THE REPUBLIC OF SRI LANKA

SURVEY REPORT
ON
INDUSTRIAL DEVELOPMENT
AT MAHAWELI GANGA PROJECT AREA

JUNE 1973

Prepared for
OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN
by
UNICO INTERNATIONAL CORPORATION

Preface

The Government of Sri Lanka is now promoting an overall development project of the Mahaweli Ganga Areas as the largest project of its kind for the utilization of water and land on the basis of the master plan compiled by the U.N.D.P./FAO survey team during the period from 1965 to 1968.

The government requested the cooperation of the Japanese government concerning the establishment of raw material utilizing industries employing the raw materials, agricultural products, mineral and forest resources available from within the area of this project as well as from the viewpoint of fully drawing the industrial development potential of the said area in such fields as importation substitution, export promotion and the employment opportunity expansion by means of the development of the above-mentioned industries.

Upon receipt of this request, the Japanese government endorsed the actual execution of the cooperation to the O.T.C.A. (Overseas Technical Cooperation Agency). The agency, in carrying out the assignments pertaining to the request, decided to conduct a survey covering the subject of medium and small scale industry development potential in the Mahaweli Ganga Areas and also to compile a master plan for the industrial development project for the advancement of middle and small scale industries which

should serve to promote the local economic development on the basis of the results obtained through such a survey so that it would be practicable to scrutinize the technical and economical feasibilities of a project which could be put into practice. The agency endorsed the actual execution of such a survey and the studies to Unico International Corporation.

Unico International Corporation therefore formed a survey team consisting of seven headed by Mr. M. Sakanashi, Manager of their Planning Department, and conducted the said field survey in February 1973. Unico conducted technical and economics study on the basis of the survey and hereby compiled a report concerning their findings. In this report, projects of which seem to be prospective in the subject development area are selected as follows:

(1) Forestry industry: Wood sawing, chip-making, exportation and/or supply of timbers to existing plywood factories

(2) Agro-based industries: Cotton ginning, oil production, feed stuff production

(3) Industry utilizing mineral resources: Ceramic industry

The OTCA takes this opportunity to express its appreciation for the efforts exerted by the members of the Unico survey team who undertook the execution of the survey and also to express deep gratitude to the officials concerned at the Government of Sri Lanka who gave the survey team every possible assistance, to the

overseas agencies of the Japanese government who also extended valuable cooperation with this team in carrying out the field survey , to the officials of the Ministry of International Trade and Industry and the Ministry of Foreign Affairs of the Japanese Government who extended their valuable cooperation in despatching the survey team to Sri Lanka.

June 1973

Keiichi Tatsuke
Director General
Overseas Technical Cooperation Agency

Fig.-1

Sri Lanka: Location and Survey

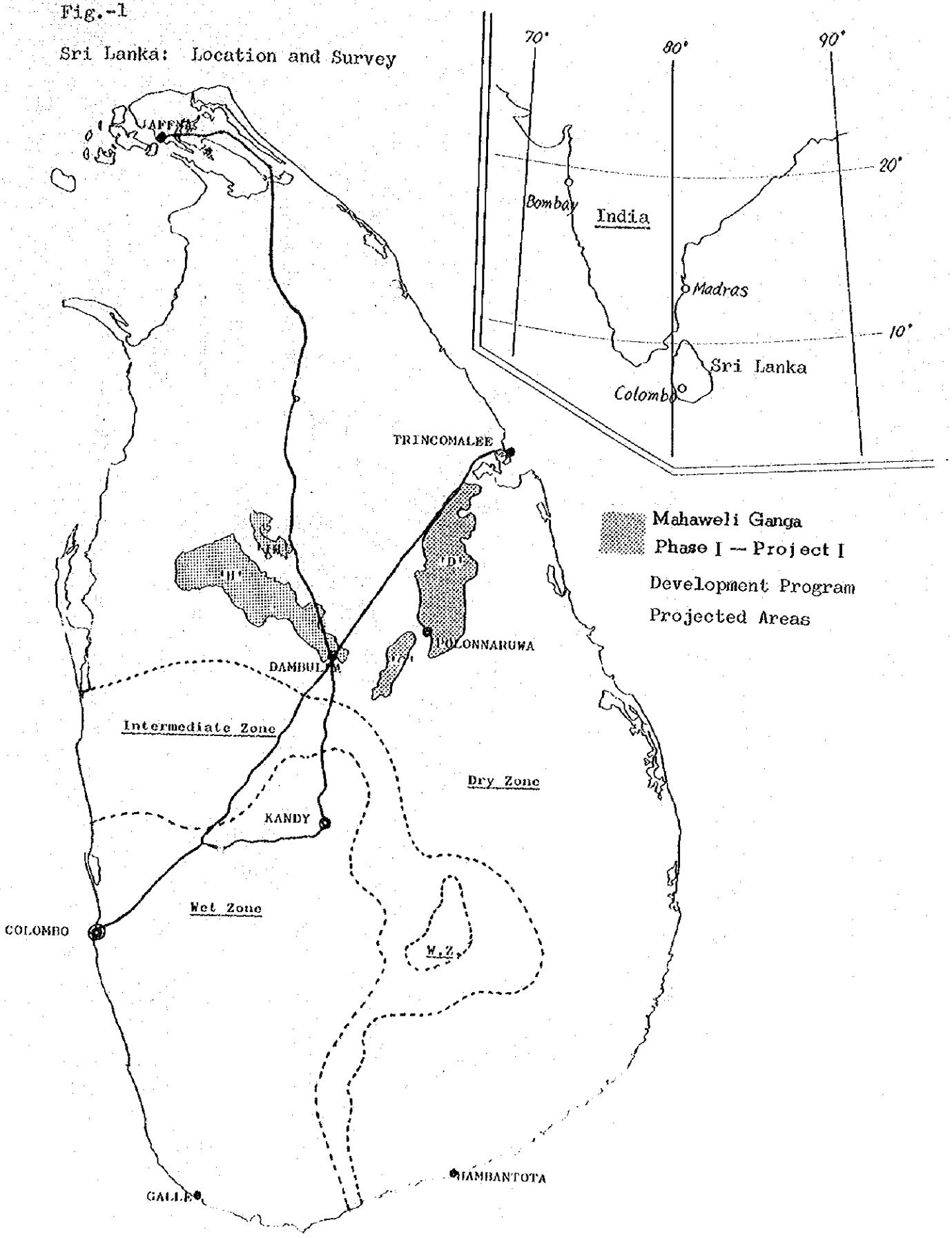
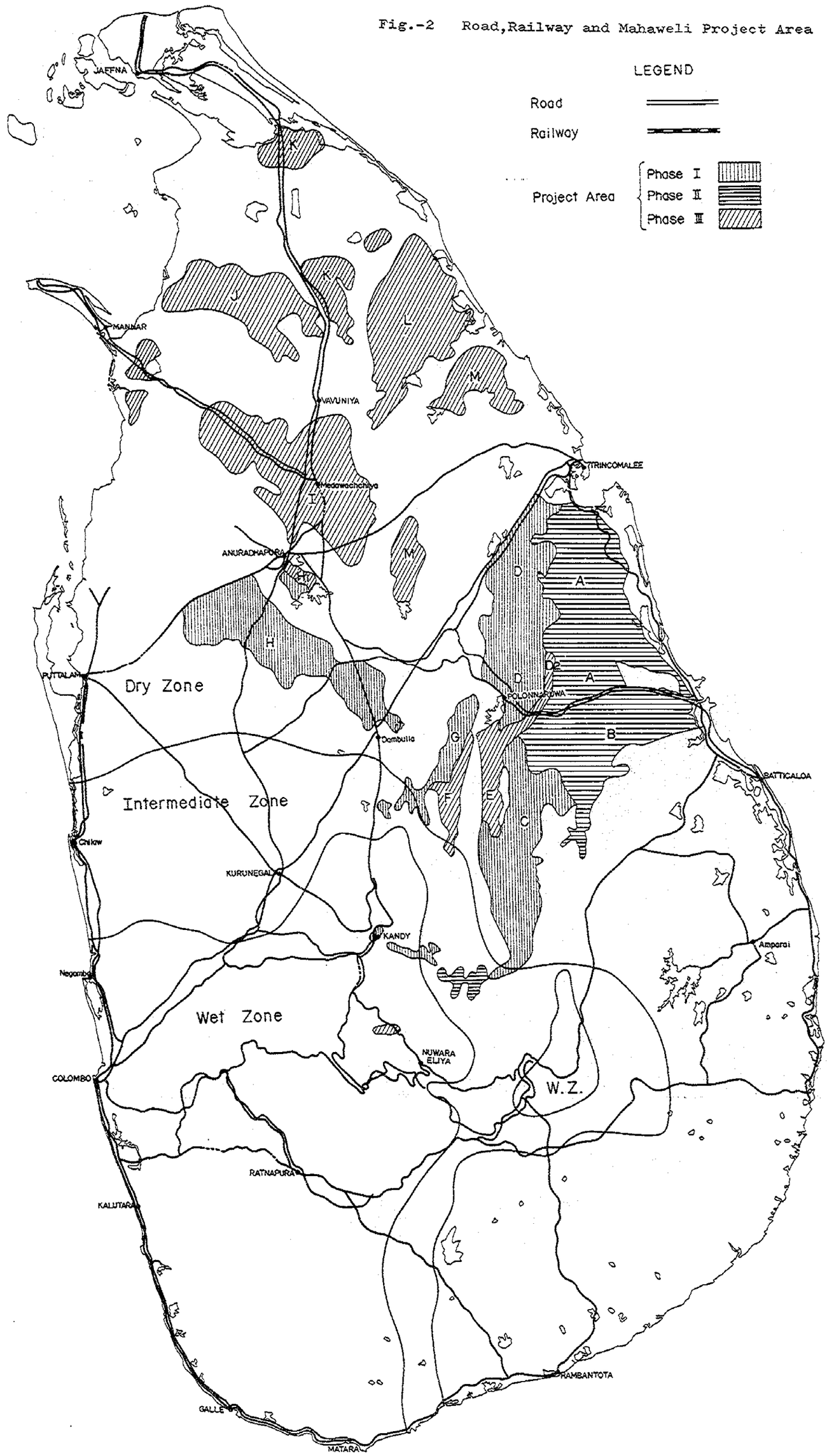


Fig.-2 Road,Railway and Mahaweli Project Area



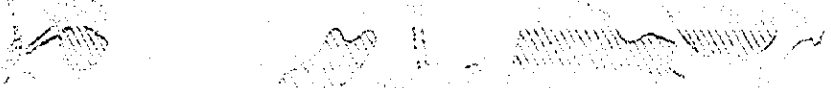
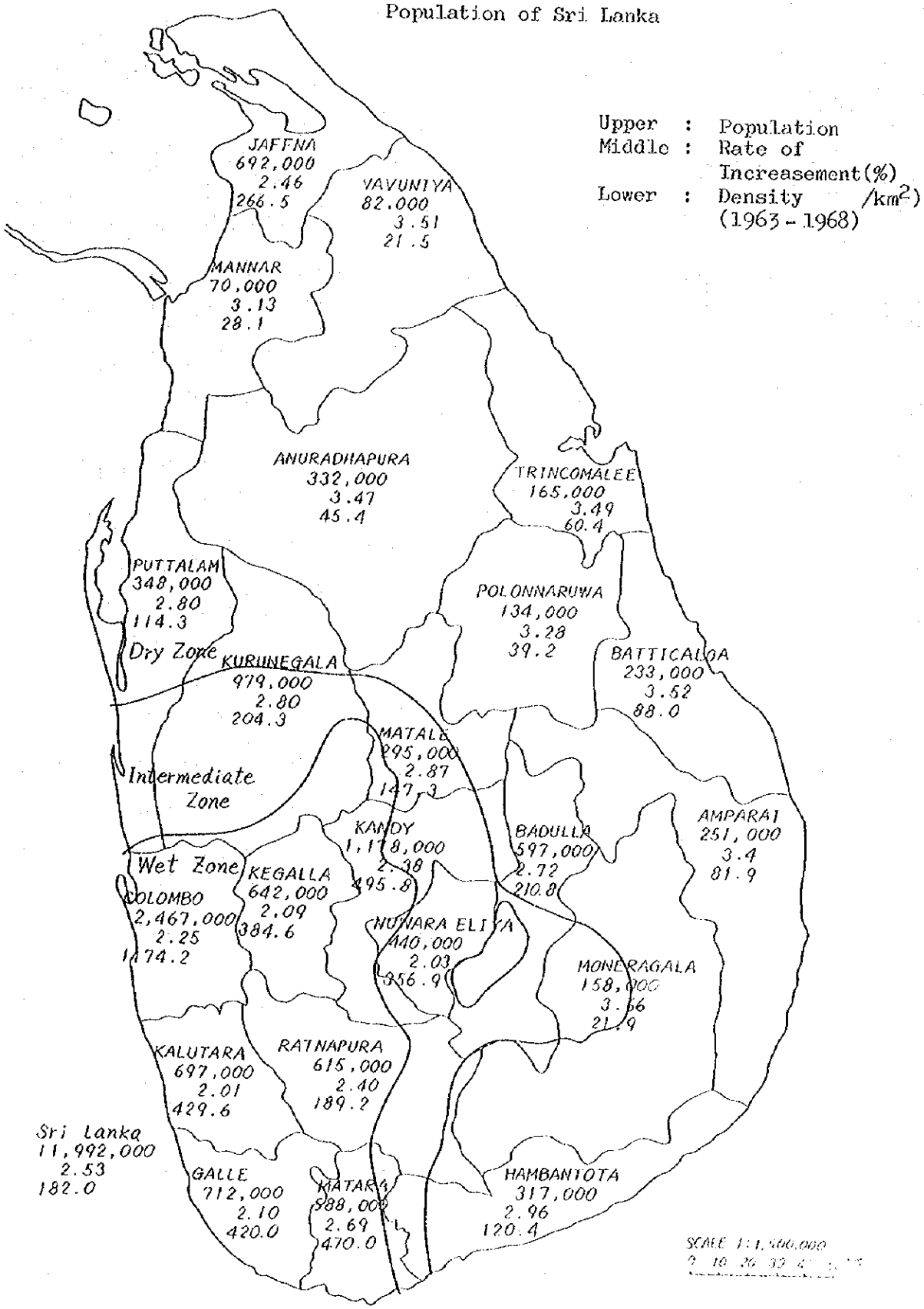


Fig.-3

Population of Sri Lanka



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I. Summary

1. The Background and the Objectives of the Survey

Scarcity of annual rainfall in the Dry Zone of the Republic of Sri Lanka which occupies approximately three-fourths of the total area of the nation has presented problems and limitations in the undertakings of agricultural cultivation and therefore the general degree of development is delayed when compared with the Wet zone of the country.

The Mahaweli Development Project was started in 1969 in order to install an irrigation and paddy field development in the Dry Zone by means of diverting the Mahaweli River which is the longest stretch of water in the country.

At present, the development of Stage I in Phase I — Project I which are scheduled to be completed by 1975 is being undertaken.

It is projected that following the completion of Stage I, Stage II projects will be commenced however the feasibility studies regarding the stage II projects have recently been completed and no detailed plan has yet been established.

This study was conducted with the objective of developing the middle and small scale industries on the basis of utilizing the resources (agricultural products, forestry resources and mineral resources) which are and can be available in the above-mentioned development area.

2. The present status of the Sri Lanka national economy and the direction of industrial development

Sri Lanka is heavily dependent upon the agriculture sector for her economy. 35 percent of its GNP is from the agriculture products mainly consisting of tea and other export crops. Tardiness in the export of these products and their falling prices in the inter-market have extremely affected the economy of Sri Lanka and, in recent years, the national economy has been showing signs of deterioration.

Especially restricted imports due to the foreign exchange control recently taken by the Government resulted in a shortage of the requisites of this country.

Due to the fact that the importation structure of Sri Lanka has been heavily inclined upon consumption goods and also due to the fact that majority of the existing industries have been undertaking processing of imported raw materials, the stagnation of the industry as a whole due to the lack of materials, equipment, etc. being directly effected by the import restrictions, is highly conspicuous.

Under these circumstances, a new five-year plan was commenced in 1972 with emphasis upon the development of middle and small scale industries utilizing domestically available raw materials.

Consequently, the general direction of the development of industry under this plan is the promotion of such industries as will directly contribute to the substitution of importation or the promotion of exports.

3. Direction of the project selection

In compliance with the above-mentioned governmental policy, the general direction in the selection of the project was to place stress upon the labour-intensive industries as much as possible and, for the industries which may fall under such a category. The following criteria are employed in the selection of the feasible industries in the framework of this project.

a) Sufficient utilization of the resources available from the subject area should be carried out.

b) The products turned out should have a ready market within the country or should be able to readily replace the existing products and at the same time should have the import substitution effects.

c) Products should be capable of directly contributing to promoting exports.

d) The industry should meet with the site conditions existing within the subject area.

As a result of technical and economical study, the selection was made as follows regarding the types of industries which have potential and feasibility for the development inside the subject area.

1) Forestry industry: Wood Sawing chip-making, exportation of logs or supply of logs as lumbers to existing plywood factories

2) Agro-based industry: Cotton ginning, oil production, feed stuff production

3) Industry utilizing mineral resources: Ceramic industry

4. Projects which can be immediately developed

(1) Of the above selected projects, the forestry industry possesses the highest extent of profitability and possibility for execution in view of the economic effects. Concerning this industry, Stage II is scheduled to be commenced in 1976 and along with the progress of the works, the effective utilization of the forestry resources will be undertaken. As a result of such promotion, the following projects in terms of the capacities mentioned will be possible:

Sawing mill: 173,000 cu. ft. per year

Chipboard mill: 36,000 tons per year

By means of the above-mentioned projects, effective utilization of the so far untouched resources will become possible and, at the same time, the promotion of exports will materialize. The investment required by such a project including wood felling, wood collecting, and material transportation facilities is estimated at Rs. 25 million in foreign currency and Rs. 9 million in local currency, totalling Rs. 34 million However, high profit/investment rate of 26.6% is expected and,

at the same time, a foreign exchange savings of US$2.8 million a year is also participated. The above-mentioned project will also contribute to the enhancement of the production capacity of the existing plywood factories which are currently suffering from a low level of operation due to the shortage of raw material woods and, in addition, exportation of the high valued raw material woods for surfacing of plywood as well as the exportation of chipboards can also be carried out.

(2) Of the agro-based industry, the cotton ginning mill (seed cotton processing capacity, 1,800 ton/year) seems necessary for immediate embarkation on construction. In the subject area of the development, the cotton cultivation project is now underway so that the cotton ginning operation within the same area is indispensable. The required investment for this project is Rs. 0.4 million in foreign currency and Rs. 0.5 million in local currency, totalling Rs. 0.9 million. Although no significant profitability will be expected, the import substitution of cotton by means of this production corresponds to US$950 per ton. Further, the cotton seeds proccessed in the said cotton ginning mill will be suppliable as feed for the time being, however, the oil production factories employing soya beans and groundnuts which are scheduled to be cultivated in stage II of the project will be constructed in 1980 so that, at this stage, the oil extraction from cotton seeds will become possible.

In all the above cases of oil extraction, the feed stuff obtained in the form of residue, produced as a result of oil extraction, will contribute to the substitution of feed stuff importation which has been and will be undertaken until then.

(3) The feasible products to be produced in the ceramic industry are good high quality bricks and earthen pipes. In this respect, effective utilization of the presently idle production facilities in Anuradhapura by means of partial rehabilitation is necessary. However such partial rehabilitation of the presently idle factories is not highly effective in view of import substitution and economy of operation. Therefore, without limiting the scope to the subject area, re-scrutinization seems to be required in order to carry out effective rehabilitation of the said idle facilities.

(4) In addition to the above, it seems necessary to give guidance to, and undertake the fostering of, a side-job cottage industry for the farmers in such activities as straw products and hand-craft products, however, it is recommended in this respect that the Industrial Development Board installed as a sub-structure of the Ministry of Industries and Scientific Affairs of the Government of Sri Lanka rather undertake product design development technical trainings and other guidance activities.
It seems necessary that practical demonstration activities be undertaken on the basis of pilot project plans.

II. Conclusion and Recommendations

1. Prerequisite Conditions for Project Selection

The following are the basic policies regarding the direction of the development submitted by the government of Sri Lanka as the prerequisite conditions for the project selection which is to be incorporated into the industry development project.

(1) Projects should contribute to the import substitution

(2) Projects should contribute to the promotion of export expansion

(3) Projects should eventually absorb the surplus labour forces of the farmers to be settled in the Mahaweli Ganga development project area

The main objective of this project is to develop middle and small scale industries (including the cottage industries on a home industry scale carried out by the farmers on a family basis) which will not call for a large extent of foreign capital investment.

On the basis of the above-mentioned policies, studies have been carried out by the Consultant regarding the projects which will materialize the effective utilization of agricultural, forestry and mineral resources to be supplied along with the advancement of the development of the Mahaweli Ganga area. During the course of such studies, consideration has been given concerning the types of the industries to be selected in accordance with the following characteristics.

(1) The industry should be of the labour-intensive type.

(2) The products of the industries should have an established basic demand.

(3) The industries to be developed should not come in direct competition with the existing industries and, in some cases, such planned project should maintain the position as the raw material supplying industry to the existing industries.

On the basis of the above characteristics of the industries to be selected, the actual type of the projects for this purpose were considered to be of the following nature.

(1) Projects, each one of which can be established as one independent project.

(2) The projects which are considered to be more advantageously implemented if governmental guidance and promotion are given, such as in the case of handcraft industries.

By dividing the actual projects into the above-mentioned two broad categories, the orientation of each aspect of the projects was established and the formulation of the implementation programmes was undertaken.

2. The Master Plan for the Industrial Development in the Subject Area for the Development.

Within the subject area, the following industries are considered to be potential for the future development.

(1) Forestry industry

(For exportation of timber, lumber, chips and material logs or raw material supply for plywood manufacturing mills)

(2) Agro-based industry

(Cotton ginning, oil production, feed stuff production)

(3) Mineral resources utilizing industry

(Ceramic industry)

In addition to the above, the straw products and handcraft products industries can also be considered in terms of the side-job type cottage industries for the farmers' families.

In the following paragraphs, an outline description will be made concerning the development patterns of each of the above-mentioned industries.

2-1 Forest Industry

The forestry resources now existing inside the Mahaweli Ganga development area will be gradually felled along with the progress of the development project and the project planning should therefore be made in view of effective utilization of these forestry resources.

In accordance with the schedule of the development project, recommendations shall be made concerning the felling plans which are considered to be the most effective. At the same time, well planned undertakings of felling, processing, collecting

and transporting of the centrally administered wooden materials shall also be undertaken. These log materials will be properly classified and some portion of them will be shipped to saw mills and some other portions will be delivered to the market. Of these logs, the high quality materials will be supplied to the existing plywood factories and, at the same time, some of them will be directly exported as surfacing materials for plywood production. Some other portions of the log will be converted into chip-boards which are also to be exported.

2-2 Agro-based Industry

The cotton ginning of the seed cotton which is planned to be undertaken in Stage II of the Mahaweli Ganga Development Project, will be undertaken. In this operation, the seed cotton will be separated into cotton lint and cotton seeds.

The cotton lint will be supplied to the existing spinning mills.

In the project area, in addition to the cultivation of seed cotton, the production of soya beans and groundnuts is also planned. Therefore, in order to collect these crops to produce oil therefrom, an oil extraction plant will be constructed.

In this plant, cotton seeds which will be produced from the above-mentioned cotton ginning mills will also be processed to produce oil. The produced oil will then be marketed as a substitution for the coconut oil which has been and is used as edible oil at present in Sri Lanka. By this means,

the exportation of the coconut oil will be promoted as a valuable source of foreign exchange earnings.

Further, the residue produced after the extraction of the oil will be used as feed stuff for cattles so that the so far imported feed stuff will be substituted thereby.

2-3 Ceramic industry

The presently idle ceramic factory existing in Anuradhapura which is adjacent to the Mahaweli Ganga development area will be rehabilitated and high quality red bricks, earthen pipes and roofing tiles will be produced in such rehabilitated factories. These products will be supplied as the construction materials to be utilized during the course of the Mahaweli Development Project.

2-4 Straw products and handcraft products

The reinforcement of the Industrial Development Board (the substructure of the Ministry of Industries and Scientific Affairs) and of the Technical Service Agency (the substructure of the Board) will be undertaken. Amongst such organizational reinforcement plans, a new organization for the purpose of promoting the development of the above-mentioned products will be established in order to undertake the training, guidance and general promoting of such industries.

3. The project to be implemented in the immediate future

On the basis of the above-mentioned master plan, the selection of the projects, the implementation of which is immediately recommended, is as follows:

(1) The plants and factories of the following facilities should be constructed with the target completion year set at 1976.

(a) Saw mill: 173,000 ft^3/year

(b) Chipboard mill: 36,000 t/year

(2) Construction of factories and mills in accordance with the following schedule:

a) Cotton ginning mill: Seed cotton processing capacity, 1,800 t/year (cotton lint 600 t/year, cotton seeds 1,200 t/year), to be completed in 1976

b) Oil production and feed stuff production factories:

Oil: 1,920 t/year

Feed stuff: 4,380 t/year, to be completed in 1980.

By the time when the oil extraction plant is set up, the produced cotton seeds shall be shipped for export or utilized as feed stuff.

4. Recommendations

1) It is recommended that practical and workable plans be promoted regarding the implementation of the projects and the detailed

scrutinization for the implementation of the above projects should be undertaken in joint cooperation with the Mahaweli Development Board and the IDB (Industrial Development Board).

2) The above-mentioned rehabilitation project of the presently idle ceramic factories should not be undertaken in mere correlation to the progress of the Mahaweli Development Project. The reason for this recommendation is that such rehabilitation to be undertaken from such a limited viewpoint would not justify the over-all economy. However, from the global viewpoint of Sri Lanka's national economy, leaving such factories idle would be a great disadvantage economically so that it is recommended that separate detailed studies be undertaken regarding the most rational rehabilitation plans from the over-all and global viewpoint.

3) The reinforcement of organizations centering around the IDB and the TSA (Technical Service Agency) should be undertaken in order to be able to actually undertake the development and the training and orientation of the above-mentioned handcraft industries. Whenever necessary, it is recommended that experienced foreign experts be invited as trainers. Depending on the particular case, it may be necessary to compile a pilot project.

III. Introduction

The Mahaweli Ganga Project is a regional development Project which is given top priority in the present Five-Year Plan. The objectives of this project are to develop the Dry Zone of this country through diversion of the Mahaweli River and to generate hydro-power by utilization of water resource in the river.

In the framework of the project master plan prepared in 1969, the Government of Sri Lanka has begun implementation of "Stage-I" in the "Phase-I" scheme and will accomplish the work at the beginning of 1975. The Government has a plan to start the Stage-II work following the completion of the Stage-I work and to this end the feasibility study of the Stage-II work was recently accomplished.

For the implementation of the Mahaweli Ganga Project, the Government organized the Mahaweli Development Board in the Ministry of Irrigation, Power and Highway whose functions are project planning, supervision and administration of the project implementation. The Mahaweli Development Board is undertaking the study for regional industrial development by efficient utilization of agriculture, forestry and mineral resources available in the development area involved in the

Mahaweli Project.

By the request of the Sri Lanka Government, the Japanese Government agreed to conduct such a study under the technical assistance programme of the Overseas Technical Cooperation Agency (OTCA). UNICO International Corporation, a Japanese consultation firm specializing in industrial development, was assigned as the consultant for the said study. This study was carried out by UNICO's study team headed by Mr. Sakanashi, industrial economist and six other experts listed below:

Project Manager	M. Sakanashi
Expert of Forestry Industry	H. Iwamoto
Expert of Agro-based Industry	S. Tsuji
Agronomist	A. Hirose
Expert of Ceramic Industry	H. Kashiwagi
Expert of Textile Industry	T. Imai
Chemical Engineer	S. Maeno

*

The team visited Sri Lanka for three weeks from February 1,1973 for the purpose of holding discussions with the Sri Lanka Government and its Agencies concerned, compiling data and information required and finding problems involved as well as

surveying the field of the project area.

This report presents a master plan for the development of industries by utilization of the said resources, and presents an implementation programme of projects to be taken up at the initial stage in the framework of the master plan, i.e. The projects which have been deemed are recommendable as a result of the technical and economical feasibility study based on the findings of present situation and problems in Sri Lanka.

It is obvious that the recommended industrial development is closely linked to the progress of the Mahaweli Ganga Project. The present position of the project is, as mentioned-above, that the Stage-I work is underway and the feasibility study of Stage-II was recently accomplished. The detailed plan of Stage-II has not yet been laid out. Concerning Stage-III onward, there is no firm plan in respect to the project scheme and schedule.

The industrial development plan which is the subject of this study should be prepared on the basis of the detailed programme of the Mahaweli Development Project. Due to the fact that there are a number of factors still uncertain from the long-range point of view it was necessary to divide the study into two phases. That is, the first phase covering a development

plan based on Stage -I and Stage-II, and the second phase covering Stage-III onward.

In this study, reference was made to the results of the feasibility study for Stage-II as the basis of the first phase, part and the second phase was based on the master plan of the Mahaweli Ganga Project, taking into account the national economy, industrial structure and importation structure, etc. of Sri Lanka.

It should be noted that the recommended development plan, particularly in the agro-based industry sector, should be modified to meet such conditions if the programme of the Mahaweli Ganga Project as the basis of the subject plan is changed.

The Consultant takes this opportunity to express its deep appreciation and gratitude to the members of the Mahaweli Development Board and to the officials of Government Ministries and authorities concerned, whose kind cooperation during the undertakings of the on-site surveys was invaluable.

Terms of reference

The terms of reference concerning this study requests that at least the following three items should be included within the scope of the survey.

(1) Completion of a master plan

Studies should be undertaken concerning markets for the mineral and industrial products in the Republic of Sri Lanka, focusing upon the future demand and the export possibility of such products as well as the product distribution structure and the supply possibility of the raw materials such as agricultural products, mineral resources and forestry resources within the Mahaweli Ganga area. Economical and technical feasibility for the establishment of such processing industries as mentioned above as well as the substantiation of the necessary infrastructure in general, and in particular, such factors as local development, expansion of employment opportunities and acquirement of foreign reserve should be taken into consideration during the course of scrutinization.

The correlation of this subject with the overall and national industrialization of project of the Republic of Sri Lanka should also be taken into consideration in order to compile a master plan for industrial development projects regarding the establishment of such processing industries (with special emphasis upon the labour intensive middle and small scale industries including cottage industry) over a span of at least ten

years incorporating the government policies of the country.

(2) Compilation of practical projects

Of the projects included in this above-mentioned master plan, selection should be made concerning such practical projects as are recommended for implementation in the immediate future. Further technical and economical feasibility studies should be conducted concerning the selected industrial fields and a guide line should be established for such factors as the production schedules of plants, mills and factories, procurement of raw materials, sales programmes, plant site conditions, plant construction schedule, estimation of necessary labour force, workers training programmes, necessary infrastructures, required funds and necessary policy system.

(3) Contribution of the projects to the economical and sociological development of the country

The extent of contribution to the socio-economical development of Republic of Sri Lanka will be assessed, in the event of the above-mentioned projects having been actually implemented, by encompassing such factors as the expansion and distribution of income, foreign exchange savings or earnings, expansion of employment opportunities, development of relative industries, development of local communities, etc.

On-the-spot Survey Schedule

Allotted date	The day of month	The day of week	Journey	Object of Survey (Place visited)	(Object of the visit)
1	2.1	Thu.	Tokyo → Colombo	Team leader Sakanashi, Tsuji, advance party of five members	Hirose, Imai, Maeno, the entered Sri Lanka
2	2	Fri.	Stay in Colombo (everybody)	Ministry of Planning & Employment	General discussion on Mahaweli Development Project
"	"	"	" (")	Mahaweli Development Board (MDB)	Discussion on surveying method with the chairman
3	3	Sat.	" (")	Ministry of Irrigation, Power & Highway	Confirming the object, etc. of this survey with the Minister attended by Japanese Ambassador (Mr. Matsui)
4	4	Sun.	"	Holiday	Discussion among team-mates work plans & arrangements
5	5	Mon.	" (")	M D B	Discussion for attaining mutual understanding between MDB and team members and on work plans
6	6	Tue.	" (")	Ministry of Industries & Scientific Affairs	Listening to and questioning Industrialization policy of Sri Lanka and present status

Allotted date	The day of month	The day of week	Journey	Object of Survey	
				(Place visited)	(Object of the visit)
6	2.6	Tue.	Stay in Colombo (everybody)	Industrial Development Board (I D B	Discussion on IDB activities including promoting small-scale industries, etc.
"	"	"	" (Mr.T,I.& M.)	Technical Service Agency	Observation study and discussion of designing and manufacturing plant of various machines for small-scale industries
7	7	Wed.	" (Mr.M.)	Management Development & Productivity Center	Discussion on present status analysis of government public corporations
"	"	"	" (Mr.H.&T.)	Ceylon Oils & Fats Corporation	Observation study of mills and listening to their circumstances
"	"	"	" (Mr.M.)	Marketing Department	Listening to the market trend of agricultural products and processed agricultural products
"	"	"	" (")	Department of Control of Imports & Exports	Survey on present status of policies including export promotion-policy

Mr. S. .. Mr. Sakanashi, team leader
Mr. T. .. Mr. Tsuji, team member
Mr. H. .. Mr. Hirose, team member
Mr. I. .. Mr. Imai, team member
Mr. I. ... Mr. Iwamoto, team member
Mr. K. ... Mr. Kashiwagi, team member
Mr. M. ... Mr. Maeno, team member

Allotted date	The day of month	The day of week	Journey	Object of Survey	
				(Place visited)	(Object of the visit)
7	2.7	Wed.	Stay in Colombo (Mr.I.)	National Textile Corporation Veyangoda Mills	Observation study of factories and survey on their circumstances
8	8	Thu.	" (Mr.S.& M.)	Department of Co-operative Development	Questioning on multi-purpose cooperative societies and other Sri Lanka cooperative societies
"	"	"	" (Mr.H.& T.)	Department of Minor Export Crops.	Survey on the trend of production market
"	"	"	" (")	Paddy Marketing Board	Listening to the situations of rice milling
"	"	"	" (Mr.M.)	Sri Lanka State Trading Corporation	Survey on the actual situation and present trend of export promotion-policy
"	"	"	Tokyo Colombo	Mr. Kashiwagi and Mr. Iwamoto of the team entered Sri Lanka	
9	9	Fri.	Stay in Colombo (Mr.S.& I.)	Forest Department	Discussion on Forest resources and lumber industry
"	"	"	" (everybody)	M D B	Discussion with M D B staff members
"	"	"	" (Mr.S.& I.)	State Timber Corporation	Survey on market trend of lumber products
"	"	"	" (Mr.H. & T.)	Food Commissioner's Department	Listenings on import/distribution of food-stuff

Allotted date	The day of month	The day of week	Journey	Object of Survey	
				(Place visited)	(Object of the visit)
9	2.9	Fri.	Stay in Colombo (Mr.H.& T.)	Land Commissioner's Department	Survey on colonization
"	"	"	" (Mr.K.& M.)	Geological Survey Department	Survey on geology map and mineral resources of Mahaweli Area
"	"	"	" (")	State Graphite Corporation	Survey on mining and market conditions of graphite and mica
"	"	"	" (Mr.I.)	Asian Cotton Mills	Survey on the actual condition of cotton industry
10	10	Sat.	Mahaweli Development Proj. (Mr.S.& I.)	Aerial survey	Survey on forest resources of the project area
"	"	"	Stay in Colombo (Mr.H.& T.)	Observation study of starch and tinning factories	
"	"	"	" (Mr.K. & M.)	Ceylon Ceramic Corporation	Survey on the present situation of public corporation and clay and earthenware industry
"	"	"	" (Mr.I)	Wellawatte Spinning & Weaving Mills	Survey on the market trend of raw materials and products
11	11	Sun.	Colombo Kandy (Mr.H,T.& I.) (field investigation)	Travelling day	

Allotted date	The day of month	The day of week	Journey	Object of Survey (Place visited)	Object of Survey (Object of the visit)
11	2.11	Sun.	Stay in Colombo (Mr.S.,I,K. & M.)	Putting in order the data and results collected	
12	12	Mon.	" (Mr.S.& I.)	Ceylon Plywood Corporation	Survey on the market trend of raw materials and products
"	"	"	" (Mr.K. & M.)	Department of National Housing	Survey on housing policy
"	"	"	" (")	Building Material Corporation	Survey on market trend of building materials
"	"	"	Stay in Kandy (Mr.H.& T.)	Department of Agriculture	Listening on the situations of agricultural and of crop diversification policy
"	"	"	" (Mr.I.)	Observation study of hand loom	industry and Batik factory
13	13	Tue.	(Mr.H. & T.)	Observation study of Dewahuwa Project	Listening to the opinions on general situations of the Project and Sri Lanka
"	"	"	" (Mr.I.)	Observation study of hand loom	factory
"	"	"	Kandy→Sigiriya (Mr.H,T.& I.)	Field investigation	
"	"	"	Colombo→Maha-Illuppallama (Mr.S,I,K.& M.)	" (including discussion with the local governor)	
14	14	Wed.	Sigiriya→Maha-Illuppallama (Mr.H.& T.)	Observation study and discussion on Maha-Illuppallama Agricultural Research Station	

Allot-ted date	The day of month	The day of week	Journey	Object of Survey (place visited)	(Object of the visit)
14	2.14	Wed.	Maha-Illuppallama →Anuradhapura→Sigiriya (Mr.K.& M.)	Field investigation and discussion with officials of Divisional Development Council	
〃	〃	〃	Maha-Illuppallama→Sigiriya (Mr.S,I,T,H. & I.)	〃	〃
15	15	Thu.	Sigiriya→Polonnaruwa (everybody)	〃	〃
〃	〃	〃	(Mr.H.& T.)	Observation study of rice milling	
〃	〃	〃	(Mr.I.)	Observation study of hand loom factory	
16	16	Fri.	Polonnaruwa→Vala Chchenai →Trincomalee (Mr.S,I,K.&M)	Field investigation and observation study of paper mills	
〃	〃	〃	Polonnaruwa→Kantalai →Trincomalee (Mr.H,T.& I.)	Sri Lanka Sugar Corporation	
17	17	Sat.	Trincomalee→Colombo (everybody)		Discussion with Government agent of Trincomalee and field investigation

Allotted date	The day of month	The day of week	Journey	Object of Survey	
				(Place visited)	(Object of the visit)
18	2.18	Sun.	Colombo Embilipitiya (Mr.H,T.& I.)	Travelling day	
"	"	"	Stay in Colombo (Mr.S,I,K.& M.)	Setting in order of the survey and investigation results and data obtained	
19	19	Mon.	Embilipitiya Hambantota (Mr.H,T.& I.)	R.V.D.B. Agriculture Research Station	Discussion on the present status and future plans of cotton cultivation
"	"	"	Stay in Colombo (Mr.S,I,K.& M.)	M D B	Data collecting and listening to detailed explanation on Mahaweli project
20	20	Tue.	" (")	"	" "
"	"	"	" (Mr.K.& M.)	"	Talking with the Director of Geological Survey Dept. on mineral resources of Mahaweli area
"	"	"	Hambantota Colombo (Mr.H,T.& I.)	Travelling day	
21	21	Wed.	Stay in Colombo (everybody)	M D B	Interim report and explanation meeting
"	"	"	" (Mr.K.& M.)	Observation study of earthen drainpipe mill and roof tile mill	

Allotted date	The day of month	The day of week	Journey	Object of Survey (Place visited)	Object of Survey (Object of the visit)
22	2.22	Thu.	Stay in Colombo (Mr.K.& M.)	State Engineering Corporation	Obtained information on Tissa Wewa factory (of straw board and roof tiles)
"	"	"	" (everybody)	Luncheon meeting	
23	23	Fri.	Colombo→Tokyo (everybody)	Returning home	

IV Outline of Sri Lanka's National Economy and the Mahaweli Ganga Development Project

1. General Economy of Sri Lanka

1-1 General Situation

The agricultural and fishery sector of the Republic of Sri Lanka (particularly such traditional export crops as tea rubber and coconuts) accounts for 35% of the nation's GNP. However the export growth of these products has recently begun to stagnate or products has been causing and, at the same time, the export prices of these items have also shown a plateau or decrease. The stagnation of the exportation of these products has been causing the national economy of Sri Lanka to suffer.

Table IV-1 shows the sector-wise gross domestic products (GDP) and the gross national products of Sri Lanka over the past five years (at constant price as in 1959). During this period, the average GNP growth was at the rate of 4.6% per year. Particularly during the past year or two, the average growth rate has been below this 4.6% level.

Table IV-1

Table IV-I Gross National Product (Standard Prices in 1959)

	1967		1968		1969		1970		1971	
		(%)		(%)		(%)		(%)		(%)
Agriculture, Forestry, Hunting & Fishing	3,061	37.1	3,240	36.3	3,276	34.9	3,395	34.7	3,375	34.2
Mining & Quartying	37	0.4	37	0.4	55	0.6	65	0.7	67	0.7
Manufacturing	1,052	12.7	1,154	12.9	1,261	13.4	1,335	13.6	1,379	14.0
Construction	351	4.3	458	5.1	520	5.6	598	6.1	550	5.6
Others	3,754	45.5	4,048	45.3	4,272	45.5	4,388	44.9	4,485	45.5
GDP	8,255	100.0	8,937	100.0	9,384	100.0	9,781	100.0	9,856	100.0
Net Factor Income from Abroad	-45		-36		-68		-86		-77	
GNP	8,210		8,901		9,316		9,695		9,779	
(I)	5.1%		8.3%		5.0%		4.2%		0.8%	
(II)	5.0"		8.4"		4.7"		4.1"		0.9"	
Population (1,000)	11,703		11,992		12,252		12,514		12,762	
GNP per Capita	702		742		760		775		766	

Note; Provisional Value from 1969 to 1970
Source: Central Bank of Ceylon Annual Report

(I) GDP Growth Rate (Rate for Preceding Year)
(II) GNP Growth Rate (Rate for Preceding Year)

Table IV-2 shows the international trade balance of Sri Lanka over the past four years. As far as the actual achievements made during this period are concerned, no conspicuous increment in the exportation is present, thus reflecting the above-mentioned stagnation of agricultural exportation. Importation, on the other hand, has also been showing a down-trend because of the import restriction policy of the government. The foreign trade balance has been attaining an equilibrium, however, the importation still exceeds exportation so that the trade balance in 1971 resulted in a deficit of Rs. 233 million. In addition to this situation, the repayment of the foreign liabilities has been showing a continuous uptrend year after year. To this, the foreign exchange deficit has been added in recent years, thereby, heavily deteriorating the foreign exchange balance of Sri Lanka in recent years.

Table IV-2

Table IV-2 Balance of International Accounts

(Unit: Rs million)

	1968	1969	1970	1971*
Export	1,976	1,909	2,017	1,967
Import	2,356	2,655	2,332	2,197
Balance of Trade	Δ 380	Δ 746	Δ 315	Δ 233
Net Invisibles Incl. Transfer Payments	Δ 269	Δ 489	Δ 766	Δ1,120
Balance on Current Account	Δ 649	Δ1,235	Δ1,081	Δ1,353

Note: Provisional Value

Source: Central Bank of Ceylon Annual Report

Table IV-3 shows the gross national expenditure (current price level) indicated in terms of market price. The saving propensity over the past five years implies that the growth of savings achieved by the people of Sri Lanka showed a sudden down-trend after 1970 so that in 1971, an adverse balance in this respect becomes apparent. Although a certain extent of growth is shown in the general government expenditure sector, the general consumption expenditure presents an adverse growth. The breakdown of gross national capital formation reveals a decrease both in governmental and private sectors.

Table IV-3

IV-3 Gross National Expenditure Indicated by Market Price (Current Price)

(Unit: Rs million)

	1967		1968		1969		1970		1971	
		(%)		(%)		(%)		(%)		(%)
Private Consumption	6,677	71.8	7,697	71.2	8,412	69.3	8,728	68.0	8,632	68.5
(I)	1,240	13.4	1,408	13.0	1,471	12.1	1,649	12.8	1,790	14.2
(II)	1,366	14.7	1,568	14.5	2,276	18.8	2,442	19.0	2,077	16.5
Changes in Stocks (III)	+11	0.1	+132	1.3	-23	0.2	+22	0.2	+109	0.8
	9,294	100.0	10,804	100.0	12,137	100.0	12,840	100.0	12,608	100.0
Genuine Foreign Investment	-289		-357		-797		-393		-209	
Less Net Receipt of International Gifts and Transfers	-22		-15		-39		-60		-74	
(IV)	8,984		10,432		11,300		12,387		12,325	
Saving Inclination	15.1%		14.8%		45.15%		7.3%		-14.9%	

(Rate for Preceding Year)

Note: Provisional Value from 1969 to 1971

Source: Central Bank of Ceylon Annual Report

(I) Public Consumption
(II) Gross Domestic Fixed Capital Formation
(III) Gross Domestic Expenditure (GDE)
(IV) Gross National Expenditure (GNE)

As has been discussed in the foregoing, due to the perpetual deficit present in the foreign exchange balance of Sri Lanka, a supplement has been made in order to fill in the gap by drawing on loans from international financing organizations and by accepting financial assistance from various foreign countries. However, as shall be discussed later, the majority of the funds thus obtained has so far been spent for the importation of consumption goods so that, as has been pointed out by the government itself as one of the issues in the Five Year Plan, the situation calls for a severe degree of import regulation. Due to this fact, the recent importation has been limited to the foodstuffs and other requisite materials to a minimum Thus, the existing secondary industries which are relying upon imported raw materials have therefore been showing a deterioration in productivity and new investments in this field have also been retiring.

1-2 An outline of the present situation of the industrial sector

As is shown in Table IV-1, the ratio in the GDP taken up by the industrial sector is 13% to 14%. This rate is not necessarily lower than the examples of other countries. The following table shows the industrial growth of Sri Lanka over the past five years.

Table IV-4

Table IV-4 Industrial Growth

	1969	1968	1969	1970	1971
1. Industrial Production at Constant Prices (Rs Mil.)	1,052	1,154	1,221	1,335	1,379
2. Growth Rate over Previous Year (%)	4.4	9.7	5.8	9.3	3.3
3. Industrial Export at:					
(a) Constant Prices (Rs Mil.)	80	88	89	122	128
(b) As % of Domestic Exports at Constant Prices	4.0	4.3	4.5	5.9	6.3
(c) As % of Industrial Production at Constant Prices	7.6	7.6	7.3	9.1	9.3

Source: Central Bank of Ceylon Annual Report and Ceylon Customs Return

Note) Above-mentioned Amount is based on the fixed price

Along with the slump in the GNP growth in recent years, the growth in the industrial sector has also been showing a down-trend. Particularly due to the fact that the exportation of industrial products has been small, the industries of Sri Lanka is highly prone to be affected by fluctuations of the domestic economy. Further, as has been mentioned, due to the fact that the reliability upon the imported raw materials is conspicuously high in the case of Sri Lanka's industries, the effects and influence of the tightening of imports by the government have been severe, thereby resulting in a general stagnation of industry in Sri Lanka.

Table IV-5

Table IV-5 Production and Utilization of Raw Materials (1971)

Items	Number of Enter-prices	Production (Rs mill.)	Used Amount of Raw Material (Rs.Thousand)					
			Domestic Raw Material		Imported Raw Material		Total	
			(a)	(b)	(a)	(b)	(a)	(b)
				%		%		%
I Food Products, Drinks, Tobacco	148	312.5	63,698	42.4	86,576	57.6	150,274	100.0
II Textile, Clothes, Leather	615	252.3	42,283	40.3	62,560	59.7	104,843	100.0
III Lumbers, Wood Crafts	12	20.8	5,073	85.7	844	14.3	5,917	100.0
IV Paper Products & Converted Paper Products	65	61.9	8,465	24.8	25,710	75.2	34,175	100.0
V Chemicals, Oil Products, Coals, Rubber, Plastic-Production	232	524.1	44,333	15.8	236,328	84.2	280,661	100.0
VI Non-ferrous Mineral Products	46	157.2	10,233	34.0	19,825	66.0	30,048	100.0
VII Basic Metal Products	1	58.6	-	-	40,027	100.0	40,027	100.0
VIII Metal Processing, Machinery, Trans-port Machines	242	226.2	23,264	18.2	104,603	81.8	127,867	100.0
IX Other Processed Products	60	20.9	1,943	21.5	7,076	78.5	9,019	100.0
Total	1,421	1634.5	199,282	25.5	583,549	74.5	782,831	100.0

Source: Central Bank of Ceylon Annual Report

Table IV-5 shows the production and utilization of the imported raw material in the year 1971 in accordance with main fields of the industrial sector in Sri Lanka. As is clear from the figures stipulated in this table, the total utilization of imported raw materials by these industrial fields amounts to 75% of the total raw material utilization, and in such sectors as the food industry and textile industry where the domestically available raw materials should normally be employed, the dependency extent of the raw material procurement on importation in these fields is approximately 60%. From these figures, it is obvious that the pattern of industry in Sri Lanka is centered around the processing industry.

While it is natural that such a pattern has been taking place in the past due to the lack of domestic resources, from the view point of effective improvement of these already existing industries, it is obvious that some measures must be taken to modify the character of industry.

1-3 Outline of importation structure of Sri Lanka

Table IV-6 shows the actual achievements of the importation of main items over the past five years. As is shown clearly in this table, more than 50% of annual total importation is taken by consumer goods. Further, while the importation of intermediate goods and productive goods are showing an annual

Table IV-6 Imports

	Import Amount(Rs mil.)					The Rate for Total Import %				
	1967	1968	1969	1970	1971	1967	1968	1969	1970	1971
1. Consumer Goods	931	1,147	1,218	1,294	1,136	53.6	52.8	47.9	55.8	57.2
A. Foods, Drinks	783	989	976	1,069	918	45.1	45.5	38.0	46.1	46.2
B. Textile Clothes	73	77	122	124	103	4.2	3.5	4.8	5.3	5.2
C. Other Consumer Goods	75	81	120	101	115	4.3	3.7	4.7	4.3	5.8
2. Intermediate Goods	441	629	592	451	388	25.4	29.0	23.3	19.5	19.5
3. Production Goods	330	383	700	546	419	19.0	17.6	27.5	23.5	21.1
4. Total (Items 1, 2,3)	1,702	2,159	2,510	2,291	1,943	97.9	99.4	98.7	99.0	97.8
5. (A)	36	14	33	22	43	2.1	0.6	1.3	1.0	2.2
Total	1,738	2,173	2,543	2,313	1,986	100.0	100.0	100.0	100.0	100.0

Note) Excl. import of delivery without compensation

Source: Ceylon Customs Return

(A) Imports unable to classify

decrease, there is a marked increase in the import of consumer goods. Of the imported consumer goods, more than 45% of the total of this category is taken up by primary food stuff such as rice, flour, and sugar.

As there is a limit to the foreign exchange reserves which can be used for importation, the total import has been gradually decreasing in recent years, however, the rate of decrease of the food stuffs is lower than the decrease extent of other imports! so that the relative importation rate of food products has been increasing year after year. Due to the governmental import regulations, the commodities other than the above-mentioned food products have also been decreasing, however, the rate taken up by these commodities has shown almost no change in recent years. As is clear from this fact, the effect of the import regulations is most severely felt by the intermediate products. Thus, it is obvious that the shortage of necessary raw materials for the industrial sector has been causing stagnation in the industry of the country. Along with the self sufficiency in the necessary supply of food products in the agricultural sector of the national economy, it is an urgent necessity for the rehabilitation and reconstruction of Sri Lanka's national economy to undertake appropriate policies which will directly realize the decrease of the importation amount of consumption goods in the industrial sector as well.

1-4 Industrialization Policies

In the policy announcement speech made by the government in 1970, the authority announced the basic policies for the nationalization of manufacturing industries and for other fields of industry. In the speech it was clarified that the heavy industries and the capital goods production industries and the basic industries shall be nationalized, and the rest of the industrial fields shall be opened to the cooperatives or to private enterprises. Thereafter, on the basis of these policies, the nationalization of industries has been steadily progressing. These basic policies are inherited in the new Five Year Plan which started in 1972.

The authorities admitted and pointed out that the past policies of development had so far been aspiring for the development of capital intensive type industries in the production industries sector in particular and also mentioned the past problems as follows.

(1) The valuable foreign reserve has been spent for the importation of raw materials for the production of items other than the absolutely necessary goods.

(2) There has been a lack of effort in the utilization of the raw material resources available within Sri Lanka.

(3) The fostering of middle and small scale industries has cooperatively been neglected.

(4) Of the investments in the consumer's goods production industries and heavy industries, some of the investments have

been allocated to build excessive facilities in comparison with the scale of markets so that rational utilization of capacity has not been fully materialized.

(5) Because of high profit margins available from the highly protected domestic market, general trends were directed to the domestic consumption market, thereby lacking the effort for the development of export markets.

In the new five year plan, the following basic policies are laid out.

(1) Expansion of employment opportunities.

(2) The advancement of the income level of the low income group, thereby stimulating demand along with the advancement of the income level so that the reinforcement of production of necessary and indespensable consumption goods shall be undertaken.

(3) The establishment of the basic industries which will bring about the "input" into the other sectors of the industries, i.e., the reinforcement of the coordination and collaboration between and among the various sectors of industries, thereby establishing a foot-hold for the further development of the production industry sector.

(4) Decentralization of the industrial sites shall be undertaken so that expansion of employment opportunities and enhancement

of raw material demand in the agricultural and forestry industrial sectors will be effected.

(5) Endeavour to decrease the foreign currency portion within the framework of the raw material procurement and investment.

(6) Expand the exportation of industrial products.

1-5 Conclusion

The problems which have so far been discussed in the foregoing paragraphs may be summarized that the necessity is the immediate improvement of the foreign exchange balance.

In order to implement such improvement, the most urgent action to be taken will be to improve the structure of the agricultural sectors, in other words, to establish sufficiency in the supply of rice and other indispensable agricultural products.

At the same time, in the field of the manufacturing industry sector, as was enumerated in the foregoing, the orientation of the development should be to extend the minimum extent of capital (decreasing as much as possible the foreign currency investment portion) and to develop such industries by the products of which the substitution of so far carried out importation will be promtly realized, such products being produced by the processing of domestically available raw materials.

It is also urgently necessary to develop such industries the products of which can be easily exported with sufficient international competitiveness. By means of the above-mentioned action, the production capacity of the intermediate goods should be reinforced as a subsequent step so that the import substitution be undertaken by means of domestically supplying such intermediate products.

Therefore, it also seems necessary to implement the production capacity improvement in the existing industries engaging in turning out the intermediate goods.

2. Mahaweli Ganga Development Project

2-1 Background

The Republic of Sri Lanka covers a total area of 65,780 km^2 and has a population of approximately 13 million. This island country is roughly divided into two zones, Wet Zone and Dry Zone with an annual rainfall of 1,900 mm as the border-line. The rain in Sri Lanka falls during the May - September season brought by the Southwest monsoon and also during November - March by the Northeast monsoon. However, the Southwest monsoon is cut-off by mountains which span the centre of the island Southward so that, during this season, the rain falls only to the Southwest part of the island so that the central, northern, eastern and southeastern parts of the country receive very little rain.

On the other hand, although the Northeast monsoon brings rain to all parts of the island, the rainfall amount is comparatively higher in the mountainous areas. Therefore, the Wet Zone situated in the Southwestern part of the island will receive an annual rainfall of 1,900 mm to 5,000 mm, however, in the Dry Zone, the annual rainfall is less than 1,900 mm. Moreover, the rainfall is limited to the October - December period. With such climatic conditions as the background, in the Wet Zone, the major products of the country such as tea, rubber, coconuts, the three major export items of the country, have been cultivated, and further, cultivation of rice and other crops has been extensively and traditionally carried out. At present no allowance is left for further cultivation. In the Dry

Zone on the other hand, paddy rice cultivation by utilizing land along the rivers or in the vicinity of numerous reservoirs and the chena cultivation by utilizing the natural rainfall has also been undertaken. However, in the case of the natural rainfall utilization agriculture, and even in the case of the cultivation by utilizing reservoir water, the yield has frequently been given up due to water shortage. This has been making cultivation in the Dry Zone extremely unstable. Consequently, in order to carry out stable agriculture in the Dry Zone, the necessary and prerequisite condition will be the substantiation of irrigation.

Due to the above reasons, 70% of the population is concentrated in the Wet Zone which occupies approximately one-quarter of the total area of the island. The remaining three-quarters of the country which is in Dry Zone houses 30% of the population, thereby representing a contrast of conspicuous and excessive congestion on the one hand, and certain scarcity of inhabitants on the other. As has been discussed in the foregoing chapter, the two major problems that now confront the national economy of Sri Lanka are unemployment and the shortage of foreign exchange. The employment opportunity is insufficient on the one hand, while the younger generation labour force has been increasing rapidly over the past years on the other.

The foreign exchange balance situation has been deteriorating year after year while approximately one half of the total importation

amount is taken up by food. This being the case, the expansion and promotion of the agriculture is one of the top priority policies of this country. By expanding agriculture and enhancing the yield of food, the unemployed labour force will be absorbed, thereby saving the foreign exchange. However, as has already been described, there is no space left in the Wet Zone for the expansion of agriculture so that it is imperative that the expansion of agriculture must be undertaken by means of promoting irrigated agriculture in the Dry Zone.

2-2 Master plan

The Mahaweli Ganga developing project was established on the basis of the above-mentioned background. This project intends to carry out diversification of the flow of the Mahaweli Ganga, the longest river in the country (335 kilometers), so that substantial irrigation will be undertaken in the eastern and northcentral parts of the Dry Zone. At the same time, the project aims at securing sufficient electric power which is necessary for the future industry in this country. When embarking upon the works of the development project, a detailed survey was conducted from March 1965 until May 1968 for three years by the UNDP/FAO under the financing of the UN Special Fund and with cooperation of Sri Lanka's counterpart, the Ministry of Land, Irrigation and Power. (Presently reorganized as the Ministry of Irrigation, Power and Highways).

On the basis of the survey results, the Master Plan for development was established. The outline of this Master Plan is as follows:

The river Mahaweli Ganga originates in the central mountainous area of the island and traverses through the central and eastern portion of the island until it enters the ocean at Trincomalee. As a result of the survey regarding the water resources of this river, it was revealed that approximately 40% of surplus water resources was still available even if complete irrigation is undertaken along the flow of Mahaweli Ganga (eastern part of the island). It was therefore revealed that such water resources as

irrigation water would be utilized for the northcentral and northern part of the island by means of partially converting the flow of the river. Therefore 15 reservoirs should be constructed along the Mahaweli Ganga, its tributaries and also the Madaru Oya so that hydro power stations may be constructed in the vicinity of the dams of these reservoirs. By means of constructing reservoirs, it would become possible to control the floods which have been threatening 520 km^2 of the delta areas on the down-stream of Mahaweli Ganga and further, a portion of the converted flow can be led to the Kala Oya basin via the Polgolla tunnel and the Bowatena tunnel. From there, water can travel further distances to supply water to the northcentral part of the island, thereby making it possible to sufficiently irrigate a cultivated area of 98,000 ha and 262,000 ha. of the projected and still uncultivated areas, totalling 360,000 ha. In the Master Plan, as shown in Attached Table IV-1, these areas to be irrigated are divided into 14 irrigation systems. Of these systems, the A, B, C, D-1, D-2, E, F and G systems are located along the flow of Mahaweli Ganga and Maduru Oya while the systems H, I, J, K, L and M are distributed in the northcentral part of the island. The total electric power obtainable from the above-mentioned hydro-power station will be 508 MW and the annual electric power production in 1990 will be 2,037 million KWH which will fill up half of the electricity demand of Sri Lanka at that time.

The pace of development will be, according to the Master Plan, as follows.

During the initial stage of development, areas of 8,000 ha. every year will be completed for irrigation as a start and from this level onward eventual improvement of the development pace will be made so that during a ten-year period from thence, the year development pitch will be enhanced to 9,200 ha. per year and thereafter, the yearly development rate will be lifted up to 12,000ha., until finally the pace will be augmented to 13,000ha. per year. It is scheduled that a period of 30 years will be necessary in order to complete this development project. The total construction period is divided into the following three phases.

Phase I (1969 - 1980)

Polgolla Diversion (1969 - 1973)

Victoria - Minipe Diversion (1973 - 1977)

Moragahakanda Multi-purpose Unit (1977 - 1980)

Phase II (1980 - 1986)

Irrigation for the basin of Mahaweli Ganga

Phase III (1986 - 1996)

Irrigation to the mid-northern area of Sri Lanka

Development of hydro-power stations along Mahaweli Ganga and tributaries.

Each one of the above three phases is further divided into several projects. These phases and the project plan contents are outlined in Attached Tables IV-1 and IV-2. Each one of the above projects contained in each phase shall be evaluated on the following criteria.

(1) A project shall be independent by itself within the same phase or from other projects of the subsequent phases and shall have no financial connections or interrelations whatsoever.

(2) A project should not undermine subsequent developments.

(3) The scale, scope and contents of a project should be in line with the land development capacity of the government. A project should be carried out in an area where no problem will be present concerning the settlement infrastructure or management.

(4) A project must coincide with the demand for the development of electrical power.

(5) A project should be economically viable.

2-3 Execution of project

2-3-1 Mahaweli Development Board

In 1968 the Government of Sri Lanka accepted the above-mentioned Master Plan compiled, by the U.N.D.P/F.A.O. The government submitted through the parliament for the fiscal period of 1968 to 1969 the budget proposal for the execution of Phase I, Project I of the Master Plan. This proposal was passed by parliament and the endorsement was made to the Mahaweli Development Board for the execution of the project. The proposed development cost for Phase I, Project I is as follows, amounting to Rs.862 million.

In this budget, Rs.500 million each was provided for the H area and G-D areas in order to establish pilot plants for agro- based industries.

Irrigation and hydro-power station:	Rs. 547,100,000
Agricultural researches and extension:	32,000,000
Settlement:	247,900,000
Agro-based industries:	10,000,000
Rural Electrification:	25,000,000
	Rs. 862,000,000

The Mahaweli Development Board (MDB) was established on 21st March 1970 under Act No. 14,1970, as the executory organization of the

Mahawelli Project (for the fore-seeable future, the execution of Phase I, Project I).

The assignments given to the MDB are to conduct the following points within the project area.

i) Administration of irrigation, drainage flood control, soil erosion and the promotion of such control.

ii) Promotion of development of the agriculture and economy.

iii) To carry out necessary coordination between the central government and local authority during the course of the development of the project area.

The MDB is under the jurisdiction of the Ministry of Irrigation, Power and Highways, however, due to the fact that the nature of the assignments of the board is highly versatile, a number of experts from various fields have gathered to form the MDB organization. The organization chart of the MDB is shown in the Attached Table IV-3 and, as shown in this table, the board consists of six departments.

The board maintains close contact with the five ministries as shown in the table encompassing fourteen bureaus during the course of carrying out their assignments. However, it seems inevitable that the industrial development inside the project area and also the utilization of the forestry resources therein will present real problems along with the progress of the assignments given to the MDB. The present survey team was actually despatched for the purpose of assessing feasibility of this field. Therefore, it seems

necessary that the Ministry of Industry and Scientific Affairs and the Forest Department should be included within the scope of the constituent authorities of the MDB.

2-3-2 Phase I - Project I

The Government of Sri Lanka concluded the following agreements for the execution of Phase I - Project I.

1) On 26th August 1969

Engineering Consultants Inc. (USA) and the government concluded a contract pertaining to the consultancy for the survey, investigation, design and work supervision of the main portion of project I.

2) On 30th January 1970

The government concluded a credit-loan agreement with IBRD/IDA concerning financing of US$29 million corresponding to the foreign currency portion of the expenditure necessary for the construction of works covered under Project I - Stage I and to conduct a survey for the items of Stage II.

3) On 23rd March 1970

Regarding the Polgolla/Complex which is the first civil engineering construction work of Stage I was awarded to a Yugoslavian firm, Ingras, as a result of an international tender.

The initial schedule from Phase I - Project I is as shown in the Attached Table IV-2. The civil engineering and construction works for Stage I, have already started, however, the work is one year behind the original schedule thereby making the present planned completion date for mid 1975.

Phase I - Project I is further divided into Stages I, 2 and 3.

(1) Stage I

Stage I consists of the following civil engineering and construction works. Polgolla Complex:

Works pertaining to the aqueduction of the Mahaweli Ganga water to Sudu Ganga which is a branch of Amban Ganga through Mahaweli dam and a tunnel.

Dam: 140 meters

Tunnel: the shape of an horseshoe which is 6-meter in diameter and 8 kilometers in length.

Hydro-power station: 50 MW (200 million KWH)

Bowatenna Complex:

Works pertaining to the blocking of the Amban Ganga by constructing a dam and a portion of such blocked water is to be diverted to the Kala Oya basin through a tunnel of 6 kilometers in length.

Sudu Ganga Training work:

Flow diversion routing works from Polgolla to Bowatenna.

Kandalama Canal and Kalawewa Augmentation:

The diverted flow fed through the Bowatenna tunnel will be led northward along a short waterway and then divided into two, the majority of the flow will then be led to Dambulla Oya in order to reinforce the Kalawewa-Rajangana system (H area), while another portion of the water will be led to Kandalama reservoir.

Improvement of the Elahera Headwork:

This work pertains to the improvement of the headwork carried out at Elahera.

Rehabilitation of existing irrigation scheme:

The existing irrigation scheme, i.e., the system covering Kandalama-Kalawewa-Rajangana system (H area), Elahera, Minneriya, Kaudulla, Kantalai system (D - G areas) and the Anuradhapura city tank (I H areas)

By means of contributing the above works, it will become possible to undertake sufficient irrigation to the already cultivated areas covering 44,000 ha. Further, it will be possible, in addition to the above, to newly developed 28,000 ha. (Stage II) in the H area, and 18,000 ha. in D - G areas.

(2) Stage II

The MDB and the French consultants, Sogreah, are conducting joint feasibility studies concerning the H area (and also I H areas,) and, at present, the drafts of the reports of such survey are being compiled. This report consists of eight volumes covering agriculture, land classification, irrigation works, settlements, marketing and credits and the survey results in each one of these fields. This report is designed to draw conclusions as to whether or not the development of these subject areas is technically feasible and economically viable.

Stage I involves only civil engineering works. Therefore, Stage II will be the first programme in the Mahaweli project which involves the new land development and the new settlement scheme. Therefore, the results of Stage II will affect greatly the progress of all the future projects. In Stage II, the development of land covering 28,000 ha. will be newly undertaken where irrigation can be completely provided (in Master Plan, the area planned was 22,000 ha.) so that during the five-year period from 1975 to 1980, 23,500 families will be newly dispatched to live inside the area (15,500 families from outside the area and 8,000 families from within the development area). The development schedule and the colonization programme are shown in Attached Fig. IV-3.
Of the above 28,000 ha., 60% will be upland. Concerning the rainfed upland cropping

., plans for full-fledged cultivation on the basis of the irrigation are being laid out. By means of this provision, agricultural production in this area will be converted to be stable cultivation operation, not only for paddy rice but also for other upland crops. Therefore, the plan aims to make possible a stable supply of products as food or as raw materials for further processing.

(3) Stage III

Mere outline plans are being formulated, however, here, it is planned to irrigate cultivation areas of 18,000 ha. in the G & D areas. It is reported that the feasibility studies concerning Stage III are about to be commenced.

2-3-3 Future plans

The above-mentioned Phase I - Project I is the only portion of the project where the execution plans have already been finalized. Regarding all plans thereafter, there is no further information other than in the Master Plan. If the Master Plan is to be put into practice in the future, it is expected that various modifications will have to be made. Actually, concerning Phase I-Project I, it can be noted that a certain extent of modification has already been made to the original Master Plan.

V Present Status of Industries in Sri Lanka

1. General

1-1 Ratio of manufacturing industries in the gross national products, the growth rate of manufacturing industries and GNP.

Table V-1 illustrates the general position of the manufacturing industries sector in the Sri Lanka national economy.

Table V-1 Industrial Sector and Gross National Product at Constant Factor Cost Prices (1959)

Item	Unit	1967	1968	1969	1970	1971
Industrial production	mil. Rs.	1,052	1,154	1,261	1,335	1,379
G N P	mil. Rs.	8,210	8,901	9,316	9,695	9 779
I.P./G N P	%	12.8	13.0	13.5	13.8	14.1
Growth rate of I.P. *	%	-	9.7	9.3	5.9	3.3
Growth rate of G N P *	%	5.0	8.4	4.7	4.1	0.9
Growth rate of IP/GNP *	%	-	1.6	3.8	2.2	2.2

Source: Central Bank of Ceylon

* Growth rate over previous year

As shown in the above table, the growth rate of the manufacturing industries and GNP in terms of simple average growth rate for the period from 1967 to 1970 are as follows.

Manufacturing Industries: 8.3%

GNP: 5.6%

The reasons for taking the period from 1967 to 1970 are as follows.

A) There was some confusion on the economical condition in the year 1971.

B) The production statistics and other data necessary for analysis are available only up to 1970.

As is evident from Table V-1, in terms of the growth rate, simple average growth rate of GNP is 5.6%, while that of manufacturing industries was 8.3%, so that the latter exceeds the former rate, However, the out-put ratio of the manufacturing industries sector comprised in the national growth in the GNP is within the range of 12.8% to 14.1% so that the growth rate on a simple average of the production cost ratio within the range is only 2.5%. In other words, in view of the effect and influences of Sri Lanka's manufacturing industries to the national economy, the industrial sector still have considerable room for further expansion.

1-2. Position of Manufacturing Industries in Exportation

Concerning the importance of manufacturing industries in the realm of exportation, the past trends are shown in Table V-2. As is clear from this table, the portion taken up by these industries in the total exportation is Rs. 28 million (in 1971) in terms of actual prices so that the rate assumed in the total exportation is 6.3% which is a mere 9.3% of the total production of the manufacturing industries of the country.

Especially in view of the long lasting objective to improve the foreign exchange situation of Sri Lanka, the further expansion of the manufacturing industrial sector within the framework of the national economy is therefore strongly anticipated.

1-3. Analysis of the various manufacturing industries

1-3-1 Trends of out-puts in the various manufacturing industries

Table V-3 shows the trends of out-puts (1967-1970) of various fields of Corporations and enterprises registered with the government. As is clear from this table, of the Sri Lanka's manufacturing industries, those which show high extent growth rates are such basic industries as iron and steel manufacturing, machinery manufacturing, etc. and other capital intensive type industries.

The tendency here is that the higher growth rates are concentrated on these types of industries and the growth rates of the other types of industries such as the production of consumer goods and other labour intensive industries are not high. In Sri Lanka, where the domestic resources are poor, it has so far been meaningful to endeavour to promote the production of capital goods and to plan for the development of heavy industries, however, due to the fact that the development of the secondary industrial fields have been left in the hands of the private sector, the development of these fields has so far been generally delayed, thereby resulting in an imbalance in the production structures of the country.

1-4 Status and Policies

1-4-1 Status:

As has been discussed in the foregoing paragraph, the qualitative problems existing in Sri Lanka's industries seem to be summarized in the following points.

1) The valuable foreign exchange had been used for the raw material importation for the production of items which are not primary necessary items.
2) Efforts for further utilization of raw materials and resources available within Sri Lanka have been lacking.
3) Heavier emphasis has been placed upon the investment into capital intensive industries and the middle and small sized industries have so far been comparatively neglected. Especially, little assistance has been available to the middle or small industries from such provisions as the credit system for fostering of middle and small industries, the actual execution assistances in marketing and production technology and other cooperation from the governmental systems.
4) Because of the fact that emphasis on development by the government has not been placed on the middle and small sized enterprises of the labour intensive type, the expansion of employment opportunities has not been successful in spite of the amount of expenditure of the valuable foreign reserve.
5) Some of the investments made to the consumable goods industry and heavy industries seemed to be in excess in view of the size of the market for the products so that proper utilization of the production capacity has not been undertaken.

6) Due to the high extent of profit margin available from the highly protected domestic markets, the general tendency inclined towards the promotion of domestic consumption of the products so that allocation of the products to exportation has not been sufficiently made.

1-4-2 Industrialization Policies

In the Five Year Plan (for the period from 1972 to 1976), the following basic policies are incorporated, encompassing a reflection of the problem discussed in the foregoing 1-1.

1) Expansion of employment opportunities.
2) Production capacity reinforcement for the generally required necessary items to cope with the increment in the demand along with an improvement in the income of the low-income group as projected in the Plan.
3) Establishment of the basic industries which will become the input to the other industrial sectors. In other words, the coordination among the industrial fields and other sectors of industry will be reinforced in order to utilize such reinforced coordination as the foothold for further expansion of the industrial sector.
4) By means of introducing a policy of decentralization of the industry over various local districts in order to improve the income of the rural sector and to expand the employment opportunities inside the rural sector, the overall industrial activities within such area will be enhanced

along with the improvement in the demand for the raw materials available within the territory.

5) The minimization of the foreign currency portion taken in the raw material procurement and investment into industry.

6) Expansion of the export market share in order to develop the industrial sector.

The basic policy for the nationalization of the manufacturing industry and the production industries in general were voiced in the throne speech made in 1970 which covered the following points.

"Heavy industries, capital goods industries and other basic industries shall be nationalized and the remaining industrial sectors shall be transferred to the cooperative or private enterprises."

Based on the basic policies, industries' sectors which will form the foundation and basic support for the industrialization of the country and the so-called heavy industries will be nationalized or placed under the government regulations.

1-4-3 Industrialization Projects

Concerning the production targets, the Five Year Plan specially mentions the production improvement plans and the investment plans of the public corporations which undertake the basic industries and, concerning the private enterprises, the Five Year Plan will provide approximately Rs.1 billion during the Five Year Plan period in the form of investment into the sector. The investment budget provided for the manufacturing industry of sectors during the Five Year Plan, is as shown in the Attached Table V-1. The outline of such investment budget is as follows.

Government Sector Investment	Rs.	3 billion
Finalized Project:	Rs.	2.24 billion
Projects under scrutinization:	Rs.	0.76 billion
Private Sector Investment:	Rs.	1 billion
Total:		4 billion

For the middle and small-sized enterprise sector, investment by means of private sectors including the cooperative is now projected. Such investment will mainly include the following industrial fields.

Textile industry

Wood products

Mining and Quarrying

Non metallic mineral product

Coconut product

Tobacco product

Light engineering

Printing and paper product

Leather product

Rubber product

Further to the above, the following fields will be taken as the fields which shall be newly developed as a part of the agro-based industry

Tapioca starch

Vegetable fibres for textiles

Vegetable oil

Natural silk

1-4-4 Efforts of the Government of Sri Lanka for the development of local district and middle and small scale industries

As one of the approaches to the objectives above-mentioned, which are also emphasized in the Five Year Plan, the following organizations in addition to existing Government Agency were established.

One of the newly established organizations is the Divisional Development Council under the jurisdiction of the Ministry of Planning and Employment. The Industrial Development Board was also newly established under the jurisdiction of the Ministry of Industrial and Scientific Affairs. The Technical Service Agency was also newly established under the jurisdiction of the above-mentioned Industrial Development Board. The purpose of establishing these new governmental organizations is, as is emphasized in the Five Year Plan, the realization of all the objectives such as:

A) Effective counter-measures for the improvement of the present lack of foreign reserves.

B) Expansion of employment opportunities.

C) Decentralization of industrial activities for the overall development of the industry covering the whole country.

The organization structures of each one of the above-mentioned

governmental offices are as follows.

1) Divisional Development Council

A) This was organized by Government Agency for the formulation of projects on the basis of the utilization of unique products in each district.

B) This organization also undertakes the input allocation of the funds (governmental funds).

C) This organization also renders assistance for the selection and acquirement of industrial plant sites.

2) Industrial Development Board

A) To carry out feasibility studies for various projects

B) Recommendations and advice regarding project administration and implementation.

C) This organization has its headquarters in Colombo and has a regional manager in certain districts and maintains close contacts between the manager and headquarters in order to scrutinize and assist the promotion of projects now being undertaken in each district.

D) With the cooperation of the People's Bank, the financing of the middle and small scale industries will be undertaken by this organization. This office will especially be in charge of the appraisal of the project.

E) With cooperation of private sector enterprises, the company named theSri Lanka Industrial Development Company Ltd. was established to undertake such activities as follows; in place of medium and small scale enterprises.

Raw material procurement, production control, business administration, marketing and export agency transactions.

F) The Attached Table V-4 describes the projects being undertaken at present by the Industrial Development Board.

G) This organization undertakes the design and administration of industrial estate.

3) Technical Service Agency

A) This agency undertakes the development and design (mainly oriented the domestic procurements) of all the machinery and equipment for use by the middle and small scale industries, the trial manufacture of items which can be produced domestically. After the trial fabrication is carried out by this agency, a commercial fabrication will be allocated to the private fabricator.

B) Advice to the engineering work in such forms as to draw pilot plans for plant and the recommendation and administration necessary for the excecution and implementation of the projects.

C) Training of the operators for industrial equipment and maintenance services.. In particular, this agency owns a patrol cars by means of which it undertakes servicing to distant districts.

It is considered that development systems which are highly organized as a mentioned above is of special attention.
The survey team was deeply impressed by the methods of actual implementation and administration of the project by these newly established governmental organizations.
The overall organization activities seemed, to the survey team, to be excellent, however, the following shortcomings may be pointed out if necessary.

A) The implementation sections of the organizations are mostly occupied by the government offices originated from the Ministry of Industries and Scientific Affairs. It may cause insufficiency of knowledges of the raw materials especially in the agricultural raw materials the positive utilization of which should be primarily promoted.

B) There was the danger of becoming too satisfied if the trial production undertaken by the technical service agency of such an experiment were isolated from the international trend.

1-4-5 Industrial Estates

There are five industrial estate areas in Sri Lanka at present, some of which are already existing and operating with others still under contemplation.

Existing industrial estates:

Ekala, (in the suburbs of Colombo)

43 lots, 42 lots already occupied

Pallekelle, (in the suburbs of Kandy)

34 lots, 22 lots already occupied

Industrial estate under contemplation:

Atchuvely, (in the suburbs of Jaffna)

under construction

Boosa (in the suburbs of Galle)), lands now being procured Pannala (in the suburbs of Kurunegara)), awaiting governmental authorization ("Budget Paper 1973" by IDB).

All the works pertaining to the selection of sites, various facilities, the details of which will be discussed later, and the selection of the qualification of the occupants (the candidates for the occupants are recruited before the commencement of industrial estates construction) are under the jurisdiction of the Industrial Development Board.

The facilities available inside such industrial estates are roughly as follows.

(1) Lands

Buildings: 95-650 (m^2)(except the shower room)

Land: 280-1,400 (m^2)

The rental rates are as follows.

Buildings: 110m^2, estates 1,400 m^2

Shower room 16m^2: Rs.371.25 per month (Atchuvely)

Buildings: 655m^2, estates 1,400 m^2, shower room 35m^2: Rs.2007.18 per month (Pallekelle)

(2) Utility Facilities

Industrial water (chlorine processed water): supplied under

appropriate pressure

Electricity: 33 KV power received by the sub station at each estate and distribution to each lot is undertaken at 440 KV. A.C. 3-phase. If required, 33KV is also available.

(3) Auxiliary facilities

The following items of auxiliary facilities are common use for the occupants of the industrial estates

(A) Canteen

(B) Fire fighting facilities

(C) Waste water processing facilities

(D) Telephone communication facilities

(E) Maintenance servicing shop, educational institutes (only provided at Pallekelle at present)

2, Agro-based Industries

2-1 Processing of Coconuts, Rubber and Tea

2-1-1 Present Situation

Coconuts, rubber and tea are the three major agricultural products of Sri Lanka and therefore the primary processing and the secondary processing of these items constitute an important industry of this country. In other words, processing plants for the drying and conditioning of tea crude rubber producing plants from liquid rubber, mills in which copra, fats and fibre processing of coconuts

already exist and have long been in operation. However, in all of these plants and mills, the extent of processing is still low and no signs of further development is present that these operations will grow as large scale agro-based industries.

2-1-2 Problems

On the basis of these existing operations and the relative facilities, versatile agro-based industry can be developed. For instance, from crude rubber materials, various types of processed simple rubber products can be turned out, and, coconut oil production or complete utilization of coconut fibre can be undertaken. Further, from coconut shells, activated carbon or powder products thereof can be produced. If the quality standard of these products is high and the price can be low, they may be directly applied as international commodities. However, under the present situation it seems that the processing industries of these items is stagnating due to the following problems.

a. Deterioration of productivity in primary products

It may be due to the international market trend that the production of coconuts and other primary products has recently been showing stagnation or reduction and it seems that this tendency has been impeding the incentives for the processing industry of these products.

A newly established yearly plan is aspiring for the rehabilitation and rationalization of these crops. New progress may materialize if such means prove successful.

b. Obsolescence of the processing facilities

A great many of the presently existing processing facilities for these products are the ones which were inherited from the colonial days. These facilities are already obsolete. It is therefore necessary to modernize these facilities by repairing them in order to enhance productivity.

c. Complete utilization of the available resources

The domestic consumption of coconuts for instance amounted to 2,616 million nuts in 1970, however, it is rather doubtful as to whether the oil and fat contained in these nuts have been utilized effectively. Concerning the fibres and shells of coconuts, little utilization has been made so far. Complete utilization of these items is as important as the reinforcement of coconuts productivity.

2-2 Rice Milling and Processing of Rice By-Products

2-2-1 Present Status

At present in Sri Lanka, approximately 160 million tons per year of paddy is being produced. The paddy produced by farmers is purchased by the cooperatives at Rs. 14 per bushel (guaranteed price). The paddy will then be stored in the warehouses of the Paddy Marketing Board (hereinafter called the PMB). The purchase of Paddy is being completely monopolized by the PMB. Whenever necessary, the PMB mills purchased paddy at government owned or private rice milling plant before delivery to to the Food Commissioner's Department. The distribution channel of the paddy and rice is shown in the Attached Fig. V-1.
Presently, there are 628 rice milling plants of which 18 belong to the PMB and 610 belong to the private sector.
Table V-4 shows locational distributions and capacities of such rice milling plants. It is said that the monthly rice milling capacity is approximately 60,000 tons. The people of Sri Lanka prefer parboiled rice so that as shown in Table V-4 the majority of rice milling plant also possess parboiling facilities.
In the H and IH ~ areas, there are five milling plants with 32 rice milling machines operating at present, the capacity of which is approximately 300 tons/8 hrs./day.

2-2-2 Problems

(1) The rice milling machines are generally obsolete and the milled rice quality is generally poor. In Sri Lanka, most of the rice millin

plants possess rice milling machines equipped with old type steel huller. Due to these out-of-date facilities, the milling efficiency and milling quality are not satisfactory. In the rice milling plants existing within the development project area, it is reported that the work often stops because of malfunctioning of facilities. Due to the fact that the rice business is completely monopolized by the government and the purchase of rice is undertaken solely by the government and the rice distribution is rationed to the people, there is no incentive for an improvement in quality. The method of milling is unlike that undertaken in Japan. The Japanese method is to mill hulled rice, however, in Sri Lanka, milling is undertaken directly to paddy, so that bran cannot be separated. The by-product produced by the separation of the rice is a mixture of powdered paddy husk and a slight extent of bran. The rationed rice distributed to the people contains a large extent of broken rice and foreign substances such as small stone particles and the milling rate is considerably low, almost closed to brown rice.

(2) Rice bran cannot be produced.

Rice bran is a highly useful as the raw material for fodder or as the raw material for producing oil. However, due to the fact that as above-mentioned, the milling facility is obsolete and therefore pure separation of bran is presently impossible. Further, as shown in the attached Fig. V-1, rice milling plant receives 100 bushels (approx. 2 tons) from the PMB for milling.

The milled rice in the amount of 51 bushes (approx. 1.43 tons) is to be delivered to the Food Commissioner's Department. This implies that the delivered rice is in the state of being almost close to brown rice in quality. Because of the present status in Sri Lanka, it would not be permissible to increase the milling rate, thereby reducing the amount of rice to be distributed to the people. Also, as long as the rice is being purchased on the basis of quantity rather than quality, the milling plant will reduce the milling rate as much as possible rather than exert efforts for increasing it. If more than 51 bushels of rice can be yielded from 100 bushels of paddy, the exceeding amount will be obviously diverted to some other routes at Rs.40/bushel or more. This practi e has actually been undertaken. Therefore, as long as the present system continues, it is considered that the possibility of producing rice bran from rice is extremely low.

(3) Reinforcement of facilities for rice milling, drying and storing

According to the Five Year Plan, the Government of Sri Lanka will increase the production of paddy up to 116 million bushels by 1976 so that self-sufficiency in the supply of rice will materialize. This implies that the reinforcement for facilities to cope with this increase will be necessary.

As shown in the Attached Fig. V-1, the flow of rice starts at the cooperatives → PMB warehouses → rice milling plant → Food Commissioner

Department warehouses -- cooperatives, so that a considerable extent of the paddy which originally left the cooperatives will eventually come back to the cooperatives in the form of rice. Therefore, if it is possible for the cooperatives to undertake the drying, storing and parboiling of paddy and then milling can be integrally undertaken in such a form as an integral milling complex, presently undertaken non-ration rice distribution flow can be eliminated and, at the same time, the purpose of the above-mentioned facility reinforcement can also be materialized. The Government of Sri Lanka is now planning to establish such a milling complex in four places during the period 1973 to 1974. The authorities incorporated Rs. 15 million as the budget for this undertaking. The milling complex will be additionally expanded until finally it is scheduled that approximately 20% of the production of the country will be handled by such a milling complex.

(4) Paddy husk

Approximately 30% of paddy weight is taken up by husk. In all the rice milling plants, the disposal of husk is a great problem. In some cases, husks are abandoned on the roadside, in some other cases are disposed of in rivers. However, a number of rice milling plants now possess parboiling facilities and petrol or wooden fuel are being used to operate such facilities. Therefore, paddy husk should be used as a substitute for such fuel. Therefore, a husk combustion furnace for the boiler is highly desired.

2-3 Processing of Oil Producing Resources

2-3-1 Present situation

The agro-based industry concerning the processing of oil producing resources is extremely poor in Sri Lanka except for the processing industry in which coconuts are employed as the raw material. Therefore, at present, the oil and fat substance production from raw materials other than coconuts is extremely low. The annual production of coconuts in this country is within the range of 2,400 million to 2,800 million nuts. Of this amount, 1,500 million to 1,700 million are consumed domestically (ref. Table V-5). If an assumption is made that approximately 250 grammes of copra is produced from one coconut and the average oil content in copra is taken as 65%, the oil/fat amount contained in one coconut is 162.5 grammes. This implies that the above-mentioned domestically consumed coconut quantity corresponds to oil/fat substance of 240,000 to 280,000 tons. Most of the domestically consumed coconuts are used for drinking or cooking material in the form of coconut milk so that it is unlikely that coconut oil is being produced for application in the form of oil products. The statistics of the production amount and importation amount of edible oil and fat products are as shown in Tables V-6 and V-7, however, these figures represent only a portion of oil/fat substance consumption in Sri Lanka. The majority of the consumption of oil products in Sri Lanka is considered to be undertaken in the form of crude coconut oil and the amount of such consumption is assessed at 50,000 to 60,000 tons. (Estimated from the figures of Table VII-1.)

The oil extraction from copra in Sri Lanka is being undertaken by small-scale private oil mills (refer to attached Table V-5) and the residue produced after oil extraction (coconut poonac, 10% to 12% oil content) is collected at the government-owned Ceylon Oils and Fats Corporation. Collected residue is further processed by the hexan extraction. The residue after such oil extraction is used as feed after being blended with other feed components to make up blended feed . Ceylon Oils and Fats Corporation owns an oil extraction and oil refining plant in Seeduwa, approximately 16 kilometers north of Colombo. The capacity of this plant is as follows.

Continuous extraction equipment	:	100 tons per day
Batch extraction equipment	:	25 tons per day
Deodorant equipment	:	30 tons per day
Fatty acid facilities	:	12 tons per day
Glycerine facilities	:	1 ton per day

The actual achievements made each year are shown in the attached Table V-6. Studies are being made so that oil extraction from materials other than copra (for instance soya beans) may become possible at this plant in the future.

2-3-2 Problems

As shown in Table V-8, the coconut related products are third in the main export items following tea and rubber, comprising 14% of the total exportation amount (as of 1971). Therefore, coconut is one of the most important resources for Sri Lanka to gain foreign exchange. The government is consequently intending to

suppress the domestic consumption of the item as much as possible in order to secure and increase the exportable quantity. According to the Five Year Plan, the target production amount of coconut during the year 1976 is set at 3,000 million nuts, consisting of 1,700 million nuts for domestic consumption and 1,300 million nuts for export. The domestic consumption amount will be controlled at the present level and the production increment portion (approximately 400 million nuts) will be allocated for export. This implies that the demand increment portion for the edible oil in the domestic market in the future must be met by oil products to be produced from sources other than the edible oil from coconuts.

The above-mentioned facts may be illustrated as shown in Fig. V-1. In the figure it is illustrated that the present coconuts' production is taken as AC of which if AB is considered as the domestic consumption portion, BC will correspond to the exportation. The production of coconuts in the future will be increased from AC to DG, however, the domestic oil and fats' demand will grow from AB to DF so that if no substitution for coconut and oil is obtained, the exportation will have to be decreased from BC to FG.

The governmental policy is to maintain the present consumption (AB) on the same level (DE) in the future, while filling up the increment portion of demand (EF) with the supply of cotton seed oil, soya bean oil and groundnut oil, thereby bringing up the coconut exportation to the EG level. In this case, the coconut oil extraction factories will be maintained as they are, and, the construction of new oil producing plants from the newly cultivated oil producing crops may be possible in the areas where these crops are scheduled to be cultivated.

For this purpose, the production increment schedules for the oil producing crops such as cotton seeds, soya beans, groundnut etc. have already been established. The problem in this instance will be the taste and the eating habits of people pertaining to edible oil. In order to supply cotton seed oil or soya bean oil to people who have long been accustomed to the utilization of coconut oil, it will be necessary to allow some time until general acceptance is obtained. At the same time, the edible oil to be newly

supplied to the people must, therefore, be attractive price-wise when compared with coconut oil. The attached Fig. V-2 shows the price of coconut and coconut oil as well as the material distribution flow of oil fat and fodder products.

2-4 Processing of Sugar, Starch materials

2-4-1 Present Situation

As shown in Table V-9 , the present situation of production and importation of sugar and starch in Sri Lanka shows a heavy dependency upon importation. Particularly in the case of sugar, the import amount has been showing yearly increases and, in 1971, the importation of sugar took first place exceeding those of rice and flour. Presently, sugar is produced at the Kantalai factory and Gal Oya factory both owned by the Sri Lanka Sugar Corporation, however, as shown in Table V-10, the operation rate of these factories is extremely low. The attached Fig. V-3 shows the prices of sugar and the distribution flow of sugar. As is evident from Table V-9 , starch is imported for the most part.

2-4-2 Problems

The major cause for the low level of sugar and starch production in Sri Lanka is the shortage of raw material crops from which to produce these items. As shall be discussed later, the cultivation of sugar cane in Sri Lanka has been undertaken by the Sri Lanka Sugar Corporation by means of plantation system, however, the yield of such plantation has been considerably lower than the international level. Concerning manioc which is the main raw material for producing starch, the majority of cultivation has been and is being undertaken in the

home garden, the primary purpose of which is for food. Therefore, the productivity is also extremely low. In order to secure stable and sufficient quantities of these agro-based industrial raw materials, it seems absolutely necessary to undertake intensive cultivation by improving irrigation, fertilization and the method of cultivation.

At the present stage, the implementation of intensive agricultural production by means of irrigation is primarily considered to be applied to the cultivation of rice, chillis, onions, pulses, etc. as the priority items in order to substitute importation and materialize self-sufficiency of supply, however, it is expected that the production of agro-based industrial raw materials will also be undertaken by means of this intensive cultivation method in the future. The cultivation of such agro-based industrial raw material crops as cotton, soya beans, sugar cane, etc. is planned for Stage II and Stage III of the Mahaweli Ganga Development Project Phase I - Project I.

At present in Sri Lanka, factories on the basis of cottage industry scale are being projected for the production of starch and derivatives thereof from manioc as the raw material. Although the scheduled plants seem to be sufficient for the production of low-grade starch, it would seem difficult to turn out high-grade industrial use starch from these facilities. Therefore, it is necessary to consider separately the construction of facilities for the production of high-grade starch as it is considered that the climate and soil conditions of Sri

Lanka is suitable for the cultivation of manioc if an appropriate method for the intensive cultivation is undertaken, it is possible to foster and develop the industry as one of the export industries.

2-5 Processing of Protein Resources

2-5-1 Present Situation

In Sri Lanka, development of protein resources which are indispensable for the nutrition of the people is not sufficient. Protein resources can be classified into two categories, i.e., vegetable protein and animal protein. The vegetable protein is chiefly provided by the oil producing crops. Soya beans are the most important crop as the agro-based industrial raw material. As the sources of animal protein, beef and cow's milk can be used, also pork, and sheep can be raised as domestic animals and dairy products produced therefrom. In addition, chicken and eggs, ducks and other domestic animals and fish meat can be utilized as sources of protein. Protein resources are not only necessary for fulfillment of the diet and nutrition of the people of Sri Lanka but also is important as feed for domestic animals, poultry and for cultivation of fish. In the case of the latter, the residue from vegetable oil extraction is mainly utilized for the purpose of fulfilling these needs, and the government of Sri Lanka is planning to foster the agro-based industry on the basis of the development of new resources in this respect.

2-5-2 Problems

The significant problem in this respect is the fact that religious customs are impeding upon the popularization of animal proteinic foods. Of the animal foods, meat of animals

is avoided to a large extent. Poultry meat is also avoided, however, comparatively less resistance is shown by the people towards fish meat. However, as it is obviously noted in the younger generation that such resistance is not so strong, the demand for the animal proteinic food will increase in the future.

As soya beans are plant food, they are the easiest food for the people to get accustomed to as a source of protein supply. However, it is not possible to obtain all necessary protein nutrition from soya beans alone. In any case, it seems highly reasonable at this stage to increase production of soya beans and the processed food therefrom for supply to the people. For a more varied food diet and also for infants, milk, butter and cheese are indispensable. Although efforts have been exerted to improve the production of these items, self-sufficiency in supply has not as yet been obtained so that a considerably large extent of importation has been carried out. The difficulty in the improvement of productivity in this field is the fact that the land in Sri Lanka available for cattle raising is limited and also that fodder supply has been suffering from a shortage. Another reason is that the processing facilities for the production of such dairy foods are not substantiated. Eggs have a high nutritional value and therefore they are one of the highly potential

sources of protein which are subject to the least extent of religious restrictions, however, self-sufficiency in the supply of the eggs has not yet been established. As it is considered that the self-sufficient supply of eggs can be easily attained if the feed can be amply available, it is desirable that the feed problems be solved and the establishment of a poultry industry should be developed. As Sri Lanka is an island country and a number of irrigation water tanks and connecting water-ways are existing inside the land, fish resources are highly potential. On the other hand, due to the climatic conditions, it is difficult to store fresh fish for a long period of time. Therefore, such industry as to process fish meat in the form of preservable food is highly desired.

2-6 Processing of vegetables and fruit

2-6-1 Present Situation

In the event where the supply of vegetables and fruit is increased and as the diet of people becomes more versatile, the agro-based industry for the production of processed food using these items as raw materials will be possible. However, at present this type of industry in Sri Lanka is still at a very early stage of development.

2-6-2 Problems

The first and foremost problem in this respect is the fact that no sufficient quantities of vegetables and fruit are being produced. As versatile types of vegetables and fruit are planned on an intensive cultivation method in the new yearly plan, a considerable improvement is expected in this field.

The second problem seems to be the state of underdevelopment of the consumption market for such items. Unless and until the food diet and eating habits of the people of Sri Lanka are improved and also the consumption standard is enhanced, the domestic market for the processed vegetables and fruit products will not be developed.

Thus, for the time being, the production of the processed fruit items will have to be destined for export. The problems

pertaining to the containers when processing vegetables and fruit will be an important problem. It is therefore necessary that such containers as glass bottles, plastic-ware, tins, etc. should be supplied at a reasonable cost in accordance with the nature and characteristics of the processed foods in this field.

Presently, the tins for the canned fruit products are being imported from overseas. It is therefore another problem that the container industry of Sri Lanka be developed.

2-7 Other agro-based industries

The production of honey and bee wax by means of beehive operation is also one of the attractive industries for this country. Sri Lanka is rich in flowers and in the Wet Zone in particular, flowers are blooming throughout the year in coconut plantations. The hygienic honey and bee wax for use in dyeing needed in this country have so far been imported for the most part and statistically speaking, the production in Sri Lanka of these items have been counted as nil. The government of Sri Lanka is now exerting its efforts for the fostering and development of the beehive industry. If this enterprise should prove successful, it would not only contribute to the saving of foreign exchange but also will contribute to the national economy as one of the speciality items of this country.

Various types of handcraft products are also potential in the cottage industry for the souvenir market and also for export. Presently, wood carved items, woven textile goods and rattan crafts are being produced, however, the methods and product design still leave a great deal to be desired. Therefore, it is recommended that the production method and the commodity design be introduced from overseas in order to develop the standard of quality.

2-8 Textile Industry

2-8-1 Present situation of textile industry

At present in Sri Lanka, a small amount of rainfed cotton is being produced in Hambantota district in addition to coir and kapok fibres as the textile raw materials. The amount of such domestic production is extremely low so that large quantity of cotton, regenerated fibres and synthetic fibres have been imported in the form of raw materials, spun yarn, woven fabric or finished products. According to the Ceylon Customs Returns, the trend of the textile trade for the period of 1960 to 1970 is as shown in Fig. V-2. Although a large extent of irregularities are present both in imports and exports, the imports have been showing a decrease because of the foreign exchange situation while exports on the other hand have been displaying a tendency to increase. Even so, the imports was Rs.210 million in 1970

and exports was Rs.56 million in the same year, so that imports amounted to approximately four times the exports.

Fig. V-3 illustrates the ratio of textile imports and exports as against the total imports and exports of Sri Lanka. As far as imports are concerned, the rate decreased to 9% in 1970 from 12% in 1960. Exports on the other hand have been maintaining a rather stable rate of 2% to 3%. The trend of the production amount of the textile items is shown in Fig. V-4. The production showed a remarkable increase from Rs.90 million in 1965 to Rs.210 million in 1970. The production amount in 1970 of Rs.210 million corresponds closely to the importation amount of the same year.

According to FAO, the per capita textile consumption amount is as shown in Fig. V-5. Although a certain extent of irregularities are noted from year to year, the level of 2.0 kg/capita was attained in 1969 and 1970. A regression line was inscribed in Fig. V-5. From this line, it can be noted that the per capita textile consumption amount showed an increment from 1950 to 1970 although the rate of increment was rather gradual.

Table V-11 shows the raw-material-wise breakdown of the textile consumption amount. It is obvious from this table that in 1962, the consumption was only for cotton and regenerated fibres.

However, from 1965 onward, wool began to be consumed. From 1966 onward, a considerable amount of synthetic fibre consumption started.

In the years 1969 and 1970, the consumption rate of various raw materials show that 70% is comprised of cotton, regenerated fibres and synthetic fibres each taking up 10 to 15% and the rest by wool. Table V-12 shows results of conversion made on the basis of raw materials of the per capita raw material-wise consumption amount for the year 1969 collected from the Ceylon Customs Returns (for the period from the latter half of 1970 onward, the amounts alone are described) and the Statistics of Industrial Production. (Those items for which no stipulations were made regarding the raw material, the technical judgements have been exerted to classify them as much as possible in accordance with the estimated raw materials. Those which could not be classified even then were proportionately allocated on the basis of the raw material-wise ratio obtained from items, the raw materials of which are clearly known.)

The data show that the per capita textile consumption is 2.0 kg., consisting of 72% of cotton, 16% synthetic fibres and 10% regenerated fibres, so that clear co-incidence with the FAO data for 1969 is noted. Table V-13 , was compiled on the basis of the Ceylon Customs Returns, the raw material-wise and form-wise classification of the textile importation for the year 1969. (The same method as employed for computing Table V-12 was also employed here.) According to the Trade Yearbook issued by the FAO, the year 1969 happened to show a decrease in cotton imports, however, when the compilation of data is made in accordance with the raw material, the importation in the form of raw materials (including the filaments of synthetic fibres and regenerated fibres) comprises only 18% of the total importation which is on an extremely low level. On the other hand, the importation of those items of higher additional values such as spun yarn, woven textiles and final products is considerably high. This tendency is especially conspicuous in the case of cotton which comprises a great portion of importation.

The distribution of textile products inside the country of Sri Lanka is largely undertaken by Lanka Salu Sala Limited, an enterprise established under the sponsorship of the government. This company monopolizes the selling business of imported textile products and also engages itself in the marketing of domestically produced textile products. At present, regarding the imported textile materials, the yearly per head procurement amount is controlled by means of the Textile Coupons (in 1971 three

coupons per person were distributed so that 5.5 meters per head were procurable altogether). Also, the domestically produced synthetic fibre products are all purchased by Lanka Salu Sala so that on the selling day of synthetic fibre Saree, the people are compelled to queue at the retailers' shops. Further, according to the Annual Report, the Central Bank of Ceylon, the representative domestically produced textile products are marketed at the wholesale price levels stipulated in Table V-14 . In view of the fact that the GDP per head in 1970 was Rs.940, it should be stated that the wholesale price level is extremely high. Further, in the case of shirting and suiting materials (Ceysilk), the 1971 price when compared with the 1970 price shows an increment of almost 30%. As mentioned above, the distribution of textile products is now being semi-controlled by the government due to the adverse foreign reserve situation. Therefore, the present situation is that the people's desire for the consumption of textile materials and products is not being sufficiently satisfied. Generally speaking, in the so-called developing countries, the synthetic fibre consumption has been showing a sudden increase and consumers recognize and acknowledge the advantages of synthetic fibre products, however, the notion of these products being luxury items strongly persists in the minds of the people so that generally no positive or aggressive views are being taken by the converting enterprise people concerning the processing of synthetic fibre materials. In view of the climatic conditions of the country, the utilization of synthetic fibre products is fully possible. Although at present the consumption of the material is

stagnating due to the foreign currency situation, if the position changes favourably, it is obvious that penetration of synthetic fibre will gradually be carried out among the consumers.

7-8-2 Problems of the Textile Industry in Sri Lanka

There are several problems which can be pointed out as being present in the textile industries of Sri Lanka, the major ones being as follows.

(1) The production of textile raw materials is close to none, the supply being entirely dependent upon imports.

(2) Large quantities of intermediate products and final products to which the value additions have already been made are imported and imports in the form of raw materials are extremely small.

(3) The productivity in the textile processing industry is low.

(4) The shortage and lack of spare parts and components in power loom mills and the shortage of spun yarn in hand loom mills are very conspicuous so that the operation rate of looms is low.

In other words, Sri Lanka has the soil and climatic conditions under which cultivation of 'irrigated cotton' can be undertaken, however, the actual production in this respect is almost zero. Therefore, the supply is presently dependent entirely upon imports. As is shown in Table V-13 , 4.5% of imports is made in the form of raw materials in the case of cotton, 70% in the case of synthetic fibres and 18% in the case of regenerated fibres. This situation may be due to many causes in addition

to the shortage of processing facilities of fibres, however, in view of the fact that the textile industry is generally labour intensive and this industry is highly favourable and advantageous to undertake in such countries as Sri Lanka where labour forces are abundant and labour costs are low, it should be seriously considered that the promotion of this industry be undertaken in this country where the unemployment rate is rather high. At present, considerable facility expansion is being undertaken in the processing facilities for textiles and it is expected that by the end of 1973, the production capacity will be achieved as shown in the attached Table V-7. Therefore, concerning cotton spinning, the production capacity will enable the fulfilment of 90% of the domestic demand within this year and in cotton woven fabric production almost complete fulfilment of domestic demand will be materialized. Concerning the cotton fabric dyeing and finishing, approximately 75% of the domestic demand will be satisfied by means of an expected increment in the production capacity. Further, two new mills for cotton spinning and some expansion of the facilities in the dyeing and finishing field are also projected so that, in the near future, the fulfilment of domestic demand will be sufficiently undertaken.

As one of the examples of the low level of productivity in the textile industry in this country, the case of cotton spinning is shown in Fig. V-6. The productivity of spinning in Sri Lanka is deemed to be 50% to 70% that of Japan and the main cause for this fact is the low efficiency.

Therefore, for the future, along with the reinforcement of spinning facilities, efforts and counter-measures for the enhancement of productivity is especially necessary. The deterioration of looms in powerloom mills due to the lack of spare parts and an increasing number of the suspended machines in handloom mills due to the lack of spun yarn are both conspicuous, especially in local areas. The shortage of spun yarn in handloom mills is especially grave. As the result of a visit to those mills by the survey team, some instances showed that the loom suspension rate reached almost 50%. There were other cases where a two-shift operation was switched to a one shift operation due to the shortage of spun yarn. Sri Lanka takes up the promotion of handloom industry in the Five Year Plan, however, it seems necessary primarily to supply spun yarn for the time being to the existing mills in sufficient quantity and with stability in order to enhance their productivity. For this purpose, it is also necessary to undertake an improvement in the quality of spun yarn. The expansion of the handloom industry will greatly contribute to the expansion of employment opportunities, however, the productivity of the handloom cannot be compared with that of the powerloom at all. Therefore, except in the case of weaving special products

which call for unique handloom characteristics, what must be pointed out as a questionable point is that the governmental plan of aspiring for producing by means of handlooms, such products as grey clothes for Batik, shirting, sarees, etc. which should normally be turned out by powerlooms.

3. Forest Industry

3-1 Background of Forest Industry

Although there used to be a private forestry in Sri Lanka, present status of forestry is that it is totally government-owned. The forests which are the subject of this industry in Sri Lanka are roughly divided into two kinds, the so-called tropical rain forests in the south and the tropical dry forests in the north. In ancient times, Sri Lanka's culture developed in the northern part of the island so that is probable that the northern forests were utilized then, however, along with the development of the southern part of the country in the modern ages, a conspicuously high extent of utilization of southern forests has been undertaken.

3-1-1 Forest Administration and Development Projects

The presently undertaken forest administration by the government can be roughly classified into the following categories.

(1) Researches, studies and guidance concerning administration, protection, replanting and other general subjects regarding forestry.

(2) Researches, studies and guidance on production, utilization and related facts of forest products.

For the purpose of implementing above (1), Forest Department

was installed at the central authorities and the branches of this office are stationed in local districts.

State Timber Corporation and Plywood Corporation have been established for implementing above (2). Most of these organizations have production facilities and sub-organizations in local areas.

Concerning the present status of forests in this country, preliminary research surveys were conducted in 1961. The results of such surveys are compiled in the "Forest Inventory". According to this document, the present status of the merchantable trees stock in Sri Lanka is as shown in Table V-15 . In order to improve the present situation in which a certain portion of these forest products consumed domestically have so far been entirely dependent upon imports, the government authorities concerned are exerting their utmost efforts for the reinforcement of the forest industry in Sri Lanka. Greater efforts will necessarily lead to an increase in the cutting volume. Therefore, forest replantation after felling and the fostering of woods will be absolutely necessary. These activities have been undertaken by the authorities as the basis of forest industry (including the anticipated pulp manufacturing industry which could emerge in the future).

3-1-2 Forest Industry Five Year Plan

According to the Five Year Plan, in addition to the installation of forest routes of 417 km per year and wood felling of 6 million ft^3 per year, the utilization of materials which are to be completely harvested in accordance with the Mahaweli project is planned, together with the utilization of the wasted rubber trees

which will be produced for the purpose of increasing the forest yield. These projects are now being undertaken by the government. By means of these projects, the tea boxes, 75% of the yearly quantity of which has so far been imported, will be domestically supplied by 1974, and at the same time, the government is endeavouring to acquire self-sufficiency in the supply of structural woods and furniture woods, the demand for which is expected to increase in the future. Forest plantations of such light and soft woods as teak, eucalyptus, pine, jack , mahogany, etc. are also being planned in order to carry out forest preservation.

It is planned that the yearly area of replantation will be 6,500 ha. for the new plantations.

In order to cooperate with this project, despite the fact that the machinery industry is rather delayed at present, a certain portion of the project is being implemented gradually and the progress in the production increment of tea boxes and the new plantation of teak woods are especially remarkable.

3-2 Consumption and Production (including importation)

3-2-1 The present status of consumption and production in accordance with FAO materials*

The present status of consumption and production of forest industry products are as shown in Tables V-16 to V-22.

*"Pre-investment Study on Forest Industries Development/Ceylon: 1969, UNDP/FAO (FAO/SF: 60 CEY-5)".

3-2-2 Demand Forecast

On the basis of the above statistics, the total of the forest products in the year 1975 will be roughly as follows:

(1) Logs equivalent.....4,928 thousand ft^3
(Products 2 464) ... Domestically consumed materials

(2) Logs equivalent.....$1,040^8$ thousand ft^3
For plywood to be consumed domestically

(3) Logs equivalent.....18 thousand to ft^3
Imported raw materials for fibre

(4) Logs equivalent.....3,341 thousand ft^3
Imported raw materials for pulp

(5) Logs equivalent.....3,900 thousand ft^3
Logs to be consumed domestically

(6) Logs equivalent.....124^5 thousand ft^3

Material woods for use as fuel

Total 12,352.3 thousand ft^3

However, the imports have been made in the quantity of 626,000 ft^3 for processed wood materials, 18,000 ft^3 for fibre board and 3,341,000 ft^3 for pulp, totalling 3,985,000 ft^3, it is estimated that the utilization of the domestically produced products will be 12,352,000 ft^3 minus 3,985,000 ft^3 equals approximately 8,367,000 ft^3. The demand forecast values on the forest industry products are as shown in Table V-23 . The required material wood amount to cope with the above-mentioned demand is shown in Table V-24 .

3-3 Forest Industry

The forest industry on the foregoing backgrounds can be roughly described as follows.

The location of the mills and factories are shown in the attached Fig. V-4.

3-3-1 Sawing

According to a survey conducted by the FAO in 1969, the situation in this field is as follows.

Where electricity is used as the prime moving power: 74 plants

Where diesel engines are used as the prime mover : 111 plants

Total : 185 plants

Average per mill raw material wood processing quantity

: 36,300 ft^3 ...*18,800 ft^3

Maximum per mill raw material wood processing quantity

: 146,000 ft^3...*60,570 ft^3

Minimum per mill raw material wood processing quantity

: 22,900 ft^3...*14,400 ft^3

*Accumulation of processed materials

1.	Average per mill number of workers	: 12 persons
2.	Maximum " " " " "	: 52 persons
3.	Minimum " " " " "	: 6 persons
1'.	Annual operation	: 213 days
2'.	Maximum operation	: 294 days
3'.	Minimum operation	: 144 days

Of the above mills, approximately 150 employ the old-type manual pushing type circular saws, however, some employ band saw machines with a sliding bed. In 1970, an excellent modern machine was installed in the integral forest industry plant of Avissawella (producing plywoods, sawing, chipboards production and woodworking). The wood processing capacity in 1969 was on a low level due to the insufficiency of the facilities, shortage of raw material logs, insufficient employment of labour forces, etc. The operation rate then was approximately 60% of the full capacity. It is also considered that this situation was due partly to the excessive varieties in the types of material woods to be processed. The raw material woods are different from each other depending upon whether they are originated in the Dry Zone or in the Wet Zone. Qualitatively, the Dry Zone woods are heavy and hard in general and in terms of shape, they are smaller in diameter and shorter in length (the average diameter of the Dry

Zone materials is 33 cm and that of the Wet Zone materials is 38 cm. The average length figures are, 397cm and 458cm, respectively.) The first place in the classification of the processed materials is taken up by the construction wood materials, followed by the packaging materials (mostly for making tea boxes) and the furniture materials.

3-3-2 Wood based panel industry

In Sri Lanka these industries are already existing except for the fibreboard industry.

(1) Plywood industry

The operations of the Gintota Mill commenced in 1941 and by 1969 a part of the Avissawella integrated mills was also started (construction commenced in 1968). At present, all the departments except the Woodworking Department are undertaking production operation. Regarding material woods consumed in these mills, a slight amount of Satin and Hulanhik produced in the Dry Zone is blended, however, for the most part the material obtained from the Wet Zone is employed. The consumption amount of the former is approximately 1.2 million ft^3 per year and the latter 4.0 million ft^3 per year. The production amounts of the above-mentioned plants are 30 million ft^2 in the case of the Gintota Mill (converted into 3-ply products) and 75 million ft^2 in the case of the Avissawella Mill. In the case of the latter, the adjacent saw mill and wood working mill are jointly supplying the waste woods to the chip mill which is also attached to the integrated mills. In the actual achievements made as of 1972 by the chip mill, 2,031 workers were employed and produced

plywoods of 23,324,783 ft^2. The facilities of the Gintota Mill are now becoming obsolete and improvements and rehabilitation are required in several parts, however, the Avissawella Mill possesses modern and excellent facilities so that full-fledged operation of this mill is highly anticipated.

(2) Chip board industry

In 1968, construction of a chip board mill was commenced adjacent to the above-mentioned Avissawella plywood mill and operation started in 1972. As mentioned above, the operation of this chip board mill was undertaken by utilizing the above-mentioned raw materials. Although the actual achievements made so far are not revealed, the production capacity is said to be 318,000 ft^2 (3/4" thickness, 3-ply).

3-3 Pulp and Paper Industry

A wrapping paper mill was first installed in Sri Lanka during World War II by employing waste paper as the raw material. However, after the war, wrapping paper products began to be imported so that this mill has since closed. Thereafter, commencement of production was undertaken in 1958 at Valaichechenai. It is also planned that a No.3 mill is to be opened in Embilipitiya. The main materials employed in these mills are domestically produced straws. Some portion of chemicals (Kaolin, caustic soda, chlorine) can also be supplied domestically. The annual production capacity of the Valaichechenai mill (printing paper and writing paper) is 10,500 tons. The raw materials are collected

from neighbouring areas and water is led from the Vakaneri tank and the Pimburettewa reservoir.

The paper board mill constructed adjacent to this mill started its operation in 1972 and the yearly production capacity of paper board for packaging is 12,000 tons. For this production, long fibre pulp is being imported from Europe for the yearly amount of 35,000 to 40,000 tons. In the vicinity of the Embilipitiya Mill, which is now under construction, there are a number of farmers' houses thus facilitating the collection of raw material straws. Therefore, high efficiency of operation in this mill is strongly expected. It is scheduled that the annual production scale of this mill is 15,000 tons.

3-3-4 Future projects

The following projects are being scrutinized in order to cover the demand stipulated in the above-mentioned Table V-23 .

(1) In order to sufficiently self-supply the demand amount in the lumbering sector, production of 15.6 million ft^3 is planned. This is approximately four times the 4,928 million ft^3 realised in 1965. For this purpose, the development of yet unutilized wood resources is planned in addition to the increment in the felling so far conducted in the Wet Zone. Considerations are also being made for the increase of felling of the Dry Zone forest resources. The reinforcement of the existing saw mills in the Dry Zone is also planned. In other words, both the felling increment and the expansion of saw mill capacities are

contemplated.

(2) In the wood based panel industry, it is planned not only to sufficiently self-supply the tea boxes which have so far been largely relying upon imports, but also to fulfil the increment in the demand within Sri Lanka in the future so that by 1975, consumption of 4.0 million ft^3 of raw material wood is planned to be undertaken. This figure is approximately four times the amount achieved in 1965. For this purpose, development of the yet unutilized raw materials in the Wet Zone and an increment in the felling of the forest resources in the same zone will be undertaken. This implies an increment in felling and the full capacity utilization within the framework of the existing mills.

(3) In the pulp and paper production sector, the self-supply of raw materials for newsprint paper (2.6 million ft^3) will be made by utilizing long fibre materials the plantation of which is now being undertaken. Concerning the writing paper raw materials (2.7 million ft^3), 40% of the total quantity is planned to be self-supplied by utilizing wood material pulp. Concerning the rest of the paper product raw materials, total importation will be undertaken for the time being. The raw material for producing paper board (1.4 million ft^3) will be supplied by means of the plantation of wood materials in high-elevation zones. In short, for the pulp industry, the felling of 4.9 million ft^3 of coniferous softwoods, and 4.1 million ft^3 of none-coniferous hardwood is expected. This implies that the project is to be undertaken on the

basis of the raw material wood which will be obtainable by means of plantation and the conversion and the processing capacity which would be made available by newly installed facilities. In view of the foregoing, the concrete estimation is already established of self-sufficiency in supply in the near future in Sri Lanka's forest industry except for the pulp industry. It is obvious that these projects require a large extent of felling (approximately four times the conventional level) from not only the natural forests but also from the planted forests, in spite of the fact that no expansion of the processing facility is required except in the sawing. This obviously signifies that felling facilities having approximately four times the conventional capacity will be required.

3-4. Problems in Forest Industry

The important factors which will greatly affect the status of the forest industry are the following.

Quality, quantity and the conditions of forest resources, supply/demand balance of the industrially produced forest products, industrial technology and facilities, and the capital to be invested.

Sri Lanka has been developing the forest industry with the objective of attaining self-sufficiency in supply of forest industrial products, and further efforts are being made for the eventual development of the industry to undertake exportation of the products.

During World War II, Sri Lanka once undertook paper manufacturing operations, however, such did not prove successful due to a defeat in competition with the imported paper products. This situation existed in various countries and this fact implies the importance of economy in carrying out an industrial operation.

Some artificially planted forests exist in Sri Lanka at present, however, the resources which are the subject of the present projects are mostly natural forests. This signifies that not all the available resources are suitable for application as raw materials for various forestry industrial products.

Depending upon the conditions of the existing forest resources, not all the available materials are fit to be employed as industrial raw materials.

There are several countries where the resource conditions are satisfactory, however, full utilization of the resources is not carried out simply because of the lack of funds or insufficiency in the available technology and facilities. Even in such countries, along with the development of the national economy, the demand for forest industrial products is increasing and therefore it is a general tendency in recent years that this particular sector of industry is being highly promoted. There are a number of factors in Sri Lanka which may impede upon the trend of forest industrial development, however, there are other numerous factors which contribute to the promotion of the industry.

(1) Impeding factors

As the whole country is now at the stage of development economically, the overall industrial level is still low. Thus, such adverse conditions as the insufficiency of technology and facilities, lack of funds, extreme insufficiency of domestic demand, etc. are present.

(2) Promoting factors

Utilizeable forest resources are present, therefore, the level of demand for producing tea boxes is amply fulfilled. A number of forecasted demand increase factors are present, for tea boxes in view of short term forecast, and industrial forestry products for general application in the long term. The government of Sri

Lanka is promoting this sector of industry with special emphasis.

The present status of the forest industry development in Sri Lanka appears to be moving towards the removal of the above-mentioned impeding factors, however, it also seems that the mode of development is not necessarily in line with the unique resource conditions existing in this country, (e.g. in spite of the fact that in the Dry Zone, there are a number of valuable wood species which are not available outside Sri Lanka, no significant industry has so far been developed by fully utilizing such materials). Also, in view of the present status of the forest industry production operations (although no details were available for the present survey), the following points attracted the attention of the survey team.

a) Generally speaking, the supply of the raw material woods to mills displayed a shortage.

b) Except for the Avissawella mill which has the most modernized operation, a number of facilities are of the old type mainly designed for treating of evergreen coniferous soft woods. Most of them are already obsolete and have definite signs of production capacity deterioration.

c) Further to the above point, there are a number of cases in which a shortage of machine parts and components is apparent and insufficient employment of labour force was present.

d) Each one of the existing mills seem to have been suffering from industrial prime-mover energy.

e) There were frequent instances of insufficient coordination between and among the mills and the cases of inadequate operation administration.

The following are the comments made by the survey team in relation to each of the above-mentioned points.

a) In the forest industry, the shortage of raw material woods will particularly affect efficiency of production. In Japan, the production of raw material woods is not necessarily geared directly to forest industrial mills, however, in the case of Sri Lanka, the production of raw materials and the processing mills are more directly connected. Thus, it is recommended that, along with the improvement in the facility performance of the mills themselves, the felling efficiency of raw material wood should also be carried out. The larger the scale of production becomes, the higher the capacity of the raw material wood felling capacities. It should be noted that the basis of the forest industry is the adequacy of the felling operation.

b) When compared with none-coniferous hardwoods, the coniferous softwood materials are easier to process owing to their general softness and roundness in shape. The presently operating sawmill machines are of the types which were designed to process mainly softwoods such as these. Therefore, when hardwood materials are treated by this type of machine, the frequency of malfunctioning will be higher and the extent of machine wear will be much more conspicuous. The operation will thus deteriorate and the finish of the products will become irregular, thereby doubly deteriorating the work operation efficiency. Therefore, the adoption of improved machines designed to handle hardwood is desirable, however, if financial situation does not permit, improvisation for modification on the basis of past experiences seems to be in order.

c) It is generally true that the parts and components of old machines are harder to obtain than in the case of newer machines. Especially in the case of Sri Lanka where no machinery manufacturer is existent within the country, it is natural that the operating factories are always suffering from the shortage of machine parts and components when they are worn.

It is therefore recommended that such machine parts and components as are prone to wear be promptly substantiated by means of procuring ample spare parts in advance.

Avoidance and reduction of cases of operation shut-down because of parts and components shortage will greatly contribute to the achievement of complete employment of the labour force.

d) The prime moving power for mills and factories should be completely substantiated at the time of construction and, in the case of shortage of the power, some remedial action for increment thereof must be promptly undertaken.

e) In order to enhance the efficiency of industrial production, it is necessary that all the sectors of industries maintain close communication. For instance, if the operation of log producing sector is suspended for certain reasons, it is important to carry out the repair servicing to the facilities of the mills taking the opportunity of such a shut-down in operation. Effective arrangements to enable such undertakings must be put into practice after mutual coordination among the administrative personnel in charge of each sector of the industries.
The employees on the other hand are required to be accustomed to the systems which are related to their own assignments and functions of their work. Within a factory, the complete employment of employees will display the full performance of the factory capabilities so that the management should always take this point into consideration in allocating and supervising the employees. Further to the above, the following problems can be pointed out.

f) Room for the improvements in the utilization aspect of the forest resources,
As has been discussed in clauses pertaining to the demand forecast, in spite of a sudden increase in the demand for the wooden

products in Sri Lanka, very few short-length, small-diameter logs are found among the logs stored in the storage yards of saw mills. This fact seems to imply that small-diameter log materials are not fully utilized even if they are harvested by cutting. (In the temperate zones, the logs over 180cm in length and 10cm in diameter are used as industrial logs.)

In spite of the fact that the so-called valuable wood materials grown in the northern part of the country are the high valued materials having rarity values and are well known even in the overseas markets, it seems that they have not been destined for the application to production where higher economical effects can be obtained therefrom.

g) Insufficiency in the cutting section

The cutting operation which is the initial step in the industrial utilization of forest resources has a great influence not only upon the forest maintenance but also on the operation of the forest products industry as a whole.

Defective cutting operations not only increase the production cost of the log materials, but may also cause production of defective (damaged) wood materials and instability in the supply of the log materials to the forestry industrial mills and factories, thereby eventually presenting an impediment which will affect the perfect utilization of forest resources and the maintenance of the resources. Therefore, as in the case of the other sections of the forestry industrial sector, the cutting section should also be substantiated under a well planned schedule in such points as techniques, facilities, and equipment for use in the operation.

4. Mineral Resources Utilizing Industries

4-1 Outline of the Mineral Resources

The outline of the geological structure and the present situation of the production of mineral resources in Sri Lanka are as follows:

4-1-1 Geological Structure

(Refer to Attached Fig. V-5)

The geological structure of Sri Lanka can be classified into the following major categories.

(1) Central Area: (Including the Mahaweli Area)

In view of geological chronology, this area is said to belong to the pre-camblian era approximately 200 million years old. This is the meta-sedimentary rocks of advanced dynamometamorphism, thermalmetamorphism and a long period of weathering. The southern half from the central area is deemed to have been formed by the intrusive rocks and produces gneiss influenced by the igneous rocks which are considered to be the intrusive rocks produced in the shape of blocks. A partial emergence of charnockites and pegmatite granites are also noted. Due to the fact that the mother rocks are originally aqueous rocks, the crystalline limestone layer's vein status is running from north to south covering the whole part of the central area.

Useful mineral resources produced in Sri Lanka at present are mostly turned out from the land blocks occupying the central area of the country.

2) South Eastern Area and North Western Inlands

In view of geological chronology, no clear demarcation can be made from the above-mentioned central area in the geological structures. This area also consists of the pre-camblian rocks which are advanced in dynamic and thermal metamorphism. Most of the rocks produced here are made of biotite-hornblende gneisses and in comparison with the central area, it is considered that the rocks in this area are considered to have been formed as a result of pyrogenetic activities. As the rock forming mineral substances, the main portion is comprized of biotite and hornblende. In the southern area, a metamorphic rock belt similar to that in the central area is present.

3) North Western Part Cenozoic Era

The Pliocene formation are running northeast to southwest on the inner side closer to the central area and the Miocene formation are surrounding the above area stretching up to the north-western shores. This formation implies a status of an inversed structure. The main rocks here are the coral limestones which contain fossils. Further, the Mesozoic formation are discovered on the western shore of the middle area in scattered status, however, it is not as yet confirmed as to whether these are the upper formation for the south-eastern area. As far as the over-all observation of the above-mentioned geological considerations is concerned, it is not

expected that the iron, copper, lead, zinc, etc. will exist in large deposits. It is rather expected, that the secondary ore shoot formed as a result of the weathering of the Miocene and the Pliocene Formation or small-scale contact metasomatic deposits formation based on the intrusion of the igneous rocks of unknown age will be located.

4-1-2 The Production Status of Useful Mineral Resources

(1) Quartz

Quartz are mainly produced in the south eastern area of Sri Lanka and vein type quartz are produced in the southern portion of the central land blocks in such locations as Opanaike, Pelmadulla, Pussela, Rattota, etc.

(2) Feldspar

The microcline feldspar is produced in the central and south-eastern areas such as Rottota, Talagoda, etc. Open pit operations of exacavation of this material is being undertaken by the Ceylon Ceramic Corporation at present in Talagoda.

(3) Industrial Clay

Kaoline:

This material is formed by the slaking of the rocks of the pre-camblian era. This material is produced in the central high-lands. The largest deposit is in the Nugegoda-Boralesgamuwa

Deposit which forms a 122 to 610 cm thick layer. The Meetiyagoda Deposit stretches over 8 to 9,6 km and exists from the layer 122 to 305 cm from the surface down to 12 m depth.

Ball-clay:

This clay is produced in a massive form. The Ceylon Ceramic Corporation is now excavating this material in Boralesgamuwa.

Other ceramic industrial materials: Other materials include zircon, monazites, magnesites silimanites and graphite which are all produced inside the island.

(4) Graphite:

Sri Lanka used to be a monopoly supplier of graphite in the world graphite market. Graphite produced in Sri Lanka contains low extent of impurities and the grade is therefore high. Graphite still constitutes one of the most important mineral resources of the country. Except for Kebitigollawa in the northern central area, most of the graphite productions are undertaken in the southern half for the central land blocks and also in certain north-western deposits, a part of which comes adjacent to the Mahaweli area. Particular deposits in this area are located in Regedara, Mipitiya, Naramana, etc.
The type of deposit can be classified into two categories, i.e., the vein type graphite which is co-produced with pegmatite and the flake type graphite existing as the secondary ore shoot.

The exportation of graphite has been decreasing historically as shown hereunder, however, the price has nevertheless been showing stability.

1916:	33,411 tons
1942:	27,734 tons
1967-1969:	10,000 tons

Further, the produced graphite has been exported as they are excavated and no significant graphite utilizing industry in Sri Lanka is existent.

(5) Mineral Sand and Silica Sand:

These materials are the so-called sea sands which are not available in the Mahaweli area. Therefore, when using these materials as the ceramic products raw materials, it would be necessary to transport them into the area from outside.

The available resources of this category include ilmenite, rutile, zircon, mozanite and silica sand.

(6) Limestone and Dolomite:

Two types of limestone are produced in Sri Lanka, i.e., the Miocene Formation (from the northwestern area land blocks) coral limestone and limestone produced in the metamorphic rock land blocks in the central area.

a) For the cement industry, the Miocene layer limestone is widely employed because of the easiness in excavation and advantages in the quality and economy. One factory utilizing it as the raw material exists in Kankesanturai and another in Puttalam.

b) The central area limestone is crystalline in quality, however, the deposit area is surrounded by Quartzite, gneiss formation, etc. (Kandy, Male, Nalanda, etc.) The mixing of MgO, dolomite, etc. is frequently noted and also the transitional status of the materials shifting from limestone to dolomite is also frequently noted. Especially, the blending conditions of MgO is said to range from a slight extent up to 20%.
Also, limestone produced in the high lands are locally called the "Kankar" which shows an advanced degree of weathering.
The utilization of limestone produced in the central area is mostly used as construction material lime so that kiln facilities are equipped in Kandy, Matale, Nalanda, Badulla, Wollimade, Ratnapura, etc. Further, the co-produced magnesite is utilized as a special flooring material, (temperature resistance from 700°C to 1,000°C) or as refractories or lining materials (for 1,500°C or over), however, it seems that there is no industrialization in the production of these materials.

(7) Mica

Mica deposits are distributed in the area ranging from the middle portion of the central area land blocks to the southern portion. Of the mica materials, the economically important materials are the muscovite, however, the scrap mica, which can be utilized as a wall surfacing material in the construction or as lubricants, painting materials, etc.

(8) Gemstones

Gemstones produced in Sri Lanka are highly versatile and the richness of the variety is considered to be rather rare in the world. Corundums, crysoberyls, Beryl stones, topazosemes, noble tourmalines, garnets, spinels, zircon, quartz, etc., are among the varieties. The main deposits are found in the sourthern portion of the central land blocks and also small scale deposits are located in Elahora, Kaluganga, which are adjacent to the Mahaweli area. The deposits are the sedimentation layer of gem gravels layer and the formation is considered to have been made as a result of river-bed sedimentation, weathering and the effects of water.

Yearly production of gemstones in Sri Lanka was 60,000 ~ 196,000 carats (1963 ~ 1968 period)

Foreign exchange of Rs. 4 million has been obtained through exportation of the gemstones.

(9) Iron Ore

a) Limonite

Limonite is concentratedly produced in the south-western portion of the central land block and the deposit reserve is estimated to be in the order to 2,200,000 tons. However, the present status of production is made in the form of scattered deposits of small scale of approximately 10,000 to 150,000 tons each, the production therefore is considered to be not quite viable economically. The deposits are considered to be the secondary shoot.

b) Magnetite

The Panirendawa and Wilagedera Deposits which are located in the vicinity of the west central ocean are secondary shoots. Together with the Madampe Deposit, the reserve is estimated to be 5 million tons. On the other hand, the magnetite produced on the border line between the central land block and the south-eastern land block accompanies Skaln Mineral so that it is considered to be a contact metasomatic deposit.

c) Mooloya Deposit

This deposit exists slightly to the south of Kandy and the economical viability of this deposit is now being surveyed.

4-2 Outline of Mineral Resources Utilization

Table V-25 to V-29 shows the statistics pertaining to the mineral resources utilization in the year 1970. In the exportation which is the primary objective of Sri Lanka, the achievement of Rs. 17.8 million was made by exporting graphite, ilumenite, etc. as shown in Table V-25 . As is obvious from a comparison with the production statistics shown in Table V-28 , these items were exported directly after production, thereby achieving very little domestic consumption. In other words, positive processing industry of these mineral resources do not exist in Sri Lanka as yet. For instance, graphite utilization amount was less than 200 tons in 1970 for the production of pencils, electrical batteries, casting materials and electrical appliances. (According to the State Graphite Corporation). Therefore, the government and the Corporations are now laying out several projects for the establishment of the processing industries of these materials for the increment in the value addition to the resources with an ultimate purpose of acquiring foreign exchange.

The projects are as follows:

(1) The Ceylon Mineral Sands Corporation

Under the cooperation from the Asia Development Bank, the reinforcement of the existing production facilities (the separation of the facilities) is being contemplated and it is

reported that the selection of a consultant firm is being undertaken for the establishment of the rationalization of excavation processes and the substantiation of the processing industry.

(2) The State Graphite Corporation

The feasibility studies for the purpose of establishing the graphite utilizing industry, i.e., manufacture of melting pots, etc., have been conducted and completed upon the basis of an economic cooperation agreement concluded between Sri Lanka and India. It is reported that at present, the Corporation is seeking an overseas joint venture partner through whom the export market of the products can be secured.

Also, concerning mica, it is said that the schedule is already made for the dispatchment of consultants from India concerning the excavation and processing of this material.

(3) The Ceylon Ceramic Corporation

A joint venture company was established under the participation of Noritake & Co., Ltd. of Japan including the objectives of exportation of the chinaware. (25% capital from Japan and 75% by the Corporation). It is scheduled that commercial operation will be commenced by the end of 1973. (Production capacity: 1,000 tons of chinaware products)

4-3 Concerning the Mineral Resources Excavation Rights

The bill pertaining to the mining industry and the mining deposits which was submitted to the parliament on 7th December 1972 was duly enacted in January 1973.

The outline of this act is as follows.

(1) Mineral resources except for water, hydrocarbons, gemstones and radio active minerals, shall belong to the government.

(2) Trial excavation, excavation, processing and selling (including exportation) shall be undertaken solely by the parties so authorized under this Act.

(3) The authorized parties are obliged to receive supervision and auditing by the governmental agency (The Director of Geological Survey) regarding the productivity and the production amount.

(4) The mines, as and when deemed necessary by the Minister of Industry, can be procured by the Corporation in accordance with the Corporation Act.

Following points can be derived by incorporating the comments made by the Director of the Geological Survey and the context of the above-mentioned Act.

1) The fundamental geological surveys shall be independently conducted by the office of the Geological Survey and the results obtained shall be publicized.

2) Parties who are interested in the data obtained in the above 1), can submit applications to the Director of the Geological Survey Office and if the procurement of the land is to be undertaken at the cost of the applicant and if the possibility risk is born by the applicant, the government will assist in the procurement of the land and any party can apply for such undertakings.

3) The produced mineral resources shall be purchased by the government or by the Corporation under the guaranteed terms and conditions.

Table V-2 Industrial Growth and Export

Year	1960	1963	1966	1967	1968	1969	1970	1971
Industrial Production (Constant Price) (Million Rs)	728	853	1,008	1,052	1,154	1,221	1,335	1,379
Growth Rate Over (Previous Year) (%)		7.1	7.6	4.4	9.7	5.8	9.3	3.3
Industrial Export								
a. Export (Million Rs) (Constant price)	73	73	70	80	88	89	122	128
b. Rate for Total Export (%) (Real Price)	4.1	3.8	3.7	4.0	4.3	4.5	5.9	6.3
c. Rate for Total Products (%)	10.0	8.6	6.9	7.6	7.6	7.3	9.1	9.3

Source : Central Bank of Ceylon
Ceylon Customs Returns

Table V-3 Development of Value of Industrial Production

(Thousand Rs)

	1967	1968	1969	1970	Simple average growth rate
1. Publication and printing					
2. Transportation-machinery	22,702	30,013 (32)	44,139 (47)	34,146 (-23)	18.6
3. Precision machinery	2,909	3,860 (33)	5,054 (31)	5,617 (11)	25.0
4. Machinery	23,703	55,212 (133)	83,393 (51)	81,919 (-1.8)	60.7
5. Electric machinery	23,513	27,042 (15)	48,015 (76)	58,866 (23)	38.0
6. Non-ferrous metal products	450	264 (-41)	382 (55)	858 (125)	46.3
7. Metal products	66,371	77,472 (17)	74,501 (-3.8)	76,389 (2.5)	5.2
8. Food products	425,397	521,007 (22)	611,190 (17)	625,489 (2.3)	13.8
9. Paper and pulp	18,681	16,030 (-14)	21,596 (35)	22,573 (4.5)	8.5
10. Fibre products	140,749	184,662 (31)	208,179 (13)	211,679 (1.6)	15.2
11. Ceramic, earthen and stone products	54,893	69,317 (26)	84,944 (23)	110,963 (31)	26.7
12. Rubber products	28,684	38,028 (33)	54,088 (42)	60,993 (13)	29.3
13. Petroleum	1,484	8,316 (460)	56,418 (580)	197,510 (250)	430
14. Chemical	134,137	164,134 (22)	139,779 (-15)	157,485 (13)	6.7
15. Iron and steel	18,009	28,597 (59)	43,643 (53)	54,317 (24)	45.3
Entire manufacturing industries	1,081,608	1,377,418 (27.3)	1,649,436 (19.7)	1,891,806 (14.7)	20.6

Note: 1. Value of production: Ex-factory price
2. Manufacturing industries: Public corporations and registered manufacturing industries
Source: Statistics of Industrial Production

Table V-4 District Classification of Private Rice Mills by Type of Milling Capacity and Availability of Storage

District	Total Mills	No. of Raw Mills	No. of P.B. Mills	Mills Doing Both	Capacity Below 10bu/hr			Capacity 11-25 bu/hr			Capacity 26-50 bu/hr			Capacity 51-75 bu/hr			Capacity Over 76 bu/hr			Number With Storage	Without Storage
					R	PB	RPB	R	PB	RPB	R	PB	RPB	R	PB	RPB	R	PB	RPB		
Colombo	68	1	50	17	-	17	16	-	8	1	-	14	-	1	6	-	-	5	-	43	25
Kalutara	43	13	13	17	6	4	15	-	3	-	2	-	-	1	1	-	4	5	2	19	24
Callo	27	25	-	2	6	-	2	6	-	-	7	-	-	2	-	-	4	-	-	17	10
Matara	88+69 (157)	157	-	-	108	-	-	7	-	-	31	-	-	8	-	-	3	-	-	69	88
Hambantota	149	149	-	-	89	-	-	17	-	-	23	-	-	12	-	-	8	-	-	84	65
Jaffna	96	7	78	11	1	13	4	3	34	4	2	27	2	1	4	-	-	-	1	84	12
Mannar	17	1	13	3	-	2	3	-	3	-	1	8	-	-	-	-	-	-	-	15	2
Vavuniya	34	7	25	2	2	2	1	-	10	1	5	12	-	-	1	-	-	-	-	30	4
Batticalo	44	8	32	4	-	-	-	1	5	3	6	19	1	-	2	-	1	6	-	37	7
Trinco.	37	2	26	9	-	8	7	4	2	1	2	15	1	-	1	-	-	-	-	20	17
Anuradhapura	79	9	61	9	1	3	3	-	8	4	-	31	2	2	18	-	6	1	-	64	15
Polonnaruwa	195	55	47	93	-	-	90	-	-	-	3	21	2	18	22	-	34	4	1	106	89
Aapara	57	27	29	1	2	4	1	1	13	-	3	11	-	3	-	-	18	1	-	50	7
Kandy	50	8	17	25	1	1	20	-	1	2	3	14	3	4	1	-	-	-	-	30	20
Matalo	20	-	12	8	-	-	6	-	2	1	-	9	1	-	1	-	-	-	-	14	6
Nuwara Eliya	3	-	1	2	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-	1	2
Kurunegala	204	5	162	37	4	46	35	1	74	1	-	26	-	-	7	-	-	9	1	120	84
Puttalam	20	-	14	6	-	6	5	-	3	-	-	3	-	-	1	-	-	1	1	12	8
Budulla	27	25	-	2	14	-	1	2	-	1	2	-	-	7	-	-	-	-	-	16	11
Monaragola	14	8	2	4	2	-	1	-	-	1	1	1	2	4	1	-	1	-	-	9	5
Ratnapura	50	20	5	35	8	-	35	1	-	-	2	3	-	1	1	-	8	1	-	25	35
Kegallo	43	-	22	21	-	2	18	-	8	-	-	11	2	-	-	-	-	1	-	21	22
Sri Lanka	1,444	527	609	308	244	108	265	39	174	21	93	226	16	64	67	-	89	34	6	886	558

1. P.B. ..... Parboiled

2. R ..... Raw

Source ; Paddy Marketing Board

Table V-5 Trend of Coconut Production, Consumption and Export Amount

(Million nuts)

Year	Production Amount	Domestic Consumption Amount	Export Amount
1966	2,630	1,601	1,029
1967	2,589	1,638	951
1968	2,778	1,675	1,103
1969	2,616	1,710	906
1970	2,447	1,573	874

Source: Five Year Plan Frame Work - Agriculture

Table V-6 Trend of Edible Oils and Fats Production Amount

(t)

	1965	1966	1967	1968	1969	1970
Butter (Incl. Cheese)	65	69	155	174	124	198
Margarine	3,309	3,850	3,564	1,977	1,779	2,220
Refined Coconut Oil	0	2,451	2,378	1,420	784	820
Animal and Vegetable Oils and Fats	0	0	163	1,489	783	1,774

Source: Statistics of Industrial Production

Table V-7 Import Amount Trend of Edible Oils and Fats and Industrial Castor Oil

(t)

		1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Edible Oils	Butter	1,487	1,744	1,609	1,554	1,531	1,000	1,228	908	1,013	1,486
	Margarine	362	555	706	424	430	30	9	3	41	77
	Vegetable Oil	33	0	10	116	4	806	1,060	1,006	580	1,397
	Animal Oil	0	0	1	0	0	0	1	0	0	0
	Total	1,882	2,299	2,326	2,094	1,965	1,836	2,298	1,917	1,634	2,960
Industrial Castor oil		125	128	131	126	179	198	236	112	93	126

Source: Calculated on the Basis of the Statistics of Industrical Production

Table V-8 Composition of Exports 1967-71

Commodity	Value in Rupees Million					Percentage of total exports				
	1967	1968	1969	1970	1971	1967	1968	1969	1970	1971
Tea	1,061	1,162	1,062	1,120	1,145	63	57	55	55	59
Rubber	282	331	431	440	307	17	16	22	22	16
3 Major Coconut Products breakdown of which	167	331	221	237	276	10	16	12	12	14
(a) Copra	18	34	26	23	24	1	2	1	1	1
(b) Coconut oil	88	133	108	116	149	5	7	6	6	8
(c) Desiccated Coconuts	61	164	87	98	103	4	8	5	5	5
Other domestic exports	121	152	161	198	202	7	8	8	10	10
Total domestic exports	1,631	1,976	1,875	1,995	1,930	97	97	98	98	99
Re-exports	59	60	41	38	17	3	3	2	2	1
Total	1,690	2,035	1,916	2,033	1,947	100	100	100	100	100

Source: Ceylon Customs Returns

Table V-9 Production and Import Amount of Sugar and Starch

(t)

		1966	1967	1968	1969
Sugar	Production	8,706	7,201	8,317	9,189
	Import	232,537	225,458	198,909	308,319
Starch (Sago Tapicka)	Production	-	-	3	4
	Import	1,615	1,703	2,787	2,078

Source: (Sugar) Five Year Plan Frame Work - Agriculture
(Starch) Industry Prospect Report IDB

Table V-10 Production Achievement of Sri Lanka Sugar Corporation

(t)

Factory \ Year	1968/69	1969/70	1971/72
Kantalai (Capacity: 21,000t)	3,653	5,478	8,000
Gal Oya (Capacity: 19,200t)	4,684	3,719	5,400

Source: Central Bank of Ceylon Annual Report 1971

Table V-11 Trend of Raw Material-wise Fibre Consumption Amount per Capita

(Kg/person, year)

Raw Material / Year	Cotton	Wool	Regenerated Fibre	Synthetic Fibre	Total
1962	1.3	-	0.4	-	1.7
1963	0.9	-	0.1	-	1.0
1964	1.8	-	0.2	-	2.0
1965	1.9	0.1	0.2	-	2.2
1966	2.0	0.1	0.2	0.1	2.4
1967	1.4	0.1	0.2	0.1	1.8
1968	1.4	0.1	0.2	0.1	1.8
1969	1.4	0.1	0.2	0.3	2.0
1970	1.4	0.1	0.3	0.2	2.0

Source: FAO Report (ESCR; FC 72/1)

Table V-12 Raw Material-wise Consumption Amount (1969)

Items / Material	Consumption Amount (t)	Rate (%)	Consumption Amount per Capita (kg/person, year)
Cotton	17,412	72.1	1.42
Wool	153	0.6	0.01
Regenerated Fibre	2,480	10.3	0.20
Synthetic Fibre	3,949	16.4	0.32
Silk	29	0.0	0.00
Hard and Bast Fibre	132	0.6	0.01
Total	24,155	100.0	1.96

Source: Calculated on the Basis of Ceylon Customs Returns and Statistics of Industrial Production

Table V-13 Material-wise, Form-wise Import Amount (1969)

(t)

Material \ Form	Raw Material	Spun Yarn	Fabrics	Products	Total
Cotton	697.5	5,667.1	6,397.8	2,768.6	15,531
Synthetic Fibre	2,775.8	217.3	167.6	788.3	3,949
Regenerated Fibre	449.5	105.4	1,538.6	386.5	2,480
Wool	0.3	103.9	3.4	45.4	153
Silk	1.7	11.0	0.6	15.7	29
Hard and Bast Fibre	13.7	5.4	83.2	29.7	132
Total	3,938.5	6,110.1	8,191.2	4,034.2	22,274

Source: Calculated on the Basis of Ceylon Customs Returns

Note; FY of Synthetic Fibre and Regenerated Fibre is included in Raw Material

Table V-14 Wholesale Price of Locally Fibre Products

Items	Unit	Average Price 1970	Average Price 1971	Change % 1971/1970
Spun Yarn 30S (Carded)	kg	Rs 10.0	Rs 10.9	+9
Cloth (L.M.D.) White	m	2.4	2.4	-
Coloured	"	2.6	2.6	-
Poplin White——→	"	2.7	2.7	-
Voile Printed fancy	"	3.1	3.1	-
Saree Fabric (Nylon satin)	"	7.3	7.3	-
Shirting (Polyester)	"	9.8	9.8	-
Dress Fabric (Nylon satin)	"	6.9	6.9	-
Saree (Ceysilk)	"	7.7	8.8	+14
Shirting (")	"	6.9	9.0	+30
Suiting (")	"	13.7	17.4	+28

Source: Annual Report Central Bank of Ceylon

Table V-15 Accumulation of Economical Forest Trees

Forest Type	Area		(A)	Total Cubage of the Forest Trees	
	ha	%	ft3	1,000 ft3	%
Wet Zone 7HW	11,576	0.4	9,150	105,920	2.3
" 7MW	46,648	1.6	5,903	275,340	6.1
" 7LW	103,500	3.6	3,658	378,551	8.4
" 7NW	63,184	2.2	1,540	97,303	2.1
Wet Zone Sub Total	224,908	7.8	-	857,114	18.9
Middle Zone 7M1	7,480	1.3	2,908	21,748	0.5
" 7L1	52,276	1.8	1,993	104,160	2.3
" 7N1	68,576	2.4	1,293	8,634	2.0
Middle Zone Sub Total	128,332	4.5	-	214,542	4.8
Dry Zone 7MD	150,384	5.2	2,743	412,428	9.1
" 7LD	1,252,096	43.7	1,753	2,194,298	48.4
" 7ND	1,047,836	37.6	773	831,701	18.3
Dry Zone Sub Total	2,479,116	86.5	-	3,438,427	75.8
High Land Zone 7M	13,600	0.5	1,725	23,460	0.5
Planting 7P	19,928	0.7	-	-	-
	2,865,884	100.0	-	4,533,543	100.0

Note: Fig.(7) indicates a classification number

H..... High Accumulation

M..... Middle Accumulation

L..... Low Accumulation

N..... Extremely Low Accumulation

(A) Cubage of forest trees per ha.

Source: A Forest Inventory of Ceylon

Table V-16 Consumption of Sawn Wood

Year	Supply from Forest Dept. (1,000 ft^3)	Import (1,000 ft^3)	Total Consumption (1,000 ft^3)	Consumption per Capita (ft^3)
1949 - 1951	1,022	450	1,472	0.19
1958 - 1960	1,416	190	1,606	0.17
1964 - 1965	2,151	313	2,464	0.22

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Table V-17 Ultimate Utilization of Sawn Wood

	Colombo District		Kalutara District	
	(1,000 ft^3)	(%)	(1,000 ft^3)	(%)
Structural lumber				
for houses	938	53	316	63
for others	88	5	7	1
Furniture use lumber	236	13	40	8
Packing use lumber	490	28	137	27
Others	27	2	—	—
Total	1,799	100	500	100

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Table V-18 Consumption of Plywood (Log equivalent)

Year	Tea Chests (1,000 ft^3)	Others (1,000 ft^3)	Total (1,000 ft^3)	Consumption per apita (ft^3)
1960 - 1961	904.0	5.5	909.5	0.0907
1962 - 1963	979.9	11.5	991.4	0.0937
1964 - 1965	1,025.4	15.4	1,040.8	0.0937

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Table V-19 Import Tea Chests

Year	Equivalent quantity in 3 layered plywood	Equivalent quantity logs
	(1,000 ft^2)	(million ft^3)
1962	52,574	821.5
1963	50,214	784.6
1964	53,795	840.5

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAD

Table V-20 Import and Consumption of Fibre Board

Year	Import quantity	Import quantity equivalent in logs	Consumption per capita
	(t)	(million ft^3)	(kg)
1960 - 1962	2,109	52	0.207
1963 - 1965	745	18	0.068
1966	1,351	33	0.118

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Table V-21 Export, Import, Production and Consumption of Pulp and Paper

	1937-39	1947-49	1950-52	1953-55	1956-58	1959-61	1962-64	1965-66
Domestic Production (t)	-	-	-	-	1,020	4,500	5,590	8,020
Import (")	14,880	13,790	19,920	24,660	29,610	37,610	32,610	35,860
Export (")	240	390	640	210	-	-	-	-
Defference between import and export (")	14,640	13,390	19,280	24,250	28,590	33,110	27,020	27,840
Equivalent in log of the above(million ft^3)	1,757	1,607	2,314	2,910	3,440	3,973	3,482	3,341
Paper consumption(t)	14,640	13,390	19,280	24,250	30,620	42,110	38,200	43,870
Equivalent in log of the above(million ft^3)	1,757	1,607	2,314	2,910	3,674	5,053	4,584	5,264
Per capita consumption amount of paper(Kg)	2.56	1.85	2.45	2.87	3.34	4.26	3.57	3.86

Source: Pre-investment Study on Forest Industries Development/Ceylon:FAO

Note: Calculation on pulp 1 t ≒ 120 ft^3

Table V-22 Consumption of Firewood and Charcoal

Year	Consumption per capita	Total Domestic Consumption
	ft^3	ft^3
1952	15.5	125.2
1958	15.0	140.7
1963	11.6	124.5

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Table V-23 Demand Forecast

		1975		1985		2000	
		Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
* Sawing million(ft^3)		8.2	6.7	11.9	8.5	20.1	12.6
* Veneer board (1,000 ft^3)		1,300	1,200	1,500	1,000	2,400	400
* Pulp, Board paper (1,000 t)		93	60	177	85	390	141
Total (logs) (million ft^3)		29	23	46	28	85	39
Breakdown of the Logs	For sawing	16	13	23	16	39	24
	For vencer board	4	4	5	3	7	1
	For pulp board paper	9	6	18	9	39	14

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Note: 1. Tea chests, box frame and sleeper (rail) are included in logs.

2. Tea chests and veneer board are included in logs for veneer.

3. Logs for pulping is from the supply to be obtained from the future afforestation.

Table V-24 Required Logs Amount (1975)

(Million ft^3)

Items	Calculation High Side		Calculation Low Side	
	Conferous leaves Tree	Non-conferous leaves Tree	Conferous leaves Tree	Non-conferous leaves Tree
Sawing	15.6		12.8	
Plywood-board				
Veneer-board	-	3.5	-	3.4
Fibre-board	-	0.42	-	0.23
Chip-board	-	0.13	-	0.03
Total of Plywood-board	-	4.0	-	3.7
Paper Products				
Newsprints	2.6	-	1.4	-
Printing, Letter Paper	0.5	2.2	0.4	1.4
Others	1.5	0.8	1.0	0.5
Board Paper	0.3	1.1	0.2	0.7
Total Production	4.9	4.1	3.0	2.6

Source: Pre-investment Study on Forest Industries Development/ Ceylon:FAO

Note: 1. Sawing is estimated by present production.

2. Plywood is also estimated by present production.

3. In Paper products, printing and letter paper consist of 80% long fibre and 20% short fibre.

In paper products other paper consists of two-thirds long fibre and one-third short fibre.

In paper products, board paper consist of 20% long fibre and 80% short fibre.

Table V-25 Sri Lanka Imported Mineral Commodities (1970)

Commodities	Unit	Quantity	Price (in Rs.) (C & F Colombo)	Main Source of Supply
Non-Ferrous				
Gypsum*	t	17,780	1,422,140	Pakistan
Casting Sand	t	19.304	7,381	U.K.
Clay				
Refractory Clay	t	11.278	3,876	U.K.
Clay	t	1,016	354,400	"
		Ball Clay 802.34		
		K.K. Clay 162.56		
		E.V.W.A. Clay 50.8		
Silicon Sand Clay	t	76.2	31,000	U.K.
Mineral Fuel	t			
Crude Oil	t	1,832,632	131,833,981	Iran
Lubricant	t	3,571	2,636,907	U.K., U.S.A.
Base Oil		10,052	8,376,842	U.K., U.S.A.

Note: 1. Total value (Rs) 144,666,527

(US$) 24,191,727

2. *For Cement Production

Table V-26 Sri Lanka Exported Mineral Commodities (1970)

Commodities	Quantity (t)	Price (Rs)	Major Destination
Graphite	9,785.096	8,935,241	Japan 38%, U.S.A. 27% U.K. 16%
Mica	488.696	101,820	Libya 68%, U.S.A. 28%
Ilmenite	78,078.584	2,634,187	
Rutile (Heavy Metals Sand)	2,245.36	C&F Japan 1,734,820 C&F, Genoa, Rotterdam, Antwerp	Mostly to Japan
Zircon (Heavy Metals Sand)	101.6	20,000	Japan
Monazite (Heavy Metals Sand)	69.088	67,972	U.K.
Limestome	408.94	12,736	406.4t U.K. 2.54t
Gemstones			
Carat	N.A.	4,295,270	N.A.
Total	91,177.364	17,802,142	

Note: 1. Total value (U.S.$) 2,976,947

2. Quantity and price indicate the total exported value of Gemstones.

3. F.O.B. Colombo

4. N.A. : Not available

Table V-27 Export of Graphite (Oct. 1969 - Sept. 1970)

	t	Cwt	Rs C
England	1,736.344	0	1,043,757 41
India	705.104	11	630,600 82
Australia	440.944	0	319,785 93
Pakistan	13.208	4	12,976 97
Hong Kong	8.128	0	7,200 94
U.S.A.	2,486.157	10	2,380,973 89
Japan	3,540.76	0	2,829,523 60
France	327.152	0	267,491 45
West Germany	101.6	0	116,667 87
Czechoslovakia	101.6	0	130,510 3
Thailand	95.504	11	71,547 74
Belgium	53.848	0	41,475 59
Poland	39.624	10	44,756 5
Indonesia	25.4	0	22,162 0
Holland	20.32	0	27,217 29
Iran	20.32	0	12,459 0
Spain	12.192	0	26,524 81
Italy	8.128	0	9,951 69
Greece	6.096	0	5,312 34
Other Countries	5.08	0	3,002 29
	9,647.936	02	8,015,987 71

Table V-28 Mineral Product Output (1970)

Mineral	Quantity (t)	Price (Rs)	Remarks
Sand Ore of Heavy Metals			
Ilmenite	84,557.616	*1,643,713	Ceylon Mineral Sands Corp.
Rutile	2,394.712	*1,116,605	"
Zircon	111.76	52,555	" (102.616t)
			National Ore Concentration (6.096t)
Monazite	16.256	*11,885	
Limestone	511,048	*3,151,000	Quantity Used for Cement Production
Clay			
Clay (for Cement)	130,048	*1,831,000	
Kaolin	2,208.784	*326,100	
Ball Clay	1,332.992	*196,800	
Clay(for Bricks and Tiles)	21,336	324,000	
Dolomite	3,398.52	192,310	
Feldspar	1,293.368	*117,120	
Gemstones (Carat)	N.A.	**4,295,270	
Glass Sand	5,361.432	*149,675	
Graphite	9,785.096	8,935,241	Export Only
Mica	488.696	101,826	Export Only
Quartz	2,391.664	*139,110	
Usual Sand	64,366.648	6,698,830	
		29,283,040	

Price (U.S.$) 4,895,157

Portland Cement Production			
Portland Cement	326,137.016	70,694,235	K.K.S. (177,774.6t) Ruhunu (74,075.544t) Puttalam(74,286.872t)
Price (U.S.$) 11,821,778			

* Ex-factory costs
** The quantity and price (amount) indicate these of the gross exportation of entire jewellery
N.A. Not available

Table V-29 Utilization of Mineral Commodities in Industry (1970)

Commodity	Quantity (t)	Value (Rs)	Type of Industry (t)	
Dolomite+	3,399	192,310	Fertilizer	2,221
			Glass	787
			Ceramics	152
			Scouring Powder	238
Feldspar+	1,293	117,120	Ceylon Ceramic Corp.	531
			Glass	552
Limestone+	511,048	3,151,000	Figures Show the Amount Utilized in Cement Manufacture Only	
Glass Sand+	6,024	**187,925	Glass	
Kaolin+	2,659	766,520	Ceylon Ceramic Corp.	1,060
			Paper and Paper Board	366
			Pharmaceuticals	122
			Paint and Distemper	244
			Pottery	208
			Agrochemicals	316
			Rubber Industry	243
Clay+	1,483	292,950	Ceylon Ceramic Corp.	112
			Insecticidal Dusts	1,269
			Rubber Industry	24
			Pottery	41
			Others	81
Brick, Tile	21,336	324,000	(N.B.I.C. Figures Only)	
	1,584	79,560	Ceylon Ceramic Corp.	
Graphite+	4.42	3,100	Tea Machinery and Foundry Works	
Gypsum*	8,128	633,600	Cement	
Moulding Sand*	133.6	61,809	Foundry Works	
Fire Clay*	11.9	7,290	Foundry Works	
Chalk Lump+	0.19	1,110	Foundry Works	
Common Sand+	3,638	145,000	Chemicals	
Total	539,474	5,963,294		

Source: Administrators Report of Geological Survey Dep. Feb. 1972

Note: 1. Total value quivalent to U.S.: $907,206
2. + Local
* Foreign
** Estimated figure and value

Fig. V-1 General Ideas of Supply and Demand Relationship for Edible Oils in Future

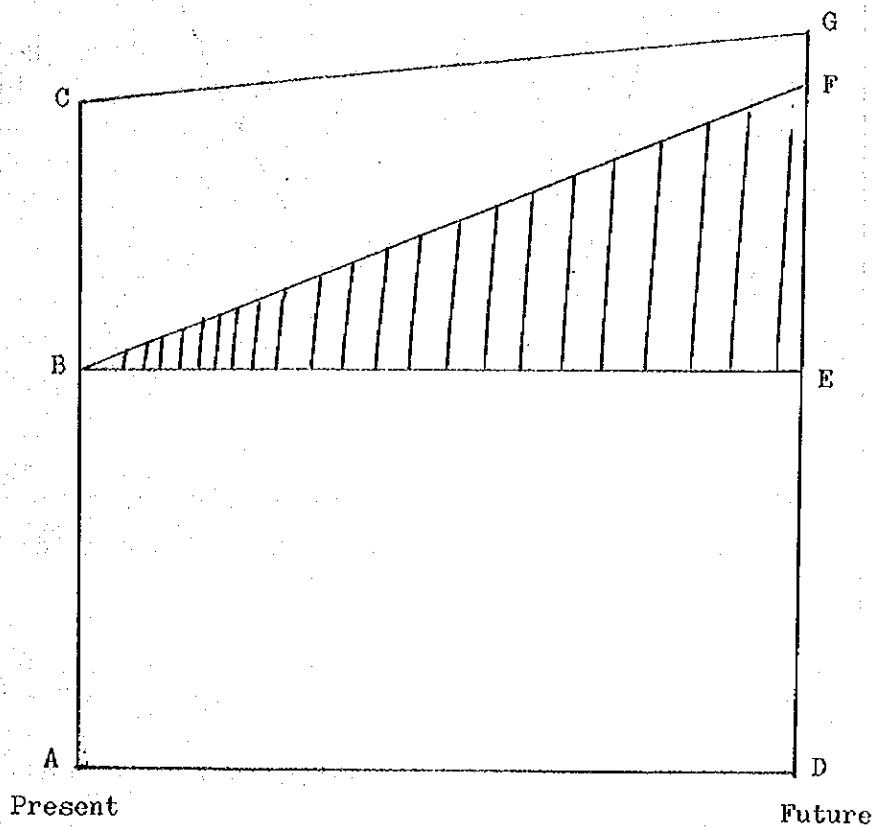
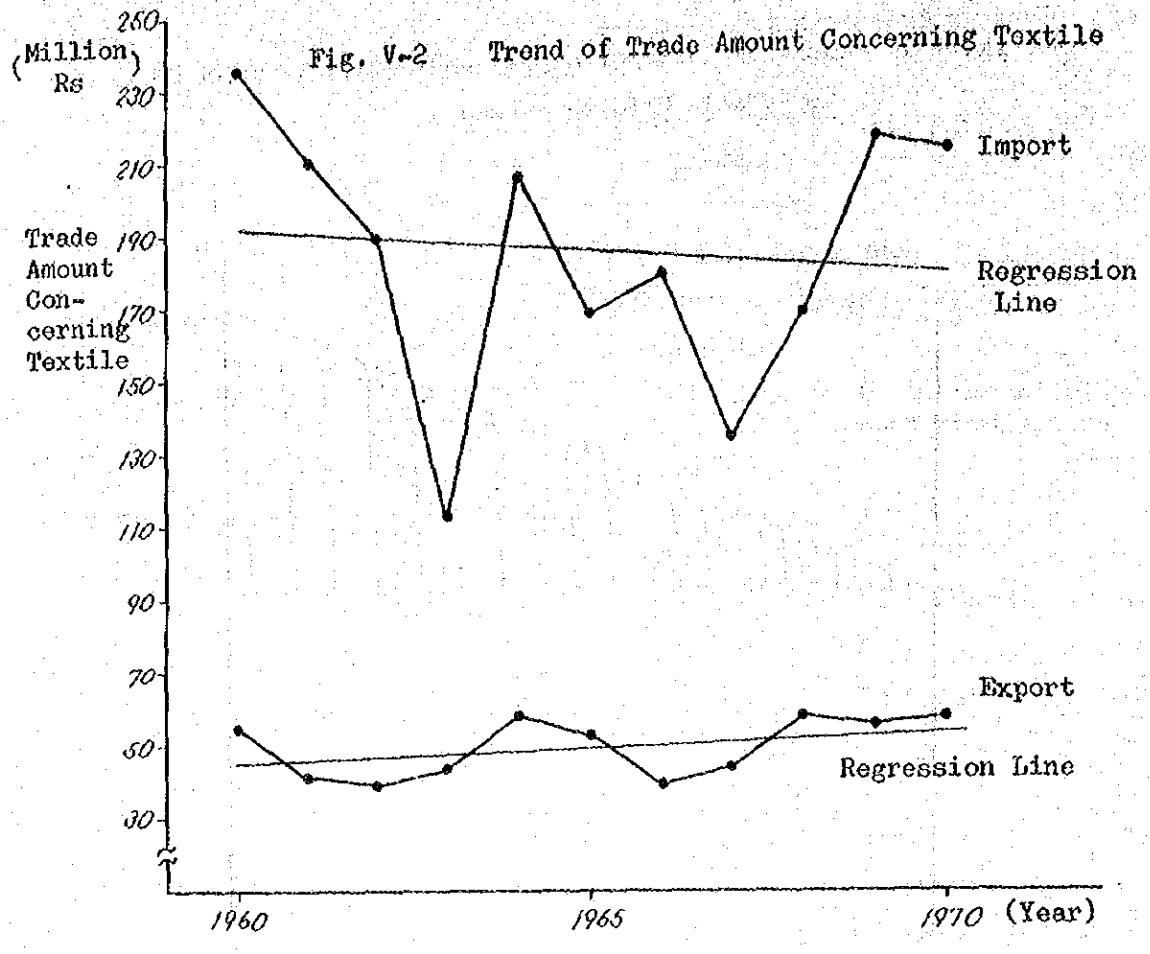
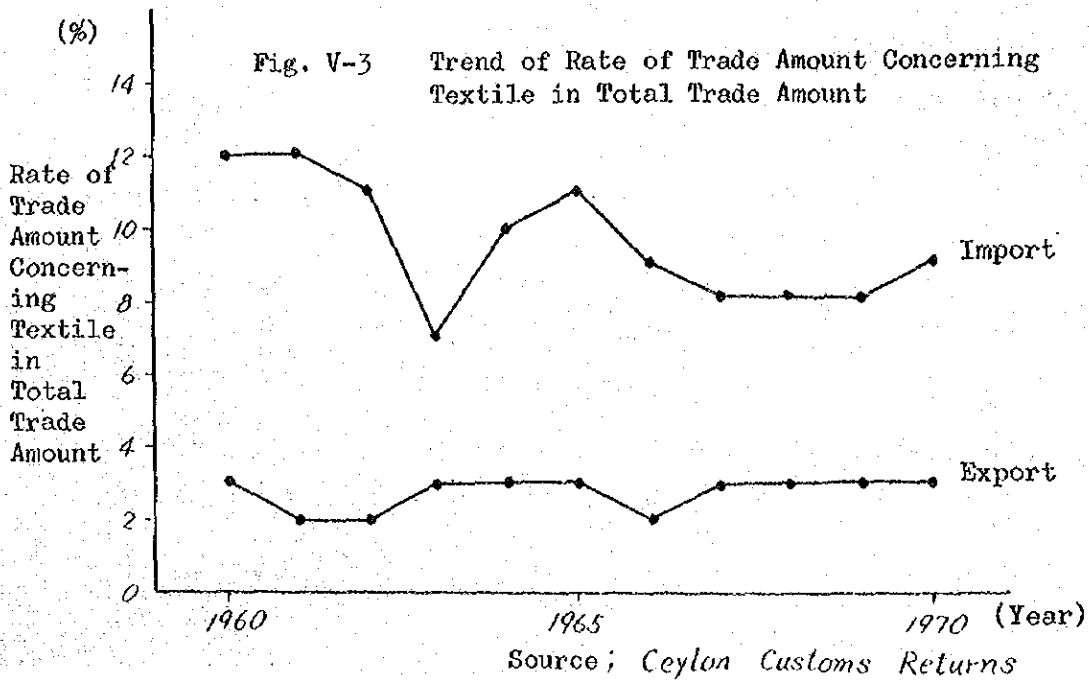


Fig. V-2 Trend of Trade Amount Concerning Textile



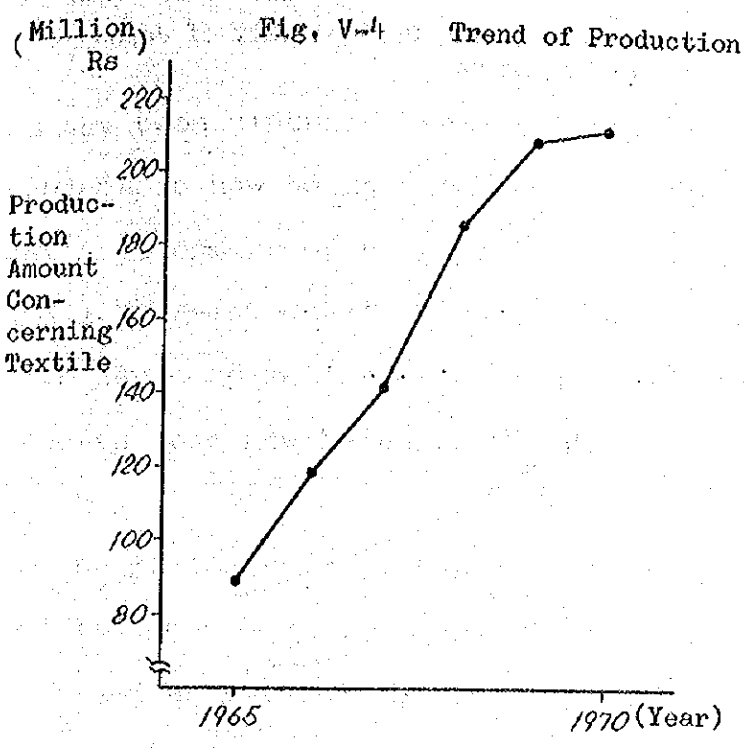
Source: *Ceylon customs Returns*

Fig. V-3 Trend of Rate of Trade Amount Concerning Textile in Total Trade Amount



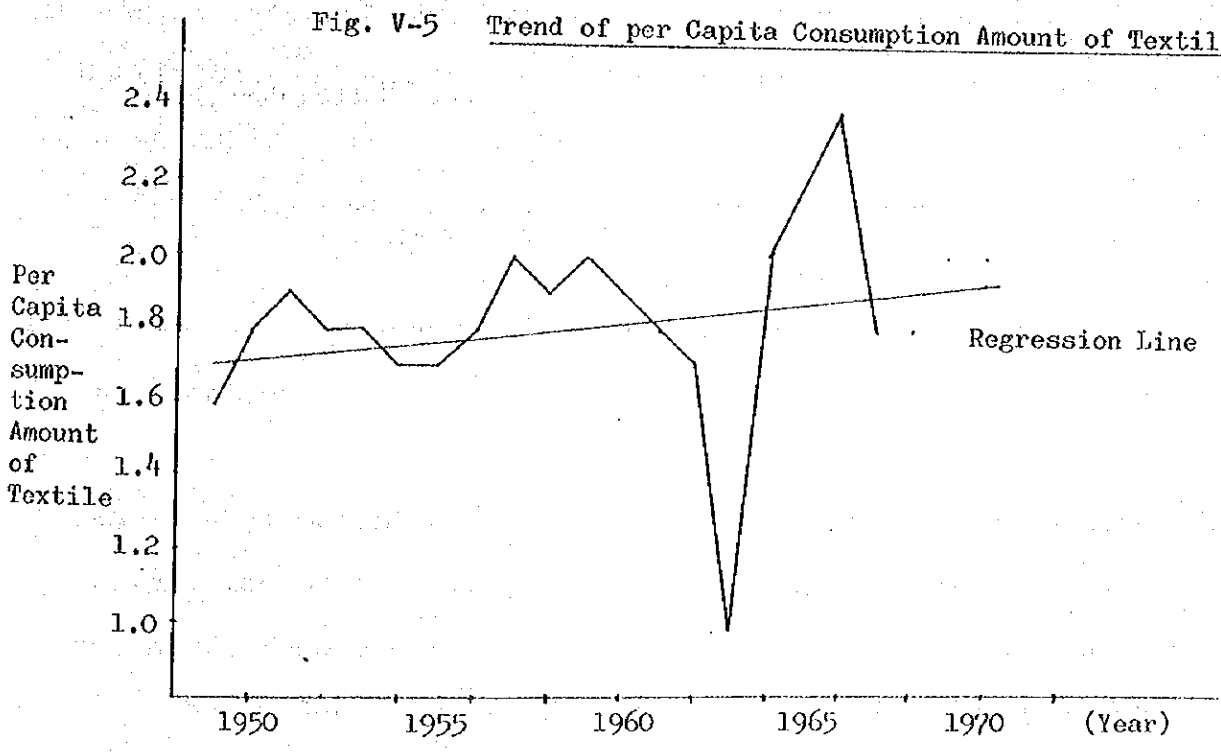
Source; *Ceylon Customs Returns*

Fig. V-4 Trend of Production Amount Concerning Textile



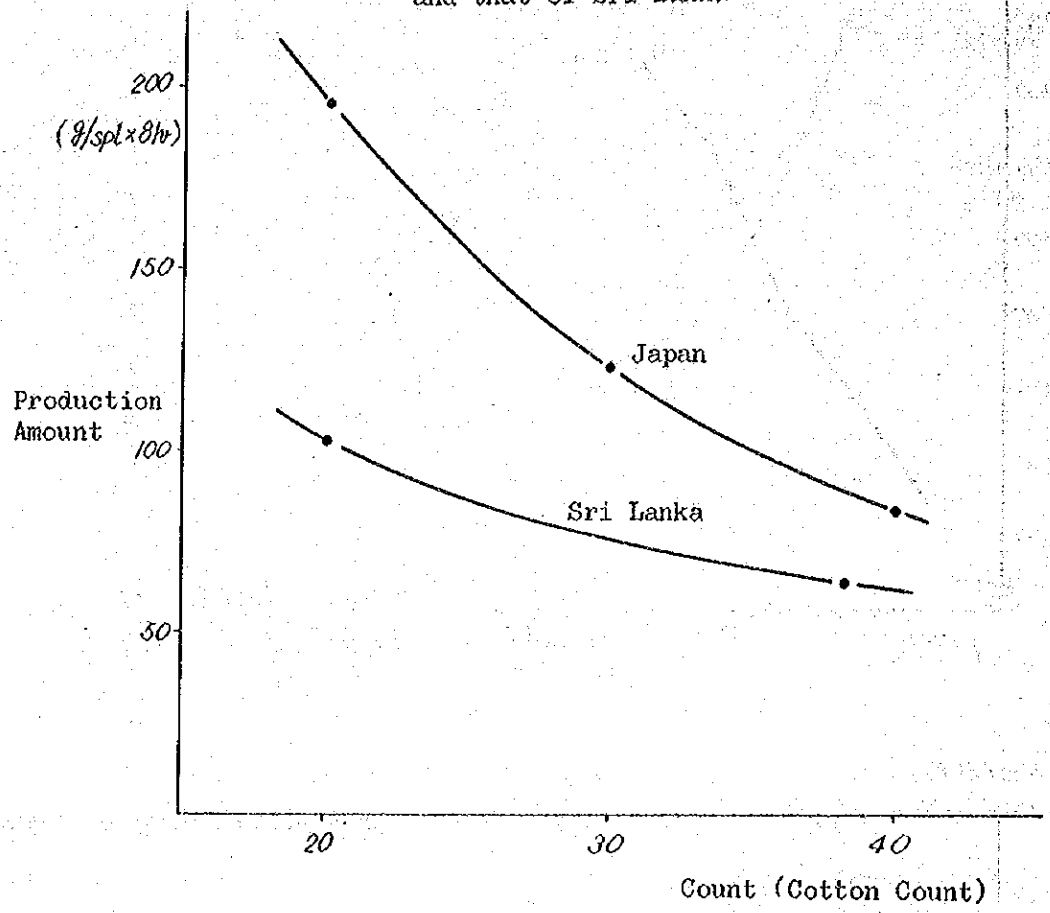
Source : *Statistics of Industrial Production*

Fig. V-5 Trend of per Capita Consumption Amount of Textile



Source: FOA Report (ESCR FC 72/1)

Fig. V-6 Comparison of Spinning Productivity of Japan and that of Sri Lanka



Source: (Sri Lanka) Ministry of Industrial and Scientific Affairs

(Japan) Textile Handbook

VI Project Area

1 General Situation of Project Area

As has been discussed in the foregoing chapters, the Mahaweli Project is now being executed with the schedule of completing the development of H and I H areas by 1980. Regarding H and I H areas, detailed surveys have already been completed with the cooperation of French consultants and the relative reports are now being compiled.

In the following paragraphs, the background of the project area will be discussed by referring to the data attained as a result of these detailed surveys. The commencement of surveys covering D ~ G areas subsequent to H and I H areas are planned to be commenced in a year or two, however, in view of the fact that D ~ G areas are adjacent to H area on the eastern side thereof, it is expected that the geographical and sociological environments of H and I H, and D - G areas will be similar to each other.

1-1 Natural environment of the Project Area

1-1-1 Location

The whole development area of the Mahaweli Project encompasses a vast stretch of territory covering the North-Central Province, Northern Province and the northern part of the Eastern Province, all in the Dry Zone. H and I H areas of this territory which

are the primary targets for the completion of development, stretches north-westward from Dambulla, which is the parting point of the trunk line (Route No. 6) connecting Colombo and Trincomalee, and another trunk line (Route No. 9) which runs from Kandy to Jaffna. The other end of H and I H area reaches the old capital, Anuradhapura, thereby comprising for the total H and I H area, approximately 93,000 ha. of land. H and I H areas are approximately 100 to 200 Km. away from Colombo, Jaffna, and Trincomalee.

The Maha-Illuppallama Agricultural Research Station is located in the approximate centre of H area. (Refer to attached Fig. VI-1 and Fig. - 1). The D-G area covers Polonnaruwa to Trincomalee covering approximately the same area as H and I H area, however, the already irrigated area here is greater than H and I H areas so that in view of agricultural production, D and G areas are slightly more advanced than H and I H areas.

1-1-2 Climate

The temperature stays stable throughout the year ranging from a minimum of 21°C to maximum 32°C. Although the annual rainfall amount is approximately 1,500 mm, there is a certain unevenness in the distribution of the rainfall seasonally. The high peak in the rainfall amount falls during the three months of October, November and December and a smaller peak is present

during April. The extent of the amount of rainfall corresponds to the Northeast monsoon (Maha season) and Southwest monsoon (Yala season), respectively so that in the Dry Zone, rainfall during the Yala Season is extremely low.

Therefore, in order to carry out cultivation activities during the Yala Season, the irrigation becomes indispensable. Also during the Maha Season, because of the unevenness or irregularity in the rainfall amount, supplementary irrigation is necessary in order to carry out ideal cultivation. The sunshine is extremely abundant so that during the dry season, the solar radiation amounts to more than 500 cal/cm^2/day. If sufficient irrigation is undertaken, it can be considered that climatic conditions are ideally suitable for carrying out agriculture or forestry.

1-1-3 Soil

As shown in the attached Table VII-2, the soils of Sri Lanka can be classified into 12 great soil groups. Of these groups, the reddish brown earth has the highest extent of distribution in the Dry Zone. The great soil groups found in H area are as follows:

(1) Reddish Brown Earth (Chromic Luvisols*): Approximately 65% of H area

(2) Low Humic Grey Soil (Gleyic Luvisols*): Approximately 30% of H area

(3) Alluvial Soil (Fluvisols*): Approximately 5% of H area

These soils exist in the area in the form of a series of catenary associations on the basis of the geographical structures and the flucutation of the level of underground water. The attached Table VI-3 shows the results of the analysis conducted to the soil samples the survey team members actually collected on site. All the samples displayed neutral to weak acidic soil reactions and they are all rich soils with an abundant base.

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* Definition of soil units for soil maps of the world, FAO,1968

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a) Reddish Brown Earth, well drained series

Horizon A is normally 10 to 30 cm thick displaying a dark brownish to dark reddish brown colour. The soil texture is sandy loam to sandy clay loam. The horizon B is dark reddish brown to red brown with a depth of 90 to 110 cm. Soil texture is sandy clay loam. Horizon C occurs at the depth of 120 to 150 cm. containing decomposed parent materials of yellowish brown to pale brown. The organic matter contents on the surface soil was 1 to 3%. For the most part, land of these soils are presently utilized for chena cultivation, during the wet season, of chili, maize and vegetables of a wide variety. The aptitude for irrigated agriculture is extremely high in the case of these soils so that it is possible to cultivate every type of crop, however, due to the lack of porosity in the soil, it is necessary to

undertake sub-surface drainage in the case of a flat area. Approximately 56% of the II area soil belong to the above-mentioned category.

b) Reddish brown earth, imperfectly drained series

The difference from the above-mentioned series in the soil profile of this series is that, in this series, A horizon and the upper portion of B horizon present a dark brown to dark yellowish brown colour. Further, in this series, brown spots are noted at the depth of 60 to 120 cm underground. The soil texture of the surface horizon of the soil is sandy clay loam to sandy loam. The porosity is low and the water permeability is comparatively low. At present in many cases, land of this series of soil is utilized as paddy fields. Although the 'productivity is slightly lower than the above-mentioned soil, this series of soil is suitable for cultivation of paddy and maize during the wet season and also suited for the cash crops cultivation during the Dry season. Artificial water drainage provision is also necessary in the case of flat areas. The ratio of this series of soils in II area is approximately 10%.

c) Low Humic Grey Soils, Poorly and Very Poorly Drained Series

The surface horizon of the soil for 25 to 30 cm in depth presents dark brown to dark greyish colour. In the poorly drained areas or in areas where continuous paddy cultivations have been undertaken, the Pseudo-gley is noted at a horizon below 30 cm from the surface and the gley is noted in a horizon deeper than 60cm. The soil texture is sandy loam to sandy clay loam. The underground water level is high and the water permeability is poor. The pH range of the surface horizon is 5.5 to 7, however, in the case of the lower horizon, the pH reading often shows 7 to 8.5 in the case of a poor drainage area. For the most part, land of this series of soil is used as the paddy field. In the areas of such soil the paddy cultivation is considered to be most suitable, however, in the areas where the drainage is poor, artificial drainage provisions must be made and it is necessary to improve reduced conditions of the soil. 20 to 25% of the land in H area is comprised by this series of soil.

d) Alluvial Soils

Except for the accumulation of organic matter on the surface horizon, no profile differentiation can be recognized in this type of soil. The depth of this soil is approximately 100 to 120 cm and the colour of the soil is brown to dark

yellowish brown in well drained areas and yellowish brown to dark greyish brown in poorly drained areas. The soil texture is loam to clay loam. Tobacco, and vegetable cultivation operations are undertaken in the well drained areas where no danger of flood is present, however, paddy cultivation is undertaken where the drainage is poor.

1-1-4 Vegetation

The vegetation of the project area consists of forests, grass lands and the cultivated fields. The natural forest vegetation consists of the so-called tropical mixed evergreen forests which contain (1) a small extent of the thorny species and a great extent of broad leaves species, both constituting shrub forests, and (2) the tree forests which mainly consists of trees. In the case of the former category, the wood height is approximately 3m and the diameter of the trees is also small (less than 25cm diameter at the breast height). In the case of the latter, some woods exceed 21m in height in the upper layer, the diameter of which is also large (some attain a diameter of 51cm at the breast height .)

There are frequent cases of destruction of forests due to cultivation and the present status of forests varies depending upon the length of the period after cultivation has been effected and completed, and the mode of the effected cultivation. The main wood species constituting the vegetation are Wira (Drypetes

spiaria) and Palu (Manilkara hexandra), Burutha (Chloroxylon swietenai), etc. Climbers which includes lianas are also often noted. On the forest floor of dense canopy, the accumulation of twigs and leaves is comparatively small, however, in the thin canopy forests, a number of such grasses as cyrto coccum trigonium and steno affrum dimidiatum are present. The teak plantation as artificial forests are also present in several areas. The grass lands are noted in the vicinity of reservoirs and in the lands upon which chena cultivation was once effected.
Some of these grasslands are in the process of generating forest so that the savanna status is being presented.

As the artificial forest vegetation, the plantations of teak (Tectona grandis) and Eucaliptas Sp. are scatteredly present, all showing satisfactory growth.

1-2 Sociological Environment of the Project Area

The MDB undertook a considerably detailed surveys concerning the actual present status of socio-economical environment of H and IH areas at the time of compiling the above-mentioned feasibility reports on Stage II area and issued this portion of the work under the title of the "Agro-Socio-Economic Survey". In the following paragraphs, reference is mainly made to this survey report and descriptions shall be made concerning the

sociological environment of H and IH areas as representing the adjacent localities.

1-2-1 Population and Villages

The initial settlement into H area was undertaken approximately 25 years ago under the Kagama-Kattiyawa Colonization Scheme, i.e., a major irrigation scheme which utilized the water of the Kalawewa Reservoir. Then the Kandalama Colonization scheme was executed by effecting the reinforcement of the Kandalama Reservoir and the utilization of the water thereof. Up to the present, colonization schemes as shown in the Attached Table VI-4, have been undertaken inside H area. Both the Kagaya-Kattiyawa Scheme and the Rajangana Scheme (an irrigation scheme utilizing the Rajangana reservoir) are still in effect, and expansion of the cultivation area is being undertaken as the Special Project (Refer to Attached Table VI-1). In addition to the above-mentioned Kandalama Reservoir, Karawewa Reservoir and the Rajangana Reservoir, in H and IH areas other reservoirs are present as enumerated in the Attached Table VI-5. Of these reservoirs, the largest, Kalawewa Reservoir, was constructed in 460 A.D. Due to the fact that water amount is not sufficient in all of these reservoirs, the presently irrigated areas (Stage I area) cannot carry out as yet a perfect double cropping.

In the Mahaweli Project, Phase I - Project I Stage I and Stage II, it is planned that the Mahaweli Ganga water

shall be fed to these reservoirs with the objective of attaining double or more cropping covering the 18,400 ha. of Stage I area and 28,700 ha. of Stage II area. In H area, village tanks in more than 200 places are present holding (average 123,000 tons per tank), by means of the tanks, irrigation to 5,300 ha. area has been undertaken. The population residing inside the present H and IH areas consists of 19,420 households including 115,300 persons in accordance with the election namelist of 1969 (Refer to Table VI-1). In Stage I area, the majority is taken up by the settlers, and in Stage II areas the majority is taken up by the traditional farmers. The natural increment rate of the population in these areas is 3.15% per year and the population growth rate including the incoming settler is 4.3% per year. As shown in Table VI-2, one fourth of the total households is comprised of encroachers, however, these enchoachers are illegaly occupying government owned premises and they are intruders from such places as Purana village which has been in existence for a long time, from older settlement areas, from other provinces of greater population. These encroachers are constantly presenting problems at the time of promoting new settlement projects. The population structure of H and IH areas are as follows

(1) Ethnic Structure:

Up-country Sinhalese 77%

Low-country Sinhalese 13%

Muslims	6%
Tamils	4%

(2) Religion:

Buddhist	90%
Moslem	6%
Christian	2%
Others	2%

(3) Population per household:

Less than 2	13.6%
3 - 4	20.5%
5 - 6	25.6%
7 - 8	21.1%
9 - 10	14.1%
11 and over	5.4%

(Average: 5.9 persons per household)

The educational background and status of employment of the residents inside the area is shown in the attached Table VI-6 and Table VI-7. The social facilities inside the area are poor so that one school is present for 2,000 people and one hospital for 45,000 people. There is one maternity hospital for 20,000 people. The employment rate of the residents is also extremely low. The average workdays per year per household is 200 days, and 75 days per worker.

Within the area, there are 131 Cultivation Committees which are undertaking the formulation of cultivation schedules and irrigation schedules for each village and also undertake to intermediate with various contentions and arguments for the purpose of maintaining unity within the villages. However, it seems that the administration of such committees in general is not being carried out quite satisfactorily due mainly to the lack of a sense of unity on the side of the villages and to the insufficiency of leadership on the side of the committee officials.

Within the area, there are also 85 Cooperative Societies (11 Primary Societies and 75 Branch Societies) which are playing the central role in all economic activities within the villages by assuming such functions as selling production commodities and daily consumption items to the villagers, purchasing agricultural products from the villagers and providing financing services to the villagers. However, it is reported that a number of such societies lack smooth relationship with the villagers and with the governmental officials.

1-2-2 Land Ownership

Table VI-3 shows the average figures pertaining to the land ownership. As shown in the table, the average figure for land ownership is 0.8 ha. for paddy fields and 0.4 to 0.6 ha. for upland fields and the area of chena cultivation within the Stage I area is not large.

Table VI-4 shows the actual cultivation area distribution. As shown in this table, the mode of land ownership in both the Stage I and Stage II areas exists within the range of 0.8 to 1.6 ha. Concerning the paddy fields in the Stage I area, the figure is between 0.4 to 0.8 ha., while in Stage II most farmers undertake to cultivate areas of 0.4 ha. Approximately 20% of the people within the Stage I area do not engage themselves in the cultivation of paddy fields, while the figure is approximately 30% in the case of the Stage II area. The upland field cultivation is done by most of the people in the areas, and the mode of ownership of land exists within the range of 0.2 to 0.4 ha. The reason for the fact that the area of chena cultivation is higher in the Stage II area seems to imply that in this area the irrigateable area is smaller at the present stage than in Stage I. As shown in Table VI-5, the cultivation operation depends for the most part on the family labour force. By the Agricultural Land Act, the selling or mortgaging of land is prohibited, however, the mortgaging or transfer of cultivation rights does seem to be practised to a certain extent by the people.

1-2-3 Land Utilization at present

The present status of land utilization is shown in the attached Table VI-8. As has been mentioned earlier, the paddy fields in the Stage I area are mainly the areas which have

already been developed under the settlement schemes executed in the past. The cropping intensity per year is approximately 1.7. The presently existing paddy fields in the Stage II area are mainly on the low humic gley soil and approximately 10% of such can be utilized for double cropping. Nevertheless, because of water shortage, approximately 25% of such areas is constantly left un-cultivated. Thus, the present cropping intensity per year is less than 1.

Coconuts grow mainly in the vicinity of irrigation canals or small reservoirs where the underground water level is not very low. In home garden areas and also in settlement areas, the cultivation of such rainfed crops as bananas, maniocs, vegetables and chilli is undertaken. The chena cultivation is undertaken in the shrub and forest areas.

1-2-4 Agricultural Production and Consumption

Tables VI-6 and VI-7 show the actual status of production and consumption of agricultural products and dairy products within H area. In the Stage I area, the main product is paddy however, in the Stage II area, the amount of rice production barely fulfills the consumption amount required within the area. In the Stage II area, the production of other agricultural and dairy products is mostly destined to intra-area consumption. Thus, no allowance for selling crops and other products outside the Stage II area is available under the present situation.

Table VI-8 shows a comparison between the per capita food consumption in the Project area as against the nation-wide statistical figures. The comparison reveals that the consumption amount of pulse and eggs in the area is lower than the national average, however, it should be noted here that the consumption amount of fish is higher than the national average.

2. Resources

2-1 Agricultural resources

As has been mentioned earlier, the amount of rainfall and season-wise distribution of rainfall is extremely disadvantageous for the growing of crops in the Project Area so that the agricultural production within the area has so far been conspicuously unstable. Even when carrying out paddy rice cultivation by utilizing the water of reservoirs which were built a long time ago, the shortage of water often forces farmers to give up the harvest. Moreover, no guarantee is given for the success in the agricultural production on the basis of chena cultivation or rainfed cultivation.

Therefore, because of the fact that there is a high extent of risk involved in investing ample labour forces or agricultural inputs (e.g. fertilizer, chemical, machinery, equipment, etc.) into the cultivation, the conventional philosophy of the agricultural production activities has been characterised by concessions on the side of the farmers regarding a low level of yield at the cost of minimized investment into

in order to keep losses to a minimum should no harvest be available at all. The objective of the Mahaweli project is to totally improve the traditional farming and traditional crops by means of supplying ample water to these water-shortage areas. From this viewpoint, the MDB conducted detailed land classification studies of the areas of H and IH which are to be firstly taken up as the subject of the development project, with particular emphasis upon the aptitude of such classified land to the irrigation agriculture. The authorities also compiled a Cropping Pattern, the details of which will be described in the latter part of this report, in the light of the policies for establishing self-sufficiency in the supply of agriculture products.

2-1-1 Classification of Lands in H Area

Detailed land classification surveys have already been conducted in accordance with the standards set forth by the U.S.B.R. (the United States Bureau of Reclamation) on the topography, possibility of drainage and other limiting factors pertaining to the lands of the H area. Tables VI-9 and VI-10 stipulates the correlation between the standards and soils, and relationship between land class and the possibility of cultivation and feasibility of irrigation. In these tables, the lands which have been classified as belonging to less than Class 5 are those which are deemed to be completely unfit for cultivation.

The land deemed to be suitable for cultivation within the Stage II area are classified in accordance with the above-mentioned standards and the results obtained are shown in Table VI-11. The table shows that approximately 60% of the total area is suitable for upland cultivation and the remaining 40% for paddy cultivation. The effective cultivation area of such selected suitable lands within the Stage II area was 75%, the rate having been obtained through calculations pertaining to the areas in which the cultivation activities can be undertaken after subtracting the areas to be occupied by roads, footpath, canals, etc., Consequently, the effective cultivation area of the Stage II is: 38,251 ha. x 0.75 = approximately 28,700 ha. Table VI-12 shows as aggregate data the effective cultivation areas within the H and IH areas.

2-1-2 The Cropping Pattern

Table VI-13 shows the correlation between the land classification and the types of crops which can be cultivated therein. Researches are being undertaken at the Maha-Illuppallama Agricultural Research Station regarding the rational methods for crop rotation and intercropping. In the light of the results of the land classification mentioned earlier, as well as the results obtained through the series of studies conducted by the Station, the Cropping Pattern was compiled and proposed by also taking into consideration the proper distribution of labour forces available from farmers' households, the enhance-

ment of revenue of agricultural households as well as the establishment of self-sufficiency policies of the Government in the supply of food. The Cropping Pattern is illustrated in Figs. VI-1, VI-2 and in Table VI-14. The Cropping Pattern consists of a crop rotation system, the details of which are as follows:

(1) Crops for self-consumption by farmers' households: (Fodder crops, fruit, vegetables, nursery, etc.)...4% of upland fields

(2) Onions-chilli-pulse-onions-chilli-onions-pulse (3-year crop rotation) ....4% of upland fields

(3) Paddy(or maize)-chilli: 15% of upland fields

(4) Paddy (or maize)-groundnut (or soya beans)-pulse ...47% of upland fields

(5) Paddy (or maize)-cotton: ... 30% of up land fields

(6) Paddy-paddy ....75% of paddy fields

(7) Paddy-paddy-paddy: ...25% of paddy fields

(One-year crop rotation for all the above categories except (2))

The attached Table VI-9 compares the above-mentioned Cropping Pattern and the results obtained through the earlier mentioned land classifications. It is obvious from this table that the results of land classification have been taken as an important criteria at the time of making decisions within the framework of the Cropping Pattern. In addition to basing upon the results of the land classifications, the selection of crops to be

cultivated under the Cropping Pattern was made with emphasis upon such types of crops that have been technically proven regarding the cultivation thereof through experiments and researches conducted by the Maha-Illuppallama Agricultural Research Station, etc. Accordingly, those crops which will present a considerable extent of technical difficulties for the settlers in cultivating have been duly eliminated from the selection. Therefore, even if a certain type of crop is strongly demanded in view of the national economy of Sri Lanka, if such crops present a high extent of technical difficulties in cultivation or if their economical viability in cultivation is not proven at the present stage, the incorporation of such items will be made into the programme from Stage III onward after conducting further studies as to the applicability.

If the development projects for the Stage II area were completed on schedule on the basis of this Cropping Pattern, it should be possible for the achievement of cultivation of various items of crops as shown in Table VI-13 at the time of the completion of the development (as scheduled for 1980).

2-1-3 Production of Raw Materials available for Agro-based Industries within the Project Area

(1) Paddy

Approximately 17,000 ha. of fields are existing within the Kalawewa area (H area) and irrigations are being undertaken by utilizing water supplies from the Kalawewa

Reservoirs and other large reservoirs as well as from small tanks existing in various locations in the area. However, due to the lack of irrigation water, the double cropping cannot be completely undertaken so that the total cultivated area is approximately 28,000 ha. The total area of paddy cultivation within the H area at the time of the Stage II completion, i.e. in the year 1980, will be approximately 56,000-72,000 ha. according to the calculations made on the basis of the Cropping Pattern established by the MDB.

The varieties of paddy to be planted in these irrigateable paddy fields will have to be the new varieties of the short-culm-high-yielding type. In various Asian rice growing countries, either the short-culm-high-yielding IR varieties which have been developed by the International Research Institute are being introduced, or efforts are being exerted in the fostering of new varieties of high-yielding types which are equivalent to the IR varieties. In Sri Lanka also, the Central Agricultural Research Institute is assuming the central role in the development of the so-called New Improved Varieties (N.I.V) including the BG-11-111, LD-66, BG-34-8, BG-34-11, etc. and efforts have been exerted for the extension of such varieties. The features of these varieties are shown in the attached Table VI-10. Due to the fact that these varieties are of the short-culm types, their viability through competition with weeds is not very high, so that in the event where the

growing of weeds cannot be controlled by means of ample irrigation water, the yield from such varieties may be less than the yield level of the traditional varieties. This implies that the pre-requisite conditions for further extention of such new varieties is the substantiation of irrigation systems.

According to the implementation programme for 1973 set by the Ministry of Agriculture and Lands, the extension target of the NIV is set at 42%, however, in the Dry Zone where irrigated agriculture is comparatively advanced when compared with the Wet Zone where the traditional rainfed paddy fields are dominant, it is estimated that the extension rate of the NIV is already considerably high. On the assumption that the fulfillment of the pre-requisite conditions within the Project Area substantial irrigation has been made and the input of abundant agricultural materials such as fertilizers, machinery, etc. is made possible, it can be assumed that the cultivated varieties of paddy will be entirely NIV. According to the data obtained by the Station, the yield of the NIV often reaches 6 to 8 tons per ha. of paddy, however, as a realistic yield forecast amount, it is more likely that the figure will be 5 tons per ha. for the Maha season and 4 tons per ha. for the Yala season, averaging 4.5 tons per ha. The straw/grain ratio of the NIV is approximately 0.8 (refer to the attached Table VI-11) and unlike the traditional varieties, the generation of straw is not so large. (In the case of

old varieties, many of them display a ratio of over 2.) Although there are several differences depending upon the variety, 30 tons of husks and 70 tons of brown rice will be obtained from 100 tons of paddy. Further, by means of milling the thus obtained brown rice, approximately 8 to 10% of rice bran will be produced.

On the basis of the above pre-requisite conditions, the theoretical figures of the production of paddy and other by-products thereof which should be attained in the H and IH areas at the time of the completion of Stage II (1980), will be as follows.

Cultivation area (aggregate)	:	56,000 -- 72,000 ha.
Paddy yield per ha.	:	4.5 tons
Total paddy yield	:	252,000 -- 324,000 tons
Straw yield	:	201,600 -- 259,200 tons
Hull yield	:	75,600 -- 97,200 tons
Brown rice	:	176,400 -- 226,800 tons
Rice bran	:	14,000 -- 22,000 tons

Regarding the utilization of straw, several problems are present in view of the presently undertaken harvesting methods and the threshing method. The method of rice harvesting in Sri Lanka is different from that practised in Japan as the cutting position of the straw stem in Sri Lanka is considerably higher than in the case of Japan, so that a great amount of straw will be left unharvested in the paddy field. Also, the harvested

rice with straw is not bundled but simply piled up in heaps in the corners of the paddy fields and then water buffaloes trample on them for carrying out threshing. Therefore, the quantity of straw which can be industrially used in the H and IH areas will be approximately one-half of the above-mentioned theoretical amount so that the maximum yield of straw from this viewpoint will be 100 thousand to 130 thousand tons. For straws to be utilized as raw material for producing straw bags, etc. it is desirable that the stem length be at least 80 cm. Due to the fact that the NIV are of the short-stem varieties, it would be highly difficult to utilize the harvested straw in this direction unless the cutting at harvesting time was to be carried out much closer to the bottom of the paddy stock. The method of threshing should also be improved accordingly. The existing paddy fields in the D-G areas are scheduled to be utilized for complete double cropping by the end of the completion of the Stage I projects.

The total area of such expected paddy fields is 40,000 ha. On an assumption that the paddy yield per ha. is 4.5 tons, the theoretical production figures can be calculated as follows.

Total paddy yield	:	180,000 tons
Straw yield	:	144,000 tons
Husk yield	:	54,000 tons
Brown rice yield	:	126,000 tons
Rice bran	:	11,000 tons

It is further planned that approximately 17,600 ha. shall be newly irrigated during Stage III, however, it is not finalized at this stage as to what extent of area will be allocated for paddy cultivation.

(2) Cotton

At present, cotton is being cultivated in the Hambantota District as one of the so called rainfed crops. The yield is 400 to 600 kg./ha. on average which is extremely low. Even during a good year, the yield reaches only 1,250 kg/ha. Further, the yield amount fluctuation from year to year is considerably large so that the cotton yield situation is not stable for raw materials of textile industry.

The Department of Agriculture has been conducting researches and studies concerning cotton cultivation as one of the irrigated crops. It has been confirmed that a yield of more than 2,500 kg./ha. can be obtained by substantiating irrigation and by setting the HC 101 as the standard cotton variety. It is therefore expected that the yield of 1,500 to 1,800 kg/ha. can be easily attained on the farmers' level. Actually, at present, there has been no record of irrigated cultivation of cotton on an individual farmer's activities. Such an operation is scheduled to be commenced in the Walawe area from the Yala 1973 onward covering approximately 400 ha. of land. According to the project laid out by the government of Sri

Lanka, irrigated cultivation of cotton will be undertaken in the Walawe and Mahaweli areas so that it is scheduled that cultivation covering 9,700 ha. during the Five Year Plan period will be undertaken in the Walawe area as the leading example, thereby aiming to obtain seed cotton of 18,000 tons. The Mahaweli area has striking similarities to the Walawe area in climatic and soil conditions. Therefore, it can be expected that all the Walawe experiences and the selection of varieties and the application of cultivation methods can be directly applied to the Mahaweli case and the resulting yield can also be applied to the case of the Mahaweli project estimation.

According to the Cropping Pattern set forth for Stage II, the cultivation of approximately 5,200 ha. is projected, thereby expecting to obtain a yield of 9,000 tons of seed cotton. In the Walawe area, it is planned to undertake compulsory cultivation of cotton by the settlers during the Yala season so that if a similar policy is enforced in the Mahaweli area, securing of the above-mentioned seed cotton production will be possible.

(3) Sugar Cane

All the execution pertaining to the cultivation of sugar cane and production of sugar are undertaken by the Sri Lanka Sugar Corporation.

As shown in Attached Table VI-12, the yield of sugar cane in Sri Lanka is on a considerably low level when compared with the yields of other countries. The personnel in charge of the Corporation pointed out that the reasons for such results were insufficient irrigation water, unsatisfactory water drainage during the rainy season and the lack of experimental research for the promotion of the yield.

Due to the fact that sugar cane is not the farmer's crop, the laboratories of the Department of Agriculture have not carried out, at least to the present, any significant research concerning the cultivation of sugar cane. The cultivated varieties are CO527 and CO775, and, it seems that it would not be very difficult to obtain a yield of 70 to 80 t/ha. with ample irrigation water and well-controlled administration as the soil and climatic conditions are suitable for sugar cane cultivation.

The operation rate of mills is extremely low. For instance, at the Kantalai factory in the D area which is adjacent to the H area, the sugar production amount is approximately 8,000 tons per year as against the production capacity of the factory of 21,000 tons per year (of sugar). In addition to the low level of the harvesting amount of sugar cane, it is noted that the recovery rate of sugar from sugar cane is also low. The cane sugar content in cane at the time of harvesting is 10% to 11% however, the actual recovery rate seems to be within the range of 6% to 7%.

According to the Five Year Plan, the cultivation in the Kantalai area will be enhanced to 3,200 ha. by 1976 with a target of yield of 75 t/ha., while, improving the recovery rate to 9%, thereby anticipating the augmentation of sugar production to 16,000 tons. It is planned that sugar cane cultivation covering approximately 12,000 ha. will have been undertaken by the completion of the Five Year Plan in 1976. In Stage III of Phase I-Project I of the Mahaweli Project, it is planned that a further 2,800 ha. of new cultivation expansion will be undertaken in the Kantalai area, however, the sufficiency of the sugar supply is too remote. The annual consumption of sugar at present is approximately 25,000 tons. If the yield of sugar is taken at 6.25 t/ha. and if self-sufficient supply is to be undertaken on this assumption, approximately 40,000 ha. of cultivation is necessary at the present stage for the cultivation of sugar cane.
The small holding system is now being studied in addition to the presently plantation system, and if the new system is implemented, it is possible that the cultivation area of sugar cane will be largely expanded. The Department of Agriculture is also planning to commence the research concerning sugar cane cultivation as a farmers agriculture.
It is therefore expected that the black sugar or liquid sugar production as a cottage industry will become the subject of attention. At any event, there is no sugar cane cultivation project layout in the Stage II area.

The lack of projects in the Stage II area seems to be due to the following reasons.

1) No technical scrutinization has been made pertaining to the sugar cane cultivation technique particularly due to the fact that no evaluation of this operation has been made in viewing it as one of the farmer's agriculture.

2) In view of irrigation and drainage, there is no sufficient land suitable for sugar cane cultivation within the Stage II area in which sugar cane may be cultivated as one of the plantation crops.

3) A sugar factory is presently existing in the Kantalai area, however, the operation rate is extremely low at this factory so that improvement of the rate at this factory will be the immediate objective of the project, however, the geographical distance between Stage II area and Kantalai is excessive.

(4) Soya beans and groundnuts

Generally, soya beans are not apparently affected by the type of soil, however, the yield is higher in particularly fertile soil. At the Maha-Illuppallama Agricultural Research Station, experiments are being undertaken with special emphasis upon the white beans (three month varieties) such as Bragg, TK-No.5, Taichung (R), etc., and a yield of more than 2 t/ha. has been achieved. Soya bean culti-

vation on the farmers' level is almost non-existent at the present stage and therefore it is not certain as to what extent of yield can be expected , however, it seems reasonable to assume that the probable rate is 1.3 t/ha. Groundnuts are suitable crops for cultivation in the Dry Zone, however, conventionally this crop has been cultivated as a rain-fed crop so that the yield was on a low level. Unlike soya beans, groundnuts have already been cultivated by farmers. In particular, a considerable area of land is now being utilized for the cultivation of groundnuts as one of the irrigated crops in the Polonnaruwa District and the Anuradhapura District. The most popular variety is A92, however, other cultivated varieties are A20, Red Spanish, Uganda Erect, Big Japan, MI-1, etc. Of these, Big Japan and MI-1 are considered to be potential in view of their high extent of yield. According to the test results obtained by the Maha-Illuppallama Agricultural Research Station, the yield range is rather wide, from 2 t/ha. to 4 t/ha. depending upon the method of cultivation. However, the instances of obtaining a yield of more than maximum 4 t/ha do exist. It seems reasonable to assume that the yield extent on the farmers' level will be approximately 1.7 t/ha. of groundnuts in the shell. According the cropping pattern for Stage II of the Mahaweli Project, approximately 8,000 ha. is planned to be developed for a culti-

vation area of either soya beans or groundnuts. If an assumption is made that 400 ha. of this area is utilized for cultivation of soya beans, and 400 ha. for groundnuts, the harvest will be 5,200 tons of soya beans and 6,800 tons of groundnuts (in shells). However, if soya beans alone are cultivated, the harvest will amount to 10,400 tons, and, if groundnuts alone, the harvest will be 13,600 tons. In either case, the harvested crops can be used as raw materials for subsequent industrial production.

(5) Maize

Maize is one of the important crops which has been cultivated as the chena crop in the Dry Zone. A portion of the harvest of maize is used as food. For the most part, the crops are consumed as feed for chicken farming. Although maize is not conspicuously affected by the nature of soil, the yield will be drastically different depending upon the cultivation conditions such as rain-fed or irrigated or fertilized or unfertilized. The yield of maize is approximately 0.5 t/ha. due to the fact that for the most part the maize cultivation is being undertaken by the rain-fed non-fertilized cultivation method. However, according to the test results obtained by the Maha-Illuppallama Agricultural Research Station, approximately 2.5 t/ha. of yield has been obtained by means of undertaking the irrigated and fertilized cultivation method.

The yield on the farmer level in the Stage II area in the future is, as far as maize is concerned, reasonably estimated at 1.5 t/ha. This being the case, the maize production obtainable from a maximum 16,000 ha., which is the scope of the planned cultivation area in the Stage II area, will be 24,000 tons. The MDB proposes prices for these agricultural crops produced on the farmers' level as shown in Table VI-16 which have been computed on the basis of the production cost of the crops as well as the yield amount thereof. In other words, if the calculation is made on the basis of the guarantee price for paddy, i.e. Rs.14/unit, the profit obtainable through one day of work will be approximately Rs.22. This implies that, in order to achieve a profit of Rs.22 through one working day in the case of cultivating crops other than paddy, for instance maize, the unit price of maize will have to be at Rs.39/unit. Unless this price level can be guarantee, farmers will have no incentive in carrying out the maize cultivation and will naturally turn to the cultivation of paddy. The present guaranteed prices for these crops other than paddy are all on a lower level than the proposed prices. This fact signifies that a positive pricing policy by the government will be necessary in order to secure stable supply of these crops as industrial raw materials.

(6) Other Crops

1) Manioc

Manioc is one of the most popular chena crops. Because of the fact that the cultivation of manioc is easy and requires little funds, the cultivation is widely undertaken throughout the nation as one of the home garden crops together with bananas, etc. It is estimated that the cultivation area of manioc amounts to approximately 80,000 ha. At present, most of the manioc produced is not utilized as an industrial raw material and consumed domestically by the producer farmers as supplementary food item to rice. Thus, the yield of manioc is on a low level of 6 t/ha. When compared with the yield level of Thailand, 20 t/ha, yield level of Sri Lanka is drastically low. Thailand is one of the representative countries where manioc cultivation is most extensively undertaken. The yield level of Sri Lanka is even lower than the world average of 8.5 t/ha. Manioc is not incorporated into the Stage II Cropping Pattern. This signifies that manioc is not given top priority as irrigated crop. In Sri Lanka, according to the results obtained in the experimental stations, 25 t/ha. of manioc yield has once been recorded as a result of fertilization

2) Kenaf

Kenaf is a suitable crop for cultivation in the Dry Zone.

This has long been grown under wild conditions in the jungles of the Dry Zone. In recent years, experiments have been undertaken by the Maha-Illuppallama Agricultural Research Station as one of the substitutes of jute. Recent test reports stipulate that the yield of kenaf in retted fibre was 5 t/ha, as an irrigated crop. Although kenaf is not incorporated into the Stage II Cropping Pattern, the incorporation will be considered in the subsequent stage if ample economical viability of the cultivation and the priority are acknowledged.

3) Castor beans

Wild castor beans are widely grown in the Dry Zone. Within the Project Area, castor beans are grown in various places, however, castor beans are not as yet chosen as the subject crop by official research stations.

4) Mulberries

No significant cultivation of mulberries is being undertaken at present. According to the Five Year Plan, it is projected that the cultivation of mulberries covering 4,000 ha. will be undertaken by 1976. The cultivation operation of mulberries is under the jurisdiction of the Department of Minor Export Crop, however, research and experiments concerning the cultivation of mulberries and the sericulture are considerably behind the progress of the studies of other agricultural crops and farming crops.

The main cultivation conditions for mulberries are: a soil pH range of 6.5 to 7.0, rainfall of 1,250 to 2,500mm per year, and temperatures of 27 to 38°C. The Project Area is also suitable for mulberry cultivation. However, it is considered that the suitable temperature for carrying out sericulture is in the range of 21 to 27°C so that air-conditioning would be necessary if the sericulture operation is to be undertaken within the area. The cultivation of mulberries within the Dry Zone is confirmed to be improved in yield by means of substantiating the irrigation system so that if priority is given to the cultivation of mulberries and sericulture as a result of thorough economic viability scrutinization, the incorporation of this subject into the subsequent stage of the irrigation project will be materialized.

5) Fruit and vegetables

As has been mentioned in VI-1-2-4, the present situation of the food production within the area falls mostly under the category of production for own consumption. Therefore, in order to carry out the production of the items of fruit and vegetables as raw materials for subsequent industrial processing, it is necessary to carry out intensive cultivation. At present, however, there are no prospects concerning the securing of a stable source of raw materials for processing operations except for the crops which have been incorporated in the Cropping Pattern.

2-2 Forestry Resources

2-2-1. Present Status of Forests (Project Area: H, D and G areas)

The average rainfall in the Project Area is 1,500mm per year and the monthly rainfall peak covers a period of approximately three months (mainly October, November and December). The temperature is high, the maximum level attains 33°C. These climatic conditions are not favourable for the growing of plants. Compared with Borneo, Sumatra, etc. where the rainfall amount is generally high, the growth of forests in the Project Area is generally impeded. (However, some species grow better under such climatic conditions.) Therefore, the forests in the Dry Zone cover a lesser extent of wood species and, at the same time, the stock is low. In view of vegetation, the forests fall under the category of the Tropical Mixed Evergreen Forest. This category of forest vegetation presents advantageous environments for human beings to undertake hena cultivation agriculture in view of such favourable factors as the easy removal of objects on the ground surface, the higher fertility of the soil when compared with areas of much greater rainfall, the lower speed of growth of miscellaneous weeds which may suppress the growth of agricultural crops. Consequently, the Tropical Mixed Evergreen Forests have long been intruded upon and destroyed in Asian areas such as Thailand, Burma, Indochina, etc. by the cultivation activities of the people.

The subject of this survey was the area of a plain and gently hilly areas located between Anuradhapura, a city known as the

ancient capital and Polonnaruwa. It is obvious that the forests in this project area have been intruded upon and destroyed by people. When the forests are observed from a high altitude, (the observation was made from a helicopter), a large area of grouped forests are distributed along the main flow of the Mahaweli Ganga and a group of small area forests (1,200 to 3,200 ha.) exist on the west end part and central-south part of the H area and in the central part of the D area. Fruther, small area strip-shaped forests exist in the vicinity of reservoirs and canals. According to the results of surveys made concerning these forests on the ground, the contents of these forests are highly versatile, the details of which will be described in the latter part of this report.

2-2-2 Forest Composition and Distribution of Trees

These forests can be categorized, strictly speaking, into two categories as suggested in "The Natural Vegetation of Ceylon" by Mr. Fernando, i.e. the Monsoon Forests and the Monsoon Shrub Forests, however, the Project Area is located in the southern part of the Dry Zone and as a while scrubed species are not so abundant and thus the forests in this area can be categorized as belonging to the Monsoon Forests. The growing processes of these forest vegetations are considered to be as follows.

(1) The woods which had not been cut out or killed at the time of chena cultivation carried out a long time ago formed a forest together with the after growing trees which grew after the termination of the chena cultivation.

(2) A certain portion of the above-mentioned survived trees were eliminated (cut) during their growth or after growth thereof.

(3) All the vegetation was destroyed at the time of chena cultivation operation a long time ago and after the termination of the cultivation, naturally grown trees have formed the present forests.

Therefore, no virgin forest in the strict sense of the word can be located within this area. In the case of the canopy of the category (1) above, the upper layer and the lower layer are present in the case of matured forests

and forms dense vegetation, however, in the case of young trees, scanty vegetation is present by presenting one single layer as a whole of the forest.

In the case of the above category (2), a dual layer is sometimes present depending upon the degree of destruction, however, generally, the forest consists of a single layer and the height of the trees is generally on a low level. As far as the density is concerned, this category is similar to the above category (1).

Concerning the category (3), generally a single layer is present although the fast growing trees are protruding and the general vegetation of the forest is dense. The species of trees growing in these forests are as per Attached Table VI-13 which has been compiled on the basis of the Forest Inventory of Ceylon. The main species of trees belong to the following families, Euphorbiaceae, Sapindaceae, Ebenaceae, Rutaceae, Sterculiaceae, Myritaceae, Tiliaceae, Lauraceae and Melastomaceae.

The Drypetes sepiaria (W. & A.) P & H -- Wira which belongs to the above Euphorbiaceae is the species which assumes the highest extent of forest occupation followed by Euphoria Longana Lam-Mora which belongs to Sapindaceae.

A number of tree species show a tendency to flocking vegetation and a small number of species (e.g. Nerau, Nawa) vegetate scatteredly. Wira, Satin and Palau are not so much affected by the geographic conditions, however, Halmila as well as Kumbuk

tend to grow in such areas where the water drainage is satisfactory and swampy conditions are present. Halimila in particular, presents vigorous natural regeneration in areas having such environmental conditions.

The distributed trees generally present scanty canopy which is not round in shape. Although the buttress are not fully developed, a number of trees present irregular trunk shapes and further, they are fluted.

Approximately ten species including Satin, Milla, Halmila, Welang, Kon, etc. are defoliation species and the rest are evergreens so that, as a whole, the forests are presenting a generally evergreen status. The wood growth speed in these forests is generally gradual so that a number of species take approximately 100 years until they are fully grown. It is also said that in the case of Palau or Kaluwara, approximately 200 years will be required for them to grow to the full extent. As the flowering and fruiting seasons are concentrated in the dry season, comparatively clear identification of such phenomena can be noted. Wild elephants and other wild animals are residing in these forests.

2-2-3 Forest Inventory

The actual field survey of the subject forests could not be undertaken during the present survey. Therefore, the data stipulated in the following paragraphs are based on the Forest Inventory of Ceylon. Concerning the scope of the forests, the

following estimation can be made on the basis of the results observation made from an altitude.

(1) In H area : 7 LD ..... 8,000 ha.
7 ND ..... 4,000 ha.

(2) D area : 7 LD .....10,400 ha.
7 MD ..... 5,600 ha.

(3) G area : 7 LD ..... 1,800 ha.

If the calculation of the inventory extent is made concerning the Phase I forest inventory of the Project Area, the result figures will be as shown in Attached Table VI-14. When compared with these calculated results, the estimated forest resource figures stipulated by the MDB are considered to be realistic. The utilizeable extent of the inventory can be calculated as follows on the basis of the data of Attached Table VI-14.

H area: 14.9 million ft^3 x 60% = 8.9 million ft^3
D area: 29.2 million ft^3 x 60% = 17.5 million ft^3
G area: 2.8 million ft^3 x 60% = 1.7 million ft^3
Total : 28.1 million ft^3

The above results can be rearranged as follows in accordance with the diameter classification. The diameter figures were taken as the chest-height diameter of erect trees.

	Diameter 10-28cm	Diameter over 30cm	Total
H area	5.5 million ft^3	3.4 million ft^3	8.9 million ft^3
D area	8.8 million ft^3	8.7 million ft^3	17.5 million ft^3
G area	1.0 million ft^3	0.7 million ft^3	1.7 million ft^3
Total	15.3 million ft^3	12.8 million ft^3	28.1 million ft^3

In view of the utilization of the wood materials in accordance with the species-wise inventory, the following can be noted. Halmila, Satin, Palau, Milla and Kaluwara are heavy, hard, strong and pleasant in appearance and are well accepted for sawn wood production and plywood manufacture. Of the inventory of over 30cm-diameter, it is expected that approximately 45% belongs to the category A which will be discussed later, 15% to category B which is suitable for general purpose sawing only.

Also, the remainder of the inventory of the over-30cm diameter after selecting the A and B category materials plus the total quantity of the below 28-cm diameter class materials are estimated to belong to the category C. Therefore, if the inventory amount of these trees is distributed in accordance with the application which is projected in the way of the present utilization of the forest resources, the following will ensue.

(1) For plywood and sawn woods: (Valuable wood materials)

12.8 million ft^3 x 45% = 5.76 million ft^3 ----A

(2) General use sawn wood:

12.8 million ft^3 x 15% = 1.92 million ft^3 ----B

(3) Chips for making pulp, chips for making boards, for use as raw materials of charcoal, as construction materials for local areas, as wooden materials for agricultural use:

[28.1 million ft^3 - (A + B)]= 20.5 million ft^3 ----C

(Note): In the actual execution of the project, the amount of A is divided into three equal parts (1.92 million ft^3 each) and shall be respectively destined to plywood mills, sawmills and for exportation.

2-3 Mineral Resources

2-3-1 Deposits of Mineral Resources

Attached Fig. VI-2 shows the deposits of the mineral resources, the existence of which have been confirmed in the Mahaweli Project Area and also in the adjacent areas. These charts have been compiled on the basis of data obtained through boring tests which have been conducted by the Geological Survey Department covering all areas of Sri Lanka. Therefore, except for the feldspar in Talagoda, and the vein quarts in Kaikawela, the resources cannot be assessed in their economical viability unless test excavation is undertaken. In other words, as discussed in II-4-2 earlier, the test excavations should be undertaken at the cost and risk of the interested miners.

2-3-2 Types of Mineral Resources

The types of the mineral resources are as shown in Attached Fig. VI-2. Within the Mahaweli Project area, the following resources are considered to be available:

Dolomite, limestone, mica, clay, feldspar and appatite,

In the vicinity of the Project Area, the following items are confirmed to be available in addition to the above items:

Vein quartz, iron ore, magnetite, magnesite, graphite.

However, concerning the appatite, the No. 4 boring tests were

underway in Feb. 1973 and it was reported then that the excavation operation of the deposit was expected to be possible reserve. (Comments made by the Director of Geological Survey.)

2-3-3 Quality of the Mineral Resources

As discussed in the above 2-3-1 only the existence of the resources have been confirmed, and no confirmation as to the quality has been obtained. Attached Table VI-15 describes the analysis values and comments concerning several samples which were brought back to Japan by the survey team. The following paragraphs will describe the views taken by the survey team concerning the mineral resources which are presently utilized.

(1) Quartz:

Quartz is being or has been produced in the form of vein quartz in the central to southeastern part of Sri Lanka. The deposits of quartz in the Mahaweli Project Area and in the adjacent areas are at Rottota, Pallekalle and Deltata. The purity is more than 98.8% and the crystal size is large. The produced quartz is being used as the raw material for dishware, sanitary ware and for the production of glass.

(2) Feldspar:

Feldspar in Sri Lanka is produced in the form of pottasium feldspar. Rottota, Talagoda, etc., are the locations of the produc-

tion in the Mahaweli Project area and the adjacent areas. The Talagoda deposit is being excavated by the Ceylon Ceramic Corporation. The product is used as the raw material for producing dishware, sanitary ware and for the production of glass.

(3) Clay:

Kaoline, ball clay, etc., are produced in the southwestern part of the country and these items have not been confirmed in the Project Area as to their deposit. The clay which can be used as a raw material for the production of red bricks, roofing tiles and earthen pipes, is available in a wide area covering the whole country. For the Project Area and the adjacent areas, Tissawewa in the Anuradhapura District and Kekirawa in the North-central District, Wenda and Kegalle in the Kurnegala District, Kadugannawa, Gampola, Kandy and Matale, etc., in the Kandy-Matale District are well known as the deposit sites of clay.

(4) Graphite:

Graphite produced in Sri Lanka is known world-wide as the crystalline flake graphite. Except in Kebitigollawa in the north-central area, most of the graphite mines are in the central to southern part of the country. The deposits in the Mahaweli Project Area and in the adjacent area are found in Ragedara, Naramana, Dalapihilla, Kahatagahatanna, etc. Of these deposits,

the Kahatagaha and the Kolongaha mines are particularly well known. The excavated graphite is directly exported and no secondary processing industry of graphite exists in Sri Lanka due to the lack of domestic industrial demand.

3. The Project Area in View of Site Conditions

3-1 Roads and Transportation

The present situation of the road and railway systems are shown in Fig. 2 which connects the major cities and the Project Area. As is clear from this figure, as compared with the Wet Zone, the transportation system of which is centered around Colombo and Kandy, the Dry Zone possesses fewer road systems. However, H, IH, G and D areas are situated comparatively close to the main roads and railway routes so that the transportation of the products into the urban areas is comparatively easy. Table VI-17 shows the distance from Anuradhapura, Dambulla and Polonnaruwa to the major cities. All the main roads are paved within the Project Area, however, the pavements are damaged in many places so that, along with the progress of the Project, a great part of the roads will have to be repaired as the amount of transportation increases.

As the means of transportation, trucks and railways are available. The cooperative societies own trucks, however, the number of vehicles is not large, so that transportation operations are mostly undertaken by forwarding private companies. The freight in the case of paddy transportation is as follows:

From the Project Area to Colombo: Rs.50.00/t by truck

From Anuradhapura to Colombo: Rs.33.89/t by railway

3-2 Population and Labour Forces

Fig. 3 shows the population, population density and population growth rates. The figures are taken in accordance with the District of Sri Lanka. The density is highest in the Colombo District and generally outstandingly higher in the Wet Zone than the Dry Zone. The Wet Zone is therefore forming a large scale consumption area. Jaffna is comparatively densely populated in the Dry Zone. The population increment ratio (1963 up to 1968) was 2.53% per year for the total of Sri Lanka, however the rate in the Project Area, for example, the Anuradhapura District and the Plonnaruwa District shows 3.47% per year and 3.28% per year respectively. Further, as has been described earlier, the population increase rate in the H area was 4.3% which is extremely high. This is due to the fact that in this area settlement is being positively undertaken. Concerning the future settlement scheme within the Project Area, it is planned and announced officially that 4,700 households per year for a given period from 1975 to 1980 will be undertaken in the Stage II area. The breakdown of such a settlement scheme is that of the total, 1,600 households will be recruited from inside the Project Area and 3,100 households from outside. Therefore, the population in Stage II area in 1980 will be 23,500 households encompassing 141,400 people on the assumption that approximately 6 persons comprise one household.

If 3 people per household have a work force potential (Refer to Table VI-1), half the population, 70,700 persons, will be eligible as the available labour force so that the irrigated area per capita of labour force will be approximately 0.4 ha. (one acre). In accordance with the Cropping Pattern set forth for the Stage II area, the situation of the farm labour in this area is shown in Table VI-18. In other words, the number of annual work days per one worker is 102 days with peaks in July when the work days amount to 12.15 days, while during December the work days are reduced to a minimum of 3.3 days. The present population in the irrigated area of H area (Stage I area) is 64,300 (Ref. Table VI-1). If the population is to increase at the present rate, the population in 1980 will be approximately 78,400, thereby increasing the labour force population to 39,200.

The total extent of the labour force required for the cultivation of Stage I area is shown in Table VI-19, calling for 4,410,000 persons/day. Therefore, the per head annual work days will be 112 days for cultivation work. These labour days do not include the days required for the care-taking of draught animals or the days required for works other than cultivation. Even if these extra work days are taken into account, it can be expected that an ample allowance is present in this area i.e., 100 days/person/$_{year}$ or approximately 1,100 million persons/day for the total H area.

3-3 Utilities

3-3-1 Water

As has been mentioned earlier (refer to Attached Table VI-5 and Attached Fig. VI-1), in H area and IH area there are large reservoirs, the total effective capacity of which is approximately 387 million tons. Further, there are as many as 200 small tanks (average capacity 123 thousand tons). The water in these reservoirs is being utilized for irrigating the paddy fields in these areas. These reservoirs are further connected to each other by canals, and it is expected that upon completion of Stage I, the water of the Mahaweli Ganga will be supplied to these reservoirs via the canals.

The water of the Mahaweli Ganga and the reservoirs is analyzed as shown in Attached Table VI-16. The fact that the water of the Kalawewa Reservoir seems to contain a comparatively high concentration of salt may present problems, however, by introducing the water of the Mahaweli Ganga into the Kalawewa Reservoir, the salt concentration is expected to be reduced to half of the present level. It is possible to use the irrigation water as cooling water and other industrial applications, therefore it is likely that no problems will arise concerning the availability of the water supply source.

3-3-2 Electricity

As has been described in IV, it is expected that the amount of electricity generated through the dams which are to be built to alter the flow of the Mahaweli Ganga, etc., will be 50 MW (200 million KWH/year). The electric power thus generated (generated in Ukuwela and in Bowtenna) is scheduled to be fed to the 132 KV lines which are already existing or are under construction so that the power distribution will encompass the whole island of Sri Lanka through the trunk transmission lines.

It is estimated that the demand for electricity covering the whole island will be as follows:

1973: 230 MW

1975: 280 MW

1980: 410 MW

(estimated by the Ceylon Electricity Board)

It is planned that upon the completion of this project, the electricity supply situation will be as follows:

1973: 380 MW

1976: 420 MW

This being the circumstance, the supply of electricity will cover the demand for some time to come. Concerning the

electricity distribution capacity, on the other hand, as shown in Attached Fig. VI-3, the following points may be noted on the basis of the existing facilities.

(1) Regarding the utilization of the 132 KV lines, it is necessary to contemplate side lines from the substations of Anuradhapura and Habarane.

(2) Concerning the 33 KV lines, distribution is now available up to Maha-Illuppallama, Kekirawa, Dambulla, Maho, and Galewela. Concerning the distribution within H area of the project area the project is being scrutinized with the framework of the Mahaweli project, however, studies are being made with the main emphasis on the supply of electricity to the settlers, therefore it is likely that a certain extent of investment will be called for in order to install transmission line sidings when industrial production facilities are to be installed inside H and IH areas. (In the project feasibility report of Stage II, the preliminary cost calculations were undertaken on an assumption basis, however, no details are given concerning the transmission and distribution of electric power).

3-4 Electricity Correlation between Electricity Power Supply Situation and Industrial Estates

As has been described in V-I, the necessary facilities are being substantiated in the named industrial estates so that the general situation is much more favorable than the above mentioned areas where the existing electricity facilities are used merely for lighting, etc., however, the establishment of the basic layout for the industrial estate undertaken by the IDB, is being carried out by allocating the lots after confirming the number of applicants to the settling program in general. The question remains as to whether or not ample facilities are still available for future industries. The industrial estates which exist in the vicinity of the Mahaweli Project area are as follows:

Existing Pallekelle (in the suburbs of Kandy)

Pannala under contemplation (in the suburbs of Kurunegara)

These industrial estates are connected by main roads to Dambulla which is located on the southwestern tip of Stage II area, and their respective distances to Dambulla is as follows:

Dambulla - Pallekelle--------55km

Dambulla - Pannala ----------72km

This being the circumstance, no problem is expected to take place in the way of transporting raw materials. In any event, when the projected industries in this report are materialized, close collaboration with IDB is recommended not only concerning the utilization of the industrial estates but also concerning the establishment and administration of industries.

Table VI-1 Population of Project Area

	Number of Households	Number of Individuals Over 16 Years	Number of Children Under 16 Years	Total Population
Stage I Area*	(10,620)	(34,300)	(30,000)	(64,300)
Stage II Area	8,800	25,900	25,100	51,000
Total	19,420	60,200	55,100	115,300

* (Incomplete figures)

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-2 Classification of Households

Unit: Percent of households

	Traditional Farmers	Colonists	Encroachers	Non Farmers	Miscel-laneous
Stage I Area	16	48	23	2	11
Stage II Area	45	3	24	9	19

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-3 Agricultural Land Area per Household

Unit: ha

	Paddy Land	Upland	Chena Land	Total Land
Stage I Area	0.93	0.57	0.12	1.62
Stage II Area	0.32	0.49	0.41	1.62

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-4 Distribution Pattern of the Area Operated per Household

(%)

	Less than 0.203ha	More than 0.203ha	More than 0.405ha	More than 0.810ha	More than 1.62ha	More than 3.24ha	More than 6.48ha
Stage I area							
Paddy Land	80.1	72.7	64.2	35.8	12.6	2.3	0.4
Upland	94.8	61.2	42.1	14.1	1.1	0.2	-
Chena Land	18.0	15.1	8.8	2.5	0.6	-	-
Total Land	100	92	87.6	77.6	34.8	6.1	0.4
Stage II							
Paddy Land	71.4	50.3	38.6	23.8	7.5	1.2	0.2
Upland	90.0	63.1	33.3	12.4	2.9	0.1	-
Chena Land	56.3	47.1	32.3	12.3	2.2	0.3	-
Total Land	100	84.2	77.3	62.3	31.5	5.7	0.7

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-5 Land Operation Pattern

Unit: Percent of land

	Paddy Land	Upland	Chena Land	Total Land
Stage I Area				
Operated by the Owner	72.4	89.5	89.3	79.3
Worked by Labourers	2.1	2.2	0.7	2.0
Rented	24.0	3.2	4.0	15.5
Unused	1.5	5.1	6.0	3.0
Stage II Area				
Operated by the Owner	51.5	84.5	97.0	75.0
Worked by Labourers	2.0	2.0	1.0	2.0
Rented	21.5	2.5	1.0	7.5
Unused	25.0	11.0	1.0	15.5

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-6 Crop Production Patterns

	Stage I Area		Stage II Area	
	Production	Percent of Production Locally Consumed	Production	Percent of Production Locally Consumed
Paddy (Kg)	662,241	37.5	163,292	79
Maize (Kg)	30,481	62	207,272	18
Other Grains (Kg)	294,652	71	741,710	78
Pulses (Kg)	45,722	62	20,321	100
Roots (Kg)	1,127,806	74	360,695	89
Tobacco (Kg)	91,444		37,086	
Chilli (Kg)	248,930	54	474,491	31
Onions (Kg)	59,692	100	21,337	100
Vegetables (Kg)	955,079	100	1,966,040	60
Coconuts ($\frac{1,000}{\text{Nuts}}$)	6,200	100	2,390	100
Bananas (Bunches)	247,000	25	70,780	39
Citrus (Kg)	28,449	58	61,471	25
Miscellaneous	28,449	47	61,471	43

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-7 Fish, Milk and Egg Production

	Stage I Area		Stage II Area	
	Production	Percent Locally Consumed	Production	Percent Locally Consumed
Milk (1,000 l)	228	100	260	100
Eggs (1,000 Nos.)	537	100	393	82
Fresh Fish (10 Kg)	8,636	100	20,321	100
Dry Fish (10 Kg)	584	100	711	100

Source: Agro-Socio-Economic Survey MDB 1971

Table VI-8 Monthly Consumption per Capita

Item	Unit	Data A		Data B	
			Household Income Group Below 200 Rs/month	Household Income Group 200-399 Rs/month	Average of Whole Island
Rice	Kg	7.43	7.21	7.92	7.83
Flour	"		1.81	1.56	1.54
Sugar	"		1.21	1.51	1.49
Pulses	"	0.05	0.43	0.48	0.47
Chilli (Dried)	"	0.20	0.20	0.18	0.19
Onions	"	0.55	0.56	0.64	0.64
Low-country Veg.	"	1.70	1.58	1.66	1.64
Up-country Veg.	"	0.48	0.66	0.83	0.85
Leaf Veg.	"	0.75	0.75	0.94	0.92
Bananas	Bunches	3.73	2.81	4.91	5.45
Coconut	Nuts	8.12	7.07	7.26	7.50
Coconut Oil			0.26	0.29	0.29
Milk	"	0.39	0.21	0.50	0.55
Eggs	Nos.	0.66	0.46	0.50	1.51
Beef	Kg		0.09	0.15	0.18
Fresh Fish	"	0.80	0.40	0.76	0.70
Dried Fish	"	0.34	0.32	0.32	0.30

Source; (Data A) Agro-Socio Economic Survey MDB 1971

(Data B) Socio-Economic Survey 1970

Dept. of Census and Statistics, Ceylon.

Table VI-9 The Land Classes, Their Limiting Soil Factors and Relationship to Soil Series

Land Class	Limiting Soil Factors Symbo (S)			Soil Series
	Texture	Depth to Gravel in inches	Alkalinity pH	Salinity Total Salt %	
1.	Moderately Coarse to Moderately Fine.	91cm plus of moderately coarse to moderately fine textured Soil, or 107cm of moderately coarse textured soil.	9.0	0.2	Reddish Brown Earth and Alluvial Soil well drained to moderately well drained
2.	Coarse to Moderately Fine	61cm plus of moderately coarse to moderately fine textured soil, or 76-91 cm of moderately coarse to coarse textured soil.	9.0	0.5	
3.	Coarse to Moderately Fine.	46cm plus of moderately coarse to moderately fine textured soil, or 61-76 cm of coarse textured soil.	9.0	0.5	
		61cm plus of moderately coarse to moderately fine textured soil.	9.0	0.5	Reddish Brown Earth and Alluvial Soil imperfectly drained.
			9.0	0.5	Low Humic Gley and Alluvial Soils poorly drained.
4R	Moderately Fine to Fine	61cm plus of moderately fine to fine textured soil.	9.0	0.5	
			9.0	0.5	Low Humic Gley Soil, very poorly drained, fine textured.

Source: Feasibility Study Stage II

Table VI-10 Correlation between Arable Land Classes and the Irrigable Land Classes and Subclasses

Group	Class	Irrigability	Sub-Classes
Arable	1	Excellent	
Arable	2	Good	2s, 2t, 2d, 2st, 2td, 2sd, 2sk, 2kt, 2df.
Arable	3	Fair	3s, 3t, 3d, 3sd, 3st, 3td, 3sk, 3tk, 3df.
Limited Arable	4	Good for rice cultivation	4Rd, 4Rt, 4F.
Temporarily Non-Arable	5	Temporarily Non-irrigable	5h (1, 2, 3, 4,) 5sd, 5Ta
Non-Arable	6	Non-irrigable	6s, 6t, 6k, 6sk.

Source; Feasibility Study Stage II.

Limiting Factors

s ... Soil depth

t ... Leveling

d ... Drainage deficiency

k ... Rock cover

f ... Flooding hazards

R ... Limited to rice cultivation

F ... Limited to coconut and home garden

h ... Too high for gravity irr gation

Ta ... Near reser (flooding)

Table VI-11 Acreage of Different Landclass

	Landclass	Acreage (ha)	Total (ha)
Upland	2s	1,151	23,308
	2t	2,217	
	2st	2,146	
	2d	2,671	
	2sd	1,605	
	2td	5,967	
	2std	4,085	
	2tk/2sk	133	
	3s	590	
	3t	1,030	
	3std	359	
	3td	195	
	3st	882	
	3sk	186	
	3tk	91	
Paddy Land	3d	1,033	14,947
	3sd	154	
	4R	13,760	
Total		38,251	

Source: Feasibility Study Stage II.

Table VI-12 Gross & Farm Areas in Areas 'H' & 'IH'

Rounded Values

(Unit; ha)

RESERVOIRS	STAGE I				STAGE II			
	GROSS AREA	FARM AREA			GROSS AREA	FARM AREA		
		UPLAND	RICE	TOTAL		UPLAND	RICE	TOTAL
KANDALAMA	3,200	-	1,600	1,600	11,300	3,100	2,600	5,700
KALAWEWA MAHA ILLUPPALAMA KATTIYAWA	8,100	-	5,300	5,300	45,300	14,500	8,500	23,000
RAJANGANE ANGAMUWA	19,400	1,400*	5,500	6,900	-	-	-	-
USGALA SIYAMBALANGAMUWA	1,200	-	600	600	-	-	-	-
NACHCHADUWA AND CITY TANKS (IH AREA)	6,500	-	4,000	4,000	-	-	-	-
TOTAL	38,400	1,400	17,000	18,400	56,600	17,600	11,100	28,700

* Lift Irrigation Project.

Source: Feasibility Study Stage II.

Table VI-13 Adequate Crops in Each Land Class

Soil Grade	Yala Season	Maha Season
1	Chilli, Onions, Cotton, Groundnuts, Soyabeans, Pulse, Vegetables, Fruit	Chilli, Onions, Soyabeans, Pulse, Vegetables, Fruit
2s,2t,2st, 2sk,2tk	Chilli, Onions, Soyabeans, Cotton, Groundnuts, Pulse, Vegetables, Fruit	Chilli, Onions, Soyabeans, Pulse, Vegetables, Fruit
2d,2sd,2td, 2std	Maize, Cotton, Groundnuts, Pulse, Fodder Crops, Soyabeans,	Maize, Paddy, Fodder Crops
3s,3t,3st, 3sk,3tk	Chilli, Onions, Pulse, Vegetables, Fodder Crops	Chilli, Vegetables, Pulse, Maize, Fodder Crops
3d,3sd, 3td,3std	Maize, Groundnuts, Soyabeans, Pulse, Fooder	Maize, Paddy, Fodder Crops
4R	Crops Paddy	Paddy

Source: Feasibility Study Stage II.

Table VI-14 Proposed Cropping Pattern

Unit: Percent area

	Very short term			Target		
	Percent of Up-lands	Percent of Low-lands	Percent of total area	Percent of Up-lands	Percent of Low-lands	Percent of total area
Paddy	38.5	200	103.1	62	225	127.2
Maize	15	-	9.0	30	-	18
Pulse	26.1	-	15.7	49.6	-	29.8
Groundnuts	11.7	-	7.0	23.5	-	14.1
Soya Beans	11.8	-	7.1	23.5	-	14.1
Cotton	15	-	9.0	30	-	18
Onions	4	-	2.4	4	-	2.4
Chilli	17.7	-	10.6	17.7	-	10.6
Miscellaneous	13.5	-	8.1	4	-	2.4
Total	153.2	200	172.0	244.3	225	236.6

Source: Feasibility Study Stage II

Table VI-15 Cultivation Area of Each Crop at the Completion of Stage II

	%		Area	ha
Paddy	90.0	145.2	25,800	41,700
Maize	55.2	0	15,900	0
Pulse	29.8		8,600	
Groundnuts	28.2	0	8,100	0
Soyabeans	0	28.2	0	8,100
Cotton	18.0		5,200	
Onions	2.4		700	
Chilli	10.6		3,000	
Others	2.4		700	
	236.6		*68,000	

*28,700 ha (Stage II Development Projected Area) x 2.366

Source: Calculated from cropping patterns of the "Feasibility Study, Stage II"

Table VI-16 Proposed Farmgate Price of Various Crops Based on Paddy Price

	Output per acre	Work-days per acre	Production Costs (Rs)				Total	Ints. Cons. per unit output (Rs)	No. on workdays per unit output	Return per workday(Rs)	Proposed farm-gate price of unit output(Rs)
			Seed	Ferti-lizer	Chemi-cals	Machi. & Others					
Paddy(1)*1	100bu	37	28	133	240	212	613	6.13	0.37	21.3	14
Paddy(2)*2	90bu	34	28	117	166	199	510	5.67	0.38	21.9	
Paddy(3)*3	90bu	30	28	133	233	225	619	6.88	0.33	21.4	
Maize	20cwt	20	14	60	110	149	339	16.95	1.00	22	39
Ground*4 nuts	20cwt	33	80	32	63	195	370	18.50	1.65	22	55
Soyabeans	15cwt	28	20	52	45	112	229	15.27	1.87	22	56
Cotton*5	20cwt	60	6	58	247	277	588	29.40	3.00	22	95

Source: Feasibility Study Stage II

*1 130 days variety

*2 100 days variety

*3 Upland Paddy

*4 Unshelled

*5 Seed Cotton

1 acre = 0.4 ha

1bu = 20 kg

1cwt = 50 kg

Table VI-17 Distance between Major Cities and Project Area

City	1968 Population (Thousand)	Distance (Km)		
		From Anuradhapura	From Dambulla	From Polonnaruwa
Colombo	558	206	148	216
Mt. Lavinia	122	218	160	228
Jaffna	102	196	248	283
Kandy	77	138	72	140
Galle	73	321	264	332
Trincomalee	40	106	109	129

*1969

Table VI-18 Monthly Distribution of Labour (Stage II Area)

	Percentage Total Area	Workday/ Acre/ Year	Workday / Worker / Acre											
			Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
(1) Miscellaneous	2.4%	216	5.16	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
(2) Onions-chilli-pulses	2.4	302	7.25	0.58	0.77	0.62	0.55	0.65	0.94	0.84	0.46	0.62	0.26	0.48	0.48
(3) Paddy-chilli	9.0	166	14.94	0.72	1.08	0.90	1.17	1.80	2.52	2.88	1.71	0.90	0.54	0.45	0.27
(4) Paddy-oilseeds-pulses	28.2	99	27.91	1.97	3.10	1.41	0.56	1.13	3.95	3.10	3.38	3.38	3.67	1.41	0.85
(5) Paddy-cotton	18.0	80	14.40	0.72	1.08	1.08	0.90	0.72	1.44	2.70	2.70	1.44	0.90	0.54	0.18
(6) Paddy-paddy	30.0	74	22.20	0.30	4.50	3.00	1.50	0.90	0.90	1.50	1.80	4.20	1.80	0.90	0.90
(7) Paddy-paddy-paddy	10.0	102	10.20	1.00	1.50	0.70	0.20	1.00	1.50	0.70	0.20	1.00	1.50	0.70	0.20
Total	100.0		102.06	5.72	12.46	8.14	5.31	6.63	11.68	12.15	10.68	11.97	9.10	4.91	3.31

Source: Calculated from Feasibility Study Stage II

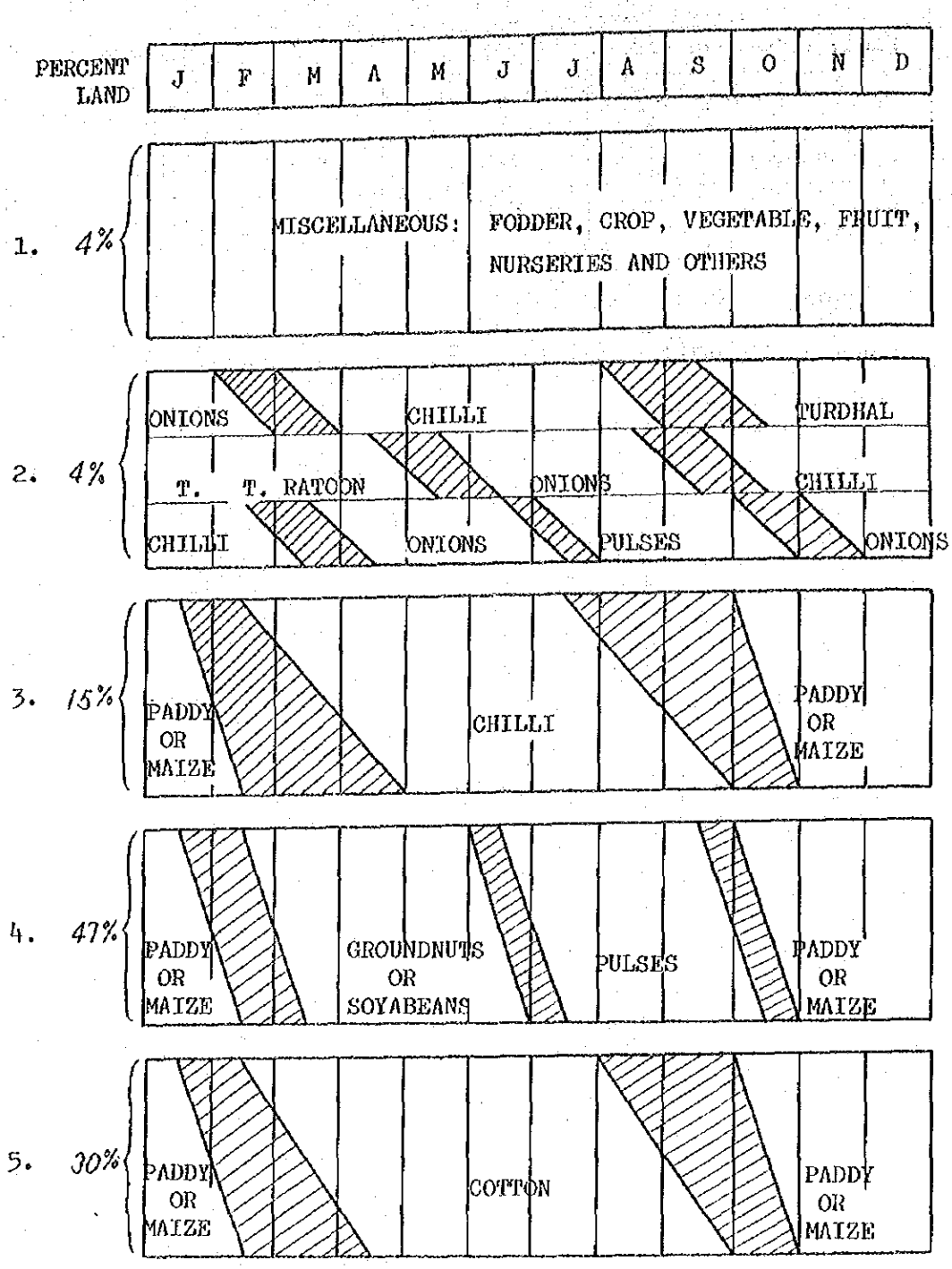
Table VI-19 Workday for Stage I Area

Crop	Workday/acre	Acre	Total Workday
Paddy (130 days var.)	37	63,000	2,331,000
Paddy (100 days var.)	34	31,500	1,071,000
Upland Crop*	120	8,400	1,008,000
			4,410,000

*Cropping intensity 2.4

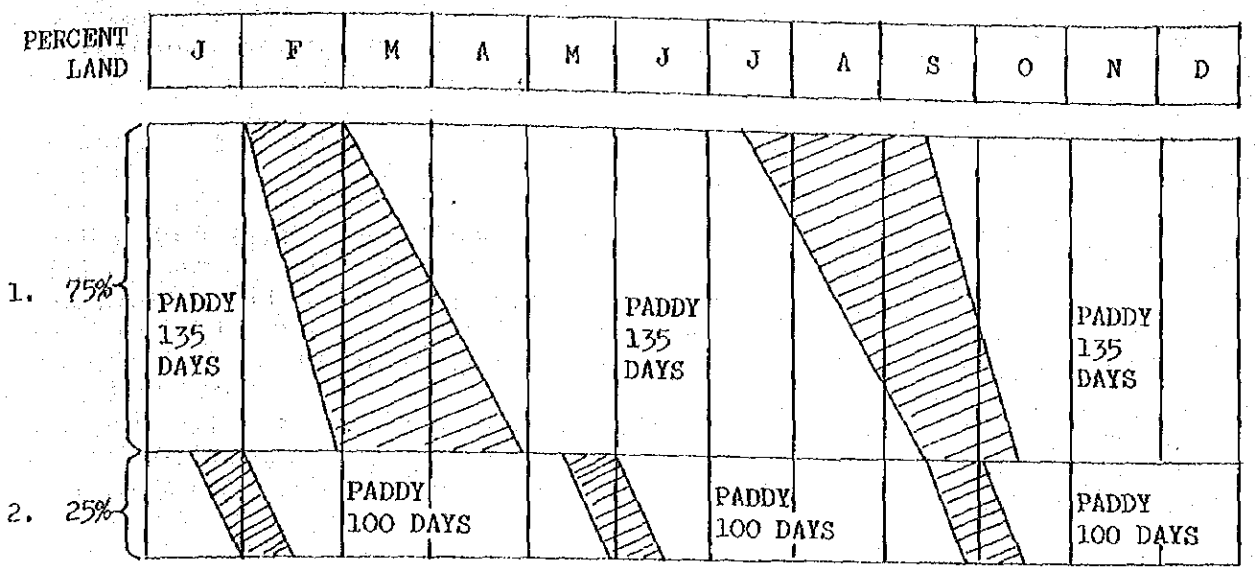
Source: Calculated from Feasibility Study Stage II

Fig. VI – 1 Proposed Cropping Pattern (Uplands)



Source : Feasibility Study Stage II

Fig. VI-2 Proposed Cropping Pattern (Lowlands)



Source: Feasibility Study Stage II