

FIFTH ANNUAL REPORT OF THE DIRECTOR

TO

THE GOVERNING BOARD OF THE
CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH



PERIOD MAY 1959 TO APRIL 1960

CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH
363 Bullers Road - Colombo 7

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HISTORICAL

The Mission of the International Bank for Reconstruction and Development in its Report of 1952 on the Economic Development of Ceylon, recommended inter alia, the immediate establishment of a Ceylon Institute of Applied Research as an autonomous body sponsored by the Government of Ceylon. The then Government accepted this recommendation and invited Dr. Francis Godwin to Ceylon in 1954, to advise and assist in the drafting of a Bill for the establishment of such an Institute. The draft Bill was passed early in December 1954 by the House of Representatives, and approved by the Senate in February 1955. The Ceylon Institute of Scientific and Industrial Research Act No. 15 of 1955 received assent on April 12, 1955.

At the invitation of the Government of Ceylon, Dr. Francis Godwin was appointed the first Director of the Institute, and his services were provided free of charge jointly by the International Bank for Reconstruction and Development, and the United Nations Technical Assistance Administration. Immediately after the assent, the Hon. Minister of Industries, in consultation with the Rt. Hon. The Prime Minister and the Minister of Finance, appointed the first members of the Governing Board. The Governing Board met on April 28, 1955 to define its policies and receive the recommendations of the Director regarding initial staff.

The I.B.R.D. Mission stated: "It is not generally appreciated that applied research of this kind is a profession in itself, to be distinguished from the more academic fundamental scientific studies. The entire success of this

programme, with its intangible training aspects, will depend upon the most skilful selection of personnel." It was fortunate that at this time, a number of officers with post graduate degrees and specialised training in advanced technologies were available with the Department of Industries, and the Act provided for the transfer of selected persons to the new Institute. With the approval of the Governing Board, eight Research Officers, a Chief Research Officer, four Research Assistants and eight other assistants of various types, were recruited from the Department of Industries. Additions to this during the first year included Dr. Ralph Liljelund, Chief Engineer, whose services, like that of the Director, were provided free under the I.B.R.D. and U.N.T.A.A. Assistance Agreement, two Research Officers, three Research Assistants, an Accountant, Secretarial Staff and Workshop and Maintenance Staff. The total numbers of persons on the Institute staff at the end of the first year was thirty-seven, all of whom, except the Director and Chief Engineer provided by the I.B.R.D. and U.N.T.A.A. jointly, were Ceylonese.

The Institute started operations on May 1, 1955 and had transferred to it the entire machinery and equipment of the Rubber Service Laboratory, besides all the technological equipment of the Industrial Research Laboratory of the Department of Industries and its entire technical library. The Government also permitted the Institute the use of the Pilot Plant Laboratory building in the premises of the Department of Industries and the Rubber Service Laboratory buildings at Kalutara.

Besides these assets which we value at Rs. $\frac{1}{2}$ million, the Act under Section 18 provided for the donation by Government to the Institute of a sum of 5 million rupees in five instalments. Section 18 of the Act further states that, "The Government shall contribute further monies as and when occasion demands, with the sanction of the House of Representatives."

Five years of operation was completed on April 30, 1960, and the Institute has now its own central buildings in Bullers Road, built at the cost of Rs. 1 million from Government Funds saved from the statutory donation made to the Institute. The buildings both in the premises of the Department of Industries and Slave Island and the Rubber Service Laboratory buildings, were handed back to the Department in 1957. The Chief Engineer, Dr. Liljelund, was recalled by the International Bank for Reconstruction and Development in December 1957 and the Director, Dr. Godwin, returned to the U.S.A. on completion of his assignment on December 5, 1959, leaving the Institute entirely in the hands of local direction.

This historical background is given as a prelude to discussing the progress towards the objects of the Institute during the last five years, and to present to the Government and the House of Representatives an objective projection of its future services to the country. In doing this we shall discuss the assistance given to the Institute by the Government of Ceylon, the Aid Agencies and the dispersal of funds provided; the staff expansion that has taken place and new expansion facilities to be provided in the ensuing years; the services rendered both to Government, Private Sector and Public, and continuity of such services; and the assets now held and valued at Rs.5 million.

ASSISTANCE: FINANCIAL, EQUIPMENT, AND PERSONNEL

Financial: The only financial assistance provided to the Institute for its operation has been from the Government of Ceylon. No other Agency, in spite of widely held beliefs, has provided funds towards the Institute's working expenses. The Act provided for a donation of Rs.5 million from the Government, and this has been paid in annual instalments of Rs.1 million, the last instalment being received in 1959. No provision for the continued support of the Institute for Government and public services rendered was made in the Budget of the Government for the Financial Year 1959/60. The Institute from the commencement of the Financial Year 1960/61, May 1, 1960, continues to provide the services formerly rendered to Government from its appropriation, from the reserves built up, in the confident hope that it would be reimbursed in October 1960 from the provisions made in the Budget of Government for the Financial Year 1960/61.

Equipment: Donations by way of equipment have been received from the Colombo Plan, Government of Ceylon, U.S. Aid and the Asia Foundation. Colombo Plan Aid from the United Kingdom provided Chemical Engineering Unit Process and Unit Operations machinery, Workshop Machinery, Laboratory benches and apparatus etc., worth £84,000 or Rs.1,120,000.00 and is by far the largest contribution to the Institute by way of equipment.

As has already been mentioned, the Government by Ministerial Transfer Order of May 1955, donated to the Institute the entire machinery, equipment, apparatus and other assets of the Rubber Service Laboratory, and the major portion of the plant, equipment, chemicals and apparatus of the Industrial Research Laboratory and its Technical Library of 4,000 volumes. These assets are valued at Rs.500,000.

The International Cooperation Administration, besides aid in the form of personnel to which reference will be made under a separate head, also provided a 150 K.V.A. Generator, library shelves and \$ 5,000 worth of books, making a total contribution in equipment of Rs.284,000.

The Asia Foundation made a small contribution of Rs.5,000 towards purchase of Library Cards from the Library of Congress, and the Card Cabinets.

Buildings and Fittings: The present buildings with a floor area of over 40,000 sq. ft. was built entirely from Government funds provided as donation under the Act at a cost of Rs.1,025,477.

Personnel: Personnel have been provided by the International Bank for Reconstruction and Development and the United Nations Technical Assistance Administration, the I.C.A. through U.S. Aid, and Colombo Plan from Canada. By separate technical assistance agreement between the Government of Ceylon and the I.B.R.D. and U.N.T.A.A. of December 1954, these agencies agreed to provide jointly the services of the first Director, Dr. Francis Godwin, for five years, and Dr. Ralph Liljelund, Chief Engineer, for a similar period. The cost of this aid was to be shared between the I.B.R.D. and the U.N.T.A.A. The Director served his full period of five years, but Dr. Liljelund served $2\frac{1}{2}$ years only and was recalled back to Washington in January 1958. The cost of this assistance to I.B.R.D. and U.N.T.A.A. is Rs.450,000 each. This constitutes the only assistance provided by the I.B.R.D. and the U.N.T.A.A.

The International Cooperation Administration through an agreement in 1957 agreed to provide personnel as Management Consultants, scholarships for Institute personnel for overseas study courses in fields of applied technology, equipment, and books referred to earlier. The cost of highly paid American specialists constitute the main cost of this assistance. The first three specialists arrived in June 1958, one of whom had full-time duties reorganising the Government Factory of the Public Works Department. A further three specialists in industrial engineering, tool and die making and general management engineering, arrived in November 1959, to serve for a two-year period. The cost of three specialists for two years, and six for another two years, is estimated at Rs.1.5 million.

Assistance towards advanced training of Institute personnel was provided for three officers -- two in U.S.A. for eighteen and twenty months respectively, and one in Japan for six months. Additional assistance is contemplated for three

to four officers in U.S.A., each scholarship tenable for periods varying from six months to two years.

Colombo Plan Aid from Canada was given in the form of a Librarian, Mr. Redmond, who trained six graduates in the CISIR Library. One of the trainees received further training at McGill University, assisted by the Colombo Plan, and has now returned to fill the post of Librarian of the Institute. The cost of services of Mr. Redmond and the scholarship for our present Librarian in Canada for one year is estimated at Rs.75,000.

EXPENDITURE ON GOVERNMENT ACCOUNT

At the start the Institute took over from the Department of Industries seven uncompleted research projects in various stages of development. Seven more projects on Government account were authorised by the Hon. The Minister of Industries during the year, together with three projects initiated by the Institute itself. During the second year of operation, on the advice of the Institute and the Governing Board, the entire expenses of the operation of the Technical Library and Information Service was debited to Government account. The Library of 8,000 volumes is freely available to the public during office hours and is used extensively by readers. A free Technical Information Service is provided through the trained librarians and the research staff to any citizen from any part of Ceylon.

Considered of major national importance was the free promotional service to small producers, cottage craftsmen, and small entrepreneurs who came to the Institute with problems connected with improvement of quality, or the know-how of some new industry they propose to start. Under this head was also the service rendered by officers of the Institute on the Committee on Standards, Low Cost Housing, Planning Committees of the Planning Council, and the Ministries of Government. Consequently expenditure of Government falls into five categories:

1. Government Projects directly approved by the Hon. The Minister of Industries.
2. Library and Information Service including cost of books.
3. Promotion -- Free Service to Small Producers and demonstrations.
4. Institute-sponsored projects.
5. General equipment and buildings.

USE OF GOVERNMENT FUNDS

TABLE I

	FY 1955/56	FY 1956/57	FY 1957/58	FY 1958/59	FY 1959/60	TOTAL FOR 5 YEARS
Projects Sponsored by Govt. and Approved individually by the Minister of Industries	298,645	318,833	258,484	243,991	420,614	1,540,567
Library & Information Service Books Purchased, Promotional Services	23,450	80,230	150,931	149,729	154,420	538,760
Institute Sponsored Projects Paid For From Government Funds	60,659	54,227	75,930	68,418	22,216	281,450
Purchase of Plant & Equipment	57,000	72,000	60,000	152,000	90,000	431,000
Installation of Plant & Equipment	—	43,000	73,000	77,000	50,000	243,000
New Buildings - Cost Paid from Government Funds only	—	306,941	459,484	250,000	9,052	1,025,477
Total Government Commitment	439,754	875,231	957,829	941,138	736,302	3,950,254

TABLE II

LIST OF GOVERNMENT PROJECTS

1955/56

1	—	1G	Vegetable Oils
3	—	2G	Desiccated Coconut Drying
4	—	3G	Hardboard
5	—	4G	Citronella Oil
6	—	5G	Cinnamon Oil
7	—	6G	Rubber Compounding and Testing (Subsidy)
8	—	7G	Rubber Seed Oil Factice
10	—	8G	Palmyrah
14	—	9G	Department of Industries (Miscellaneous Services)
17	—	10G	Banana Stalks - Fibre
19	—	11G	Vegetable Tannin
20	—	12G	Rauwolfia Serpentina
21	—	13G	Bottling of Toddy in a Preserved State
23	—	14G	Sago Bulletin

1956/57

24	—	15G	Caoutchoucine
26	—	16G	Further Research on the Local Production of Acetic Acid
27	—	17G	Production of Sugar from Indigenous Palms
33	—	18G	Palm Sugar Research, Training & Demonstration Centre at Kakkapalliya
37	—	19G	Improved Plywood Manufacture

1957/58

44	—	20G	Rancidity in Coconut Oil, Its Mechanism and Prevention
46	—	21G	Mechanised Kitchen
47	—	22G	Miscellaneous Services to Government Stores Department

1958/59

53	—	23G	Study and Recommendations on Costing, Operational Economy and Techno-Economic Prospects for Eastern Paper Mills Corporation
54	—	24G	Eucalyptus Oil Distillation
58	—	25G	Technical advisory services and Miscellaneous Testing - Port Commission
52	—	26G	Miscellaneous Testing - Department of Rural Development & Cottage Industries

1959/60

63	—	27G	Technical Assistance in Developing Ceylon's Standards
65	—	28G	Specialized Technical Services to Police Department
66	—	29G	Technical Assistance to the Department of Public Works
68	—	30G	Miscellaneous Testing - Civil Medical Stores
70	—	31G	Clay Investigation at Bangadeniya
71	—	32G	Assistance to the Salaries & Cadres Commission
76	—	33G	Development of Coir Rope Making Machine
81	—	34G	Clay Investigation at Anuradhapura
82	—	35G	Evolving a Suitable Bottleneck for Arrack Bottles
83	—	36G	Job Evaluation - Paranthen Chemicals Corporation

TABLE II

LIST OF GOVERNMENT PROJECTS

1955/56	
1	Vegetable Oils
2	Deodorized Coconut Oil
3	Handboard
4	Chromic Acid
5	Cinnamon Oil
6	Rubber Compounding and Testing (Subsidy)
7	Rubber Seed Oil Factory
8	Palmyrah
9	Department of Industries (Miscellaneous Services)
10	Banana Stalks - Fibre
11	Vegetable Tannin
12	Ranwella Serpentine
13	Holding of Tobacco in a Protected State
14	Sago Bullock
1956/57	
15	Caustic Soda
16	Further Research on the Local Production of Acetic Acid
17	Production of Sugar from Indigenous Plants
18	Film Sugar Research, Training & Demonstration Centre at Kakapallya
19	Improved Plywood Manufacture
1957/58	
20	Ranching in Coconut Oil, its Mechanism and Prevention
21	Mechanical Kitchen
22	Miscellaneous Services to Government Stores Department
1958/59	
23	Study and Recommendations on Costing Operational Economy and Techno-Economic Prospects for Rubber Paper Mills Corporation
24	Respiration Oil Distillation
25	Technical advisory services and Miscellaneous Testing - Port Commission
26	Miscellaneous Testing - Department of Rural Development & Cottage Industries
1959/60	
27	Technical Assistance in developing Ceylon's Standards
28	Specialized Technical Services in Rubber Department
29	Technical Assistance to the Department of Public Works
30	Miscellaneous Testing - Civil Medical Stores
31	Clay in connection with Rubber
32	Assistance to the Rubber & Cattle Commission
33	Development of Coir Rope Making Machine
34	Clay Investment in Agriculture
35	Developing a Swallow Bottle neck for Attack Bottle
36	Job Evaluation - Paranthan Chemicals Corporation

The actual committed expenditure year by year is shown in Table I and the list of the projects individually approved by the Hon. Minister of Industries in Table II.

Thirty-six Government projects were approved during the five years, and the contracted value of this work alone was Rs.1,540,167. The project on the Chemistry and Utilisation of the lesser known Vegetable oils of Ceylon, was worked on during the whole period 1955 - 1960, and had cost until then Rs.147,855. Included in this list was a special project on sugar manufacture from coconut palm juice for which Rs.200,000 was provided in 1957. Most Government projects were long-term investigations of fundamental character such as the Mechanism of the Rancidity of Coconut Oil, Essential Oils, Toddy Preservation, Tannins, etc. Projects also included were miscellaneous services and projects of immediate assistance to Government Departments and State Corporations. Departments and Corporations thus served are: (1) The Department of Industries; (2) Government Stores Department; (3) Port Commission; (4) Department of Rural Development and Cottage Industries; (5) Police Department; (6) Public Works Department; (7) Excise Department; (8) Civil Medical Stores; (9) Plywood Corporation; (10) Eastern Paper Mills Corporation; (11) National Small Industries Corporation; (12) Paranthan Chemicals; (13) Department of Marketing.

The expenditure on the 40,400 sq. ft. area new buildings amounted to Rs.1,025,000. Installation of both equipment purchased on Government account and donated by the various Aid Agencies cost Rs.233,000 -- while additions to plant and equipment during the five years amounted to Rs.431,000. The Library which had 4,000 volumes at time of transfer has been extensively expanded and the 4,000 volumes added since 1955 was made at a cost of Rs.218,000.

INCOME FROM THE PRIVATE SECTOR

Forty-six projects were sponsored by the private sector of industry, the research institutes, the Gal Oya Development Board, and others. The total number of clients now served exceeds 350. The services rendered included long and short-term research, special testing, technical studies, technical supervision of factories, project vetting, management and costing studies etc.

The major research projects from the private sector had included the operations of a Soils Laboratory at Gal Oya for Soil studies, the investigation into the manufacture of Instant Tea direct from green leaf for the Tea Research Institute, the concentration and preservation of coconut milk for Ceylon

Coconut Products Limited, the investigation into discovering a local filler for fungicides and insecticides for Fisons Pest Control Limited, besides others.

The total income during the five years from projects and miscellaneous services to the private sector was Rs.655,396. The receipts year by year, is shown below. With the present slow rate of industrial development the income from the private sector is unlikely to exceed Rs.250,000 in the next five years.

The main source of financial support for research operations and services, equipment and administration, should, in our opinion, be the Government.

	FY 1955/56	FY 1956/57	FY 1957/58	FY 1958/59	FY 1959/60
Income from Private Sector	53,127	118,770	91,326	167,173	225,000 (Proj)

STAFFING

The Institute commenced operations on May 1, 1955 with a Director supplied by the IBRD and UNTAA, and twenty-two others from the Government, of whom ten were Research Officers and six Research Assistants. By May 1956 the staff had increased to 37 and included a Chief Engineer supplied under the same agreement which provided the services of the Director by the IBRD and UNTAA. The present staff -- excluding the five Management Consultants provided under the U.S. Aid Programme, consists of a Director, a Chief Research Officer, a Chief Administrative Officer, ten Research Officers, eight Research Assistants, an Accountant, four Management Counterparts, Stores Superintendent, Workshop Superintendent, twenty-four skilled workmen in the Workshop, Secretaries and Stenographers totalling 76 persons.

Increase in the staff has been gradual, with thirty-seven at the end of the first year and almost double at the end of five years. A matter of some considerable regret, however, has been the static position of staff in the research and development division. The main increase has been in the workshop and allied services, the administrative, secretarial and accounting staff, and in the new Management Division staff which, by an agreement with ICA, has provided four Ceylonese counterparts for the U.S. consultants.

With the increased staff arose the necessity for an organisational set up, and in 1958 the staff had been grouped into three divisions: Research and Development, Management,

and Administration. Further sub-divisions were made by the creation of three Sections in the Research Division, and these were Chemical Technology, Process Engineering and Rubber Technology. The increase in services during the last five years indicate the necessity for the increase in cadre of research officers and research assistants, and the expansion of the already existing services to applied physics, analysis of food and drugs, fundamental research into natural products. Three new Sections for these fields have now been suggested and approved by the Governing Board. The new organisational chart showing functions and the divisional charts are shown at the end of this report.

The staff under categories Research Officers and Research Assistants, Librarians, Administrative Staff, Secretaries, Stenographers and Clerks, and Workshop Personnel, are shown in Table III, each column giving the number as at 30th April of that year -- with a projection for 1961 and 1962.

REORGANISATION OF STAFF AND SERVICES

The Institute, as its name implies, has for its objectives, not only industrial research but also scientific research in its field of study. Industrial research includes both research and development. It aims at producing advances in technology by scientific and technological investigations. A new process or method evolves from fundamental and applied research. The adoption of the new process through semi-scale and pilot scale to large-scale production is called development.

In Ceylon, industrial know-how, management techniques and talent, are either extremely scarce or non-existent. Consequently development of a process by itself is insufficient, unless the new process can be demonstrated on a large enough scale, and the machinery and capital required closely determined so as to indicate profitability. This service to be effective had to explore markets, design buildings, layout machinery, introduce costing procedures, besides many other management techniques. Hence arose the need for a Management Consultation Service as part of the Institute's already existing scientific service.

Management Division: In 1958 the I.C.A. agreed to provide a highly competent Management team from the consultant firm of Frank Mayer Engineering Co. of Los Angeles. Five such specialists including their own Field Chief who also functions as Chief Management Engineer, are now with the Institute. One of them with over forty years of experience in Workshop Management with the Caterpillar Tractor

STAFF CATEGORIES

TABLE III

STAFF CATEGORIES	APRIL 1956	APRIL 1957	APRIL 1958	APRIL 1959	APRIL 1960	APRIL 1961	APRIL 1962
Director	1 ^a	1 ^a	1 ^a	1 ^a	1	1	1
Chief Research Officer	1	1	1	1	1	1	1
Research Officers	10	10	10	9	9	13	15
Research Assistants	7	9	8	8	9	12	14
Chief Administrative	—	—	1	1	1	1	1
Accountants	1	1	2	2	2	1	1
Stores Supdt.	—	—	1	1	1	1	1
Workshop Supdt.	—	—	1	1	1	1	1
Secretaries	1	1	1	3	3	3	3
Clerks & Stenographers	4	4	3	5	6	7	7
Attendants	1	1	1	1	1	1	1
Watchers & Gardeners	3	6	5	2	3	3	3
Librarians	—	—	2	2	2	2	2
Library Trainees	1	6	—	—	—	—	—
Drivers	1	1	3	2	2	3	3
Workshop Personnel	5	9	14	23	25	25	26
Workshop Apprentices	—	—	—	—	—	5 ^c	5 ^c
Management Consultants ICA	—	—	—	3 ^b	6 ^b	5	2 ^b
Ceylon Counterparts for ICA men	—	—	—	4	4	5	5
Management Trainees	—	—	—	—	—	6 ^c	12 ^c
Chief Engineer IBRD/UNTAA	1 ^a	1 ^a	—	—	—	—	—
	37	51	54	69	76	96	105

^a DIRECTOR - Dr. Francis Godwin - Provided by IBRD/UNTAA for 5 years

^b MANAGEMENT CONSULTANTS Provided by ICA and Contract Expires June 1962

^c TRAINEES & APPRENTICES - Are carried as a service to industry and not for absorption into Institute

Company was specially assigned by request to the reorganisation of the Government Factory. As part of our contract with the I.C.A., the Institute besides providing working facilities, is also expected to recruit Ceylonese counterparts for these specialists. Four such counterparts were provided, and three of them have been with the Management Division for over eighteen months. In addition to the local training under these specialists, it will be admitted that the Ceylonese counterparts should also be given overseas training in their specialised fields. Provision for such training already exists in the Assistance Project of the I.C.A., but the salaries cost of the officers while on scholarships, have to be met by the Institute. Similar scholarship facilities have been available under the same project for our Research Officers and Research Assistants, and it is hoped that the Institute will avail itself of these facilities. Consequently, an overseas training programme, including Exchange Fellowships and study leave, has been proposed for the ensuing years, and expenditure on salaries while out of the Island has been provided.

Training of Production Managers
and Development of Skills:

The biggest handicap to local industry has been great paucity of management talent. This has prompted the Institute to request U.N.T.A.A. assistance for a Management Professor in order to train six graduates with some industrial experience as Production Managers. The proposed programme of training would give these men a thorough grounding in production management techniques, and an insight into local industrial problems through actual assignments of these trainees to the Management Consultants of the Institute. These trainees at the end of the year's course, will be available to Government Corporations and private industry for engagement. Similar training facilities are being provided for young men in the Institute Workshops under an apprenticeship scheme. Four of these boys selected from the Basic Technical Training Institute are now undergoing an intensive practical course in Workshop Practice.

Productivity Centre: The short-term Implementation Programme Report of the Committee on Industry for the Unplanned Sector, made specific mention of Productivity in the following terms: "It supports the proposal to set up a Productivity Organisation (a) to find ways and means of raising productivity in given situations of capital labour ratios, and (b) to promote by various means, productivity consciousness among workers and managers. It endorses the suggestion by the Japanese Mission (which visited Ceylon recently), this country's benefit, by association as a member

of the Asian Productivity Organisation, from parallel experiences in other countries. A particular benefit of such association would be the study of types of capital intensiveness in industries and farms that are ideal for under-developed countries entering the stage of development. At present the alternatives before them are generally the acknowledged backward technology existing, and the most up-to-date machinery devised for the needs of highly skilled Western economies."

The Director served as alternate Chairman of the Subcommittee on Unplanned Sector of Industry, and on the advice of the Planning Council agreed to set up a Productivity Centre within the Institute. As an initial step a Seminar on Industrial Development and Productivity was organised by the CISIR on May 6 and 7, and the Productivity Association inaugurated by the Minister of Industries at the end of the second day of the Seminar.

A nucleus for productivity already exists in the Management Division of the Institute which has, during the last two years, rendered most valuable service in the fields of industrial engineering, market research, job evaluation, materials flow, materials handling. Fields not covered have been industrial relations, statistics, and industrial economics, operational research and productivity information. In these fields, offers of assistance have been made by both the I.L.O. and the U.S.O.M. Even though the specialists might be provided almost free of charge, there would be the additional cost of Ceylonese counterparts. Productivity is of national interest and only the Government can be expected to meet the cost of such work. To maintain a programme of work even with limited staff, will entail an expenditure of Rs.100,000 per annum.

Industrial Promotion Corporation: An important recommendation made in the Plan Report of the Planning Council and endorsed by the Implementation Committee on Industry, is the early setting up of an Industrial Promotion Corporation primarily to serve the private sector and to have powers to contribute to share capital. At the request once again of the Planning Secretariat, the Institute agreed to request the services of an advisor in this field, through USOM, in order to prepare in conjunction with this Institute, a comprehensive report on the scope of the proposed Corporation, the operating procedures, and a draft Bill with recommendations to the Government of Ceylon. A request for an advisor, with experience in such corporations in this region, has already been made to the USOM and this advisor is expected to work at

the Institute, and directly with the Director.

Standards Bureau: The Institute has, from its inception, undertaken the key role in regard to Standards. By turning to an additional use, its broadly diversified and experienced technical staff, its familiarity with local manufacturing problems and its highly valuable variety of precision instruments the CISIR has, in fact, provided Ceylon with a Bureau of Standards, and has come to be recognised as serving this function.

The application of Standards is not merely a protection to the consumer, but in fact the best remedy to any traditional prejudice in favour of imported merchandise and hence a more practical form of protection for local manufacturing enterprises. The CISIR has already demonstrated, in a number of industries, that it is possible to win over and expand the market for a local product in a comparatively short time simply by manufacturing it to a dependable standard of quality subject to impartial testing.

The Director serves on the Standards Advisory Council, and there is a member of the staff of the Institute on every Committee on Standards. The testing work and the establishment of Standards have taken considerable time of our staff, and this most important contribution has been made at Government cost. This volume of work both from the private and Government sector has necessitated the creation, in the Research and Development Division, of a Section on Applied Physics, and another on Analysis of Food, Drugs and Industrial Products. The Applied Physics Section would include in its scope, the expansion of the already existing Electronics Section, new work on electrical technology, instrument maintenance, instrument design and standards. The Analytical Section will be headed by a Fellow of the Royal Institute of Chemistry, and would undertake chemical analyses of food, drugs and industrial products.

Fundamental Research: No research institute, even in the highly commercialised applied field, can afford to ignore the value of fundamental research, as that constitutes the fountain of new knowledge. All the world over it has been recognised that the minimum fundamental work required to keep even an applied research institute fed with that fresh knowledge, is 30% of the total research budget. It is regretted that in the expansion of other facilities directly connected with industry and discussed earlier, the main fountain of knowledge itself has been forgotten. It is intended to remedy this by the creation of a section on the Chemistry of Natural Products.

The Ministry of Health, and particularly the Ayurvedic Council, have in the past two years sought the assistance of the Institute for a systematic study of the chemistry of pharmacology of ayurvedic drugs, herbs and other natural products. In December 1965, Professor Haworth of the University of Sheffield, and one of the outstanding authorities on natural products, was in Ceylon as Chief Guest to the Ceylon Association for the Advancement of Science, and he endorsed the view that the Institute should have a strong fundamental research team on natural products. There are fortunately in Ceylon, a number of research scientists, who had been working under Professor Haworth and fully conversant with recent techniques in this field.

Work of this fundamental character with no immediate practical application, becomes part of a national programme and so does aspects of Applied Physics referred to earlier, and only the Government can possibly support such a programme of long-term research. The cost to Government on staff alone per year on this necessary programme, will be Rs.100,000.

BUILDINGS

As earlier indicated, the total floor area of the present building is 40,400 sq. ft. In view of the expansion of facilities already implemented under research and management, and new activities under productivity and training fields, additional floor space of 20,000 sq. ft. is urgently required.

The original library area is already crowded, and a new library with 5000 sq. ft. floor area is necessary within the next two years at present rate of development and increased reading room space indicated by the wide use of the Library from the public, University students and Government Departments.

The benches and working areas of the chemical laboratories have recently been reorganised so as to give almost 100% more bench space. Even with this the laboratory accommodation is grossly insufficient as some of the rooms originally reserved for laboratory had to be reallocated for Management Division staff. The additional laboratory and pilot plant space required is 10,000 sq. ft.

Accommodation for the Productivity Centre and training facilities for Production Managers and Skilled Technicians and T.W.I. courses for Supervisors and Foremen, is expected to be another 5000 sq. ft.

The total cost of a building similar to the two-storey wing along Bullers Road is estimated at Rs.500,000. Preliminary plans have been prepared and approved by the Governing Board.

ASSETS OF THE CISIR

The Government of Ceylon has made the largest contribution towards existing assets of the Institute. The Colombo Plan Aid from U.K. contributed over 1 million rupees worth of laboratory plant, air conditioners, audio visual equipment, workshop machinery, laboratory benches, and testing instruments. I.C.A. Aid has included a 150 KVA generator, library books, auditorium chairs and library steel shelves.

ASSETS	Govt. in Rs.	Aid Sources
BUILDING	1,025,000	
LIBRARY { By transfer	200,000	
{ By CISIR		
Purchase	218,000	
{ By ICA		24,000
EQUIPMENT { By transfer	300,000	
{ By Purchase	300,000	
INSTALLATION	364,000	
LAB. PLANT & MACHINERY		1,120,000
CASH RESERVES	1,200,000	
(On 30.4.1960)		
GENERATOR etc. ICA Aid		260,000
Total Value	3,607,000	1,404,000

The Government also leased $2\frac{1}{2}$ acres of crown land on which the present laboratories have been built. The total assets of the Institute are now valued at Rs.5 million, of which Rs.1.2 million is in cash reserves. In the absence of Government provision in the 1959/60 Budget, the cash reserve is being utilised to support long-term Government projects of a continuing nature and to defray cost of Library and Information services, Promotion and Administration.

OPERATING EXPENSES OF THE INSTITUTE

The CISIR is mainly an applied research institute working for an extremely wide range of industries, and among its clients are the Government Departments, Corporations, Ceylon's producers, manufacturers, investors, other research institutes and the general public.

Present CISIR services include:-

Process Research, Resources Studies, Waste Material Utilisation, Natural Products Research, Standards Testing, Process Development, Instrument Design, Machinery Design and Fabrication, Chemical and Physical Testing, Rubber Compounding for Special Uses and Products, Radio Communication, Metalurgy, Fuel Technology, Chemical Engineering, Industrial Microbiology, Soils Chemistry, Silicate Technology, Materials Testing, Library and Information, Free Promotion to Small Producers and Investors, Plastics Technology, Paint Technology, Technical Supervision of Factories, Plant Location, Factory Layout, Production Scheduling, Proforma Costing, Efficiency, Fuel Economy, Stock Control, Quality Control, Job Evaluation, Modern Cost Accounting Systems, Technical Consulting, Industrial Project Evaluation and Project Preparation.

The present laboratory buildings, and the extensive equipment have greatly increased the Institute's capacity for service, but these assets themselves can do nothing. The Library with its 8000 volumes on every aspect of industrial technology and management probably contains more academic knowledge than any research institute however large can amass in their staff, but it cannot use it. Whatever the CISIR accomplishes must depend on the initiative, ingenuity and research ability of its staff. Men of this calibre are rare, and no country can afford to ignore their contribution to industrial development. Ceylon has, however, been fortunate in having a very talented team already trained in the Universities of Europe available when the CISIR was formed. They were pressed into service, adequately compensated, and given the environment and climate for effective work.

Trained scientific manpower will always be the main cost of any research institute and the CISIR is no exception. The staff costs, including allowances, and the Provident Fund contribution on its eighty-six members for the Financial Year 1960/61, is estimated at Rs.740,000. Library and information services have been important aspects of the Institute's work and many producers, manufacturers, entrepreneurs have been assisted in the last five years. In order to keep abreast of the rapidly advancing technologies, the library has been expanding at the rate of 1000 volumes per year, besides subscribing to 150 scientific and technical journals. This cost is Rs.75,000 per year.

Other costs include travelling of staff, training of new research men, exchange fellowships, study leave abroad, cost of office supplies, general maintenance, and laboratory and workshop running costs. These miscellaneous costs are estimated at Rs.300,000 making a total operation cost of Rs.1,345,000 per year.

In arriving at the last figure, we have, however, not provided for depreciation of our equipment valued at Rs.3,000,000, and for gradual replacement. No provision has also been made for the already pressing need for extension of buildings. We are of the opinion that a reserve of Rs.200,000 should be provided for equipment and buildings each year.

The annual operating expenses of the Institute since its inception in 1955, with a projection for the Financial Years 1960/61 and 1961/62 is shown in Table IV.

QUANTUM OF FINANCIAL ASSISTANCE FROM GOVERNMENT

Manufacturers, investors and entrepreneurs do not customarily pay out money for technical services unless they are satisfied that their investment in practical technology pays dividends. Our 350 clients is certainly an indication of confidence in the services provided. CISIR in the last five years has played an important role in industrial development and has been justifiably proud of its achievement. Its impartiality and independence has never been questioned and the reports of the Institute have earned a name for reliability and scientific quality both in Ceylon and abroad.

Established to further Ceylon's productive development through applied research and technology, the Institute has provided a multitude of services referred to earlier. Help is provided on new schemes, and research is carried on continuously in fields which seem to offer possibilities for new industries. Free services and advice have been given to many of Ceylon's small producers, manufacturers and entrepreneurs. A large volume of Government sponsored long-term fundamental and applied research has been actively maintained. Its aim is to provide a firstclass, thoroughly practical and efficient service of applied research, production technology, industrial know-how, and advice, in all aspects of industrial production for the aid of Ceylon's factories and industries both public and private, her cottage industries and the general public.

The major factor which has made such useful and efficient service possible is the Institute's unofficial and impartial status. Government assistance has been generous and has been made without strings -- a factor which has helped the efficient operation of the Institute.

In terms of finance, the Government has been the major client of the Institute. Government work and its supported free public services amounted to 80% of the total budget of the Institute every year for the last five years.

It will be admitted that no research institute rendering the wide variety of services referred to in this report can be maintained without the major financial support of the Government. This principle has been accepted for the research institutes of the plantation industries which are financed through a cess collected by the Government on the export of tea, rubber and coconut. The average income from cess, of the Tea Research Institute is Rs.2,256,000 and the income of the Rubber Research Institute from cess and a Government grant for small holdings work for 1959 is Rs.2 million.

Ceylon is still industrially underdeveloped and present industrial production is low even by South East Asian standards. Consequently financing of the Institute's services by way of cess on local production would not be feasible. For the same reason and until our industrial production becomes appreciable, the Institute cannot expect an annual income from the private sector of above Rs.250,000. The major part of the operating expenditure has therefore been for services rendered to the Government during the last five years and detailed in pp.5, 6 and Table I of this Report. If the Institute has served the country in its dominant role in industrial development, through applied research and technology, it has a right to expect the continued financial support of the Government towards rendering the services it has rendered with acceptance during the last five years. In our opinion, the services should be further extended and a greater degree of collaboration instituted between the CISIR, the Ministries, Planning Council, Government Departments and State Corporations.

The order of expenditure of this Institute indicated by the Budget for 1960/61 of Rs.1,345,000 is lower than similar budgets of the Rubber Research Institute and the Tea Research Institute in spite of the larger number of senior scientists on our staff. The Government has contributed at the rate of Rs.1 million per year for the last five years, the last donation being paid to the Institute in June 1959. Financial provision for continuation of Government work in the Institute after April 1960 should have been provided in the Government Budget for 1959/60. This was unfortunately not done because no application was made for such funds.

In order, however, to maintain the continuity of our research and the other services already rendered to Government Departments, and the general public, we have agreed to continue these services by utilising the reserves which are specially built up for capital expenditure. Without Government financing and Government work which has been the mainstay of the Institute, the Institute will be forced to close down for lack of operating funds. It is

imperative, therefore, that Government should indicate its policy towards this Institute early, by the provision of funds in its annual budget.

The Institute has received considerable aid in the form of equipment and personnel from a number of agencies. As a national institution, it cannot, however, ask for or accept financial aid from these agencies for operating expenses even if such aid was offered, as we feel that this would not be in the national interests.

The Government accepted the essentiality of a Research Institute when the CISIR was formed, and we feel certain would want its services continued in the ensuing years. If that is their wish, the financial support from Government in the sum of Rs.1 million per year requested herein, will be provided in the Government Budget in the coming year.

STAFF CHANGES

The total staff as of April 30, 1960 was 76 and this included six management consultants, one of whom, Mr. L.G. MacMaster completed his assignment as of May 6, 1960. The effective additions in Ceylon staff was 4 and this included Mr. R.L.P. Senewiratna, formerly of the Government Railways, who joined the Institute in March 1960 as Research Engineer, Mr. A.P. Dias, Research Assistant, Miss Anne Potger, typist and Mr. N. St. E. Misso, Apprentice Trainee. Mr. Gunasekera Watcher, replaced Mr. A.D. Samuel who left the services of the Institute in March 1959.

Dr. Perampalan, Head Chemical Technology, functioned as Chief Chemist and Deputy Works Manager of the Cement Factory besides being responsible for the expansion proposals of that factory. His services were made available to the Cement Corporation on the usual terms of full salary reimbursement and overheads.

Dr. Godwin Bids Goodbye:

During this year the Institute bade goodbye to its first Director, Dr. Francis Godwin, who left the Island on termination of his 5-year assignment on December 5, 1959. It will be recalled that Dr. Godwin was a member of the World Bank Mission to Ceylon in 1951 and the Mission's report published in 1952 suggested the establishment of an Applied Research Institute. In 1954 he visited Ceylon under World

Bank aegis to assist in drafting the Act which set up the CISIR. By agreement with the World Bank and the U.N.T.A.B., he was invited by the Government of Ceylon to be the first Director of this Institute. He arrived in Ceylon in February 1955 and to him fell the initial task of recruitment of staff, effective transfer of equipment, the search for temporary quarters, the installation and organisation of the laboratory in order to provide the services to the public with the least delay. The Act received assent on April 12, 1955 and on May 1, 1955 the Institute in hired premises -- with benches fitted with gas, water and electricity -- was open for service. Within a year plans were made for the new building and he personally designed the service facilities, layout and fittings with more than professional competence. He will always be thought of as the architect of the CISIR and he can be assured that the present buildings on which he lavished so much time and energy will always remain a monument in memory of his devoted service to the Institute.

The Chairman of the Governing Board, Mr. D.H. Balfour, at the last meeting held on November 1959 before Dr. Godwin's departure said -

"I would first like to stress the great achievement of Dr. Godwin in building and equipping this magnificent Institute in the record period of five years. During this period of building he was able to organise immediately from the very inception a service to the public and to government so that at no time during his five years of service was there a period of stagnation. To those who understand the difficulties of research this was indeed a very creditable performance. So far as I am personally concerned, this work of Dr. Godwin has been the realisation of one of my most fervent dreams, as scientific research has always been one of the foremost urges of my life.

"I would like to emphasize here without equivocation that I have a great admiration for the work he has done here. There is one great and happy thought that Dr. Godwin will be able to take away with him: On the work done by this Institute which he has built will depend the happiness and hopes for a better way of life of many generations to come. This, in my humble opinion, is the summit and ultimate goal of achievement -- not one's own happiness and aggrandisement, but the happiness it will give to others. Dr. Godwin can take this comforting thought away with him. I hope Dr. Godwin will live many years to see the realisation of this goal.

I must welcome Dr. Sundralingam as the next Director of this Institute. He is undoubtedly the most distinguished scientist we have in Ceylon and that distinction covers the period of time that I have served in this country. On his shoulders will rest the burden of fulfilling the purpose of Dr. Godwin's mission in this country and I have no doubt he will be equal to this great task."

In reply to the sentiments expressed by the Board, Dr. Godwin had this to say -

"This meeting is my last opportunity, as Director, to speak to the Board of the CISIR. I have only a little to say in review, for we have worked together and understand each other. Five years go very quickly.

"As we know, Ceylon's need for an institution like the CISIR as an instrument of industrial and economic development, and some of the essential conditions under which it could hope to achieve its ends, were first pointed out in recommendations of the 1952 World Bank Survey. Subsequently your Government, through negotiated agreement with the World Bank and United Nations, invited me to come here to organize and help to shape the policies of such an institution, from the drafting of its Parliamentary Act onwards, and to lead it for an initial period in preparation for wholly Ceylonese direction.

"This period is now over. The programme has followed its intended course, even through difficult national times. The CISIR is a going concern with some measure of public recognition and respect, making its contribution to economic progress, and a very able Ceylonese who has shared in its growth has been named to succeed me as Director very shortly.

"My job has been to build and deliver an organization; and in the proper objective of an international Technical Assistance project, it is now time for me to move on and leave it in competent local hands. I do so confidently. But you will understand a little feeling of personal sadness that is the penalty of such an assignment. It is precisely because I love the CISIR that I must leave it, so that it may strengthen and succeed hereafter by itself; and for the same reason I must leave a fine staff for whom I have such affection.

"As organizer I have tried to build around a set of operating principles distilled from the accumulated experience of mine and others elsewhere in similar endeavour. In

some cases this has meant change from local custom, since the CISIR represents an entirely new type of institution for Ceylon. The results have been gratifying, for Ceylon has proved readily adaptable. I hope these principles of operation will continue, or that any modifications will be subjected to the cold test of results in terms of clientele reactions. In this connection, while CISIR service to government is equally important, it will always be the voluntary financial support of the private sector that will truly measure the public confidence in the institution.

"As Director I have tried to follow the axiom, so well known to the profession, that the main job of a research director is to protect the research men from those who want to direct them.

"If one factor can be singled out as the most responsible for the Institute's success to date, it is its independent status. Autonomy was the most basic thing sought in creating the CISIR, and I commend to the Board unceasing defense and even considerable strengthening of this status in future, if the Institute's value to the nation is to be maintained. If any would question the importance of this, there are plenty of experiences of other research institutions elsewhere available for study.

"In consultation with the Bank and U.N. after my return to Washington I shall, of course, prepare a summary of observations and recommendations to Ceylon for the further improvement of the CISIR as an effective instrument of national development. The Board is invited to call attention to any special aspects which might be dealt with in such a summary, in addition to those on which notes have been made during my present assignment.

"Above all, I want to take this opportunity to thank every member of this Board personally for the cooperation and many acts of assistance by which we have, jointly, been able to achieve the Institution that we have here. My association with all of you has been an inspiration, and I shall remember this opportunity and privilege of working with you as an outstanding chapter. I wish you every success for the future, and I know that you share my pride and love for the CISIR that we have built together."

Appointment of Chief Research Officer:

With the appointment of Dr. Sundralingam as Director, the post of Chief Research Officer was filled by Mr. S.F. Laurentius, M.Sc.(Tech.) Manchester, A.R.I.C., A.C.T.M., G.I.Chem. E. He joined the Department of Industries in 1940 as Chemist and was awarded a scholarship in 1945 to do post graduate work in chemical engineering. He obtained the Master's degree of Manchester University and returned to Ceylon in 1950. He was one of the Government officers recruited to the Institute right from its inception, and at time of appointment held the senior position of Section Head in the Institute.

INSTITUTE SERVICES

A detailed review of the 250 research projects and services undertaken both on behalf of the Government and the private sector of industry will however be impracticable in a report of this kind. Details of many of the privately sponsored projects and studies are confidential and can only be disclosed with the permission of the client. Certain developments which are either under patent or in the process of patent are also for that reason not described in detail. Subject to these restrictions, the summaries below are a fair sample of the type and nature of the services rendered by the Institute during the year.

Library and Information Service:

The Library and Technical Information Service of the CISIR is open to all who wish to make use of it. Its function is the procuring, processing, storing and disseminating of scientific, technical and business information. Disseminating information that will keep its users well informed and up-to-date in their own and related fields of work and interest is one part of the service; the other and equally important, is the provision of answers to specific enquiries.

The clientele of the CISIR library varies widely. The library though established to serve the staff of the Institute, is now consulted and used by others as well. Our non-CISIR users range from college and university students to foreign experts in Ceylon. In addition to individuals, several organisations and institutions are using the library and the several services provided by it. More than a hundred

persons and organisations are monthly informed of the additions to our shelves, of books and periodicals. Books, other than reference volumes, are loaned to those who are able to provide us with sufficient identity. On an understanding with the library of the Institution of Engineers (Ceylon) and the CISIR library, members of the Institution of Engineers (Ceylon) can borrow books from the library. Books are sent by post only to co-operating institutions. In addition to its book-lending service, the CISIR library serves and is looked upon, as the centre of technical, scientific, industrial and business information. Other than monographs, a wide range of handbooks, encyclopedias, abstracts, indexes, journals, manufacturers' catalogues, trade directories and standards are used for gathering information to answer the several enquiries that come to the library. These inquiries come by letter and telephone. Quite often people come in with their problems. Usually answers have been provided, otherwise ways and means of obtaining an answer are suggested.

Some typical inquiries answered during the course of the year were:

1. What was the production of Caustic Soda in Japan for 1957 and also the addresses of five leading manufacturers of the product.
2. Could you provide me with a list of books and periodicals on all aspects of printing?
3. I am interested in the manufacture of soaps and inks. Please be good enough to enlighten me on the following and oblige:

A formula for the manufacture of:

- (a) Washing soap
- (b) Toilet soap

4. Let me know the most economical chemical compound that may be used as chlorophyll in the preparation of tooth powder and where it can be bought.

When requests for the formula of products are made, attention of the inquirer has always been drawn to existing standards or specifications. In reply to a request for the

formula and method of manufacture of "good soap", the following was said in addition to providing the formula and method: "The product manufactured, to be marketable, should conform to certain minimum standards. In this connection I would like to draw your attention to CEYLON STANDARD 8 of 1957 on SOAP, which prescribes for certain minimum requirements in the product."

A large number of requests to train librarians had to be turned down, but however in-service training was provided for the librarians of:

The Public Health Department of the C.M.C.
 The Education Department
 The Labour Department
 The Architectural Branch of the P.W.D.
 The Research Institute of the P.W.D.

Several other librarians have come to study our methods of organization of library materials and methods of library administration, which we consider a tribute to our organisation and administration of the Library and Information Service.

Additions to the Library:

The complete set of Indian Standards, consisting of over three thousand, has been the most significant addition to the library for the year. Through the good office of the Commercial Counsellor of the Embassy of the Federal Republic of Germany, the library is now the depository of all English translations of German standards. An addition of about 700 new books brings the number of volumes on the shelves to about 8,500. About 40 new journals were added bringing the number of journals received to a little over two hundred. Another significant addition to the library is the Commonwealth Index of Scientific Translations -- which is an index in cards arranged alphabetically by author of all available translations of scientific articles into English, available in the Commonwealth and a few other countries.

The complete Index should have well over 40,000 cards, but our Index has only about 13,000. Cards issued since the inception of the Index in June 1951 to May 1958 approximating about 33,000 are somewhere in Ceylon but cannot be traced. It is only since August 1959 that the cards have been sent to us. It is a pity that so valuable a tool of reference should be incomplete. The library owes a debt of

gratitude to Professor W.A.E. Karunaratne who made it possible for us to get at least these 13,000 cards and for having made arrangements to see that all further additions to the Index are sent to us. Since then we have been regularly receiving additions to the Index from U.K. through the External Affairs Ministry.

Through a grant of five thousand dollars from the United States Operations Mission to Ceylon, a little over 400 books and 12 journals were ordered. To date the library has received about 360 books and 11 journals. A complete set of Federal Specifications has been ordered as part of the grant. By arrangements with USOM the library is receiving catalogues of all leading American manufacturers. To the USOM we are indebted for this grant and for the supply of all I.C.A. publications and other technical and business literature. An addition of another 540 feet of shelf-space brings the total shelf-space available to 1980 feet. At the rate at which we are expanding the stacks should be full in another three years.

Liaison with other Libraries and Institutions:

Close liaison has been maintained with most of the technical and general libraries in the city. Liaison has also been maintained with the Tea Research Institute, the Coconut Research Institute, the Rubber Research Institute and the Technical Training Institute, in Ceylon, and abroad with INSDOC, I.S.I., C.F.T.R.I., in India; PANSDOC in Pakistan; ASLIB, D.S.I.R., B.S.I., R.A.B.R.M., and Science Museum in the U.K.; N.R.C. in Canada; C.S.I.R.O. in Australia; and the U.S.B.E., A.M.A. and Chemurgic Council in the United States.

Free publications are received from most of the foreign Trade Consuls and Trade Commissions. In exchange for our Annual Report we are receiving journals from the National Library of Peking (Acta Chimica Sinica and Scientia Sinica) and the Battelle Memorial Institute, Columbus, Ohio (Battelle Technical Review).

The Library is the Ceylon centre of all examinations of the Library Association (of U.K.) and is one of the few Approved Libraries in the country.

During the course of the year under review, books and other library material have increased in number; the services rendered have increased in volume, and the clientele has increased in number and type. The increase in the volume of service rendered and the increase in clientele, is a sure indication that the library is being used -- and usage is the surest measuring rod of the usefulness of a library.

Instant Tea Direct from Green Leaf:

Instant tea as a product is not new. Brands of instant tea have been on the market in the U.S.A. for some years but these were made from the conventional manufactured black tea. The final product, while freely soluble in hot water, did not have the satisfying qualities one associates with a brew made from black tea, for the reason that two losses in quality characteristics were involved, once in the process of black tea manufacture, and again in the extraction of black tea and subsequent drying to produce instant tea. In spite of this loss of quality, the effective labour saving and difficult disposal of spent leaf were factors which encouraged the consumption of this product.

Logically, if quality losses were minimised by processing green leaf direct to instant tea without going through black tea, a higher quality product approaching black tea brew characteristics would result. Tea producing countries alone would benefit by such a development -- as green leaf cannot be preserved long enough for processing in consumer countries. The exhausted leaf can be retained in the country and the estate for manuring, while reducing freight charges as instant tea is one quarter of the weight of black tea. Ceylon has increased the production of tea and new markets for our tea have to be found. Instant tea it was argued, could provide the new market in the traditionally coffee-drinking markets of Europe and America.

It was these thoughts which prompted the Tea Research Institute to sponsor the investigation into the manufacture of instant tea direct from green leaf. Their quality standard was not the instant tea from black tea, but the black tea itself.

The investigation was started in 1958 and early experiments proved that more knowledge on the chemistry of withering, rolling and fermentation was necessary if the quality characteristics were to be attained. Both high country and mid-country leaf was experimented on and leaf for this purpose was sent down from the estates by rail to Colombo in special containers. Almost 18 hours elapsed between plucking and processing and the moisture content of the leaf was reduced to 75%. In the process of drying were other reactions involved and what reactions if any are involved in withering are some questions that we had to find answers for.

Withering, according to tea makers, reduces the moisture content of the leaf and thereby becomes flacid for rolling -- a process which gives the characteristic shape and twist to black tea. If this is so why not reduce moisture content by drum drying or hot air drying quickly?

What are the reactions involved in "fermentation" and rolling? Literature on the subject was scanty and often misleading theories were offered by individual workers. The main task was the sifting of all information available and gathering by planned experiments the answers to a number of questions which were essential to our enquiry.

Several hundred experiments under varying conditions contributed to the final selection of a process for manufacturing instant tea direct from green leaf, of a quality acceptable to both by ourselves and our discerning client the Tea Research Institute.

Of some of the earlier samples, a tea taster reported as follows: "This is the best selection of Instant Tea samples I have yet examined.... The main characteristics which distinguishes these from practically all previous instant tea samples is the touch of brightness in the liquors. The achievement of this characteristic, in my opinion, represents an important advance inasmuch as the phrase "recognisable as tea" can now be changed to "undoubtedly is tea." Samples cream well on cooling which indicates a fairly high caffeine content. In my opinion these are on the verge of possessing a little quality and in any case can be regarded as meriting the description of quite a pleasant beverage". The samples referred to were made from mid-country leaf which our planters describe as having neither the strength and colour of the low country leaf nor the quality and flavour of the high country leaf. The process developed will be of special significance to mid-country tea as although we cannot put quality and flavour where these characteristics are absent in the leaf, the colour and strength can be considerably improved in the process of manufacture of instant tea. Tea is the major export industry of Ceylon and the Institute is therefore happy to have contributed towards further development of this vital industry.

Vegetable Oil Resources:

Fundamental studies on the chemical composition and potential uses of vegetable oils indigenous to Ceylon were

commenced in 1955 and are being continued. The variety of ground nut known as "Big Japan" was chosen for a detailed study of the composition of the component fatty acids during the year under review. In this series rice bran oil, sweet orange seed oil, Dombé seed oil, sunflower seed oil and twelve varieties of ground nut oil have been studied. A paper on the composition of the component fatty acids and their glycerides was published by Dr. A.H. Weerakoon, in the Journal of Science, Food and Agriculture in May 1960.

No precise information regarding the origin of the "Big Japan" variety of ground nut is available. It would appear that this variety of ground nut was introduced to Ceylon from India. The composition of the component fatty acids of "Big Japan" ground nut oil obtained from Ceylon grown ground nut has been established to be as follows:

% by weight

Myristic	1.21
Palmitic	13.09
Stearic	7.52
Arachidic	6.21
Behenic	0.25
Hexadecenoic	6.97
Oleic	36.26
Linoleic	28.49

The presence of hexadecanoic acid to the extent of 6.97% by weight is unusual. The maximum proportion in which this acid has been reported to occur in ground nut oil is 2.4% in an Argentine variety, other varieties containing less than 0.5%.

Ground nut oils fall broadly into 3 categories, differing somewhat in their fatty acid composition, as follows:

	<u>Saturated</u>	<u>Oleic</u>	<u>Linoleic</u>
A	15 - 18	66 - 60	19 - 22
B	18 - 23	56 - 50	25 - 27
C	22 - 24	48 - 39	30 - 37

The oil of "Big Japan" ground nut, however, does not fall distinctly into any of these categories. Thus, while its saturated acid content of 28% is in excess of the maximum observed in Group C, its content of Oleic acid (36%) is below the minimum observed in Group C. Linoleic acid, however, seems to be present within the usual range.

Viewed with respect to linoleic acid content only, the Ceylon oil closely resembles oils of Indian and, in some instances, of North American origin. It is probable therefore, that the introduction of a selected variety of ground nut into Ceylon has no major effect on the degree of total unsaturation of the seed oil.

Proteins from Coconut:

The average diet of the children of Ceylon is so deficient in protein that most children, particularly from lower middle class and worker class, suffer from protein malnutrition. This is further aggravated by the non-availability and high cost of fish in the inland and up-country areas of Ceylon. The request for a survey of edible protein sources as an additive to food was made to the Institute by the Nutrition Division of the FAO.

Coconut, which is indigenous to Ceylon, is a rich source of protein and investigations of a long-term nature were initiated by the CISIR. Coconut pponac which contains 20 - 21% protein was the obvious first choice for investigation. Unfortunately it also contains 15 - 16% fibre which makes it inedible by children. The objective was therefore either to extract the protein without denaturing it or to separate the fibre by mechanical means from the pponac. The latter alternative was impractical and methods of extraction of protein were attempted.

The two main processes generally employed for the separation of protein from vegetable sources are:

1. Extraction of the protein bearing material suspended in water with dilute caustic soda at a pH of 7.5.
2. The "salting in" and "salting out" process which consists of suspending the protein bearing material in 10% salt solution clarifying and subsequent precipitation of protein with ammonium sulphate solution of 0.2% saturation.

Both the methods were tried with expeller pponac and solvent extracted pponac using varying temperatures, but the extraction of protein obtained was extremely low and the highest yield was 1 - 2% of the pponac. The recovery was therefore below 10%. This seems to indicate that the proteins

originally present in the kernel have undergone some form of denaturation resulting in low solubility in caustic soda and salt solutions. This change in character of the proteins could, it is believed, be due to heat treatment the kernel has been subjected to first in the production of copra and subsequently in the expelling or extraction of the oil.

The next phase of the investigation was on the extraction of proteins from coconut milk. For these experiments the starting material was creamed coconut milk which has the following composition:

<u>Constituents</u>	<u>Amount as %</u>
Oil	65.4
Water	24.2
Meal (by difference)	10.2
Protein in creamed milk	8.0
Protein in meat	85.4

Each average size nut contained in its cream 10.2 gms of protein. The oil was separated by either mild heat treatment or coagulation by dilute acid. The meal separated from the oil and water contained over 70% protein.

The coconut oil industry is based on free availability of copra which is sent either through expellers or solvent extraction units to produce oil and poonac. Any attempt to produce edible protein in sufficient quantity for Ceylon involves changing the raw material poonac to fresh nut and the process of oil extraction. The oil obtained through creamed milk is perfectly water white and is resistant to rancidity for long periods. These characteristics might, in spite of the obvious objections of the oil industry, turn the scale in favour of a process which produces most needed edible protein, white oil of superior quality, and still have poonac.

Multi-Purpose Food:

As a corollary to our project on edible protein, an investigation was started to explore indigenous raw materials necessary for a multi-purpose food both for children and adults. Multi-purpose food has been produced with considerable success by the Meals for Million Foundation in U.S.A. and a similar product is already past pilot stage in India.

It has been found that three types of Multi-purpose Food are prepared by the Foundation. They all contain processed Soya-bean Meal together with onion powder, herbs, protein derivatives, food yeast and fortified with Calcium pyrophosphate, Kelp, Vitamin A ester, irradiated Ergosterol, Vitamin B₁, Riboflavin (Vitamin B₂) and Niacinamide. One product consists only of these constituents where the soya-bean meal accounts for 86%. The other is similar to this but has in addition salt, spices and artificial seasonings. The third variety is similar to the first except that 25% of the soya protein is replaced by dry milk solids and is intended mainly for infants and hospital use.

The Indian preparation is made up of:

75 parts of edible low fat groundnut meal (free from grit, cuticle and germ)

25 parts roasted Bengal gram dhal

and added vitamins and minerals.

The results of a comparative study of the Indian and the American (Meals for Millions Foundation) products are given in tabular form in Table I.

TABLE I

COMPOSITION OF INDIAN AND AMERICAN MPF
(Values per 100 grm)

Constituent	Indian MPF	American MPF
Moisture (grm)	6.8	6.7
Protein (N x 6.25)(grm)	41.9	42.3
Fat (grm)	8.5	7.6
Ash (grm)	7.0	6.5
Carbohydrate (by diff.)(grm)	35.8	36.9
Calcium (grm)	0.665	0.587
Phosphorus (grm)	0.820	0.440
Iron (mg)	5.1	7.0
Thiamine (mg)	1.3	0.7
Nicotine Acid (mg)	14.0	7.0
Riboflavin (mg)	3.0	1.2
Vitamin A (I.U.)	3000.0	2940.0
Vitamin D (I.U.)	300	235
Calorific value	387	386

In any scheme for the manufacture of a similar product in Ceylon, the major consideration should be that it should both meet the nutritional deficiencies in the average local diet, and also be available at a price within the reach of all -- especially those of the lowest income group. For this reason, it would be necessary that at least the major components of the proposed food are indigenous to Ceylon. Coconut poonac, which is a rich source of proteins and is available in plenty, has to be ruled out on account of the high percent of indigestible fibres in it. On the other hand, gingelly poonac and groundnut are free from such a disadvantage and are indigenous materials suitable for a multi-purpose food. Gingelly seeds should however be freed of grit and sand and dried before expelling the oil so that the poonac would be suitable for incorporation into a food. In this connection it might be mentioned that for the removal of sand and grit from Kurakkan, gingelly and rice has already been developed in the Institute as part of another project and a few of the prototypes are now in use in Kurakkan flour and rice mills.

The average intake of protein required by an adult for good health is 60 - 65 grammes per day whereas the intake on normal diet of the lower income groups in Ceylon is possibly 35 - 40 grammes per head per day. To overcome this degree of deficiency the manufacture of multi-purpose food should be on a very large scale and this in turn would only be possible by providing suitable incentives, including the maintenance of the guaranteed price scheme, for the extensive cultivation of gingelly and groundnut in Ceylon. Only on such a basis would the commercial production of Multi-purpose Food be economically feasible.

Rubber Compounding and Testing:

To encourage and improve local manufacture of rubber goods the Institute, under Government sponsorship, afforded a compounding and testing service. The objective was to provide formulations for new products, hitherto not manufactured in Ceylon, to undertake experimental compounding followed by testing, to improve the quality of products now manufactured, and to test the products of local manufacture for conformity to predetermined high quality standards. The charges made were kept low during the first three years and the deficit met by a subsidy from Government. Two years ago the scale of charges were raised to almost double the earlier rates and the service is now almost self-supporting. In spite of the new scale of charges the local rubber manufac-

turing industry has only increased the calls on this service, which is itself a high tribute to the role the Institute continues to play in the development of the local rubber goods manufacturing industry.

This service was availed of by four Government departments, two Government sponsored Corporations, and all the rubber manufacturing firms in Ceylon. High quality compounds, both from latex and dry rubber, were developed during the year for Hawaiian slippers, play balls, latex dipped goods, soles and heels, latex cast vases, rubber mats, typewriter erasers, tread using H.A.F. black, and neck rings, the last item for the Government Railways, and the others for individual rubber goods manufacturers. Raw materials and chemicals, materials in process, and finished goods tested, included accelerators, fillers, camelback, shoes, soles and heels, tyres and tubes, belting, gum boots, beadwire, rubber mats, besides others. For use in the triaxial machine of the Soils Laboratory of the Irrigation Department, 1000 rubber sheaths to particular strength and size were manufactured and supplied.

Some of the leading manufacturers maintain a regular monthly account with the Institute for product testing as the basis of continuous and impartial quality control. This service was availed of by two footwear manufacturers, one retreading and general goods manufacturer, and one tyre and tube manufacturer.

One manufacturer had, during the last five years, used the Institute's services of technical supervision of production on a regular monthly fee basis. This has entailed regular weekly visits to the client's factory, to control quality, to test their products, to maintain overall quality and quantity output, to suggest improved methods and better formulation, and to act as consultants to the Management. During the year under review this manufacturer had considerably increased output of his main product and developed two additional lines of manufacture.

Bicycle Tyre and Tube Manufacture -- Institute's Service to a New Industry:

Until late 1959 the entire requirements of bicycle tyre and tubes were met by imports mainly from the U.K. Bicycle is the popular form of transport for the worker and the annual imports of 35,000 bicycles is therefore likely to be bettered in the coming years and replacement tyres

of 1101/12
and 1101/13

and tubes was also expected to increase over the existing figure of 250,000. The C.I.F. value of imports of bicycle tyres and tubes was Rs.1.5 million and this was considered an adequate market for a new industry.

A market exists only at a particular price range and quality. A sponsor will further require information on raw materials, machinery, choice of technology, labour skills, economic unit of production, unit cost, technical know-how, capital required, quality specifications of product, and detailed information on present market and projection of market for the next few years. The Institute was asked to prepare a full project report which would provide detailed information on the nature, quality and type of equipment, manufacturing methods, material requirements for a chosen production, labour required and level of skill necessary, power requirements, fixed capital on land, building and machinery, working capital requirements, cost of production based on predetermined high quality specification, and a profit and loss statement based on production related to local consumption.

On the basis of this report the sponsors, as businessmen, were required to assess profitability and their ability to accept the risks inherent in any business. Having made a decision to proceed with the establishment of the industry, detailed programming on capital required, (how much and when), purchase of machinery, construction of factory buildings, erection of machinery, provision of services such as water, power, and housing, and training of supervisory personnel and production managers, will have to be made. Collaboration with a reputed foreign company both in the financial and technical aspects of the new venture, was recommended. The Institute assisted in the negotiations of the sponsors with the foreign company in regard to nature of technical assistance, laid down specifications for raw materials and finished products, advised on where and what machinery to purchase, and also determined the number of foreign technicians required for erection, experimental trials, and first-stage production, and the period of their stay in Ceylon. It also selected for training for 1 year in the foreign collaborating concern, three young Ceylonese who were expected to take over full charge of production from the foreign technicians within 1 year.

The phasing of various aspects of this industry were carried out to a carefully prepared schedule and in 15 months from the time the preliminary report was made, a local industry was producing high quality tyres and tubes. The detailed

efforts spent on this project were well rewarded when the entire production came under complete Ceylonese Management within 6 months of commencement of production. We are indeed very proud to record that both quality and quantity has improved since its products were released on the market in November 1959. The quality of the product has been high and no difficulties were experienced in marketing.

The Institute continues to provide this concern with regular testing service and technical supervision of its factory.

Preservation and Bottling of Coconut Toddy:

Coconut toddy from the time of leaving the spathe, to collection and transport, to storage and disposal in taverns, is subject to heavy infection, and most of the bowel diseases of persons addicted to toddy can be traced to this source. The unhygienic conditions of the vats, utensils, and environment of the taverns, add to an already serious condition of bacterial contamination. Bacteria free toddy can, however, be a wholesome drink, and yeast contained in it is a valuable source of Vitamin B.

In 1956, at the request of the Prohibition Commission, and with Government sponsorship, the Institute developed a process of sterilisation which permitted the preservation of toddy for 1 - 2 years in bottled form. Harmful chemical preservatives which were in use in earlier war time processes were dispensed with, and preference was given to pasteurisation techniques which not only preserved the taste, but also killed all micro-organisms present.

Details of the process were reported to the Excise Department and the Ministry of Industries and Home Affairs, and it is a matter of considerable regret that the process with its attendant health improvement possibilities, is still not exploited. During the year under review, further bottling was undertaken under laboratory conditions at the request of the Minister of Industries, and several samples supplied to the Ministry and the Excise Department. A number of samples were retained in the laboratory for further studies on keeping qualities during storage.

At the World Fair Carnival at St. Joseph's College, the pilot plant operated for a week and the toddy bottled at the site was sold within the premises. The process has been fully tried out and two-year old samples have maintained the original flavour and quality.

Clay Surveys for Tile Factories:

Brick and tile factories depend on adequate supply of clay of the right quality. No factory can survive unless its basic raw material is available both in quality and quantity within close proximity. Detailed surveys of clay deposits to determine quality and quantity will have therefore to be made before embarking on a tile factory proposal if later failure of project is to be avoided.

Clays vary in such physical characteristics as plasticity, shrinkage, water absorption, workability and sintering temperature. The requirements for tile manufacture is a pure clay or blend of clays which give high plasticity, easy workability, low shrinkage, low sintering temperature and exhibit low shrinkage both in air drying and firing and low water absorption on the fired product.

The clay survey is generally carried out on the 210 feet grid system with bore holes down to 12 feet. Samples are drawn from each bore hole at various depths and each sample is then examined for particle size, water of plasticity, linear shrinkage at various temperatures; sintering temperature and the properties of the fired product such as water absorption, colour, cracks and warpage are also studied. The investigation should indicate whether sufficient clay is available for operation of the factory at its projected production level for 40 - 50 years, and what blending of clays within the areas of the selected field or fields is necessary to produce a tile to the highest standard specification.

Two such investigations were carried out on Government account, one for the tile factory to be set up by the National Small Industries Corporation at Bangadeniya, and the other for Mannar. In both cases adequate clay deposits of the right quality were proved to be available.

Industrial Products Testing:

The establishment of Standards by itself, does not improve quality. Products for which minimum quality standards have been laid down should be regularly tested and facilities for such testing should exist if quality production is to be assured. For many years the only specification for tiles to be used on Government buildings was that they should be "imported Indian Mangalore pattern". Fuel was purchased on British Standard Specifications, and oil companies tendered, but tender samples or bulk supplies were

never tested. The Institute has, from its inception, served both the Government and the public as an industrial testing institution. Test reports indicated conformity or otherwise, to appropriate Ceylon, British, Indian or other standards, and what steps should be taken in the manufacture of the product in order to attain minimum standard quality.

During the year under review, almost 500 samples were examined in the Institute. The products included textiles, tobacco, tea, ghee, fertilisers, lime, sand, mortar, concrete blocks, asbestos sheets, sand, stoneware pipes, steel rods, fire-bricks, clay bricks, tiles, wire nails, galvanised wire, fibre, dates, brake fluid, baking powder, liquid chlorine, vitamin preparations, bandages, sealing wax, water, soap, ink, sulphur dust, gypsum, dolomite, belting, P.V.C.wire, crown cork, fuel oil, lubricating oil, French polish, torch batteries, accumulators, rubber chemicals, retreading compounds, footwear, bicycle tyres and tubes, arrack and rectified spirits, besides many others. Regular testing service on a monthly agreement basis were afforded for footwear, rubber goods, gin spirits, concrete blocks and reinforcing rods.

The testing service has been greatly appreciated by the public and greater use is being made of this facility.

Technical Services for Gal Oya Development Board:

Under the sponsorship and financing of the Gal Oya Development Board the Institute entered into a broad agreement in 1955 to provide a number of essential technical services. A laboratory was established by the Institute at Amparai specifically designed to carry out major soil surveys, to investigate problems of soil fertility, and to undertake testing of industrial products manufactured within the Gal Oya area.

The soils in the Valley are, by comparison with the North Central Province, of low agricultural value. The soil problems in the area can be classified into four categories: (a) Soil salinity; (b) soil alkalinity; (c) sandy soils failing to retain water; and (d) swampy soils. The Institute's laboratories found not only satisfactory, but also economic solutions for reclaiming every one of these defective soils. In every case the soils were rendered fully productive by appropriate treatment. Incorporation of ground gypsum removed salinity and slight alkalinity. Where soils were highly alkaline with p_H of 9.5 - 10, the application of sulphur brought about a marked improvement in the soil conditions and it was possible to raise a crop of paddy in

affected areas where even grass failed to grow earlier. The two other problems were widespread and interconnected. The sandy soils were on high ground and the water drained down to lower areas causing swampy conditions. The simple method of incorporating paddy straw in the sandy soils enhanced the water retention, and the addition of lime in the lower areas ameliorated the swampy conditions.

Soil surveys continue to be the major work of this laboratory. A total extent of 90,000 acres on the right bank, of which 57,000 acres are irrigable, were surveyed and the soils classified into four types and recommendations made as to most efficient land use. On the left bank soil surveys of the paddy lands were continued in order to formulate a scheme for better fertilisation. A soil survey of the area served by the Namal Oya reservoir showed this area to be suitable for citrus cultivation.

Earlier reports referred to the extensive investigations carried out for improving the production of tobacco in the Valley. The earlier trials were confined to irrigable lands, but during this year it was extended to high land provided with lift irrigation facilities. Manurial trials on high land confirm the earlier finding that a mixture containing 25 lbs. of nitrogen, 100 lbs. of phosphoric acid, and 80 lbs. of potash bearing N/P, N/K and P/K ratios of 2.5: 3.1: 12.5 is the best for tobacco in the Gal Oya area.

As part of the services of the Soils Laboratory at Amparai, on-the-job training was provided to the Gal Oya Development Board trainees of the Technical Training Institute. C.I.S.I.R. staff members also assisted in instruction at classroom level. Other work included regular testing of tiles produced in the Gal Oya Factory, and minor investigations connected with the supply of drinking water to the Valley.

Market Surveys:

Markets make industries. Production will be of no value if products are not consumed. Consequently accurate information on the existing market for the proposed product, its possible expansion, the quality and price at which market can be sustained or expanded, is essential before financial investment in an industry. Market Surveys provide such information.

The survey on prefabricated buildings was carried out on Institute account in order to investigate the true prospect for local prefabrication of one or more standard lines

of such structures in Ceylon to supply domestic needs. The findings were based on interviews with businessmen, government departments and officials, architects, local engineering firms and others. The survey indicated that greater use should be made of prefabricated structures whether locally made or imported, in order to help speed the national development programme, and to reduce building costs. The cost of prefabricated structures were approximately Rs.4/50 per square foot, while conventional type costs were over Rs.10/-. Erection time of these structures was only a fraction of conventional structures.

Sufficient scope exists for local fabrication of prefabricated structures, but local efforts in this direction are however inadequate to speed the construction necessary for economic development so urgently required in Ceylon. Because of the greater consideration of economy and speed in the national development programme, the survey recommends that until such time as one or more local firms are actually producing and offering for immediate sale standard structures of acceptable quality and comparable cost, no special restriction be placed on import of standard prefabricated structures. It is the CISIR view that even lighter and cheaper prefabricated structures can be designed for local manufacture and to serve local conditions. To encourage local fabrication it is suggested that specifications for public buildings be amended to incorporate greater use of these structures.

Other surveys made included envelopes, photogravure printing, steel fabric and barbed wire. In investigating the scope of photogravure printing, a detailed study was made of the possible business in printing of industrial labels, advertising matter and posters, textbooks and magazines in Sinhalese, Tamil and English, and exercise books. The annual consumption of labels in the Island was surveyed in the tea industry, soap manufacture, safety match industry, beverages and alcoholic drinks industry, aerated water industry, torchlight battery manufacture, textiles and shoes manufacture among others. The all-Island annual demand for industrial labels which carried an import duty of 110% was approximately 500 million.

Preventive Maintenance:

Because of poor maintenance, inexperienced workers and supervisors, unfamiliarity with new machines, climatic problems and similar hazards, machinery breaks down more often in Ceylon than in the industrially developed countries

of the West. And when it does, because of distance from parts suppliers, long and costly delays follow. Consequently the most essential requirement for an industrial project is an adequate stock of spare parts and an effective system of preventive maintenance.

In industrialized countries, large maintenance costs are accepted and include preventive work to forestall serious damage to expensive equipment. In Ceylon, the need for preventive maintenance is even greater because of inadequate provision of spare parts in many cases, and because of additional hazards caused by poorly trained workers. Having spent large sums in capital machinery, the management must ensure that equipment will not be allowed to breakdown.

The objective of a Preventive Maintenance Programme is to determine the "point" when maintenance is necessary in order to avoid breakdown and damage to expensive machinery. This is achieved through inspection reports and review cards on each major piece of machinery and by the provision of trained maintenance staff to carry out the programme.

Such a maintenance programme was developed for the Oil and Fats Corporation for the Provender Milling Plant and installed at the operational level. The installation involved training of maintenance crew and the system is to be extended to other production sections of the Corporation.

Product, Process and Factory Layouts:

A great deal of time can be added to the total work content of a process by bad layout, which causes unnecessary movement of materials and uses up time and energy of the workers without adding anything to the completion of the job. In many factories there was no planned change since the first layout. Machinery, benches and even whole sections have been added from time to time, either for expansion or additional product manufacture without careful planning. The result has been that materials often made long roundabout journeys in the cause of manufacture of the final product.

The layout of a factory should be such as to make the flow of work through it as easy as possible. Each operation is placed next to the one before it in the manufacturing sequence, and the product should go from process to process without having to go back along the same path. A process layout is one in which all machines or processes of the same type are grouped together. A product layout is one in which

all machines concerned in the manufacture of the same product are grouped together. Most factories producing more than one product will involve a combination of both process and product layouts.

During the year 1959/60, factory layouts were made for a shirt factory, desiccated coconut mill, metal cork factory, wood-screw and wire nail factory, pencil factory, besides others. The client who requested development of an improved layout of the D.C. mill was anticipating expansion of production while utilising existing facilities and buildings. The report submitted incorporated improved materials handling methods, production sanitation and control requirements, besides a full layout of the factory.

Technical Feasibility Studies and Profitability Prospects:

Technical feasibility studies attempt to determine how well the technical requirements can be met, which location would be most suitable, and what the size of the plant should be. It requires a careful study of the availability, cost, quality and accessibility of the raw materials, supplies, fuel, power, water, land, labour, housing etc. Some industries would require to have their raw materials imported, in which case accessibility to ports would be an advantage. Certain others would require large supply of water, often of particular quality, in which event the plant should be located near source of such supply. Those industries classified as "weight losing" because the finished products weigh less than the raw material due to elimination of waste material, would suggest location near source of raw material and adequate effluent disposal facilities.

Important considerations affecting feasibility, are the availability of skilled or trained personnel, the acquisition of know-how, and the right size of the plant. Often a project is sold by a machinery salesman whose main objective is to sell the most expensive equipment at the best possible price. The machinery offered may not be the best of its type or the most desirable for the size of production envisaged. Where no industrial tradition and skill exist, it is foolhardy to use ultra modern equipment with push button controls, as these would require accurate maintenance and highly developed skills for operation. With low skills available it might, in the first instance, be advantageous to use more rugged although not so modern machinery, as these would entail lower maintenance and less skilled operation, although without lowering of

quality of product manufactured. The acquisition of know-how and training of local personnel are factors of importance which have to be planned for in advance.

Optimum size of unit will depend on production costs, and this, in time, will depend on capital investment, processing efficiency etc. The main cost increases in Ceylon are due to excessive capital costs in relation to production. In many cases machinery costs have been unduly high and to this has been added stone-faced buildings at high cost. Often it is necessary to obtain competing quotations for machinery, determine adequacy and matching of the different units in the flow, and compare capital costs in relation to varying order of production.

The most important aspect is the choice of technology involved in an industrial venture. It is just as necessary to avoid ultra new patented and never-tried processes, as it is to avoid obsolete processes. The choice has to be made in relation to local conditions, and has often to be modified to suit the special circumstances of the country.

Technical and economic feasibility studies were made on abrasive stone and wheels manufacture with possible addition of abrasive paper and cloth; lead pencil manufacture, standard ice plants, besides others.

Established industries with low profit operation in certain sections have requested assistance in making profitability studies of their operations. Service in this field has been rendered during the year to a crown cork manufacturer, in order to determine costs at various levels of expanded production; a food distribution company regarding the cost of bread and confectionery manufacture; the Milk Board regarding milk supply and delivery costs, besides others. In a study of a battery cells plant, recommendations were made on maintenance of individual machines, handling, lighting, raw materials supply and specifications, planning and scheduling of production, cost control, efficiency of individual units of machinery, besides training and management organisation.

Miscellaneous Services:

At the request of the Salaries & Cadres Commission, a survey of teachers' salaries and conditions of service was made in 1960, and recommendations made on the rationalisation of the three grades of Head Masters, three grades of Principals and seven categories of Teachers. Suggested monthly consolidated scales covered the 70,000 teachers in the Island. For the

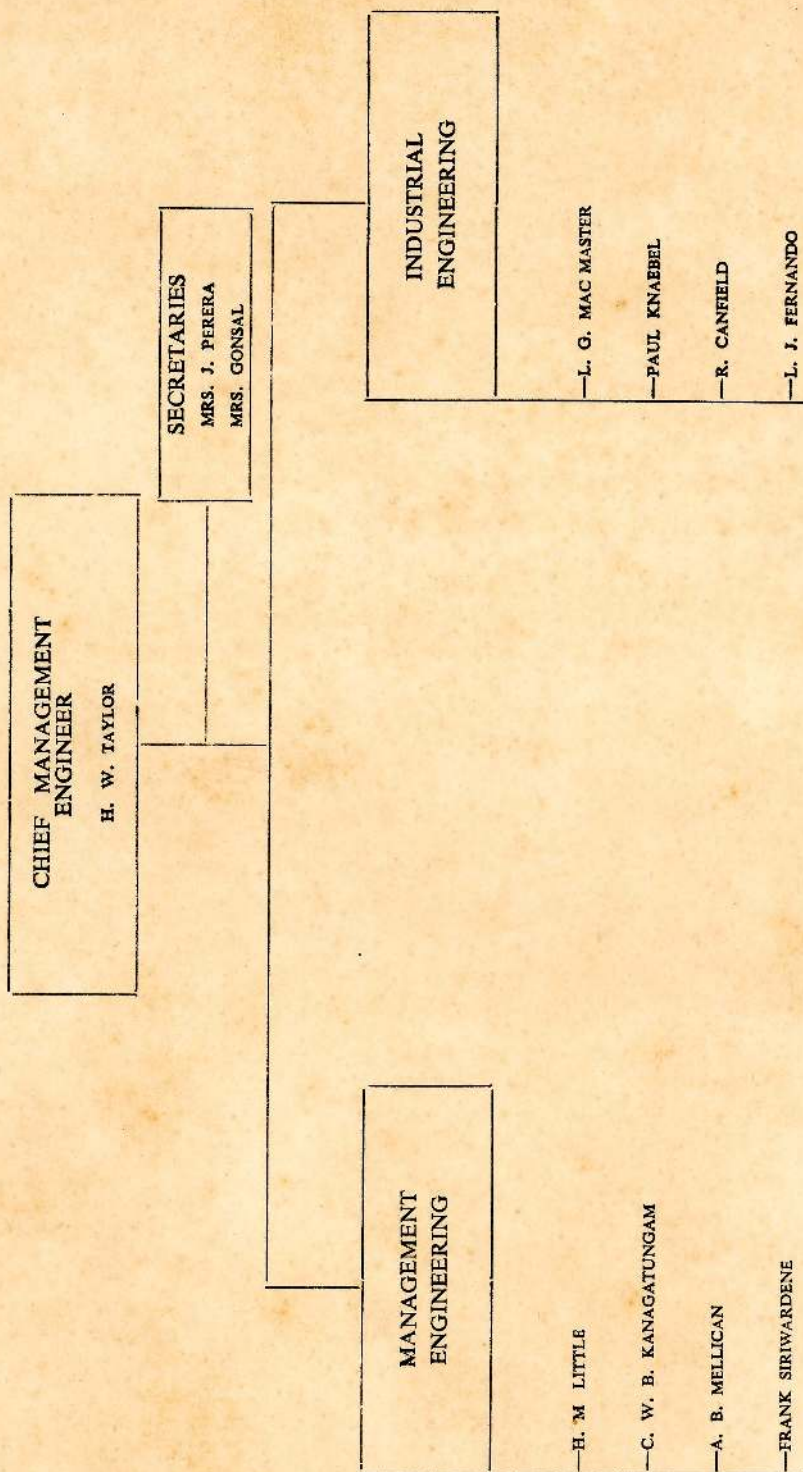
Plywood Corporation various studies were made, particularly the factory layout and expansion programmes received attention.

The development of small industries has been one of our most important activities. Entrepreneurs and small businessmen have come in for assistance and advice on small ventures, and such advice has always been given free of charge. Advice has been sought on such small industries as joss-sticks, shoe cream, hair cream, cosmetics, sealing wax, sugar candy, mineral waters, fruit juices, jams and preserves, rope-making, carbon paper, pens, clips, nails, barbed wire, buckets, inks, cables, rubber products, plastics, confectionery, tooth powder, detergents, soap by cold process etc. The Department of Cottage Industries has continued to use the Institute for advice on modification of machinery used in their textile and coir centres. Cottage Industries products have been tested and recommendations made regarding improvement of quality.

The above review is only a sample of the variety of services rendered by the Institute. Limitation of space precludes description of the many other services rendered.

The Institute has reason to be proud of its record of service during the last five years. The lack of financial support and a clear indication of Government intentions and policies with regard to further financial assistance have caused it some concern. Given that support the Institute feels confident that it can not only maintain the existing services, but expand still further towards achieving the targets of industrialisation planned for by the Government. It is confident that support will be readily forthcoming. It looks forward to the future with confidence and hope.

MANAGEMENT DIVISION



MANAGEMENT DIVISION

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 CHIEF OF MANAGEMENT

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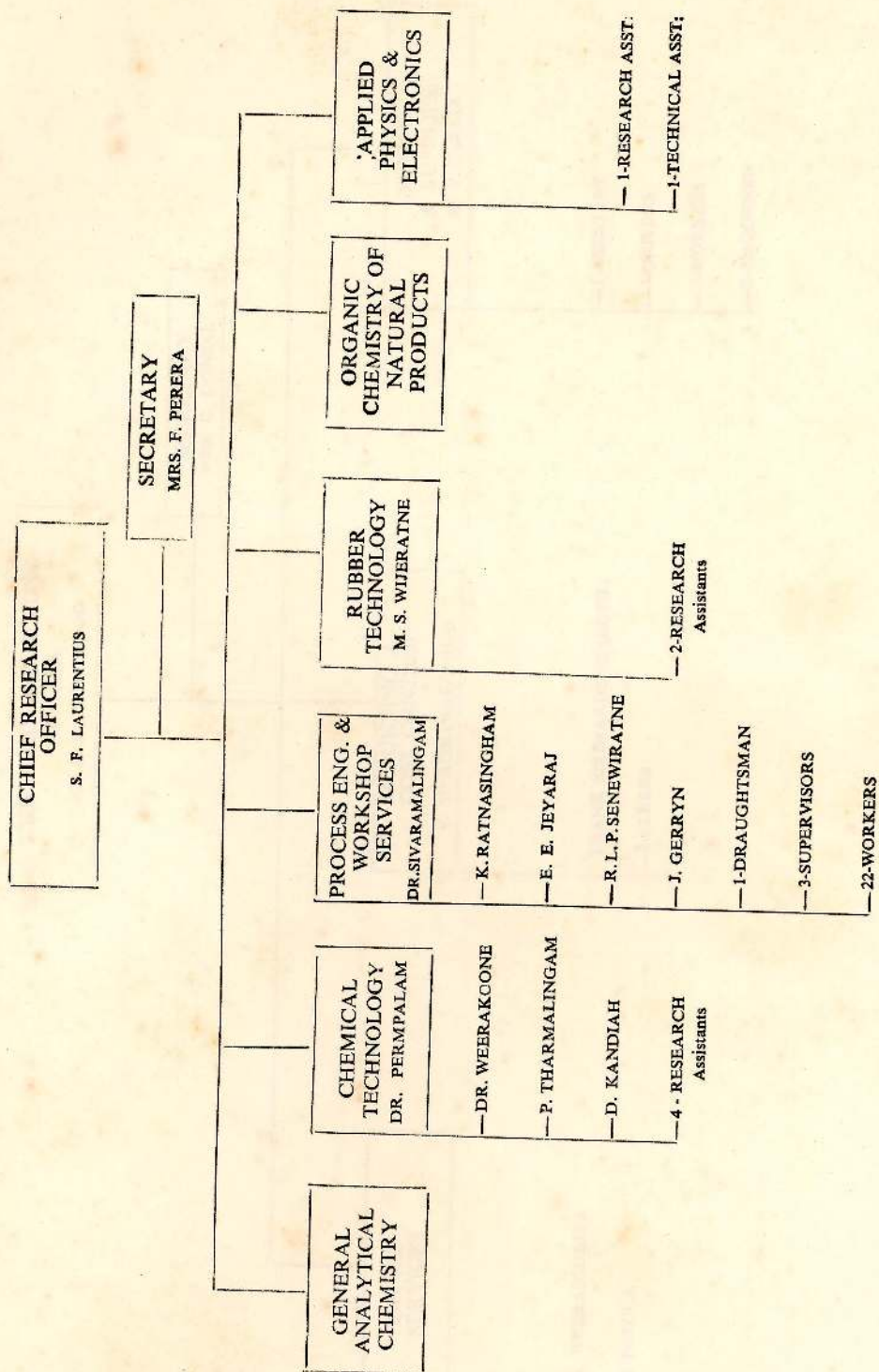
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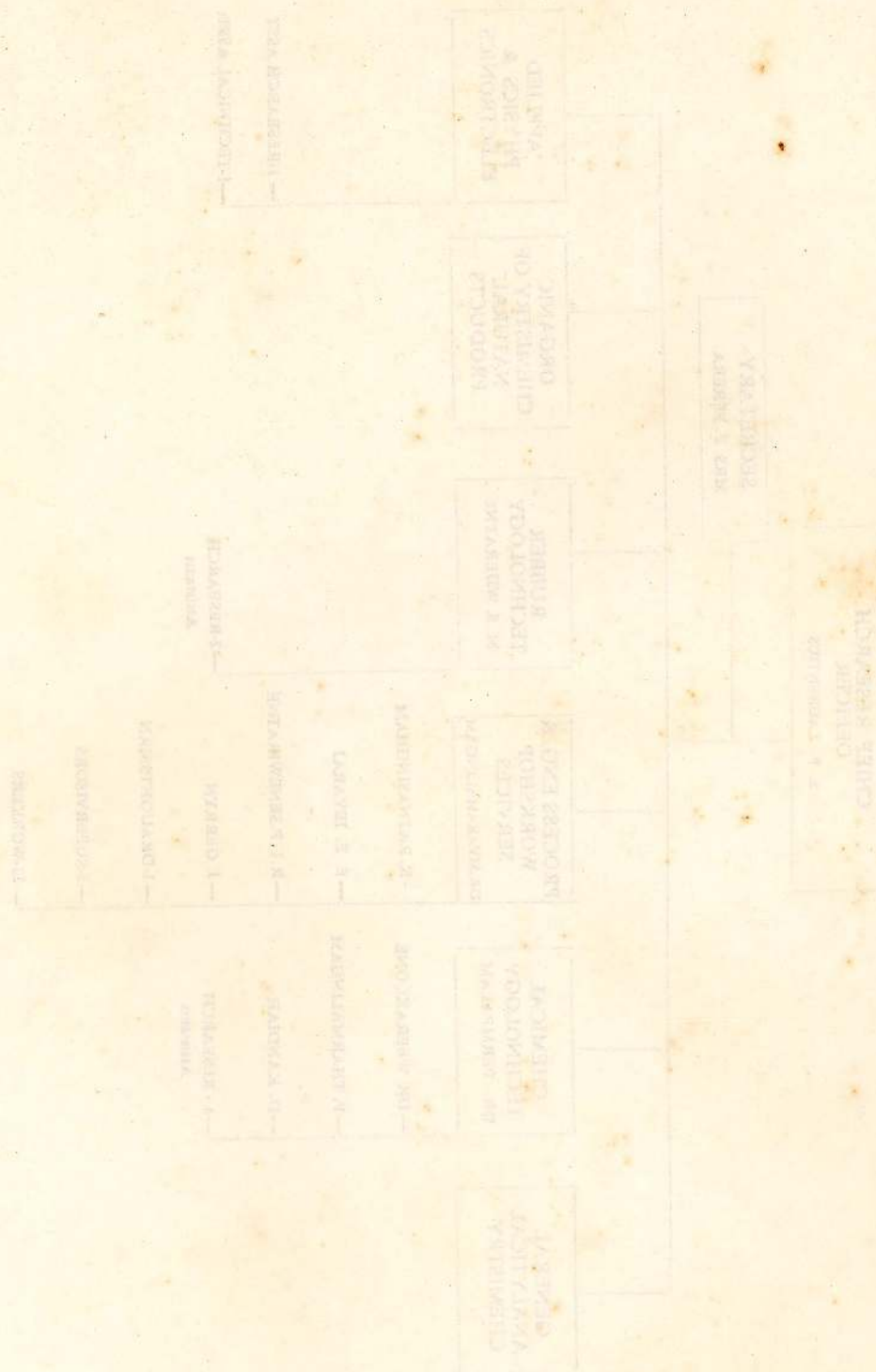
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RESEARCH & DEVELOPMENT DIVISION



RESEARCH & DEVELOPMENT DIVISION



ADMINISTRATIVE DIVISION

