver

23. Television has been recognised as an important medium for audio-visual education and entertainment and it is currently receiving serious attention from Government. An experimental TV transmitter has been working in Delhi for the past few years. This is the only TV service existing at present in India. The Committee on Broadcasting & Information Media on Television for India in their Report (February, 1966) has stated: "It should be our aim to provide in a period of seven years television services to all towns with a population of 100,000 or over. On this basis, 113 towns in an area of approximately 5.73 lakhs of sq. miles or 47 per cent of the total area of India would be covered."

Research on Television Receiver

24. One of the main hurdles in the way of expansion of television services in India is paucity of television receivers, which are needed in large numbers. In the beginning of 1961, the CEERI, on its own initiative directed its efforts to indigenous dovelopment of various items of equipment that go into a TV system, giving first priority to the TV receiver. In December, 1964 the Institute developed a laboratory-model of the television receiver and demonstrated it to the engineers and officers of the All India Radio, which is the principal Government agency connected with the growth of television in the country. The Institute has so far spent Rs. 1 lakh on its research activities in the area of television system and the major project that has fructified is the television receiver.

25. The television receiver designed and developed at the Institute conforms to International Radio Consultative Committee standards and employs inter-carrier system. It is stated by the Institute that "the design of the receiver is restricted to Channel IV in Band II having carrier frequencies at 62·25 and 67·75 Mc's for vision and sound respectively, because the present All India Radio transmission is at Channel IV only."

When asked whether the design of the receiver could be adopted to the future transmission channels of All India Radio, the Institute has informed the Committee in a written reply as follows:

> "Yes. Because of the limited propagation range of television transmitters, the first twenty transmitters, if located evenly throughout the country, can be accommodated in the same channel. This channel is almost free for allocation to a number of stations. In anticipation of the situation, where for any reason, it may be necessary to have multi-channel receivers in the country, in the near future, work has already been going on at the Institute for developing the multi-channel turret tuner. This would be like a small box which could be fitted into the television receiver in which space has already been set aside for the purpose. Since, during the next ten years, only one channel would be active in most places, many people would prefer to install the multi-channel turret tuner only when it is required. However, if necessary, the turrent tuner can be installed in certain models of receivers right from the start."

26. It is noted that after the demonstration of the TV receiver, Deputy Chief Engineer of the All India Radio commented as follows in February, 1965:

> "As I mentioned at the Sub-committee meeting, a single channel receiver will have limited utility. Further such an allocation cannot be pictured at this stage till it is cleared by the Department of Communications. It would, therefore, be preferable to design the receiver to provide reception in any channel in Band I and Band III for the present."

Bhagvantam Committee in October, 1965 has stated in its Report that "Bands I and III are recommended as the proper bands for television for the next 7 to 10 years in India."*

27. As regards the performance of the TV receiver developed by the Institute, the Committee note that the Deputy Chief Engineer

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*At the time of factual verification of the Report, the CEERI has stated as follows:—

> "Earlier attempts were being made to make out that the Delhi Station would be the only one operating in band I and that all the other Stations would go to Band III. Bhagvantam Committee's recommendations saying that *Band I* and Band III were the proper place vindicate the stand of CEERI that several other stations could also be put in Band I."

of All India Radio held in December, 1964 after watching a demonstration of TV receiver set made by CEERI that "The overall performance of the receiver is not satisfactory. The picture quality is seriously impaired by leakage of sound signals into the picture circuit."

In a subsequent letter dated the 15th February, 1965 the Deputy Chief Engineer, All India Radio suggested to Director CEERI that:

> "The note we had prepared was based on my personal observations of the performance of the receiver during the scheduled telecast on the evening of 22nd December, 1954. The difficulty regarding 'Sound breaking through' seems to have been overcome by the time the demonstration had been arranged on 24th December.
>
> The picture showed r.f. interference, higher than permissible percentage of distortion on sound, vertical sync instability, raster fold-over at the top, displacement of rastor to the right, shading etc. It was also worked from an external stablised power supply. In effect the receiver performance was much below the standard expected for domestic viewing. Some new effort needs to be put in to achieve improvement. In our note we had only pointed out the existence of certain defects which are of course remediable.
>
> You will appreciate that a television receiver for domestic use should be a rugged device requiring no running adjustments of a critical nature. Also the performance of a TV receiver is capable of being assessed on a quantitive basis against standard specifications using standard test procedures. Some time ago our Research Department had drawn up a set of draft minimum performance requirements of TV receivers. I am enclosing a copy of the same for your perusal and return. I would suggest that, for a start the Pilani TV receiver may be made to meet these minimum requirements. We will be glad to test your prototype and render any other assistance you may require in improving the performance of your receivers."

The Director, CEERI in his reply dated the 27th February, 1965 to the Deputy Chief Engineer, All India Radio has stated as follows:

> "The impression that was given to us by the distinguished viewers at the time of the demonstrations as well as in subsequent conversation was that they found the performance to be comparable to that of commercial receivers.

this is understandable since the main parameters that contribute to picture quality were near perfect. The finishing touches that are being given refer to marginal points of the type listed by you.

I am thankful to you for sending me the draft specifications which have been prepared by your Research Department for domestic television receivers in the country. Kindly let us know whether all TV receiver manufacturers follow these as 'minimal' specifications."

The Committee would like Government to take a firm decision about the Bands which would be used for TV transmissions so that the design of TV receiver may be suited to it.

The Committee would like to stress the need for continuous improvement of the TV receiver designed by CEERI so that it meets not only the performance requirements laid down by the Research Department of All India Radio but proves competitive both in quality and cost with the imported sets. In particular, they would like alignments of the TV receiver to be so optimised as not to require any running adjustments of critical nature which lay public cannot be expected to handle.

B. Pilot Plant Production

28. The batch production unit for TV receivers was inaugurated at the Institute on the 17th March, 1965. About a dozen developmental models of TV receivers have been produced by the Institute. On the Ist April, 1965, the Ministry of Information and Broadcasting wrote to the Director of the Institute as follows:

"As you are aware, under the expanded TV service in Delhi, a considerable number of TV sets would be required for sale to the public. We are endeavouring to arrange as many sets as possible to meet the immediate requirements of Delhi public, without involving any expenditure in foreign exchange. It is expected that you would be able to sell the thousand sets proposed to be manufactured at the Institute, and hence the manufacture may be taken up for immediate supply to the public. As soon as the daily programme, which is to start in May, 1965, comes into operation, these sets will be immediately in demand by the public."

On the 5th April, 1965, CSIR wrote to the Ministry of Finance for the sanction of Rs. 1,90,000 worth of foreign exchange which was required for import of some essential components. The CSIR stated *inter alia* in the letter:

"The set developed at the Institute is estimated to cost Rs. 800 only (ex-Institute) of which the foreign exchange component is only Rs. 150 or so. For undertaking the manufacture of 1,000 receivers (along with the necessary spares) some equipment and spares involving foreign exchange of Rs. 40,000 is also required. The total foreign exchange for the project would thus amount to Rs. 1,90,000. These components and equipment are not indigenously available and cannot be fabricated any where in India.

Since the matter is of extreme urgency and the normal allotment of foreign exchange for the half-year 1st April, 1965—30th September, 1965 will take some time to be communicated, I shall be grateful if an *ad hoc* special allotment of the amount of foreign exchange required for this project namely Rs. 1.90 lakhs is made so that the Director, CEERI, Pilani may place orders for the components and the equipment immediately."

29. The Department of Economic Affairs raised a number of queries with the Ministry of Information and Broadcasting which were replied to by the Ministry of Information and Broadcasting. The Ministry of Information and Broadcasting stated in conclusion:—

"We would however recommend allotment of foreign exchange, because they may be able to produce a 1000 TV sets by setting up a manufacturing plant, which will take a long time. There will further be a saving in foreign exchange, as the cost of a completely imported TV set will not be less than Rs. 350 whereas the cost of components will be only Rs. 150."

30. The Ministry of Finance approved in July, 1965 the release of foreign exchange to the Institute to the extent of Rs. 1.95 lakhs for the procurement of imported components subject to their clearance by the Directorate General of Technical Development from indigenous angle. The import licence was finally issued to the Institute in November, 1965. During evidence before the Committee in January, 1966, the Director has stated that "because this is tied to a Dutch credit, we had again to place an order and their is another loop to go through. A few days ago, we received a copy of the letter from the Finance, authorising the bank in Holland to pay against this Dutch credit. So this is the position in January, 1966."

31. It will be seen that production of TV receivers at the pilot plant of the CEERI has yet to start because of delays in the issue of foreign exchange and import licence.

32. Asked to indicate the arrangements made for marketing as well as after sales service of television sets to be manufactured at CEERI, the Institute has informed the Committee as follows:

> "CEERI has set up a nucleus Centre for servicing Television sets in Delhi. This will be expanded further. In the initial stages, marketing will also be done through this Centre directly. In the subsequent stages, when full scale plants are about to put their products into the market, a transition phase may be introduced where some of the CEERI receivers are sold through their marketing organisation so as to ensure a smooth changeover."

33. Asked to indicate how the pilot plant would be utilised after the manufacture of TV sets is stopped at the CEERI, the Institute has informed as follows

> "The Television Pilot Plant will continue to batch produce newer models of television sets in the years to come. This will help putting them into large scale production. At present, the next stage being developed is a transistorized portable television set. Subsequently, other types of sets such as colour television sets might be developed if the plans of the A.I.R. regarding introduction of colour television are known well in advance."

The Committee are not able to appreciate the inordinate delay of nine months in completing various formalities to import components worth Rs. 1·90 lakhs which were required for starting the production programme of 1,000 T.V. receivers at the Pilot Plant of the CEERI. They are particularly disturbed to note that while the import of these components has been delayed, Government have arranged for import of 5,000 T.V. receivers. The Committee have commented on this aspect in para 39 of the Report.

C. Commercial Exploitation of the know-how of TV Receivers

34. The National Research Development Corporation has entered into agreement with two private firms for commercial production of

TV receivers designed by the CEERI. The particulars of these agreements are given below:—

Name of the firm.	Date of Agreement	Terms of agreement
M/s J. K. Rayon, Kanpur	28-6-1965	Lumpsum: Rs. 75,000 payable in three instalments. Royalty: 2% Nature of Licence: Non-exclusive. Period of Licence: 14 years.
M/s Telerad Pvt. Ltd., Bombay	19-12-1965	Lumpsum : Rs. 75,000 payable in three instalments. Royalty : 2 % Nature of Licence: Non-exclusive. Period of Licence: 14 years.

The Director General, Scientific and Industrial Research has informed the Committee during evidence that "know-how has not yet been passed off. These are patented processes.* NRDC has licensed these to two parties. But the two parties have not yet obtained manufacturing licence from the Ministry of Industry. It is after they obtain manufacturing licence that we will impart know-how to them."

The Secretary of the Ministry of Industry has informed the Committee that "manufacturing licence has not been granted yet because we are awaiting that policy decision from Government as to whether this production should be in the private sector or public sector..... This is pending consideration."

The Committee do not feel happy at the delay in the manufacture of TV sets in the country after having given the patent rights to two firms on payment of royalty and thereby creating the necessity of importing TV sets from abroad. They hope that an early decision on the question raised at a late stage of private or public sector manufacturing TV sets will be decided without any further delay so that the indigenous manufacture may start soon and obviate the necessity of any further import. The Committee deprecate this tendency of importing things from abroad while these can be manufactured within reasonable time in the country.

*At the time of factual verification, C.S.I.R. has stated as follows:

"Steps are being taken for obtaining patents. Also on the advice of the Patents Officer, C.S.I.R., the printed circuitory bears an inscription all rights reserved by C.S.I.R."

D. Television Service for India

35. The Ministry of Information and Broadcasting (All India Radio) prepared a "Master Plan for Television Service for India" around 1962 and revised it in 1964. The Plan calls for an estimated investment of Rs. 100 crores spread over five plans commencing from the Fourth. In accordance with its basic cancept, only an allocation of Rs. 4 crores has been asked for in the Fourth Plan for establishing centres in Madras, Bombay, Calcutta and Kanpur.

The target set out in the Plan are as follows:

Plan	No. of Transmitters in Service	Population Coverage	No. of domestic receivers
Fourth	6	9%	6 lakhs
Fifth	16	19%	40 lakhs
Sixth	46	50%	800 lakhs
Seventh	150	70%	140 lakhs
Eighth	250	95%	200 lakhs

The Master Plan states that:

> "200 lakh receivers represent a monetary value of approximately Rs. 1000 crores—a considerably larger sum than the total investment on transmission facilities and it is probable that the likely economic development in the next 25 years may not be in a position to support investment on such a scale on the part of the viewing public. If, on the other hand, viewing is to be organised by the States on a community basis the investment on receivers could be cut down to about one tenth or Rs. 100 crores and a policy of subsidizing community viewing centres may become practicable.
>
> In any event, the need for rapid development of a T.V. equipment and receiver industry is apparent. If the requirements anticipated at the different stages for transmiting and studio equipment and for receivers are assessed and publicised in advance, the industry in the public or private sector would be in a position to chalk out appropriate programme of phased manufacture within the country."

Asked whether the Ministry of Information and Broadcasting/ All India Radio had consulted CSIR/CEERI for the preparation of Master Plan, the Ministry of Information & Broadcasting have stated: "CSIR/CEERI was not consulted before drawing up the Master Plan. The Master Plan is a departmental note and was prepared in the Planning & Development Unit of All India Radio. Development Plans are prepared by the departments and the CSIR Research Institutes are normally not consulted before development plans are drawn up. They are consulted only where there is a special problem having bearing on research."

The Committee consider it extremely unfortunate that in that beginning when Master Plan for TV was being drawn up by All India Radio in 1962/1964, they did not take the research organisation (CEERI) into confidence. The Committee feel that while preparing schemes which might entail import of equipments or foreign collaboration, the Departments concerned should contact the research institutes whether the know-how is available with them or can be developed within reasonable time. The Committee have no doubt that had there been close coordination between A.I.R. and CEERI right from inception, it should have been possible to accelerate research on TV receiver and perfect a TV receiver model meeting all the requirements. The Committee, however note that since 1965 there has been closer coordination between CEERI and A.I.R. and would stress that research and user departments which are both in the public sector should work hand in hand in the interest of improving television services for the country.

E. Bhagvantam Committee Report

36. The Ministry of Information and Broadcasting constituted in June, 1965 a Technical Committee on Television to advise on certain aspects of Television. The Committee was headed by Dr. S. Bhagvantam and included among others, the Director of the CEERI. The important recommendations of the Committee are summarised below:

(1) The Master Plan for country-wide coverage of television which had been prepared by All India Radio was considered. It was felt that by and large this could serve as a satisfactory guide on the basis of the techniques known at present.

(2) For a 10-year period it was felt that 16-18 stations, one each in the Capital of States or at other suitable locations along with relay stations where needed, would meet the requirements. The possible locations suggested were Bombay, Calcutta, Madras, Kanpur, Srinagar, Chandigarh, Jaipur, Ahmedabad, Bangalore, Trivandrum, Hyderabad, Cuttack, Gauhati, Patna and Bhopal.

(3) The proposal of the Ministry of Information and Broadcasting to set up in the Fourth Plan, TV Stations at Bombay, Madras, Calcutta and Kanpur and relay stations to extend the coverage at Delhi was considered appropriate.

(4) The Committee was emphatic that there was no need to invite foreign experts for setting up the stations envisaged in the Fourth Plan. Enough technical competence is available within All India Radio to handle this work.

(5) The Committee was definitely of the view that indigenous production of TV receivers should be encouraged even from the initial stages and the import of TV receivers should be restricted to a great extent if not stopped.

(6) The Committee came to the conclusion that there may not be a demand for more than 5,000 receivers during the next two years. The Committee were informed that 2,000 receivers are being imported from Hungary, 1,000 through Shri D. T. Gandhi and the Pilani Institute was scheduled to produce 1,000 receivers during the first year of the Fourth Plan.

(7) By the end of the first year, the indigenous production should start and the output in the Fourth Five Year Plan should be as follows:

At the end of	Output	Installed manufacturing capacity
2nd year	10,000	12,000
3rd year	15,000	18,000
4th year	20,000	24,000
5th year	25,000	30,000
TOTAL	70,000	84,000

(8) The Committee stressed the urgency and importance of establishing sufficient capacity for production of components and the TV receivers indigenously. The Committee urged the adoption of a policy of encouraging indigenous know-how and suggested that Department of Industry should take this into account while establishing the required capacity.

F. Chanda Committee Report

37. The Report of the Committee on Broadcasting & Information Media on Television for India, headed by Shri Asok K. Chanda, was laid on the Table of Lok Sabha on the 21st February, 1966. The important conclusions of the Chanda Committee are given below:

> "It should be our aim to provide in a period of seven years television services to all towns with a population of 100,000 or over. On this basis, 113 towns in an area of approximately 5.73 lakhs of square miles or 47 per cent of the total area of India would be covered."*

> "We are of the opinion that the limited production of television sets which the Bhagvantam Committee envisages will fall far short of the minimum required to carry the programmes of the sixteen studio centres we have suggested. Nor will the limited number attract advertisement revenue to the extent necessary for obtaining foreign collaboration or to sustain programmes of quality. We consider

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*At the time of factual verification of the Report, the Ministry of Information and Broadcasting have stated as follows:—

> "The Chanda Committee has recommended 113 Television Stations, without any valuation of the cost, but this has been done on the presumption of commercial advertising. The minimum cost of one Station is about Rs. 1 crore, and, therefore, we have decided to set up only four Television Stations during the Fourth Five Year Plan. The foreign exchange components for these four Stations will exceed Rs. 2 crores. In terms of our foreign exchange position and the resources, it is impossible to set up so many stations. Further, the financing presumed by the Chanda Committee is on the pattern of commercial advertising in the United States, which pattern we have not accepted. The Chanda Committee's recommendations are, therefore, under examination. In any case, to set up 113 Stations in 7 years is clearly an impossibility. We contemplate setting up one Station in each State Capital during the next 7 years."

that the production in the first five years should not be less than five lakh sets."

"There must be a survey by a competent agency to determine the plan of development of television; the possibility of satellite communication and the reasons for proceeding with conventional links; in the interest of economy there must be standardisation of equipment and receivers and the present tendency to obtain them from different sources should be given up; the advantages of developing frequency modulation for sound radio side by side with television should be availed of; there is need for legislation regarding suppressors for electrical appliances to prevent difficulties in reception."

G. Import of TV Receivers

38. The Ministry of Information and Broadcasting have furnished the following information regarding the import of TV sets:

"*Import of TV sets from Hungary*—The import of 2000 sets from Hungary was resorted to in order to meet the immediate demand for TV receivers consequent upon introduction of a daily one hour programme by Delhi T.V. Centre with effect from 15-8-1965.* The import was on rupee payment basis. The C.I.F. value of the receiver, which has a 23" screen, is Rs. 590/-. The sets are being sold to the

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*At the time of factual verification of the Report, the Ministry of information and Broadcasting have stated as follows:—

"The studio facilities having been made available and a daily programme for the public having been initiated for a population of 33 lakhs, at least 10,000 receivers should be there, if not more. Accordingly, we had to import the receivers, which we have imported, without which the Television Station could not be run to any purpose. The demand of receivers has been stated by us to run into several thousands according as the programme content increases. We propose to increase the programme by another hour as soon as further equipment, which is under orders, is received. The programmes will cover agricultural programmes in the villages, family planning and sanitation programmes, and also programmes for mass education. This we propose to do in another three months time. Accordingly, receivers should be in position in the interest of publicity and education. We cannot hold up education of the masses, if there is delay in their manufacture."

public by M/s Dilwali Traders, Chandni Chowk, Delhi who have been appointed as their business associate by the S.T.C. The sale price to the public has been fixed at Rs. 1530/- exclusive of sales tax. The break up of the price is as follows:

	Rs.
(*i*) C.I.F. Value	590
(*ii*) Customs duty	617
(*iii*) Clearance Charges	18
(*iv*) Landed cost	1225
Distributors margin @ 20% of the landed cost.	245
S.T.C's. Commission	15
Loss of insurance due to breakage, loss of customs duty and miscellaneous.	45
TOTAL	1530

Import of TV sets through Shri D. T. Gandhi.—One thousand TV sets have been imported through Shri Gandhi, a national of Uganda. The foreign exchange involved in the import thereof is to be provided by Shri Gandhi from his own sources. The details of these sets are as below:

(1) Japan Sanyo 16" 600 Rs. 333.33p CIF Bombay.

(2) Ireland IEC 23" 400 Rs. 551.83p CIF Bombay.

1000

The sales prices of 16" Sanyo set has been fixed at Rs. 950/-. The sales price of 23" Irish set has been fixed at Rs. 1550/-. The prices are exclusive of local taxes which would be charged extra.

The State Trading Corporation are making arrangements for sale of these sets to the public."

During the course of evidence, the representative of the Ministry of Information and Broadcasting has stated that "we have placed an order for another 2,000 for importing from Yugoslavia. So, it will be 5,000. .....We have assessed the need of the public by

enquiries made and by the applications registered, and I feel that the requirement immediately today will be about 30,000."

Asked to indicate how the import of these sets would affect the development of manufacturing capacity for TV sets with CEERI know-how, the Institute has informed the Committee in a written note as follows:

> "It can be stated without much fear of contradiction that massive imports of completed television sets would have a smothering effect on development of manufacturing capacity for television sets with CEERI know-how. In order to get manufacture through indigenous know-how started, it may need positive encouragement especially in the initial stages. Dumping of goods by competitors can provide an extremely hostile environment even to established manufacturers with large resources. In the economic field it is well known that in some cases, they may even be wiped out by "dumping" practices. For an infant industry just starting with the help of the national research effort, one would hope that if not an atmosphere of positive incentive at least an atmosphere of lack of disincentive, could be created by the decision making authorities in accordance with the national policies.
>
> In January 1965, the A.I.R. experts had firmly indicated the total requirement of receivers as 25,000 in ten years. The Committee of Technical Experts under Dr. Bhagvantam had estimated the requirement as 5,000 receivers in the first two years of the 4th Plan.
>
> At present there does not seem to be any reason why the estimates mentioned above should be grossly exceeded by imports themselves. Besides spending several times as much foreign exchange, we might be allowing our own industry to suffer."

39. The Estimates Committee note that the Committee of Secretaries which was constituted to advise on proposals for expansion of television services in India has examined the Reports of the Bhagvantam and Chanda Committees and has made certain recommendations to Government about manufacture of TV receivers with CEERI know-how and for undertaking manufacture of components suitable for TV receivers within the country.

The Committee would like Government to take an early decision in the matter, keeping in view their declared policy of encouraging the exploitation of indigenous know-how to find substitutes both for imported know-how & imported products.

The Committee are concerned at the import of 5,000 TV sets which may well have the effect of flooding the market with the imported receivers. In view of the present stringency of external finance and in consonance with the declared policy of encouraging indigenous know-how, the Committee are opposed to any scheme of importing T.V. receivers from abroad. The Committee further feel that the multiplicity of sources of imported T.V. sets would give rise to the problems of procuring spare parts and servicing of receivers of diverse origins.

The Committee would like to draw attention to the assessment made by Bhagvantam Committee that there may not be a demand for more than 5,000 receivers during the next two years. The Committee are of the view that indigenous production of TV receivers should be encouraged right from the initial stages. The Committee would like Government to make full use of this opportunity for development of TV industry in the country with indigenous know-how so that it can provide suitable base for development and manufacture of radar and other electronic equipment.

H. Cost of Television Receiver produced by CEERI

40. The ex-factory prices of the TV receiver manufactured by using the 'know-how' developed at the CEERI are stated to be as follows:

Model	Price
	Rs.
(*i*) 17" receiver	800
(*ii*) 19" receiver	850
(*iii*) 23" receiver	950

The above figures include a profit of 70 per cent but do not include distribution charges and excise duty and other leviable taxes.

The Ministry of Information & Broadcasting have informed the Committee that the prices of TV receivers offered by different countries are as follows:

		Rs.	
(1) Japan	16"	383·33	C.I.F. Bombay.
(2) USSR	21/23"	425·00	C.I.F. Indian ports.
	19"	312.00	Do.
(3) Czechoslovakia	23"	506·54	C.I.F. Bombay.
	19"	413·23	Do.
(4) Ireland	23"	551·83	C.I.F. Bombay.
(5) Hungary	23"	590·00	C.I.F. Bombay.
(6) Yugoslavia	23"	590·00	C.I.F. Bombay.
(7) U.A.R.	23"	697·82	C.I.F. Indian ports.
	19"	559·86	Do.

Asked about the reasons for high cost of the CEERI model, the Director has informed the Committee during evidence that "the cost of components in this country, which are mostly done by foreign collaboration, are two times more than the cost abroad." The Secretary of the Ministry of Industry has further stated that "not only in this case, but generally speaking, most of the components we produce here are about 50 per cent at least more costly than in western countries where they are mass produced."

41. Asked about the value of components that go into a single TV set manufactured at the CEERI, the Committee have been informed as follows:

(1) Rs. 275 worth of components are manufactured by the CEERI itself.

(2) Rs. 85 worth of components are manufactured by the private sector.

(3) Rs. 15 worth of components are manufactured by the public sector.

(4) Rs. 150 worth of components are to be imported from abroad.

Asked to indicate whether any long term measures have been thought of for farming out manufacture of television components which are at present being made at the pilot plant of the CEERI, the Institute has replied that "this matter is being constantly kept in view and some sub-contracting may eventually be resorted to. Item 1 above can then be Rs. 225 and items 2 and 3 together Rs. 150."

42. Asked to indicate the efforts made to develop indigenous manufacture of components which are being imported, the Institute has replied that "TV Picture Tube development project has started. This constitutes 70 per cent on the imported components." Asked further to clarify whether the difficulty in manufacture of these components is one of know-how or of manufacturing capacity, the Institute has given the following information:

> "Some of the components which are used in TV sets only and not in radios (*e.g.*, some valves) are not being manufactured in the country. With the technological base and manufacturing capacity available, it would not be difficult for existing units to switch about 10 per cent of their capacity over to these components as and when the demand justifies economic production. The difficulty is thus partly of know-how and partly of demand. Know-how for components other than valves has been developed at CEERI which has also taken up the problem of developing Picture Tubes which account for about two thirds of the cost of imported components."

Asked whether the imported components would be indigenously manufactured if a country-wide television system is established, the representative of the Ministry of Industry has stated that "as soon as the policy decision on television is firmly taken, then we would be in a position to appreciate the demand. We could ask the B.E.L. to do it. Our present expectation is that B.E.L. would be able to do it."

It is noted from the minutes of the eighth meeting of the Executive Council of the CEERI held on the 9th February, 1965 that the Managing Director of the Bharat Electronics Ltd. had informed the Executive Council that the "manufacture of Picture Tube was not a big problem. Bharat Electronics can undertake production of about 10,000 tubes per year."

It is understood that at the meeting of Committee of Secretaries held on the 23rd December, 1965 to consider the expansion of Television services, the Secretary, Defence Supplies stated that "Bharat Electronics Limited were in collaboration with Philips of Holland and Nippon Electric Company of Japan. He expected that the B.E.L. could undertake manufacture of picture tubes with Philips collaboration. He pointed out that it was necessary that in designing a TV receiver for India, account should be taken of the type of picture tubes and valves which will be manufactured by B.E.L. This

would indicate that in the first two years or so, whilst still importing picture tubes the imports should be confined to the types and specifications which will later be adopted for manufacture in India."

The Committee would like Government to take an early decision about the development/manufacture of picture tubes which constitute 70 per cent of the value of imported components required for manufacture of TV receivers. The Committee feel that the CEERI should be encouraged to develop them and should be given the required help and time for the purpose. In case CEERI is not able to develop the picture tubes at an early date, Government should consider in consultation with CSIR the question of purchase of know-how for manufacture of picture tubes in B.E.L.

The Committee are concerned at the high estimated cost of TV receiver to be produced with indigenous know-how as compared to the cost of imported receiver which has been explained by Government as being due to the high cost of imported components and raw materials as well as high costs of indigenous components manufactured with foreign collaboration. The Committee stress that reasons for the high price of these components should be gone into by a small committee of experts in order to devise measures to bring down the price of electronic components by encouraging standardisation, mass production and effecting other economies.

I. Research on Television Camera

43. The CEERI started research work on Television Camera in 1963. The project was given a lower priority in 1964 because the Institute concentrated its attention on T.V. receivers. The Committee have been informed that the Institute would take another 6 months to complete the research on this project and would start batch production of television camera in about 10 months time.

The Committee would like CEERI to intensify research on television camera after settling the specifications with All India Radio so that the project developed is in accordance with the requirement of the user department. The Committee would also like CEERI to keep the Ministry of Industry and Directorate General of Technical Development informed of the progress made so that no foreign collaboration agreements in this behalf are entered into and negotiated in the meantime. The Committee hope that after the project is completed successfully, necessary patents would be taken immediately and no time would be lost in forming out the process for commercial exploitation through National Research Development Council.

V

SPONSORED RESEARCH IN CEERI

44. The Committee have been informed that the Central Electronics Engineering Research Institute has an Information and Liaison Group which conducts surveys of user needs and helps the Director and technical staff in problems identification of problems and allocation of priorities. Asked to indicate the number of problems which the user departments and the industry has referred to the Institute during the last four years and the solutions provided, the Institute has furnished the following information.

A. Projects taken up by CEERI at the instance of industry

(1) Modules for transistorized radio receivers. This was sponsored by industry and was to be completed in 9 months. This was done.

(2) H.F. Signal Generator—The work has been completed. It took approximately three years.

(3) Assistance in improving transistorized megaphones. This was completed in about six months.

(4) Assistance was rendered to M/s Siva Electronics on Loudspeakers. This took about two weeks.

(5) A transistor circuit testing thermostat was supplied to M/s Semiconductors Ltd. This took about six months.

The Committee note that while CEERI has been able to provide a solution to the problems referred to them by the industry during the last four years, their number is only five. The Committee suggest that CEERI should intensify its liaison arrangement with the industry so as to inspire greater confidence in them and to invite more problems for solution at the Institute. The Committee would like CEERI, in particular, to help the industry in meeting the problem of import substitution and effect reduction in cost of production.

B. Assistance to Small Scale Industries

45. It has ben stated by the Institute that "Consultancy services are being rendered to entrepreneurs who want to set up small scale industrial units pertaining to the manufacture of components and ancillary equipment in the electronics industry." Asked to give details

of small scale industries assisted by the Institute, the Institute has furnished the following information:

"Consultancy on smaller problems has been given to numerous parties. Consultancy on setting up new enterprises has been given in the following cases:

(i) The Institute was consulted by the promoters of a firm (M/s Arjuna Electronics Private Ltd., Hyderabad) even before the firm was launched. The consultation was done in multiple visits and meetings, and the results of these are reflected in the programme taken up by this concern.

(ii) A note was received from the small scale industries department, Government of Rajasthan, indicating the desire of an entrepreneur to build some electronic instruments. Work on transistorized power supply was taken up accordingly. This development was handed over to the entrepreneur, and their engineer was trained at the Institute. It is hoped that this product would make a good base for the entrepreneur to enter the field of electronics.

(iii) M/s J. K. Rayon are setting up a plant for manufacture of T.V. receivers for which the design and planning is being done by CEERI."

Asked whether any fee is charged for giving consultancy service to small scale industries, the Institute has stated that:

"In order to encourage industry to come to the Institute no fees are at present being charged for consultancy service."

The Committee note that many small scale industries have undertaken the manufacture of electronic and radio components. The Committee feel that CEERI can be of great help to small scale industries which have largely to depend upon indigenous know-how for their future development. In view of the intended expansion of T.V. Services in India, CEERI can advise small scale industries to take up manufacture of components required in production of T.V. receivers. The Committee recommend that Central Small Industries Organisation should help to formulate the requirements of Small Scale Industries in the field of electronics and forward them to CEERI who should try to furnish the solution on priority basis.

C. Table Model Transistor Radio

46. The Small Scale Industries Association of Bombay requested the Institute in December, 1963 for designing a table model transistor radio. The Institute took up the project in January, 1964 and has completed a laboratory model of the transistor radio in January, 1966. The Institute has stated that "tests carried out so far indicate that it falls in the high quality class, as designed. Tests are continuing."

Asked about the expenditure incurred on the development of transistor radio, the Institute has stated that "No separate budgeting is done on project basis. Manpower detailed was one scientist (80 per cent time) and on scientific assistant (100 per cent time)."

The Institute has stated that the price of the transistor radio designed by the CEERI is "approximately Rs. 350 per set (ex-factory). The market price of a similar set (approximating to same features) will be about Rs. 600." The Institute has further stated that negotiations to release the know-how for commercial exploitation "are in preliminary stages."

Considering the great demand for transistor radios in the country, the Committee are concerned that CEERI has taken more than two years in developing a table model transistor radio. The Committee would like the work to be intensified in transistor radio sets with a view to its commercial exploitation. They also feel that the cost of the transistor set (Rs. 350—ex-factory) is on the high side. The Committee urge that efforts should be made to bring down the cost of the transistor radio so as to place it within the reach of general public.

D. Projects referred by the Ministry of Defence

47. A number of projects were referred to CEERI by the Ministry of Defence/Defence Research and Development Organisation. Some of them are given below:—

(1) (*a*) *Development of R. F. Signal Generator.*—Work on the design and development of these test instruments was originally started by CEERI on its own. The Ministry of Defence gave exact specifications of their requirements in 1964 to CEERI who immediately started work on meeting the specialised defence requirements.

A laboratory prototype unit has already been successfully completed. Another unit was built in collaboration with a private firm which is expected to do commercial production and subjected to rigorous tests as required by the Defence. A production-worthy unit, fully meeting all environmental and other specifications, is being developed and is to be completed in early 1966.

(2) *Development of Magnetrons.*—Magnetrons are the most essential components of majority of the radar systems.

(i) *Development of 0.5 Megawatt Magnetrons.*—Work on these tubes was originally started by CEERI on its own. The Ministry of Defence gave exact specifications of their requirements in 1964 to CEERI.

Development work on the type of 0.5 Megawatt magnetrons required by the Defence is nearly complete. Further development work, as well as setting-up of batch-production facilities, is hampered by lack of essential raw materials and equipment. Foreign exchange is required for importing them as they (or suitable substitutes) are not available in India.

(3) *Development of S-Band Travelling-Wave-Amplifier Tube.*—Work on this tube was originally started by CEERI on its own. The Ministry of Defence have expressed interest in this work in late 1965. Work has reached the stage of assembling laboratory prototypes. Some special materials, etc., are required to be imported for this project. Requirements have been communicated to the relevant authorities.

(4) *Development of VHF Transistorised Signal Generator.*—Work on this also was originally started by CEERI on its own. The Ministry of Defence gave the exact specifications of their requirements in 1965 to CEERI.

Some preliminary work has been done. A detailed technical note giving the proposed plan of the development and the requirements in respect of foreign exchange, etc., has been prepared and submitted to the relevant authorities.

(5) *Development of Pen Recorders.*—These instruments are used for continuously recording values of quantities like voltage, current, temperature, etc., in complex equipment/plants. Work on their development was originally started by CEERI on its own. The Ministry of Defence requested CEERI in late 1965 to incorporate

certain sepcial features in the unit being developed by C.E.E.R.I. so that the unit would suit their requirements. A laboratory model of the unit being developed by C.E.E.R.I. is ready. Work is being done to incorporate in this unit the features required by the defence users.

(6) *Development of Delay Modules.*—The problem was forwarded to C.E.E.R.I. by the Ministry of Defence in late 1965. Preliminary work has been done and results reported to the indentor. The matter is being discussed with the latter to clarify certain points and to plan batch-production of these units.

(7) *Development of VHF/UHF Silicon Planar Transistors.*—Work on the development of VHF planar transistors was started by C.E.E.R.I. on its own. The Ministry of Defence has asked C.E.E.R.I. in late 1965 to submit a technical note on the development of VHF as well as UHF transistors for use in defence equipment. The development of VHF transistors is nearly complete. The technical note giving details of the work already done and facilities required in the form of foreign exchange, etc., for further work on the development of these transistors has been submitted to the authorities concerned.

(8) *Development of Closed-Circuit Television Systems.*—Work on television system parts was originally started by C.E.E.R.I. on its own. The Ministry of Defence has asked C.E.E.R.I. in late 1965 to look into the problem of developing two *specialised* closed-circuit television systems for defence use. The problem is under active study.

The Committee note that many of the research projects were initiated by C.E.E.R.I. on its own and later the Ministry of Defence have expressed interest in them. The Committee would stress the need for closer collaboration between the Ministry of Defence Electronics and Radar Development Establishment and Defence Electronics Research Laboratory and C.S.I.R./C.E.E.R.I. The Committee would also urge that the progress of research projects for defence should not be allowed to suffer for want of foreign exchange for procuring raw materials and equipments which are absolutely essential and are not available in the country.

The Committee suggest that Government should also examine the question of Defence Research and Development Organisation bearing the expenditure incurred in progressing research projects meant for their use.

E. Problems referred by other Government Departments

48. Following problems were referred to CEERI by various Government Departments:

(i) Simultaneous Translation facilities for Lok Sabha. This problem was referred by the Lok Sabha Secretariat sometime in July, 1963. The design for the system was prepared by this Institute and the installations according to Central Electronics Engineering Research Institute designs were carried out by a private concern.

(ii) Acoustical Treatment of the Conference Room of the Prime Minister.

The problem of acoustics in the Conference room of the Prime Minister was referred to the NPL and CEERI. The remedial measures for better intelligibility were suggested after various measurements were taken.

The problem was taken up in August/September, 1963.

(iii) Acoustic treatment of the Auditorium of the Karnatak Medical College, Hubli. This was referred by the Mysore Government (P.W.D.) and was completed in October, 1963.

(iv) Audiography Room—Karnatak Medical College, Hubli.

The designs for the Audiography Room were given by the Institute towards the end of 1963. This work was undertaken at the request of the Mysore Government (P.W.D.).

(v) Communication (VHF) facilities in the Khetri Copper Mines, Rajasthan. This problem has been referred in early half of 1964. Work is continuing.

The Central Electronics Engineering Research Institute has informed that "no fees have been charged as regards consultancy work. It may be mentioned that consultancy in Architectural Acoustics has been rendered to either Government Departments or Educational Institutions."

The Committee note that research work on acoustics is done by Central Electronics Engineering Research Institute, National Physical Laboratory and the Central Building Research Institute, all working

under the Council of Scientific and Industrial Research. They apprehend that there may be unnecessary duplication of research and recommend that there should be close co-ordination between these three institutions as regards their work on acoustics.

The Committee recommend that consultancy work on acoustics for outside parties may be undertaken by one of the institutions to be specified in this behalf, which may take the assistance as necessary of the other two institutions.

The Committee would like consultancy fee to be charged from outside parties for rendering advice in acoustics.

F. Cooperative Research

49. The Committee have been informed that plans for the establishment of a Cooperative Research Association for Radio and Electronics industry were discussed during the second half of 1964 by the Director-General, Council of Scientific and Industrial Research and Director, Central Electronics Engineering Research Institute with a prominent industrialist in the line. In order to get an accurate idea about the viewpoint of the radio industry on various matters connected with the proposal, a questionnaire was circulated to the industry. It has been stated that the response from the industry has been encouraging.

Based on the information obtained from the industry, tentative proposals for a Cooperative Research Association have been prepared by the Director, Central Electronics Engineering Research Institute and circulated to the interested parties. It has been stated that Memorandum and Rules and Regulation have been finalised. Sixteen members of the Small Scale Electronics industry have already signed as promotee members and the association is expected to be registered shortly.

The Committee understand that Japan has set up "The Electronics Association of Japan" in 1957. It is composed of more than 200 members, comprising Scientists, Members of Parliament, leading government officials concerned as well as corporations operating broadcasting, railways and telecommunication and principal manufacturers of electronic products. Its main objectives are to invite the exchange of views from various circles on numerous problems concerning electronics, its development and utilization, and to map out from a national point of view plans for enhancement of technology and finally to steer the national efforts in conformity with the integrated policy.

The Committee feel that industrial research can best be carried out in collaboration between the scientists and the users. The formation of cooperative research associations is an effective method of bringing about such collaboration. Apart from other benefits, the Cooperative Research Associations which are mainly user biased, generate research potential within the industry for future development and improvement. The Committee commend the efforts made by Central Electronics Engineering Research Institute in setting up a Cooperative Research Association of Radio and Electronics industry which will greatly benefit the industry. They hope that this Research Association will soon begin to function effectively. The Committee would urge Government to encourage the formation of Cooperative Research Associations in industries where they do not already exist.

VI

COMMERCIAL EXPLOITATION OF PROCESSES

A. Processes for Commercial Exploitation

50. The CEERI has evolved 18 products|processes so far which are ripe for commercial exploitation. The particulars of these products| processes are given in Appendix II. It is noted that the following products have been released for commercial production:

Name of the product.	Name of the Firm.	Terms of Licence.
1. Four point resistivity probe.	M/s Oriental Science Apparatus Workshops, Ambala Cantt.	Lumpsum : Rs. 4,00 Royalty : Nil. Nature of Licence: Non-exclusive.
2. Digital frequency meter.	Do.	Lumpsum: Rs. 15,000 (in two instalments. Rs. 10,000 and Rs. 5,000). Royalty : 5 per cent Nature of Licence: Non-exclusive. Period of licence: 14 years.
3. (*a*) Electronic Flash Tube (*b*) Power pack for flash tube.	M/s. J. B. Advani-Oerlikon Electrodes Pvt. Ltd., Bombay.	Lumpsum: Rs. 6,000 Royalty: Nil. Nature of Licence: Non-exclusive.
4. Transistorised power supply.	M/s Omega Electronics Jaipur.	Lumpsum : Nil. Royalty : 2½ % Nature of Licence: Exclusive. Period of Licence : 14 years.

Asked to indicate the annual income from the processes leased out to industry, the Committee have been informed that "the processes were licensed only recently. It may be noted that the five scientific divisions at the Institute were formed in the years 1958, 1959, 1960, 1961 and 1962 respectively. As such most of the projects at this Institute are of a relatively recent origin."

It has been stated that negotiations have also been concluded for farming out the following products:

1. Microwave Components (Circulators, Isolators, Waveguides and flanges)	M/s. Arjuna Electronics Pvt. Ltd., Hyderabad.	Lumpsum: Royalty : Nature of Licence: Period of Licence:	Nil. 5% Non-exclusive 14 years.
2. Television Receiver.	M/s. J. K. Rayon, Kanpur.	Lumpsum : Royalty : Licence: Period of Licence:	Rs. 75,000 payable in 3 instalments. 2% Non-exclusive 14 years.
	M/s. Telarad Pvt. Ltd., Bombay.	Lumpsum: Royalty: Nature of Licence: Period of Licence :	Rs. 75,000 payable in 3 instalments. 2% Non-exclusive 14 years.

It has been further stated that negotiations are in progress for releasing the know-how on (1) Moving Coil Microphones, (2) Sound Level Meter, and (3) Servo-operated Pen Recorders. The remaining products would be released for commercial exploitation after these are industrially engineered.

It will be seen that 18 products/processes have been successfully developed so far by the CEERI for commercial exploitation. Out of these, only four products have so far been released for commercial exploitation but have not actually gone into production. Negotiations have been concluded in respect of two more products. For three more products negotiations are in progress for their commercial exploitation. Three products were developed at the Institute at the instance of private companies which are now using them exclusively. About six products of the Institute still remain to be industrially engineered.

The Committee feel that the time gap in the commercial exploitation of the processes developed by the Institute, should be reduced to the minimum. They have already made suggestions in this regard

in para 44 of their Hundred and Third Report on National Physical Laboratory. The Committee would also urge that the successful processes of CEERI should be widely publicised to stimulate interest of industrialists and users.

B. Research on Tape Recorders and Record Players

51. The work on tape recorders has been taken up by the CEERI very recently. During evidence the Director of the Institute informed the Committee that the Institute has finished the work on the laboratory development of electronics required in the tape recorders. As regards the record players, the Director has further stated that "a few laboratory models of pick-ups, which is one of the most important items, have been made and the work is progressing."

The Committee hope that CEERI will make vigorous efforts to successfully complete their research work on tape recorders and record players as these products are of common utility. They would like that the know-how developed would be got patented and farmed out for commercial exploitation without delay.

C. Research on Microwave Systems and Navigational Aids

52. All radar equipment comes under the heading of 'Microwave Systems'. The Bharat Electronics Ltd. has commenced the production of 'Super Fledermaus Radar' but its planned capacity is only 13% of the total requirements of all types of radar.

During evidence, the Director of the Institute has stated that "Microwave Systems covers a large field which includes microwave links, radar, navigation aids, radio astronomy and satellite communications. The Telecommunications Research Centre and the Indian Telephone Industries are working only on the microwave links. The rest of it is still quite a large field."

The Committee are happy to note that considerable expertise has been developed in microwave technology in the CEERI, the Tata Institute of Fundamental Research, Bombay and the Telecommunication Research Centre, Delhi. The Committee would like close coordination between the research efforts of these institutes in order to develop radar equipment for the use of defence services as early as possible.

D. Research Projects held up due to non-allocations of foreign exchange

53. The C.E.E.R.I. has informed the Committee that "more recently, because of the lack of allocations of foreign exchange for the regular research projects, considerable difficulty has been experienced in procuring equipment. Many of the items are of very small value say, a few hundred rupees. Work is sometimes held up."

Asked to give details of projects held up on account of non-allocations of foreign exchange, the Institute has furnished a statement* showing research projects affected which is given in Appendix III.

The Institute has further stated that, "Only those items have been shown, for which all the formalities have already been completed except release of foreign exchange, which has been awaited for about a year in most cases."

It has been stated that for C.E.E.R.I., "the normal channel for securing the forign exchange is Council of Scientific & Industrial Research. CSIR gets the requirements of every laboratory together with the priorities which the laboratories suggest and then processes all the import requirements with licensing authorities and the Ministry of Finance."

The Committee were informed during evidence that the projects on 'Transistor circuitry for Condenser Microphone' and 'Development of a Gas Type Laser' were held up for over a year on account of non-availability of foreign exchange to the tune of Rs. 75 and Rs. 5000 respectively. The Director of the C.E.E.R.I. further informed the Committee about the development of gas type laser as follows:

> "I understand that some laboratories have already started importing. This is an instrument which we can give to several other laboratories also. This is a very promising area."

Asked to comment on the non-availability of small amounts of foreign exchange as in the above cases, the representative of the Ministry of Finance stated as follows:—

> "If for a particular project which was very beneficial, the only snag was the difficulty in regard to foreign exchange worth about £5, I think they could have got this out of the total allocation. I do not know whether a separate reference

*The list does not include projects sponsored by the Defence authorities. Foreign exchange requirements for these are being taken up with the sponsors (Defence authorities). Please also see para 47 of the Report.

was made to the Economic Affairs Department regarding this. I suppose that was not necessary, because when there is an annual allocation of a few lakhs of rupees, I think a small amount like that could have been found out of the total amount."

The Director General, Scientific and Industrial Research has informed the Committee during evidence as follows:—

"Till about the middle of March, 1965, we were able to meet almost all the requirements from the laboratories. It was only in March when we had utilised about half our allotment which was about Rs. 38 lakhs at that time, that there was a certain ban, and we could not utilise anything more, and even some of these cases that had been processed were also stopped. Since that time we have been going to the Department of Economic Affairs for allotment on specific projects of great importance and we have been getting the grants on an ad hoc basis."

Asked to indicate whether the present procedure of sanctioning of foreign exchange is satisfactory, the CSIR has informed the Committee as follows:—

"Previously powers were being delegated to the CSIR for issuing foreign exchange sanctions against the foreign exchange allocation in respect of proposals under free resources (imports from countries having no rupee payment Agreements with India), after the concurrence of the F.A. to CSIR, without reference to the Ministry of Finance (DEA). However proposals relating to Rupee Area were cleared by the Ministry of Finance (DEA) from Trade Plan angle. Such powers have been withdrawn with the imposition of ban on imports w.e.f. March 1965. In case these powers are again delegated to the CSIR with the allocation of foreign exchange as done earlier, it will help expedite issue of foreign exchange sanctions in respect of proposals under Free Resources.

The foreign exchange allocation at present is made on six monthly basis. It would be preferable if it is made on yearly basis.

Sometimes small items are required urgently without which research work in Laboratories/Institutes is held up. To meet situation like this, it would be necessary that foreign

exchange allocation between two to three lakhs is made by the Government of India for the purchase of UNESCO Coupons which will ensure speedy procurement of small stores."

The Committee note that while foreign exchange worth Rs. 5,000 was not sanctioned for the development of gas type laser by the CEERI, many laboratories were allowed to import the instrument. This is yet another instance of lack of coordination where foreign exchange has been expended to import instruments which could have been developed within the country by spending small amounts of foreign exchange to intensify research. The Committee feel that important projects which require only a small amount of foreign exchange should receive greater attention of CSIR while processing the demands of its various laboratories. The Committtee also recommend that Government may examine early the suggestion of CSIR that "foreign exchange allocation between two or three lakhs be made by Government for the purchase of UNESCO Coupons which will ensure speedy procurement of small stores."

VII

COORDINATION OF RESEARCH ACTIVITIES

A. Coordination between different Institutions

54. It has been stated that there are at present about 20 institutions in the country which are working on the various aspects of electronics. The names of the institutions are given below:

(1) C.E.E.R.I.

(2) Electronics Division of Atomic Energy Commission.

(3) Electronics Division of N.P.L.

(4) Bharat Electronics Ltd.

(5) Indian Institute of Technology, Kharagpur, Kanpur, Bombay, Madras and Delhi.

(6) Electronic Departments of Universities.

(7) Electronics and Radar Development Organisation (Defence).

(8) Defence Electronics Research Laboratory.

(9) Defence Service Laboratory.

(10) Solid State Physics Laboratory.

(11) Defence Research and Development Laboratory.

(12) Post and Telegraphs Telecommunication Research Centre.

(13) Tata Institute of Fundamental Research.

(14) All India Radio Research Department.

(15) The Civil Aviation Research Department.

(16) Indian Institute of Science, Bangalore.

(17) Physics Research Institute, Ahmedabad.

Asked to indicate the coordination existing between C.E.E.R.I. and these institutions working in the same field, the Committee have been informed as follows:—

"Coordination between C.E.E.R.I. and the institutions takes place at several levels which may be listed as under:

(1) Exchange of reports.

(2) Mutual visits of scientists.

(3) Membership on various committees formed by the Government of India such as:

(i) Electronics Committee and its Working Groups.

(ii) Technical Committee for Electronics and its Working Groups.

(iii) Radio & Telecommunication Research Committee.

(iv) Committees of the Indian Standards Institution.

(v) Membership on the Senate and Board of Studies of teaching institutions.

(vi) Membership on Executive Councils.

(vii) C.E.E.R.I. representation on Defence Electronics Research Committee.

It has further been stated that close coordination is maintained with these institutions in the choice of programme at C.E.E.R.I. For example, in the field of semi-conductor devices, C.E.E.R.I. did not take up any work on the development of semi-conductor materials which is already being done at the Atomic Energy Establishment and the Solid State Physics Laboratory of the Ministry of Defence as well as National Chemical Laboratory of the C.S.I.R. Thus, when the work in this area was started at C.E.E.R.I., it concentrated on a new technology of making transistor devices namely silicon planar transistors. By concentrating on this, the Institute has been able to develop in a relatively short period, the technique of fabricating silicon planar transistors."

During evidence the Director of C.E.E.R.I. further stated that "There are joint meetings which our staff attend and whenever they are on tour, they usually visit industries also. I can say without exaggeration that generally I know all the work that is being done in any of these organisations. I believe that similarly there will be other persons also who know what is going on all over the country".

During their visit to Pilani in December, 1965, the Study Group of the Estimates Committee have been informed that while the Managing Director of B.E.L. is represented in the Executive Council of C.E.E.R.I., the Director of C.E.E.R.I., is not on the Board of Directors of Bharat Electronics Ltd.

The Committee consider that the existing arrangements of coordination between the various research organisations doing work on

electronics in the country are not quite satisfactory as they are mostly based on *ad-hoc* membership of Government Committees or informal exchange of visits and literature

The Committee consider that as the strategy of research in electronics has been broadly laid down by the Electronics Committee it should be easier to effect closer liaison between leading research organisations so as to avoid duplication of research work as well as to derive mutual benefit from each others experience.

The Committee recommend that there should be inter-locking of membership in the management committees (i.e. Executive Council, Board of Directors etc.) of the various research organisations working in the same field. They would further suggest that the Director of C.E.E.R.I. may be represented on the Board of Directors of B.E.L. which is the premier unit manufacturing electronics equipment in the country.

B. Coordination with Universities

55. It has been stated that there is close and formal collaboration between the Institute and the Birla Institute of Technology and Science and the Indian Institute of Technology, Delhi. Agreements have been concluded with these Institutes for training their students in various disciplines of electronics engineering at the C.E.E.R.I. The terms of agreement are given at appendix IV.

The Institute is also having informal collaboration with other Institutes and Laboratories. It provides training facilities to undergraduate and post-graduate students of electronic engineering in universities and institutes of technology. About 20 trainees are taken every year.

The C.E.E.R.I. has also helped Jadavpur University by providing printed circuits required in the field of computers.

Asked about any plans for entering into similar formal agreements with other leading universities and colleges, it has been stated that "the scheme may be extended after seeing the results of these two pilot projects." It has been further added that geographical and other features will not be as convenient as in the cases of Birla Institute of Technology and Science, Pilani and the Indian Institute of Technology, New Delhi.

The Committee welcome the agreements, entered into by C.E.E.R.I. with the two institutions (viz. B.I.T.S., Pilani and I.I.T.,

New Delhi) as they consider that closer associations provided by those agreements between the two organisations will prove beneficial to both. They would like C.E.E.R.I. to establish, in due course, institutional links with other Universities and technical institutes interested in advanced research in electronics for their mutual benefit.

C. Training Courses

56. The Committee have been informed that C.E.E.R.I. conducts the following courses:

"(1) Advanced Refresher Courses.—Since 1963-64 advanced training courses (comprising lectures and practical demonstrations) in various disciplines of electronic engineering are being held every year. In the course held in December —January, 1964, forty trainees from the industry, CSIR Laboratories and other Government institutions participated. Fifty-five trainees from various research institutions, industrial organisations, defence and government department attended the second series of the training courses held in April-May, 1965.

(2) Specialised Training.—Training facilities are provided to under-graduate post-graduate students of electronic engineering in universities and institutes of technology. About twenty trainees are taken every year.

(3) Graduate Apprentices.—Three to four science graduates are taken as paid apprentices for one year training in various research groups. They are eligible for regular employment in the Institute subject to their successful completion of the training and the availability of posts vacant.

(4) Workshop Apprentices are taken every year for training in various trades in the workshop. The number of trainees depend upon the requirements and the period of training ranges between 1 and 3 years, depending upon the qualifications, prior experience and progress of the apprentices. A stipend of Rs. 75 per month is paid to each trainee. The trainees are eligible for regular employment subject to their successful completion of training.

These training programmes have been very useful and would be continued.

In addition, agreements have been concluded with the Indian Institute of Technology, Delhi and the Birla Institute of Technology & Science, Pilani for training their students in various disciplines of electronic engineering."

C.E.E.R.I. is a premier research institute in electronics and has a large programme of expansion during the ensuing Plan period. The Committee would like the training facilities in the Institute to be put to effective use keeping in view the overall requirements of electronic industry.

VIII

GENERAL MATTERS

A. Testing Laboratory

57. It has been stated that there is a severe bottleneck in respect of testing facilities available for the electronic industry. Two of the best equipped centres for the work are:

(1) Chief Inspectorate of Electronics, Bangalore; and

(2) Electronics and Radar Develoment Establishment, Bangalore.

It has been stated that the above testing centres have a considerable testing load from the regular manufacturers under the defence auspices at Bharat Electronics Limited and other places.

The CEERI has proposed to establish a testing laboratory at Pilani at a cost of Rs. 30 lakhs. The most important function of the testing laboratory would be to provide testing facilities for various products on which work is being done at the Institute. It has been stated that in order to take the laboratory work to the final stage after user acceptance, it is necessary to give them not only exhaustive electrical tests but also environmental and durability tests. Equipment needed for this purpose includes humidity chambers, dry heating chambers, cold chambers, shock and bump test machines vibrating testing machines, etc.

The facilities at CEERI would also be made available for testing developmental models of the industry at large which, at present, does not have an outlet where they can get results of testing speedily.

Capital and Recurring Expenditure

58. It has been estimated that during the Fourth Five Year Plan, a capital expenditure of Rs. 22 lakhs and a recurring annual expenditure of about Rs. 1·5 lakhs would be required for the setting up of the testing laboratory.

Asked about the revenue to be earned from this laboratory, it has been stated that the testing fees would not be the only source of revenue since the testing laboratory would also play a part in

development of know-how of the CEERI and in taking up the projects developed, through their final stages of engineering. There would also be savings of foreign exchange, through replacement of imported equipment and imported know-how which can otherwise run into difficulties since users insist on environmental and durability tests being performed on the products of development.

59. *Location.*—Asked whether the testing laboratory at Pilani would be made use of by the industry, the Institute has furnished the following reply:

> "The advantage of having testing facilities of the type and of the modest scale described above at Pilani would be that not only would the Institute be able to give complete tests to its own developmental products but it could also give such tests to the firms coming to the Institute for consultancy and other work. In this way, it could provide 'One-Stop Shopping' for the industry in respect of its requirements."

The committee note the following observations made by the Electronics Committee:

> "The establishment of test facilities in each area of the country in which the electronics industry is established in an urgent necessity, and the Committee considers that such centralised test facilities should be available as early as possible in the industrial centres such as Bangalore, Bombay, Calcutta and Delhi. The Committee therefore recommends that to begin with:
>
> (a) the Atomic Energy Establishment at Trombay be asked to set up test facilities for the Bombay region;
>
> (b) the N.P.L., New Delhi, be asked to augment the existing facilities to cater for the needs of the Delhi region;
>
> (c) the Defence Research and Development Organisation at Bangalore be asked to augment the existing facilities to meet the requirements of the Southern region; and
>
> (d) similar facilities be set up in Calcutta or elsewhere in the Eastern region.

The Committee are inclined to agree with the views of the Electronic Committee as far as electronic industry is concerned. They feel that CEERI also requires some testing facilities for various products being developed by it. The Committee would like Government to take a decision about the scale of facilities to be provided at Pilani

keeping in view the above observations and the fact that Pilani is situated far away from manufacturing centres like Calcutta, Bombay, Bangalore, Delhi, etc.

B. Extension Centres

60. The Third Reviewing Committee of CSIR (1964) observed that "A Central Institute's task of identification of technical problems, of their preliminary exploration and finally of the application of completed processes can be facilitated by its having a certain number of field stations in various parts of the country.... The facilities of these extension centres should essentially be such as to enable them to contact the local industry and assist them in translating into practice the results of research carried out by the parent specialised laboratories. Attempts should be made to invite the local industry to share in the financial participation and control of the field stations. In appropriate cases, it may even be desirable to let the industry or the "user" have the entire control and responsibility for a field station wherever possible". The Reviewing Committee recommended that "since the electronics industry is mostly concentrated ner Bangalore and Bombay, the CEERI could well locate field stations at these places with user participation."

It is noted from the Fourth Plan proposals of the CEERI that "it proposes to set up at least two and possibly upto four extension centres during the Fourth Five Year Plan period. It is anticipated that the expenditure on each of the extension centres during the Fourth Plan period would be to the tune of Rs. 1·0 million, out of which half would present the capital expenditure."

Asked about the progress made in establishing the extension centres, the Director of the Institute has informed the Committee during evidence as follows:

> "The Small Scale Industry for radio manufacturers in Bombay and also the Instrument Manufacturers' Association in Bombay have recently made proposals for starting co-operative research centres and taking assistance from C.S.I.R. also. In that direction we have been already in touch with the Bombay area. One extension centre can come in that area. Another area which has been showing interest in the small scale industry of Punjab. For that also the Punjab Government had recently invited the

Director to see the sites and they had offered their co-operation. A proposal has been sent to the C.S.I.R. for helping the centre that Punjab Government have by an extension centre of C.E.E.R.I. beside it."

The Committee hope that careful consideration will be given to locate the extension centres of the C.E.E.R.I. so that these can render maximum assistance to the electronic industry. The Committee endorse the Reviewing Committee's views that attempts should be made to invite the local industry to share in the financial participation and control of extension centres.

C. Executive Council of C.E.E.R.I.

61. Rule 71 of the Rules and Regulations of the Council of Scientific and Industrial Research states that "for each National Laboratory, at the time considered appropriate by the Governing Body, there shall be appointed an Executive Council responsible for the control and general direction of the laboratory within the framework of rules and regulations and directives issued from time to time by the Governing Body."

The functions of the Executive Council are as follows:

(i) To consider the scientific programme as recommended by the Scientific Advisory Committee and to appropriate funds within the block grant (which may be allotted to the National Laboratory by the Governing Body).

(ii) To frame the annual budget of the National Laboratory on the basis of the views of the Scientific Advisory Committee with the block grant and to regulate the expenditure.

(iii) To consider proposals for projects recommended by the Scientific Advisory Committee and/or the Board of Scientific and Industrial Research which require additional expenditure beyond the block grant to make recommendations to the Governing Body regarding the same.

(iv) To determine the strength of staff; and take decisions on creation, suspension and abolition of posts provided that in the case of Junior Scientific Officers and above this should be subject to the approval of the Governing Body.

(v) To appoint scientific and such other staff as provided by regulations framed by the Governing body of the Council

of Scientific and Industrial Research, other than those of Junior Scientific Officers and above who shall be appointed by the Governing Body of the Society;

(vi) To consider extension of service of staff (except the staff appointed by the Governing Body) as referred to in (v) including extension beyond the age of superannuation in accordance with rules; and

(vii) To impose penalties on members of the staff in accordance with the rules, provided that no officer of the rank of Junior Scientific Officer and above is dismissed or discharged except with the previous approval of the President.

Meeting of Executive Council:

62. Bye-law 39 of the Rules and Regulations of the Council of Scientific and Industrial Research states that:

> "Meeting of the Executive Council shall be convened not less than twice a year in the National Laboratory or such other place as the Chairman may decide."

A special meeting can be convened under Bye-law 40 if not less than half the number of members of the Executive Council make a request to that effect.

The Committee note that since its inception, the Executive Council of the C.E.E.R.I. has held only 9 meetings till 1965. The particulars of the meetings held by the Executive Council since 1962 are given below:

Meetings

(1) 9-8-1962

(2) 21-8-1963

(3) 19-8-1964

(4) 9-2-1965

(5) 17 & 18-8-1965

It will be seen that while rules provide for at least half yearly meetings of the Executive Council, in actual practice it has held only 9 meetings so far and that except in the year 1965, the Executive Council has not held the minimum of two meetings in any year so far.

During evidence it has been stated by the Director, C.E.E.R.I. that, "It is only since 1964 that research and development programmes have increased substantially which justify the holding of the Executive Council meeting biennially. Neither the outside members nor Finance nor the C.S.I.R. members felt the need before that to have the meetings twice a year."

The Committee regret to observe that the meetings of the Executive Council of C.E.E.R.I. were not held even twice a year before 1965, which is a violation of the Rules and that also without even amending the rules. They feel that the C.S.I.R. should see that the Executive Council is being properly convened and utilised. In this connection the Committee will like to refer to their recommendation contained in para 137 of the Report on National Physical Laboratory.

D. **Scientific Advisory Committee of C.E.E.R.I.**

63. Rules 75 and 76 of the 'Rules and Regulations of C.S.I.R.' state that:

> "The Executive Council of a National Laboratory shall be assisted by a Scientific Advisory Committee, appointed by a Governing Body."

The Scientific Advisory Commitee of a National Laboratory shall consist of scientists actually engaged in the particular subject leading industrialists interested in the subject and representatives of the concerned Ministry or Ministries of the Government of India. The Director of the Laboratory shall be ex-officio chairman of the Scientific Advisory Committee.

The function of the Scientific Advisory Committee as laid down in the Rule 77, are as follows:

(i) To consider the budget of the National Laboratory and give its views;

(ii) To consider and recommend the programme of research for the Laboratory;

(iii) To review the progress of research;

(iv) To consider the annual report;

(v) To make recommendations relevant to the implementation of research projects; financial and otherwise;

(vi) To advise on matters of policy relating to patents and publication, excepting scientific communications to learn-

ed periodicals, urgent publications may be undertaken at the discretion of the Director in consultation with the Director-General;

(vii) To advise on pilot plant investigation;

(viii) To maintain liaison with universities, Government Departments and industry; and

(ix) To advise on processes considered fit for release to industry and to the National Research Development Corporation.

During evidence the Director of C.E.E.R.I. state that "there is a Scientific Sub-Committee of the Executive Council. This is the one that goes over the programmes."

The Committee have pointed out that non-observance of Rules in this regard by the National Physical Laboratory also. They are unhappy at the indifference shown by the authorities concerned in observing the provisions of the Rules. In para 138 of their Report on National Physical Laboratory the Committee have already recommended for the appointment of Scientific Advisory Committees in all the national laboratories where they have not been formed so far. They hope that urgent action would be taken to appoint the Scientific Advisory Committee for C.E.E.R.I. also.

E. Publicity

64. The Committee have been informed that the Institute published the following:—

(a) Annual Reports,
(b) Quarterly News Letter,
(c) Brochure entitled "Products Developed at C.E.E.R.I.",
(d) Brochure entitled "Welcome to C.E.E.R.I.",
(e) Brochure issued on the inauguration of Batch Production Unit for Television Receivers and other Electronic Equipments at C.E.E.R.I.

It has been stated that the quarterly News Letter in which the work being done at the Institute and the current trends in Electronics are brought out to the notice of users, industry, universities and other research organisations.

The Committee hope that all out efforts will be made to give wider publicity to the activities of the Central Electronics Engineering Research Institute so that the results of the research being done at the Institute reach the parties concerned quickly and they derive benefit out of it in time. They would further suggest that exchange

arrangements may be made by C.E.E.R.I. to obtain information and publicity material brought out by other institutes doing work in Electronics.

F. Amenities for Staff

65. The Committee have been informed that at present the Central Electronics Engineering Research Institute has a housing colony with 125 quarters. Another 25 quarters are under construction. The colony is well planned with metalled roads, street lighting and parks. There is a staff hostel which is fully furnished, and has a spacious lounge and a dining room. It is meant mainly for unmarried members of the staff. Occasional trainees are also accommodated here. Adjoining the hostel is a guest house with air-conditioned rooms. This is intended for scientists and industrialists on short visits to the Institute. The Institute has a club which provides facilities for outdoor and indoor games.

During their visit to the Central Electronics Engineering Research Institute, during December, 1965 the Study Group of the Estimates Committee have been informed that there are no facilities of community centre and shopping centre for families of the employees of C.E.E.R.I. The Committee note that the construction of a community centre and a dispensary for the staff colony was recommended by the Executive Council of C.E.E.R.I. in August 1959 but the same have not been constructed so far.

The Committee consider that in an out-of-the-way place like Pilani it is necessary to provide basic amenities of housing, medical, marketing etc. to the staff to attract and retain promising scientists. They would like Government to examine early the question of providing a Community Centre at moderate costs at Pilani for the use of the staff of C.E.E.R.I. and their families. The Committee note that medical and marketing facilities exist at Pilani for the staff of Birla Institute of Technology and Science. They suggest that the same may be made available to the staff of C.E.E.R.I. by mutual agreement with the Birla Education Trust, Pilani.

IX

CONCLUSION

66. The electronics industry which requires raw materials, components, equipment and systems, offers a vast field for research. The Central Electronics Engineering Research Institute has mainly concentrated on the following specific areas for research in electronics:

(i) Television receivers and associated equipment, transistor sets, sound recording and reproduction; which are of considerable importance in the field of cultural progress, social education and entertainment.

(ii) V.H.F. links and digital communications which are useful in the field of specialised communications.

(iii) Recorders and controllers which are of use in the field of industrial controls.

(iv) Signal generators, digital equipment and ocilloscopes which are important in the field of electronic instrumentations.

(v) Magnetrons, carcinotrons and travelling wave tubes—in the field of navigational aids and microwave systems, which are of strategic importance.

During the short period of its existence, the Institute has achieved significant success in developing television receivers which will be in great demand in view of the television service which is to be introduced within the country. The Institute has also helped in the solution of defence problems and is making good progress in developing high-power radars for defence use.

The Committee have no doubt that with its reputation, the Institute will contribute greatly to the development of Electronics Industry in the country which, according to the Electronics Committee, is expected to produce electronic equipments worth over Rs. 1,600 crores during the next ten years. The Committee feel that with the coordinated efforts of all the electronic institutes in the country it should be possible to build up indigenous know-how and import substitution in the field of electronics. The Committee would like C.E.E.R.I. to intensify research on transmission equipment for radio and television as also on television camera so as to develop indigenous know-how for these important equipments as early as possible.

They would also like greater attention to be paid to the development of tape recorders, record players, transistorized radio and television receivers etc. which are items of utility for the general public. The Committee see no reason why it should not be possible for India to build up an export market for electronic equipments in the Asian and African countries in this labour intensive industry. The Committee recommend that the programme of research in electronics in the country should be intensified as it is the nervous system of modern technology.

The Committee feel that the Institute should seriously apply itself in helping the industry to reduce the cost of production and improve the quality of the indigenous electronic components so as to bring them at par with the best available in the world.

ARUN CHANDRA GUHA,
Chairman,
Estimates Committee.

NEW DELHI;
April, 15, 1966.
Chaitra 25, 1888 (*Saka*).

APPENDIX I

(*Vide* para 18)

Details of the Fourth Plan Proposals of CEERI

(i) AUDIO ENGINEERING AND ACOUSTICS

1. *Acoustic Transducers*

1.2(1) Work on ultrasonic magnetrostrictive transducers for directional microphones (moving-coil and condenser types) will be undertaken. These are particularly useful in applications where discrimination against background noise is required.

1.2. *Other Transducers*:

1.2(1) Work on ultrasonic magnetrostrictive transducers for high power (about 1 KW) industrial applications will be continued.

1.2(2) *Magnetic Record Reproduce Heads.*—Work initiated in this direction during the end of the present Plan period (*i.e.* 3rd Plan) will be continued. The basic objective in this project will be to design and develop magnetic heads for audio frequency applications.

1.2(3) *Loudspeakers and loudspeaker System.*—A number of concerns have started assembling loudspeakers with the help of foreign know-how. It is intended to set up a development programme in collaboration with some of the Indian concerns to produce better design for both general purpose loudspeakers and for high quality loudspeakrs and for high quality loudspeaker systems.

In conjunction with the programme of high quality microphones and sound systems, this project could yield very fruitful results and may also become a source of foreign exchange.

2. *Acoustical Materials*

2.1. *Continuation of work already started.*—Work of analysis, study and measurements on acoustical materials already started in the third plan period will be continued.

2.2. *Collaboration with Manufacturers of Acoustical Materials.*—Thermal insulation materials in the form of mineral wool, glass, wool, etc., are being manufactured in India. Also, some amount of insulation boards which could be used in acoustical treatment are being indigenously produced.

In order to make effective use of the above materials for acoustical treatment, it is intended to set up a collaborative scheme with the manufacturers. This will go a long way in fulfilling an important need of indigenous acoustical materials.

3. *Audio Equipment and Instruments*

3.1. *Continuation of work already started.*—Design and development of the audio equipment and releasing them to industry will be continued. In particular, the consolidated programme of sound systems will be intensified.

4. *Speech Analysis*

As has already been mentioned in report on Third Five Year Plan, bandwidth compression systems for speech signal are assuming increasing importance. From a survey of the available data and recent developments in this field, it has now become clear that channel vocoders and voice-excited vocoders are capable of transmitting speech signal in digital form over a channel of reduced bandwidth. It is planned to consolidate and intensify this programme of work.

5. *Setting up of Facilities*

In view of the programme of work being done in the present plan, and the programme envisaged for the coming plans, it is essential to set up the following facilities:

(a) *An echoic Chamber.*—This is a room for obtaining echo-free conditions. It will be used for measurements on microphones, loudspeakers, small size machinery, etc.

(b) *Reverberation Room.*—A properly designed reverberation room meeting the international specifications will be essential for measurements of acoustical properties of materials, measurements on loudspeakers, etc.

(c) *Acoustically Treated Room.*—A room treated acoustically is needed for conducting subjective tests on microphones, loudspeakers, sound systems and for intelligibility tests on speech systems.

(ii) Communication Systems

1. *Television Systems*

It is hoped that by the end of the Third Plan ending in March, 1966, the know-how on T.V. receiver and the test equipment, *viz.* (1) Transistorised pattern generator, (2) Standard Synchronization wave-form generator, and (3) medium power experimental transmitter unit will be transferred to the industry for commercial production.

Reseach and development effort will be committed to the following projects:

1.1. *Closed-loop Television System.*—The work on the development of this system can be divided into two main sub-heads:

1.1.1 *Vidicon Television Cameras.*—To satisfy specific demands of studious, field pick-up systems, process control and research programmes, development of different types of camera units will be taken up. Work on a completely transistorized 1 vidicon camera is already in progress. Sophisticated versions of the same equipment will be developed for remote controlled operations and high quality reproduction systems for different environmental conditions.

1.1.2. *Video Monitors.*—As the development work on cameras progresses, work on simplified and also on sophisticated high quality video monitors will be started. It is proposed to start work on both tube and transistorized versions of the equipment simultaneously. Different versions of the equipment will be made available by the end of the Fourth Plan. The unit will be used in control room monitoring in conjunction with T.V. cameras.

1.2. *Remote Control Facilities.*—In order to control the camera from a remote point, it is proposed to start work on two types of R-C systems.

1.2.1. *Simple Remote Controlled Systems.*—This will have direct control of three main operations, *viz.* beam, focus and target. Optical focus and aperture controls will be prefixed and will be operated manually, when required.

1.2.2. *Remote Control Using Servo-Drivers.*—This system will be fairly complicated and will enable full control of T.V. camera from a remote place in respect of the following operations:

(i) Mechanical focussing and aperture control.

(ii) Electrical focus, beam and target control.

(iii) Pan and tilt control.

(iv) Lens turret drive.

The application of such a system will be needed in all complicated process controls, where access is either difficult or impossible.

2. *V.H.F. Communication Systems.*—Work initiated during the Third Plan on the development of the following modules will be completed:

(a) VHF FM frequency selecting and generating units.

(b) IF amplifier units.

(c) Discriminator units.

(d) Audio & Modular units.

These modules will be used for fabricating different types of communication equipment described below:

2.1. *Antenna Systems.*—Research effort will be directed towards the development of VHF antenna systems for vehicular communication, T.V. antennas. Frequency independent log-periodic arrays of dipoles or monopoles.

2.2. *Telemechanical Equipment for Mining.*—Work on the development of VHF Wireless communication system for installation at Khetri Copper Mines was started in May, 1964. It is expected that prototype equipment will be ready for installation by the end of December, 1966.

2.3. *Communication Equipment.*—Using the modules developed at CEERI, the following types of equipment will be developed and fabricated:

(a) VHF trans-receivers 100-184 Mc/s 50 Watts.

(b) Radio Relay Equipment 50-150 Mc/s 50 Watts.

(c) VHF Airborne and ground to air Wireless Stations 250-400 Mc/s.

(iii) Electronic Instrumentation and Automation

1. *Instrumentation.*—Current engineering and productionising phase of the following instrumentation projects, expected to be developed by the end of the Third Plan period, will be undertaken:

(i) Transistorised servo-operated pen recorder for use in hospitals and industrial organisations.

(ii) Digital Frequency Meter (upto 100 Mc/s) for general use in Electronics Industry.

(iii) Spark Advance Indicators for Automobile industry and service stations for cars.

(iv) Portable Oscilloscope with 5 Mc/s bandwidth for Radio and Electronics Industry.

(v) Transistorised R.F. Signal Generator (30 Kc/s, 30 Mc/s) for use by various organizations, such as All India Radio, Overseas Communications, Defence and Radio & Electronics Industry.

2. *Computor Engineering.*—Engineered model of an analogue computer with 10 operational amplifiers will be constructed. In addition, design and construction of some of the basic digital instrumentation modules will be taken up, which would serve as basic building blocks of digital computors.

3. *Control Systems Engineering.*—Development programme on nonlinear control systems initiated during the Third Plan will be continued. Design and construction of some compact nonlinear function generators and servo modules using transistors and other solid state devices would be undertaken. These systems find extensive use in chemical process control, in aircrafts and ships.

Research and development of the following control instruments for industry will be undertaken.

(i) Twist tester	For textile industry.
(ii) Rick counter	
(iii) Batch counting and registering Unit	For Railways and consumer goods industry.
(iv) Digital Speedometer	For automobile industry.

It is expected that breadboard models of the above mentioned instruments would be ready by the end of the Fourth Plan.

Research programme will be initiated on numerical control of machine tools and design and construction of the following basic modules:

(a) Constant speed control drive for tape movements and drilling machines.

(b) Positioning servo-mechanisma.

(c) Data processing units.

(d) Pulse pattern generator incorporating basic flip-flop circuits.

4. *Printed Circuits and Miniaturisation.*—The following research and development projects will be undertaken:

(a) Production of some of the miniature components such as resistors and inductances by the thin film technique.

(b) Survey and general feasibility studies regarding the use of indigenous materials for printed circuits with the help of other C.S.I.R. laboratories.

(c) Setting up and finalization of the test facilities for printed circuit work and direct help to the industry in setting up the printed circuit techniques through CEERI extension centres.

Solid State Devices

1. *Devices Fabrication*

1.1 *Germanium Diodes*: The present project on developing the process of fabricating germanium general purpose diodes will be continued. The diodes are being made at present under batch production conditions. The detailed testing, applications and the passing over of the process to an industry should be completed by the middle of 1966.

1.2. *Germanium Fast Switching Diodes*: Because of a large demand from some consumer departments like P & T etc., work towards developing the process for manufacture of fast switching diodes will be initiated. Our experience of germanium general purpose diodes will be a great help on the development of this project.

1.3. *Silicon High Frequency Power Transistor*: The developmental work on the present project on planar passivated transistor, 75 mc, 5 watts would be completed by the end of 1965. The batch production and its passing over the industry would be completed by the end of 1966.

1.4. *Varactor Diodes*: In this period, point contact and diffused varactors will be developed. Efforts will be made to develop the microwave package also indigenously.

1.5. *Silicon Integrated Circuits*: Silicon opitaxial structure would be utilised for fabrication of simple semiconductor integrated circuits such as flip flop and Darlington amplifier, etc.

2. *Lasers*

In the first phase of this project, work has already started towards the development of a Xenon gas-filled laser which would operate at 3.4 micron wavelength. Work would also be initiated to develop Helium-Neon lasers operating in the visible region.

Facilities would be developed to measure the output power of these gaseous lasers.

(v) Vaccum Tubes

The following programme is proposed to be carried out:

1. Industrial engineering of Magnetrons and Power Triodes; batch production of these tubes. Development of higher power magnetrons and some special purpose transmitting tubes.

2. Prototypes of S-Band Travelling Wave Tube, S-Band M-carcinotron, parametric amplifier and harmonic multiplier. Work will be continued on the development of special purpose microwave components such as circulators, isolators, dual-directional couplers, etc. depending upon the requirements for these.

3. Work on the systems built around indigenously developed microwave elements will be started. Complete harmonic power sources for various bands and parametric amplifier systems will be developed.

4. Work will be started on the development of Radar R. F. subassembly.

5. Exploratory work in the following areas will be continued.
   Crossed-field Beam-wave Interaction

   Beam-Plasma Interaction.

   Some prototypes based on this exploratory work will be built.

6. Research work in the area of millimeter and sub-millimeter waves will continue.

(vi) Industrial Engineering

The Industrial Engineering Group set up recently performs the following functions:

1. Development and batch production of industrially engineered prototypes of the laboratory models of electronic equipment developed at the Institute prior to handing over the know-how to the industry.

2. Development and fabrication of specialized research equipment required at the Institute or by other organizations.

3. Servicing and maintenance of electronic instruments used at the Institute.

A small beginning has been made in this direction. By the commencement of the Fourth Five-Year Plan, the activities of this group are expected to be in full swing. With the overall growth of the research and development work at the Institute and increased demands from the industry, a growth rate of about 25 per cent per annum is expected during the entire period of the 4th Plan.

(vii) Auxiliary Fields, Library, Documentation, Extension and Consultancy

1. *Library and Documentation*

The documentation service which is now being established will be strengthened to accomplish the following tasks:

(a) Systematic scanning of incoming literature for preparation of annotated project-oriented bibliographies;

(b) Preparation of abstracts;

(c) Evaluation of trends in Electronics in Asian countries; and

(d) Assessment of research and development work in other institutions in India.

In addition surveys of reading behaviour and information level of scientists will be conducted.

2. *Publications*

Publication of Newsletter, technical papers, monographs, brochures, etc. will be continued. With the overall growth of research and development work at CEERI., considerable expansion in the publication work is envisaged.

3. *Industrial Liaison*

By the end of the Third Five Year Plan, a number of products/processes developed at the Institute will reach the stage of commercial exploitation. A close co-operation with the industry is, therefore, of vital importance for effective utilization of results of research and identification of future research and development problems. With these aims in view, the following studies are envisaged:

(i) Assessment of demand for consumer and non-consumer types of electronic equipment and appliances.

(ii) Surveys of raw-materials for the Electronics industry.

(iii) Economic structure of large and small scale Electronics industry and their contribution to the gross national product.

(iv) Assessment of the economic contribution to the industry by processes and products developed at C.E.E.R.I.

(v) Market research for products developed at the Institute.

4. *Operational Research*

It is proposed to set up an operational research group for studying:

(i) Consumer behaviour in respect of Electronic Equipment and appliances.

(ii) Role of electronic industry in overall industrial development of the country.

(iii) Inventory control problems in the industry.

(iv) Assessment of usefulness of technical assistance rendered to the industry.

(v) Application of PERT (Programme Evaluation Review Technique) and other related techniques in research and development projects.

(vi) Research, Budgeting and project selection.

5. *Training*

Short term training courses are now being organized for the benefit of industrial personnel and research workers of other institutions. This effort will be almost doubled in the fourth plan period. In addition, advanced courses are envisaged for our research staff.

(viii) DEVELOPMENT AND EXTENSION SERVICES IN INDUSTRIAL ESTATES

Extension Services

After a proper survey of government and other users and location of Industry, some place or places will be chosen for the location of one or more Extension-*cum*-Development centres. The basic objective of these centres would be the fostering of co-operative ventures and helping the industry to be self-reliant in its development testing and standardising work.

C.E.E.R.I. in conjunction with the respective State Governments and other related departments would strive to establish such centres at the chosen places. These centres would initially provide the following facilities:

(i) Common Test facilities.

(ii) Standarisation of Components.

(iii) Technical Advisory Service.

(iv) Market Research.

In the 2nd phase these services would be broad and the following other facilities would be incorporated:

(a) Development of new instruments, appliances and equipment.

(b) Research work mainly devoted to the specific problems of the constituent units.

The constituent units or the respective State Governments or both can be and would be associated with such centres from the beginning and asked to share part of the cost, by providing the following facilities:

(i) Buildings and other civil works of the centres.

(ii) Administrative and lower category staff.

(iii) Library and documentation services.

APPENDIX II

(*Vide* para. 50)

Statement showing processes developed by the C.E.E.R.I. for Commercial exploitation

Name of the item	Date of commencement of research	Date of completion of research	Brief indication of the result	*Expenditure incurred on the research	Date of utilisation on a pilot plant scale	Date of utilisation on a commercial scale	Remarks (including reasons for delays, if any)
1	2	3	4	5	6	7	8
1. Television Receiver (Valve Version)	1961	December 1964	Laboratory model completed and demonstrated at ITE Convention, New Delhi.		Industrially engineered for batch production.	Negotiations concluded for commercial production.	
2. Transistor circuit testing thermostat.	June 1963	February 1964	Project sponsored by M/s. Semiconductors Pvt. Ltd., Poona. Unit completed and handed over to the party.		Not applicable.		
3. R.F. Signal Generator	January 1961	1964	Completed under productionization at M/s. Eastern Electronics Pvt. Ltd., Faridabad.				
4. Digital Frequency Meter.	December 1962	March 1965	Laboratory prototype completed and tested.			Know-how transferred to industry in July, 1965.	
5. Transistorized voltage regulated power supply.	September 1962	February 1964	Laboratory prototype completed.		Industrially engineered model completed in September, 1964.	Know-how transferred to industry in September, 1965.	

1	2	3	4	5	6	7	8
6. RF tuner for Automobile radio receiver.	March 1962	September 1962	Project sponsored by M/s. Semiconductors Pvt. Ltd., Poona.				Unit supplied to the sponsors.
7. Transistorized servo operated pen recorder.	June 1962	December 1965	Laboratory model completed.				Negotiations for commercial production in progress.
8. Four-point Resistivity Probe.	August 1962	March 1963	Completed.		Industrially engineered and batch-production completed in April, 1965.	Know-how transferred in July, 1965.	
9. Electronic Flash Tube	October, 1961	October, 1964	Industrially engineered model completed.			Know-how transferred in July, 1965.	
10. Microwave Components:							
L—band circulator	March, 1963	December, 1963	Laboratory model completed.				Negotiations concluded for commercial manufacture. Know-how to be transferred shortly.
X—band circulator	Do.	Do.					
Directional coupler	Do.	January, 1964					
X—band isolator	Do.	November, 1964					
11. Moving Coil Microphone.	September 1958	March 1965	Eight units successfully fabricated and tested. Design frozen.		Ready for commercial utilization.		Negotiations in progress.
12. Condenser Microphone and Pre-amplifier.	January 1959	June 1965	Four units completed. Design frozen. Performance satisfactory.		Do.		

13. Sound Level Meter	September, 1958	December, 1964	Several laboratory units fabricated and design frozen.	Do.	Negotiations in progress.
14. Sound Systems	July, 1963	Continuing	Following units have been completed : 1. Recording amplifier. 2. Mixer preamplifier. 3. Power amplifier. 4. Tone control unit. Designs of the above frozen.		
15. Table Model Transistor Radio Receiver.	January, 1964	November, 1965	Two prototypes made. To be batch-produced prior to transfer of know-how.		
16. Planer Silicon Transistor.	January, 1964	December, 1965	Successfully fabricated arrays of 30 transistors.		
17. Magnetrons S-band (500 KW)	August, 1959	April, 1964	Laboratory models completed.		Further development and industrial edgineering in progress for meeting the User requirements.
18. Coxial Power Triode	1961	December, 1965	Laboratory model completed.		

APPENDIX III

(*Vide* para 53)

Statement showing the research projects of CEERI which are held up due to non-allocation of foreign exchange

Name of the Project	Utility of the project	Whether sponsored by industry/ Govt. Deptt.	When initiated	Qnty. & value of annual imports of items	Foreign exchange requirements to complete research		Foreign exchange so far spent on the item	Time schedule (when the project was to be completed)	Progress made so far	Remarks with particular reference to efforts made in securing foreign exchange
					Items required	Amount				
1	2	3	4	5	6	6(a)	7	8	9	10
A. Components										
1. Printed Circuits	Modern trend in electronic circuitry which saves lot of labour and has high reproducibility in the production of various modules used in T.V. receivers, test instruments, communication equipment etc.	C.E.E.R.I. initiated (Interest shown by small scale Industry)	December, 1964	Import figures not available. Kindly see our covering note. Estimated requirements in the next 10 years as projected by Electronics Committee is Rs. 4,600 millions in this area of components (A)	1. P.C. Boards Drilling Machine 2. Connectors . 3. Screen Printing Machine . 4. Infrared Radiant Heat Oven . 5. Epoxy Gliss Copper clad Laminate .	Rs. 10,000 1,000 8,200 10,000 1,850		Dec., 1965	We have basic facilities for small scale production and these are heavily loaded.	Our normal channel for securing the foreign exchange is Council of Scientific & Industrial Research.

2. Planer Transistors	Extensively used in professional Electronic Equipment.	C.E.E.R.I. initiated (Defence authorities have also shown interest)	Jan., 1964	See pre-page	1. Silicon slices	Rs. 3,700	Dec., 1965	Successfully fabricated a few transistors.
					2. Boron doped gold strip	2,100		
					3. Single crystal chips	4,700		
					4. Hyper Pure foil 1"	4,500		
					5. Ti-Al wire	300		
3. Printed Components	Used in many modern systems.	C.E.E.R.I. initiated.	Dec., 1963	Do.	1. Borosilicate Glassware Chamber (Bell Jar)	600	Do.	Some experimental components printed.
4. Integrated Circuits	Current trend in Microminiaturization in Defence & Communications, and in Computers.	Do. (Defence authorities & University of Jadavpur have shown interest)	April, 1965	Do.	1. Kanthal wire strips	500	Dec., 1966	Components individually fabricated on slices. Diffusion facilities set up.
5. Varactor Diode	For parametric amplifiers in Defence and Satellite Communication.	C.E.E.R.I. initiated (Defence have shown interest)	Feb., 1964	Do.	1. KPR Solution	200	Dec., 1965	Developmental work almost completed for varactors for parametric amplifications. Some work on power varactors have been initiated.
					2. Metallized Sleeves	1,200		
6. Power Triode	Industry and Broadcasting.	C.E.E.R.I. initiated (Three re-	1964	Do.	1. Kovar sheets	1,100	Do.	Laboratory Model completed.

1	2	3	4	5	6	6(a)	7	8	9	10
A. Components—Contd.						Rs.				
		search organisations have shown interest)			2. Kovar Tubing	350				
7. Common facilities such as Induction Heating Furnace, Clean Room, Spot Welder, Dimineraliser for water, etc. For Devices like Magnetron, Power Triode, Transistors, Integrated Circuits.	For the R & D work on active components.	Common needs for all the preceding projects.	Please see above for different projects.	See pre-page	1. Line cells	200		Continuing facility for a range of project.	Facilities running, but sometimes lack of small items delays all the projects.	Our normal channel for securing the foreign exchange is Council of Scientific & Industrial Research.
					2. Degreasing Gun .	500				
					3. Cleaning Mats. .	1,600				
					4. Omet Iron sheet	400				
					5. Glass Tubing .	8,300				
					6. Desiccator Vaccum .	500				
					7. Thermo-couple Gauge	180				
					8. Empty H_2 cylinders	1,500				
					9. Apeizon Grease .	200				
					10. Beryllium Copper rod	220				

						Rs.			
B. Sound Systems, TV & Radio Receivers and other Consumer Products									
1. TV Sets (Transistorised)	Extensively used in education & entertainment.	C.E.E.R.I. initiated on behalf of consumers.	Nov. 1965	Import figures not available. Estimated requirements in the next 10 years is Rs. 4,950 millions in area (B)	1. Transistorised TV Set . .	800	Dec. 1966	Project is in an exploratory stage.	Do.
2. TV Camera	For TV studios closed loop TV education and entertainment.	C.E.E.R.I. initiated on behalf of consumers.	Jan. 1964		1. Low frequency crystals. 2. Vidicon Tube	550 800	July 966	Individual circuits assembled & tested. Final Lab. Model under test.	Do.
3. Transistorised Radio Receiver.	Domestic entertainment field.	do.	do.		1. I. F. Transformer 2. Battery Capacity Indicator. 3. Rotary Switch Some miniature components.	500 130 200 75	Dec. 1965	Labb. Model completed.	
4. Transistorised Supply for Condenser Microphone.	Makes the use of these microphones more convenient.	Do.	Jan. 1965				July 1965	Project put in abeyance.	
5. Crystal Pickup.	Extensively used in professional and consumer eletronic field.	Do.	Dec. 1964		1. Stylii	300	Aug. 1965	Facilities like lapping, cementing & electric contacts set up. Testing facilities set up.	Do.

1	2	3	4	5	6	6(a)	7	8	9	10
						Rs.				
B. Contd.										
6 Tape Recorder.	Extensively used in professional and Consumer electronic field.	C.E.E.R.I. initiated on behalf of consumers.	Jan. 1965		1. Super Mumetal Laminations.	500		Dec. 1965	Amplifier Erase circuitry under test. Deck is being designed.	Our normal channel for securing the foreign exchange is Council of Scientific and Industrial Research.
					2. Record Head Laminations	550				
7. Sound Systems	Largely used in the P.A. Systems.	Do.	July 1963		1. Microphone Connector	250		End of 1965	Following units have been completed. 1. Recording amplifier. 2. Mixer preamplifier. 3. Power Amplifier. 4. Tone control	
					2. Insulated Double Plugs.	500				
8. Acoustic Testing.	Testing of Auditoria.	Do.		See prepage	1. Level Recorder	13,5000	Kindly see our covering note			Do.
C. Communications Systems										
1. V.H.F. Communication System	From Mine to Pit-head point to point communication	Khetri Copper Mines NMDC	April 1964	Import fig. available.	1. Power Transistors	2,000	Do.	July 1965	Low Power version is under test.	

2. VHF Trans/ Receiver	Point to point Communication for civil and military use.	Border Police Force Mi- Home Affairs	Do.	Estimated requirements in the next 10 years is Rs. 6,600 millions in Area (C)	1. Power Transistors 2. Diodes 3. Ferrite Cores 4. Quartz Crystal 5. Resistors 6. Pot Cores 7. Head sets	7,380 900 180 350 200 170 600	Do.	Do.	Low power version is ready and under test.	Do.
3. Lasers	For advanced Communication Systems.	C.E.E.R.I. initiated.	Feb. 1964	See pre-page.	1. He Gas flasks 2. Thermo-couple Pressure Gauge 3. Pyres Glass Dices. 4. Vitrosil Glazed Tube. 5. Accessories for Gas Laser 6. Photovoltic Detector 7. Spherical Mirrors 8. Unpumped Laser Tube 9. Filled Gas Laser Tube	160 150 200 240 1,400 1,300 2,400 750 1,250		Dec. 1965	Vacuum system set up. Mirror holders designed. Some Pyres plates prepared and polished. Xenon flash tube fabricated and tested.	Do.
4. Common facility for several projects in communications area.	Testing of wave forms.	Common facility		Do.	1. Oscillos-cope.	30,000	Do.			Do.

1	2	3	4	5	6	6(a)	7	8	9	10
D. Test Instruments						Rs.				
1. R.F. Signal Generator.		C.E.E.R.I. initiated (Defence has shown interest)	Dec. 1961	Import figures not available. Kindly see our covering note.	1. Three Gang Tuning Condensor 2. Lietz wire	350 260		Sept. 1964	Prototype tested by CIL, Bangalore. Production Models coming up.	Our normal channel for securing the foreign exchange is Council of Scientific and Industrial Research.
2. Oscilloscope	General Test tool. Used extensively in Research, Teaching, Industry.	C.E.E.R.I. initiated	Aug. 1965	Estimated requirements in the next 10 years is R.3 85 millions for the entire area in(D)	1. C.R. Tube 2. Rectifier Tube	1900 200		May 1966	Lab. version is under test. Modification for greater band width being incorporated.	
3. Pen Recorder (Servo Operated)	Extensively used in Defence and Industry	C.E.E.R.I. initiated (Defence & several laboratories have shown interest)	June 1962	Do.	1. Recording paper. 2. Control Transmitter 3. Power Transistor 4. Potentiometer	200 900 900 1,500		Dec. 1965	Lab. Model Completed	Do.
Maintenance of test Instruments										
1. Servicing and Maintenance of Test Instruments	R. & D Work in the laboratories	Many projects.	Does not arise.	Does not arise	1. Spares for Q. Meter. 2. Spares Signal Generator 3. —do— Frequency convertor Unit. 4. Cable	750 170 2,500 300		Does not arise.	Not applicable	Do.

5.	A.C. Probe Diode Tube	750
6.	Miniature Motor	500
7.	Crystal	450
8.	Oscilloscope accessories	100
9.	Glass Flow-meter	260
10.	Oscillo-scope probe	250
11.	Spares for Transistor Testor	550
12.	Plug in unit for Oscillos-cope	3,300

APPENDIX IV

(*Vide* para 55)

Terms of Agreement entered into by CEERI with B.I.T.S. and I.I.T. for coordination.

1. *Indian Institute of Technology, New Delhi:*

(a) I.I.T., Delhi, would conduct a post-graduate course in Electronics tailored to the special needs of the C.E.E.R.I., as recommended by the Executive Council of the latter at their meeting held in August, 1964.

(b) I.I.T., Delhi, would associate the senior members of the staff of the CEERI in selection of candidates for this course.

(c) The C.S.I.R. would place 3 junior research fellowships at the disposal of the I.I.T., Delhi, for award to 3 of the candidates selected for this course.

(d) These candidates would be provided facilities for practical training during summer months in the CEERI.

(e) The senior staff of the CEERI would give lectures for a few days at the I.I.T., Delhi, on specialised topics.

(f) After completion of the course, CEERI could select from the 3 fellowship holders or other members of the class, personnel for absorption in the Institute.

2. *Birla Institute of Technology & Science, Pilani.*

(a) Selected scientists of the CEERI will be invited by B.I.T.S. as visiting Professors/Lecturers/Instructors in teaching and research to Under-graduate and Postgraduate classes in fields of Electronics and Advanced Physics and allied subjects. They will deliver a course of lectures in the subjects as per the BITS syllabus.

3.4. (a) (b) The faculty of the BITS will be invited to be associated in selected Research Projects being done at the CEERI.

(c) Students of the BITS will be permitted to work in the Labs. of the CEERI under the supervision of the Scientists concerned.

(d) Selected Scientists of the CEERI will be invited to act as Guides in M.E. and Ph. D. thesis work in their special fields.

(e) The Faculties Members & Post-graduate students will be permitted to be members of the CEERI Library, and scientists of the CEERI will be permitted to become members of the BITS Library.

(f) The Workshops and Production Depts. of the two Institutes will assist each other whenever specialised facilities are required.

(g) Scientists of the CEERI will be permitted to enrol as students in M.E. and Ph. D. scholars of the B.I.T.S. They will be given same concessions as the staff members of the B.I.T.S.

APPENDIX V

Summary of Recommendations/Conclusions

Sl. No.	Reference to para No. of Report	Summary of Recommendations/ conclusions
1	6	The Committee commend for implementation the comprehensive report on the subject of development of electronics during the next ten years which has been produced by the Electronics Committee (1966) under the distinguished Chairmanship of late Dr. H. J. Bhabha. The Committee would like Government to take integrated action to develop the electronics industry. In particular, they would like that the research programme should be intensified and related to the production programme as set out by the Electronics Committee. The Committee share the faith of the Electronics Committee that "the very backwardness of the country in electronics and smallness in size of the present electronics industry could be turned into an asset, if early stages in the development of the industry in other countries are by-passed and the industry planned on the basis of the latest ideas and techniques". The Committee also agree with the recommendations of the Electronics Committee that "the industry should be planned and organised from the very beginning in such a way as to build into it the capacity to keep abreast of progress in the rest of the world without continuing dependence on foreign assistance. India should indeed be able to make its own contribution to the rapid advance of electronics. Thus, the importance of building into the industry from the very beginning powerful design and development groups and of supporting fundamental and applied research cannot be over-emphasised. This will not only save large sums of foreign exchange in the course of the next ten years, but is the only method of establishing a self-sufficient

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		and self-reliant electronics industry capable of keeping pace with developments in the rest of the world"
		The Committee would like the research in the country to be forward looking so as to design, develop and produce the next generation of equipment indigenously.
		The Committee note that the Electronics Committee has assessed the requirement of 3,00,000 engineers, scientists and skilled workers for electronics industry by 1975. The Committee would like Government to draw up and implement an integrated programme for training adequate number of personnel to meet the requirements of the electronics industry.
2	13	The Study Group of the Estimates Committee which visited C.E.E.R.I. in December, 1965 were impressed with the organisational set-up of the Institute and close cooperation and coordination between various divisions in furthering research on projects.
		The Committee realise that inspite of the fact that Pilani is situated far away from the centres of research and manufacture of electronic equipment and suffers from lack of rail connection, the Research Institute has been located there because of its proximity to the Birla Institute of Technology and Science and the munificent donation given by a Trust. The Committee hope that the drawbacks of location as mentioned above will be compensated by the quiet and calm atmosphere of the place which should make for concentrated research. They also hope that Government would try to improve the rail and road communications to Pilani.
3	14	The Committee are glad to note that research projects at C.E.E.R.I. are selected with reference to the needs of the industry and Government departments and that discussions are also held with user departments regarding modifications in time schedules, specifications etc. In this connection the Committee would, however, like to refer to the recommendation made by them

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		in para 24 of their Hundred and Third Report on National Physical Laboratory regarding the principles to be observed in the selection of individual projects.
4	15	While the Committee appreciate the initiative taken by the C.E.E.R.I. to introduce the project concept and a proforma for planning the projects, they feel that full benefits from this scientific approach would accrue only if estimated expenditure on individual projects is also assessed in the very beginning and the progress is also watched with reference thereto. They hope that this would be done forthwith.
5	21	The Committee consider that in addition to indicating the importance of the proposed research projects, the national laboratories and research institute should also show in each of their Plan proposals, a broad estimate of the money and time required for completion of individual project so as to enable the Central planners to assess the requirements with reference to outlays and time factor and to take decisions accordingly. The Committee recommend that C.E.E.R.I. should incorporate the necessary data in respect of all research projects included in the Fourth Plan proposals. The Committee would further suggest that Fourth Plan proposals of C.E.E.R.I. should be given wide publicity among the scientists, user industries/Government departments, universities and related institutions so as to invite their suggestions.
6	22	The Committee are glad to note that C.E.E.R.I. has formulated a tentative Fifteen Year Perspective Plan. They agree that such a long term plan in the field of research, particularly in a subject like electronics—which is a fast developing subject, should be flexible. The Committee recommend that the perspective plan of C.E.E.R.I. should be given wide publicity among the scientists, industry, user departments, universities and research institutions for inviting their suggestions so as to make improvements in the proposals and avoid unnecessary duplication. The Com-

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		mittee would further suggest that the perspective plan should be reviewed periodically in the light of developments and advances made in electronics research within the country and abroad.
7	27	The Committee would like Government to take a firm decision about the Bands which would be used for TV transmissions so that the design of TV receiver may be suited to it. The Committee would like to stress the need for continuous improvement of the TV receiver designed by CEERI so that it meets, not only the performance requirements laid down by the Research Department of All India Radio but proves competitive both in quality and cost with the imported sets. In particular, they would like alignments of the TV receiver to be so optimised as not to require any running adjustments of critical nature which lay public cannot be expected to handle.
8	33	The Committee are not able to appreciate the inordinate delay of nine months in completing various formalities to import components worth Rs. 1.90 lakhs which were required for starting the production programme of 1,000 TV receivers at the Pilot Plant of the CEERI. They are particularly disturbed to note that while the import of these components has been delayed, Government have arranged for import of 5,000 T.V receivers.
9	34	The Committee do not feel happy at the delay in the manufacture of TV sets in the country after having given the patent rights to two firms on payment of royalty and thereby creating the necessity of importing TV sets from abroad. They hope that an early decision on the question raised at a late stage of private or public sector manufacturing TV sets will be decided without any further delay so that the indigenous manufacture may start soon and obviate the necessity of any further import. The Committee deprecate this tendency of importing things from abroad while these can be manufactured within reasonable time in the country.
10	35	The Committee consider it extremely unfortunate that in the beginning when Master Plan for

1	2	3
		TV was being drawn up by All India Radio in 1962/64, they did not take the research organisation (CEERI) into confidence. The Committee feel that while preparing schemes which might entail import of equipments or foreign collaboration, the Departments concerned should contact the research institutes whether the know-how is available with them or can be developed within reasonable time. The Committee have no doubt that had there been close coordination between A.I.R. and CEERI right from inception, it should have been possible to accelerate research on TV receiver and perfect a TV receiver model meeting all the requirements. The Committee, however note that since 1965 there has been closer coordination between CEERI and A.I.R. and would stress that research and user departments which are both in the public sector should work hand in hand in the interest of improving television services for the country.
11	39	The Committee would like Government to take an early decision on the conclusions of the Committee of Secretaries regarding the manufacture of TV receivers, keeping in view their declared policy of encouraging the exploitation of indigenous know-how to find substitutes both for imported know-how and imported products. The Committee are concerned at the import of 5000 TV sets which may well have the effect of flooding the market with the imported receivers. In view of the present stringency of external finance and in consonance with the declared policy of encouraging indigenous know-how the Committee are opposed to any scheme of importing TV receivers from abroad. The Committee further feel that the multiplicity of sources of imported TV sets would give rise to the problems of procuring spare parts and servicing of receivers of diverse origins. The Committee would like to draw attention to the assessment made by the Bhagvantam Committee that there may not be a demand for more than 5000 receivers during the next two years. The Committee are of the view that indigenous

1	2	3
		production of TV receivers should be encouraged right from the initial stages. The Committee would like Government to make full use of this opportunity for development of TV industry in the country with indigenous know-how so that it can provide suitable base for development and manufacture of radar and other electronic equipments.
12	42	The Committee would like Government to take an early decision about the development/manufacture of picture tubes which constitute 70 per cent of the value of imported components required for manufacture of TV receivers. The Committee feel that the CEERI should be encouraged to develop them and should be given the required help and time for the purpose. In case CEERI is not able to develop the picture tubes at an early date, Government should consider in consultation with CSIR the question of purcase of know-how for manufacture of picture tubes in B.E.L. The Committee are concerned at the high estimated cost of TV receiver to be produced with indigenous know-how as compared to the cost of imported receiver which has been explained by Government as being due to the high cost of imported components and raw materials as well a high costs of indigenous components manufactured with foreign collaboration. The Committee stress that reasons for the high price of these components should be gone into by a small committee of experts in order to devise measures to bring down the price of electronic components by encouraging standardisation, mass production and effecting other economies.
13	43	The Committee would like CEERI to intensify research on television camera after settling the specifications with All India Radio so that the project developed is in accordance with the requirement of the user department. The Committee would also like CEERI to keep the Ministry of Industry and Directorate General of Technical Development informed of the progress made so that no foreign collaboration agreements in this behalf are entered into and negotiated in the meantime. The Committee hope that after

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		the project is completed successfully, necessary patents would be taken immediately and no time would be lost in farming out the process for commercial exploitation through National Research Development Council.
14	44	The Committee note that while CEERI has been able to provide a solution to the problems referred to them by the industry during the last four years, their number is only five. The Committee suggest that CEERI should intensify its liaison arrangement with the industry so as to inspire greater confidence in them and to invite more problems for solution at the Institute. The Committee would like CEERI, in particular, to help the industry in meeting the problem of import substitution and effect reduction in cost of production.
15	45	The Committee note that many small scale industries have undertaken the manufacture of electronic and radio components. The Committee feel that CEERI can be of great help to small scale industries which have largely to depend upon indigenous know-how for their future development. In view of the intended expansion of TV Services in India, CEERI can advise small scale industries to take up manufacture of components required in production of TV receivers. The Committee recommend that Central Small Industries Organisation should help to formulate the requirements of Small Scale Industries in the field of electronics and forward them to CEERI who should try to furnish the solution on priority basis.
16	46	Considering the great demand for transistor radios in the country, the Committee are concerned that CEERI has taken more than two years in developing a table model transistor radio. The Committee would like the work to be intensified in transistor radio sets with a view to its commercial exploitation. They also feel that the cost of the transistor set (Rs. 350—ex-factory) is on the high side. The Committee urge that efforts should be made to bring down the cost of the transistor radio so as to place it within the reach of general public.

1	2	3
17	47	The Committee note that many of the research projects were initiated by CEERI on its own and later the Ministry of Defence have expressed interest in them. The Committee would stress the need for closer collaboration between the Ministry of Defence Electronics and Radar Development Establishment and Defence Electronics Research Laboratory and CSIR/CEERI. The Committee would also urge that the progress of research projects for defence should not be allowed to suffer for want of foreign exchange for procuring raw materials and equipments which are absolutely essential and are not available in the country. The Committee suggest that Government should also examine the question of Defence Research and Development Organisation bearing the expenditure incurred in progressing research projects meant for their use.
18	48	(i) The Committee note that research work on acoustics is done by Central Electronics Engineering Research Institute, National Physical Laboratory and the Central Building Research Institute, all working under Council of Scientific and Industrial Research. They apprehend that there may be unnecessary duplication of research and recommend that there should be close coordination between these three institutions as regards their work on acoustics. (ii) The Committee recommend that consultancy work on acoustics for outside parties may be undertaken by one of the institutions to be specified in this behalf, which may take the assistance as necessary of the other two institutions. (iii) The Committee would like consultancy fee to be charged from outside parties for rendering advice in acoustics.
19	49	The Committee feel that industrial research can best be carried out in collaboration between the scientists and the users. The formation of cooperative research associations is an effective method of bringing about such collaboration. Apart from other benefits, the Cooperative Research Associations which are mainly user biased,

1	2	3
		generate research potential within the industry for future development and improvement. The Committee commend the efforts made by Central Electronics Engineering Research Institute in setting up a Cooperative Research Association of Radio and Electronics industry which will greatly benefit the industry. They hope that this Research Association will soon begin to function effectively. The Committee would urge Government to encourage the formation of Cooperative Research Associations in industries where they do not already exist.
20	50	The Committee note that 18 products/processes have been successfully developed so far by the CEERI for commercial exploitation. Out of these, only four products have so far been released for commercial exploitation but have not actually gone into production. Negotiations have been concluded in respect of two more products. For three more products negotiations are in progress for their commercial exploitation. Three products were developed at the Institute at the instance of private companies which are now using them exclusively. About six products of the Institute still remain to be industrially engineered. The Committee feel that the time gap in the commercial exploitation of the processes developed by the Institute, should be reduced to the minimum. They have already made suggestions in this regard in para 44 of their Hundred and Third Report on National Physical Laboratory. The Committee would also urge that the successful processes of CEERI should be widely publicised to stimulate interest of industrialists and users.
21	51	The Committee hope that CEERI will make vigorous efforts to successfully complete their research work on tape recorders and record players as these products are of common utility. They would like that the know-how developed would be got patented and farmed out for commercial exploitation without delay.
22	52	The Committee are happy to note that considerable expertise has been developed in microwave technology in the CEERI, the Tata Insti-

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		tute of Fundamental Research, Bombay and the Telecommunication Research Centre, Delhi. The Committee would like close coordination between the research efforts of these institutes in order to develop radar equipment for the use of defence services as early as possible.
23	53	The Committee note that while foreign exchange worth Rs. 5,000 was not sanctioned for the development of gas type laser by the CEERI, many laboratories were allowed to import the instrument. This is yet another instance of lack of coordination where foreign exchange has been expended to import instruments which could have been developed within the country by spending small amounts of foreign exchange to intensify research. The Committee feel that important projects which require only a small amount of foreign exchange should receive greater attention of CSIR while processing the demands of its various laboratories. The Committee also recommend that Government may examine early the suggestion of CSIR that "foreign exchange allocation between two or three lakhs be made by Government for the purchase of UNESCO Coupons which will ensure speedy procurement of small stores".
24	54	The Committee consider that the existing arrangements of coordination between the various research organisations doing work on electronics in the country are not quite satisfactory as they are mostly based on *ad hoc* membership of Government Committees or informal exchange of visits and literature. The Committee consider that as the strategy of research in electronics has been broadly laid down by the Electronics Committee it should be easier to effect closer liaison between leading research organisations so as to avoid duplication of research work as well as to derive mutual benefit from each others experience. The Committee recommend that there should be inter-locking of membership in the management committees (*i.e.* Executive Council, Board of Directors etc.) of the various research organisations working in the same field. They would

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		further suggest that the Director of CEERI may be represented on the Board of Directors of B.E.L. which is the premier unit manufacturing electronics equipment in the country.
25	55	The Committee welcome the agreements, entered into by CEERI with the two institutions (*viz.* B.I.T.S. Pilani and I.I.T, New Delhi) as they consider that closer associations provided by those agreements between the two organisations will prove beneficial to both. They would like C.E.E.R.I. to establish, in due course, institutional links with other Universities and technical institutes interested in advanced research in electronics for their mutual benefit.
26	56	CEERI is a premier institute in electronics and has a large programme of expansion during the ensuing Plan period. The Committee would like the training facilities in the Institute to be put to effective use keeping in view the overall requirements of electronic industry.
27	59	The Committee are inclined to agree with the views of the Electronics Committee in regard to the testing facilities to be provided as far as electronics industry is concerned. They feel that CEERI also requires some testing facilities for various products being developed by it. The Committee would like Government to take a decision about the scale of facilities to be provided at Pilani keeping in view the observations of the Electronics Committee and the fact that Pilani is situated far away from manufacturing centres like Calcutta, Bombay, Bangalore, Delhi, etc.
28	60	The Committee hope that careful consideration will be given to locate the extension centres of the CEERI so that these can render maximum assistance to the electronic industry. The Committee endorse the Reviewing Committee's views that attempts should be made to invite the local industry to share in the financial participation and control of extension centres.
29	62	The Committee regret to observe that the meetings of the Executive Council of CEERI were not held even twice a year before 1965, which is

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		a violation of the Rules and that also without even amending the rules. They feel that the CSIR should see that the Executive Council is being properly convened and utilised. In this connection the Committee will like to refer to their recommendation contained in para 137 of the Report on National Physical Laboratory.
30	63	The Committee have pointed out the non-observance of Rules as regards Scientific Advisory Committee by the National Physical Laboratory also. They are unhappy at the indifference shown by the authorities concerned in observing the provisions of the Rules. In para 138 of their Report on National Physical Laboratory, the Committee have already recommended for the appointment of Scientific Advisory Committee in all the national laboratories where they have not been formed so far. They hope that urgent action would be taken to appoint the Scientific Advisory Committee for CEERI also.
31	64	The Committee hope that all out efforts will be made to give wider publicity to the activities of the Central Electronics Engineering Research Institute so that the results of the research being done at the Institute reach the parties concerned quickly and they derive benefit out of it in time. They would further suggest that exchange arrangements may be made by CEERI to obtain information and publicity material brought out by other institutes doing work in Electronics.
32	65	The Committee consider that in an out-of-the-way place like Pilani it is necessary to provide basic amenities of housing, medical, marketing etc. to the staff to attract and retain promising scientists. They would like Government to examine early the question of providing a Community Centre at moderate costs at Pilani for the use of the staff of CEERI and their families. The Committee note that medical and marketing facilities exist at Pilani for the staff of Birla Institute of Technology and Science. They suggest that the same may be made available to the staff of CEERI by mutual agreement with the Birla Education Trust, Pilani.

1	2	3
33	66	The Committee have no doubt that with its reputation, the Institute will contribute greatly to the development of Electronics Industry in the country which, according to the Electronics Committee, is expected to produce electronic equipments worth over Rs. 1,600 crores during the next ten years. The Committee feel that with the coordinated efforts of all the electronic institutes in the country, it should be possible to build up indigenous know-how and import substitution in the field of electronics. The Committee would like CEERI to intensify research on transmission equipment for radio and television as also on television camera so as to develop indigenous know-how for these important equipments as early as possible. They would also like greater attention to be paid to the development of tape recorders, record players, transistorized radio and television receivers etc. which are items of utility for the general public. The Committee see no reason why it should not be possible for India to build up an export market for electronic equipments in the Asian and African countries in this labour intensive industry. The Committee recommend that the programme of research in electronics in the country should be intensified as it is the nervous system of modern technology. The Committee feel that the Institute should seriously apply itself in helping the industry to reduce the cost of production and improve the quality of the indigenous electronic components so as to bring them at par with the best available in the world.

APPENDIX VI

Analysis of Recommendations/Conclusions contained in the Report.

I. CLASSIFICATION OF RECOMMENDATIONS.

A. Recommendations for improving the organisation and working:

Serial Nos. 3, 5, 6, 13, 14, 15, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 33.

B. Recommendations for effecting economy:

Serial Nos. 4, 17, 18, 27.

C. Miscellaneous recommendations:

Serial Nos. 1, 2, 7, 8, 9, 10, 11, 12, 16, 19, 32.

II. ANALYSIS OF MORE IMPORTANT RECOMMENDATIONS DIRECTED TOWARDS ECONOMY.

S. No.	S. No. as per summary of recommendations (Appendix V)	Particulars
1	2	3
1	4	Estimated expenditure on individual projects should be assessed in the very beginning and the progress watched with reference thereto.
2	17	Government should examine the question of Defence Research and Development Organisation bearing the expenditure incurred in progressing research projects at CEERI meant for their use.
3	18	Research on acoustics should be co-ordinated with that of the Central Building Research Institute and the National Physical Laboratory.
4	27	Scale of testing facilities to be provided at CEERI should be decided keeping in view the observation of Electronics Committee and the fact that Plani is situated away from manufacturing centres.