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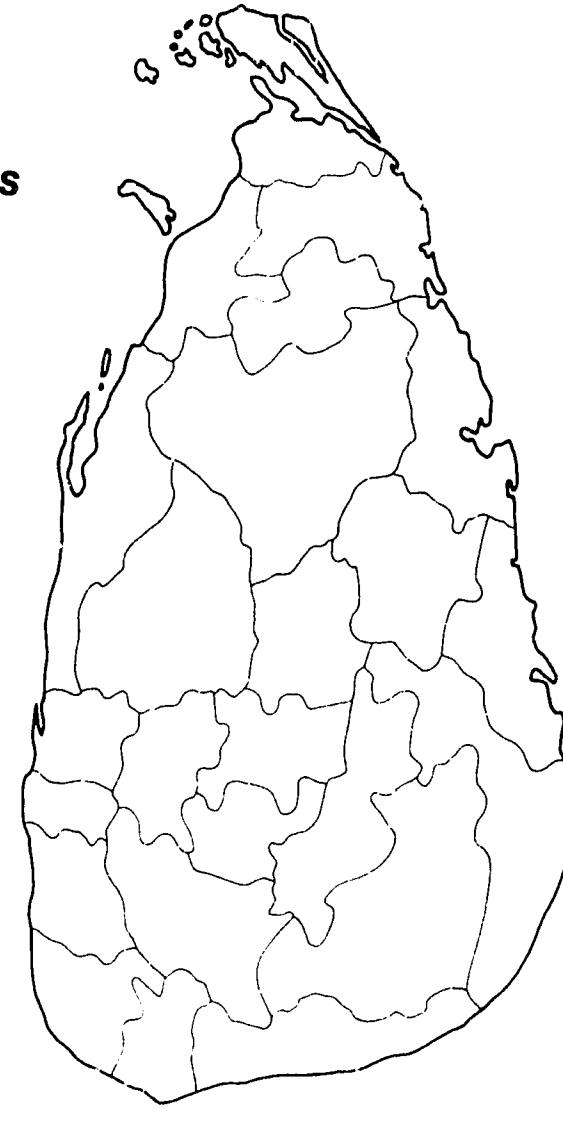
August 1983

Developing Sri Lanka's Private Sector and Its Investment Opportunities

Volume 3
Opportunities in Agro-Based Industries



Arthur D. Little International, Inc.

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DEVELOPING SRI LANKA'S PRIVATE SECTOR AND ITS INVESTMENT OPPORTUNITIES

Volume 3

Opportunities for
Agro-Based Industry Development

A Report Prepared by

Arthur D. Little International, Inc.

For the

Sri Lankan Ministry of Finance and Planning

and the Coordinating Committee for Private Sector Development

Commissioned by the

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August, 1983

Arthur D. Little International, Inc.

PREFACE

The present report - Opportunities for Agro-based Industry Development - is the third of four volumes comprising a larger study entitled: Developing Sri Lanka's Private Sector and Its Investment Opportunities.

Arthur D. Little International, Inc. was asked to undertake for the Ministry of Finance and Planning and the Coordinating Committee for Private Sector Development a study of means to strengthen and expand Sri Lanka's private sector and to identify key investment opportunities for private enterprise. The study, which occured from February to June 1983, was conducted by a team of Arthur D. Little consultants and industry specialists in cooperation with a counterpart team of Sri Lankan professionals.

Early in the project the study team identified several sectors of Sri Lanka's economy which, on the basis of a general survey, appeared to offer important commercial opportunities for the private sector. Equally important, development of these sectors could be expected to contribute in a significant way to the growth of Sri Lanka's productive capacity, national income, employment, and foreign exchange.

Seven sub-sectors were chosen for in-depth industry profiles. In the present volume covering the agro-industrial area, studies were conducted in fruits and vegetables, coconut products, the dairy industry and fisheries. In the industrial sector, three surveys were undertaken in the rubber products industry, the light engineering industry (particularly as related to agriculture), and the minerals processing industry.

The other three volumes of the study are as follows:

Volume 1 - Summary of the Study

Volume 2 - Definition of the Private Sector and the Environment for its Development

Volume 4 - Opportunities for Development of Manufacturing and Minerals Processing Industries

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CHAPTER 1

EXECUTIVE SUMMARY

SUMMARY PROFILE OF THE FRUIT AND VEGETABLE INDUSTRY

A. OVERVIEW

Fruit and vegetable production in Sri Lanka is carried out almost exclusively by small-scale farmers in home gardens, on a total acreage roughly estimated at 500,000. Because of the favorable climatic and agronomic conditions, a wide variety of fruits and vegetables are grown, including carrots, leeks, chillies, cabbage, tomatoes, okra, mangoes, passion fruit, and mangosteen, totaling approximately 800,000 MT annually. The Sri Lankan farmer is generally relatively well-educated, familiar with vegetable and fruit cultivation and with modern farming practices such as irrigation, fertilizer, pesticides, and terracing, and is market-oriented in his attitude. The large areas of irrigated land coming into production as part of the Mahaweli Development Project offer significant potential for expansion of the fruit and vegetable industry, particularly for export.

B. CONSTRAINTS

The lack of linkages between production, processing, and marketing is the primary factor constraining the development of the industry; this constraint has a large impact on farmers. Because the flow of market information to farmers is negligible or nonexistent, the Sri Lankan farmer generally has no reliable markets for his goods. Market demand is generally not "pulling" production, leading to inefficiencies, loss of production and profitability, higher costs, and lack of growth for the industry. Linkages between production and processing, and production and marketing need to be further developed through the establishment and strengthening of supply arrangements (contracts) with farmers. Another major constraint to farmers is the lack of seed material of appropriate quality and varieties in adequate amounts.

There are estimated 15 to 20 fruit processing firms in Sri Lanka basically processing only acid foods, canning them with pasteurization as the method of preservation. Industry products include passion fruit and mango cordials and juice, canned tropical fruit salad, and canned mango, jakfruit, and papaya. Processing by pasteurization followed by hot-pack filling is not acceptable or technologically adequate for general vegetable canning. As a result, no vegetable processing industry exists in Sri Lanka.

The technology and practices of the fruit processing industry are rudimentary, and the technological base of the industry is weak. With possibly one or two exceptions, the fruit processing industry does not produce goods that can be either exported or substituted for imported products.

The main problem the industry faces is an insufficient market. Poor understanding of the market on the part of producers and processors alike has resulted in few linkages of processors to the market, and has constrained the industry's growth and its flow of products. Other major constraints processors face are the unavailability of trained food technologists, the high cost of the imported packaging materials because of import duties, inadequate knowledge of products available internationally, and a lack of government support.

C. OPPORTUNITIES

Sri Lanka's fruit and vegetable exports have quadrupled over the past five years, primarily through sales to the Middle East markets. Its proximity to the Middle East is a comparative advantage in this large, relatively new market for fruits and vegetables. More than 100 private exporters of fruits and vegetables are now operating in Sri Lanka, and it appears that farmer, processor, and exporter are beginning to understand more about the quality, variety, and packaging requirements of export markets.

As this development continues, and through increased communication between producer, processor, exporter, and export market buyer, the fruit and vegetable industry should be able to increase its market share in the Middle East and further develop other markets. Marketing of fruits and vegetables is constrained by Sri Lanka's inconsistency in maintaining a market and lack of a market strategy. The high air freight rates are another major constraint to fresh fruit and vegetable exporting.

The objective of this study is to identify entry and expansion opportunities for private enterprise, building on Sri Lanka's comparative advantages, and recognizing its constraints, some of which were briefly mentioned above. These private enterprise opportunities are summarized below:

- Production of seed for fruits and vegetables and multiplication of seedlings for nontraditional and exportable varieties. This opportunity arises out of the domestic demand, which exceeds supply by nine times, and which is particularly keen for exportable varieties, i.e., okra, striped watermelon, bitter gourd, strawberries.
- Expanded processing of the Jaffna mango for the domestic market and possibly export markets. Arising out of a unique raw material supply situation, and what appears to be a unique product, this opportunity would require a low capital investment and would be labor-intensive.
- Small processing and packing operations at the community level in the Mahaweli area, utilizing production from home garden plots in a concentrated area. This opportunity would entail a joint venture between community ownership (producer association) and a private sector processor who presently markets.These could be a series of small basic, labor-intensive operations throughout Mahaweli, which would preserve surplus home-garden production, producing processed

products for the community's own consumption and for the domestic market.

- Increased linkages between producers, processors, and marketers, through joint ventures or contract arrangements between farmers, wholesalers, processors, and exporters. This opportunity has particular potential for a large-scale venture in the Mahaweli area, where the large dry land areas under irrigation, totaling close to 350,000 acres, present opportunities for such crops as tomato, okra, etc., for processing and export.
- Joint venture between existing groups of fresh fruit and vegetable exporters and Air Lanka or other air service for the purchase of aircraft to provide air freight service for fresh produce exports, primarily to Middle East markets. This opportunity would help to eliminate the major constraint on exporters cause by high air freight rates and limited availability. Such a venture would also build on the increasing export volume by forward integrating and gaining more control over the marketing channel.
- Joint venture of private sector consulting firm with C.I.S.I.R. to provide technical assistance to the food processing industry in Sri Lanka. There is no public or private sector entity currently providing technical assistance to the industry, and there is a lack of trained, experienced technical resources available to the industry from any source. This weak technological base affects product quality, food safety, plant productivity, and profitability of the industry. There appears to be a demand in industry for assistance in product development/formulations, process development, packaging, plant design/layout, quality control, and training of plant staff.

SUMMARY PROFILE OF THE COCONUT PRODUCTS INDUSTRY

A. OVERVIEW

Coconut processing activities are organized into six major product areas: copra, oil, desiccated coconut, charcoal, brown fiber, and white fiber. Just under half of all nuts produced go into processing; 70% go into copra and oil production and the remainder into the production of desiccated coconut. Most (75%) of the husks from the seasoned or brown nuts that are processed are used for mattress and bristle fiber; a small amount (4%) of green husks from nuts going to the fresh market are used for white fiber. In terms of tonnage, copra is the largest product area (140,000 tons per average year) followed by oil, fiber, desiccated coconut, and charcoal. In terms of value of production, oil (about Ea 2 billion per average year) is the largest product group, followed by copra, desiccated coconut, fiber and charcoal. Desiccated coconut has the greatest value added of all coconut products and provides the greatest monetary return per coconut processed.

The processing segment of Sri Lanka's coconut industry can be evaluated internationally in terms of the size of copra activities. Over the period 1971-80, average annual production of copra in Sri Lanka (187,000 MT) ranked fourth after the Philippines, Indonesia, and India. Sri Lanka's processing segment is half the size of India's but less than one-tenth the size of the Philippines'. Overall, coconut processing in Sri Lanka has been slowly contracting since 1964, because of the decreasing availability of raw materials. The technology used in processing is generally labor-intensive, with few changes made in equipment or facilities in the last 15 to 20 years.

Industry experts in Sri Lanka believe that the processing efficiency of most firms is low, partly because there is no incentive to improve it (margins allowed by the government are low) and partly

because of the low world price of coconuts. The quality of copra and oil produced is highly variable, because there is no effective premium on quality. Investment in updated, more efficient, and even integrated coconut processing technology that maintains the existing high labor-to-capital ratios would increase yields, add more value, and open new domestic and foreign markets to the industry.

While the industry's operations are largely in the hands of private enterprise, the government has traditionally exercised heavy control and regulation of its activities through the Ministry of Coconut Industries. The main policy toward the industry has been to control exports of coconuts and coconut products through the use of export duties to: (1) ensure their availability for the domestic market at low consumer prices; and (2) maximize foreign exchange revenue for the national budget. This government policy has had the effect of absorbing most surplus revenue resulting from Sri Lanka's comparative advantage as a low-cost producer. As a consequence, the industry's operators have been deprived of profits that could be reinvested in expansion and in improvement of productivity. The Ministry of Coconut Industries has sought to offset this factor through various subsidy schemes to stimulate investment by growers. Such subsidies have focused on fertilizer use, the replanting of old low-yielding palms, and the planting of palms on new lands. Some subsidies have gone to processors in the form of rebates to cover wages when export restrictions stopped processing temporarily.

The present duty scheme adopted in November 1981 was intended to overcome many of the shortcomings of previous schemes. Nevertheless, the present scheme does not permit a downward adjustment to compensate for declining world prices, thereby intensifying the downward pressure on grower prices. In addition, as the market regains its strength with rising prices and the scheme goes into operation (as has happened since June 1983), the scheme will effectively siphon away the increased revenue which could be passed on to growers, thereby helping them to recover from the previous years of low prices. If the

industry's position internationally is to be preserved in the future, the full impact of the present scheme needs to be evaluated in light of the more competitive world market which has evolved in recent years.

B. CONSTRAINTS

The major constraint facing the industry has been and continues to be the government's policy. Over the years the numerous duty schemes, export restrictions, and subsidies that have come and gone have increasingly brought the industry to at best a standstill or continued slow decline, threatening the significant contribution it has made to employment, foreign exchange, and value added.

To overcome this constraint, a major revision of the present duty scheme is required. In 1980, the World Bank observed that if adequate incentives were to be restored to coconut growers (and processors), a substantial readjustment of the relative prices of nuts was required. The wholesale price of nuts on the domestic market has typically been kept, by means of export duties, at 2 to 2.5 times below export market prices. Higher returns to growers and processors will allow for greater investment to increase production and processing yields. Lower duties on exports may initially mean lower revenues to the government, but as the industry gains strength and expands so will the tax base. A small duty on a large base can generate more revenue than a large duty on a small and slowly contracting base.

A second major constraint facing the industry is in the area of product and processing technology. Since there has been little incentive to invest in the industry, the adoption of new technology has been blocked. Thus, while industry experts in Sri Lanka are aware of technology developed and adopted in other countries of the world, the technological and economic feasibility of adopting those technologies in Sri Lanka has not been examined. The new products and markets made possible by this technology are not well known to the Sri Lankan industry and thus the opportunities they offer have not been assessed.

C. OPPORTUNITIES

Assuming the above constraints can be overcome, entry and expansion opportunities exist within the industry. Coconuts, coconut kernel products, and white fiber all have strong markets domestically and internationally, suggesting that if the industry's production and productivity were to increase, revenue would increase as well, providing an increase in employment opportunities and foreign exchange generation and a growing tax base for government revenue.

- Coconut oil refining and packaging in consumer-size containers for the domestic and export markets. Refined and packaged oil on the domestic market commands at least twice the price of the raw oil presently produced and sold. The Middle East presents an attractive export market. A small plant with a capacity to refine 15 tons/day would require an estimated Rs. 15 million investment. One plant of this size could process about 3,000 MT of oil per year, equal to about 8% of average annual exports over the period 1971-81.
- Integrated coconut processing facilities, capable of producing coconut milk, and all sub-products such as oil, pulp, and water. Coconut milk is a staple of the domestic in Sri Lanka. About 1,000 million nuts are used by households for this product. It is estimated that household processing wastes at least 30% of the oil available in the coconut kernel, or some 300 million nut equivalents of oil (37,500 MT) per year. To meet 25% of the domestic demand for coconut milk through industrial processing, would require an investment of some Rs. 500 million. Concurrently, domestic nut consumption for milk preparation could be reduced by an estimated 75 million nuts/year. This quantity of nuts is equivalent to 9,375 MT of oil, reflecting a 47% increase in average annual exports, or to 11,029 MT of desiccated coconut, reflecting a 31% increase

in average annual exports. Before industry operators can invest in this type of integrated technology (milk processing) as well as the technology to improve processing efficiency (oil and desiccated coconut), the technologies need to be tested and adapted to Sri Lanka's conditions. Investment in new processing technology with high labor-to-capital ratios will require domestic technological support if processors are to adapt it readily support which could be developed at the Coconut Research Institute.

- White fiber or coir yarn processing plants where productivity can be increased and the processing period decreased. White fiber processing is presently a time-consuming and labor-intensive cottage industry. Of the coconut fiber products, it commands the highest price and represents the only growing market. Raw material (green husks) for the production of while fiber is abundantly available, with only 4% of present supply now being used. Investment in this product group will require development and testing of technology with a high labor-to-capital ratio.

SUMMARY PROFILE OF THE DAIRY PRODUCTS INDUSTRY

A. OVERVIEW

The dairy sector is an integral part of the overall livestock industry and contributes about 2% to Gross Domestic Product (GDP) of the Sri Lankan economy . This sector has been highly controlled by the government during the past two decades and has therefore been subjected to shifts in government priorities. Presently, the government is interested in removing itself from direct management of activities that are more appropriately managed by private sector initiative.

Dairying is an important activity for many small land holders and landless tea estate laborers. For this reason, effective development of the sector would have significant impact on the lower income groups in the economy. Because of these impacts, the sector has been chosen as an area of further investigation in an effort to identify opportunities where private sector initiatives can be utilized to promote development of the sector and ultimately benefit the small farmer.

B. OPPORTUNITIES FOR SRI LANKAN PRIVATE SECTOR INVESTMENT IN THE DAIRY INDUSTRY

The dairy industry offers several opportunities for private sector involvement in both production and processing:

- Establishment of milk collection systems.

There is a large market for locally produced milk. Establishment of milk collection systems could help small farmers receive a greater share of the price paid to producers by eliminating the middlemen who collect milk at very high cost to the farmer.

Establishing 16 or 17 milk collection centers domestically could increase farm income by approximately Rs 214 million per year and rural employment an estimated 1,400 jobs. Foreign exchange savings of Rs 248 million a year would be possible. Finally, regional economic development objectives would be substantially advanced.

- Establishment of commercial dairy herds.

There are entrepreneurs with land resources that can be used effectively to support dairy development. Increased support for establishing about 300 commercial dairy farms can increase incomes to rural commercial farmers by an estimated Rs 188 million per year. Employment could be expanded by 1,200 to 1,500 rural jobs. More than Rs 219 million a year could be saved in foreign exchange expenditures.

- Establishment of small-scale regional multi-product dairy processing plants.

This project would provide a means for integrating production and processing activities in a local area, thereby creating stable businesses. This venture has the potential of yielding a 15-20% return on sales and attractive returns to investment.

Establishment of five regional multi-product dairy processing plants can increase farm incomes by an estimated Rs 62.5 million/year and 400 rural jobs could be created. Foreign exchange savings of Rs 73 million/year are possible.

- Establishment of new ice cream production capacity.

The market for ice cream is growing and is not effectively served in many cities outside Colombo. The value added when converting milk to ice cream (Rs 35.3 per gallon) seems to be sufficiently high to make it an attractive investment opportunity. One ice cream plant, if

domestically produced milk is used, can increase farm income by Rs 6 million a year, create 75 jobs, and save Rs 7 million a year in foreign exchange.

- Development of spray drying plant.

The market for spray dried dairy products is the largest in Sri Lanka and most of the product is presently imported because of a lack of local supply. Nestle is building a new spray dry plant at Ambewela that is expected to be profitable. Another plant at Ambewela should be profitable under proper management with an estimated 20% return on sales. Bringing such a plant to full operation at two shifts per day can increase farm income by Rs 178 million a year, employ 1,200 persons in rural areas, and save Rs 205 million a year in foreign exchange.

C. CONSTRAINTS CONFRONTING REALIZATION OF THESE OPPORTUNITIES

The key constraints that restrain development of the dairy sector include:

Production Constraints

- Milk prices are not based on production cost realities. They are not high enough to attract investment capital into commercial-scale dairy farms. At present prices, commercial-scale dairies do not receive an adequate return on capital.
- Producer associations at the small-farmer level lack management and financial backing to set up collection systems on their own.
- New entrepreneurs cannot operate in milk sheds where there are National Milk Board (NMB) collecting centers unless they joint venture with NMB or develop their own market.

- Government policy restricts land ownership; therefore, unless some mechanism can be developed to make sufficient land available to support commercial dairy farm development, the expansion of such farms will be slow.
- There are insufficient cows with potential for high yield to build herds rapidly.
- There is no clearly stated government policy supporting dairy herd development.
- Feed concentrates are in short supply and often too high priced to be attractive to dairy farmers; therefore, solutions to feed supply problems are essential.
- Prices of imported milk are currently subsidized as they are products in surplus in the international markets. Such dumping practices cause unfair competition for local producers and are a deterrent to development of dairy farms.

Processing Constraints

- Present supplies of milk are insufficient for existing process facilities; an adequate milk supply must be assured before constructing a new facility.
- Lack of a clearly stated government policy with respect to how milk prices will be determined at both farm and consumer levels may deter investors.
- Funding on terms acceptable to the entrepreneur is frequently not available.

Market Constraints

From a market viewpoint, there is no limitation the size of the market. However, unless a clear pricing policy is established at producer, wholesaler, and retailer levels many entrepreneurs may be discouraged. In selected local markets, the product mix of a facility may be sufficiently diversified to provide an attractive return on investment, but the private entrepreneur tends to be discouraged from mainstream markets.

SUMMARY PROFILE OF THE FISHERIES SECTOR

A. OVERVIEW

The fisheries sector in Sri Lanka is comprised of several subsectors. One subsector, shrimp (prawn) mariculture production for export, appears to have particularly high potential for growing private sector investment with favorable implications for export sales, resource utilization and employment.

Other subsectors would appear to have medium to low potential for new private sector investment, including the following:

- Speciality products for export (Beche de Mer, shark fins, jellyfish, seaweed);
- Value-added processing of inland finfish;
- Aquarium exotics for export;
- Marine finfish production; and
- Manufacture of fishing equipment (boats, gear, etc.).

These subsectors are affected by some or all of the major constraints on private investment in Sri Lanka including:

- lack of sufficient proven export market demand; and
- high risks and costs leading to low profit margins.

Two other subsectors--culture of bivalves (oysters, mussels, etc.) and harvest of squid (cuttlefish for export)--might have medium or higher potential for new private sector investment. However, there are inadequate basic data on potential markets and sustained resource availability for these subsectors to evaluate these opportunities.

B. OPPORTUNITIES FOR SRI LANKAN PRIVATE SECTOR INVESTMENT IN PRAWN MARICULTURE FOR EXPORT

The factors which make prawn mariculture a potentially attractive private sector investment opportunity in Sri Lanka are as follows:

- Established, large, growing export markets. Sri Lankan exports of prawns have been valued at about Rs 300-400 million per year in the recent past. Most of these exports have been to Japan, with the U.S. a secondary market. Export demand has consistently outstripped the available supply, which is still based almost entirely on maximum sustained harvests of naturally-occuring prawn populations in coastal waters. Prawn consumption in the established markets remains at least two orders of magnitude greater than the present Sri Lankan supply capability, and market growth in these and other areas (e.g., Western Europe and the Middle East) may be anticipated.
- Linkages to existing processing capacity and other industries. There are about a dozen "packers" exporting frozen prawn from Sri Lanka on a regular basis. Their combined processing capacity is reportedly significantly underutilized because of shortfalls in the resource supply available from harvests of natural populations. Prawn mariculture could be linked to another possible growth sector, the production of animal feeds, because of anticipated requirements for feeds comprised in part of such local products as fish meal and rice bran.
- Competitive advantages versus other potential producing countries. Sri Lanka is within 10 degrees latitude of the equator and has coastal waters and sites of the quality required for prawn mariculture yields comparable to the highest achieved anywhere else in the world. At least four highly valued prawn species occur in Sri Lankan coastal and brackish waters and appear amenable to existing state-of-the-art mariculture techniques. Labor cost advantages would also be expected to prevail over some other potentially competitive locations.

- Commercial prospects. The commercial prospects for prawn mariculture ventures in Sri Lanka appear attractive. The analysis performed for this study tends to confirm the optimism reported in earlier studies performed by prospective investors and international organizations. It is estimated that a relatively large commercial prawn farm of the size currently under active consideration by several Sri Lankan private sector investors (i.e., about 200 hectares) would realize sales revenue in the neighborhood of roughly Rs 100 million annually, with an estimated profit margin of no less than about 30% under normal operating conditions. The analysis also suggested that larger operations would be more profitable, but that self-supporting ventures on as little as 50 hectares could be profitable. Subsidized, small-holder production on plots as small as one hectare could also be economically attractive.
- Impacts. Prawn mariculture would have highly favorable impacts on the balance of trade and would provide for increased utilization of Sri Lanka's natural resources. Presently envisioned projects could increase export sales by Rs 300-400 million by 1985 and would help eliminate the present supply shortfall that constrains development of new export markets. Employment impacts would be positive, but not of great absolute magnitude. It is estimated that about two new local jobs would be created for each hectare committed to prawn mariculture. This would translate to perhaps one to two thousand new jobs by 1985.

C. CONSTRAINTS ON INCREASED PRIVATE SECTOR INVESTMENT IN PRAWN MARICULTURE

The factors which would be expected to constrain the development of new private sector opportunities in prawn mariculture in Sri Lanka are as follows:

- Site availability and selection. Estimates of the areas potentially suitable for prawn mariculture in Sri Lanka range from about 1,000 to 5,000 hectares. This is enough land to at least double present levels of export production (if developed), but raises a question about the ultimate extent of the development opportunity. In addition, proper site selection can be critical to the success of any venture, especially those of larger scale.
- Capital requirements. Prawn mariculture has significant capital requirements. A prototypical 200 hectare base-case shrimp "farm" evaluated in this study has construction costs estimated on the order of Rs 100 million and annual operating costs of about Rs 60 million. These types of costs suggest that such ventures, even if financed with special export-related loans with interest rates in the neighborhood of 12-15%, would be beyond the means of most Sri Lankan private sector investors without some foreign joint-venture (or other) capital support.
- Risk. As with fisheries ventures in general and mariculture ventures in particular, risks are relatively high due to the number of events that can lead to harvest or crop failure. State-of-the-art technology in site selection and facility engineering can minimize but not eliminate such potential risks.
- Technology Transfer. Prawn mariculture is an emerging technology, and one in which significant advances have been made in commercialization in the last 5-10 years. The technical know-how required for successful commercial-scale production must be imported to Sri Lanka via joint ventures or the purchase of consulting services. Some efforts in this direction have begun, but the technology transfer is still in a relatively early stage.

- Government Policies. If, as is generally believed, there is only a relatively small area of the Sri Lankan coastal zone that is well-suited to the development of prawn mariculture sites, the issue of government policy becomes especially important to the prospective private sector investor. In the one extreme, the government could allow a few, relatively self-sufficient private entrepreneurs to develop as much acreage as they could each afford and collect, process and export the products. On the other extreme, the government could subsidize small-holder production by supplying post-larval shrimp to many small grow-out ponds, constructed and operated with government financial assistance. The government or private sector could then process and market the product at a cost-effective scale.

During the course of this study, there appeared to be a strong emerging sentiment in both the private and government sectors in favor of the development of a comprehensive sector development plan for inventory of and assignment of allocation priorities to potentially suitable prawn mariculture sites and hatchery facilities. The present situation is sufficiently uncertain as to make the private sector uneasy about the risk of large-scale investment in the absence of clear government planning priorities.

CHAPTER 2

INTRODUCTION

Opportunities for agribusiness development in Sri Lanka stem from a number of sources including: (1) expected growth in domestic or world demand, (2) sectoral bottlenecks, (3) government priorities, (4) changing tastes and preferences, and (5) the country's competitive advantages and disadvantages. This introductory section summarizes the principal advantages and disadvantages inherent in Sri Lanka's agricultural sector which will tend to determine what related industries successfully develop and how this development must be designed.

Competitive Advantages

- An inexpensive, relatively educated, highly trainable labor force of significant size. In this respect Sri Lanka compares favorably with other less developed countries. While several others may have marginally less expensive labor, they may not be as educated or trainable.
- A sizable university-trained professional class who often have managerial or other experience in the West.
- A private sector entrepreneurial "class" responsive to opportunities when constraints not too restrictive (e.g., credit, technical know-how, joint venture participation).
- Generally well-developed physical infrastructure (roads, rail, ports, air, communications).
- The possibility of inexpensive sea shipment for bulk items which are either imported or exported.
- Generally good proximity to the Middle East and European (East and West) markets vis-a-vis potential competitors with similar agronomic conditions.
- Two season production potential (Maha and Yala) which permits more market flexibility.

- Varied micro-climates (dry, intermediate, wet zones; elevations from sea level to over 2,200 meters) which permit a wide spectrum of crops to be grown.
- Controllable irrigation water in place or soon to be developed.
- Reasonably significant quantities of government-owned, undeveloped, cultivable land available for distribution.
- A farm sector quite responsive to financial incentives and promising market opportunities.
- A reasonably large domestic market for food and agricultural items; good import substitution opportunities.
- Reasonably extensive and effective agricultural research and extension system.
- Availability of a wide diversity of locally produced agricultural commodities which indicates:
  - The existence of a broad and diverse base of agricultural skills and knowledge and a varied, multi-faceted support system.
  - The potential for "blending", handling, and/or marketing complementary products.

Competitive Disadvantages

- Distance from North American and Japanese markets vis-a-vis potential competitors with similar agronomic conditions.
- Monopolistic air freight situation with uncompetitive rates.
- Relatively limited development resources and the need to maintain government revenues and employment generated by the sector.
- Dominance of small farms which requires input marketers and output handlers/processors to deal in small quantities with large numbers of buyers or sellers. This tends to increase unit costs and the difficulty in maintaining raw material quality control.

- Continued commitment of the government to small farmers which prevents large tracts of land being available for large, self-contained "industrial" agricultural projects (which attract outside investment and can often speed the implementation process and generation of foreign exchange).
- Relatively small domestic market for the higher valued food and agricultural products (in fresh or processed form).
- Poorly developed capital markets for financing large, high risk or deferred revenue (e.g., tree crop) projects.
- Religious influences which tend to constrain the growth of certain markets such as dairy, poultry, and livestock.
- A holiday system which effectively increases labor costs and reduces operational efficiency. (Ten days of holidays annually is typical in the U.S. versus as many as 40-60 days in Sri Lanka.)
- Small export volumes which prevent competitive shipping rates from being obtained for certain commodities. This places Sri Lanka at a disadvantage with exporters with larger volumes available for movement.
- Limited cold storage or refrigerated transportation.
- Existence of many government corporations which are not subject to the same operational constraints facing private sector competitors. This is related to outright government domination of certain key industries.
- Erratic unpredictable nature of government regulations of participation and intervention in the agricultural sector.

The following chapters include the detailed sector profiles undertaken by the team of Arthur D. Little and Sri Lankan consultants. The four sectors selected for study include the fruits and vegetable sector, coconut products, the dairy industry and fisheries. The final chapter includes a brief discussion of other agro-based opportunities which were noted during the course of the study and which may merit further study.

CHAPTER 3

FRUIT AND VEGETABLE SECTOR

I. PROFILE OF FRUIT AND VEGETABLE INDUSTRY

Sri Lanka now grows many varieties of fruits and vegetables, and its climate and growing conditions are suitable for many other varieties. Fruits and vegetables have not received much attention in Sri Lanka because of the economic importance of the coconut, tea, and rubber sectors, and because of the farmers' traditional preference for growing rice as the mainstay of their diet. Thus, the fruit and vegetable industry is underdeveloped, and data and information on this part of the agricultural sector are limited. The production and marketing of fruits is not commercially organized, although there is fruit processing industry at a very elemental stage of development. Vegetable production and marketing are more organized, but there is no vegetable processing industry in Sri Lanka.

A. STRUCTURE OF INDUSTRY AND GOVERNMENT PARTICIPATION

The basic structure of the fruit and vegetable industry in Sri Lanka is shown in Table 1. The primary components of the industry are production, processing, and marketing with supporters and coordinators providing services to facilitate the various activities, such as inputs, financing, research and development, government regulations, and industry/trade associations. Production and marketing activities are entirely in the hands of private sector operators, most of them small-scale. The public sector's Lanka Canneries is involved in fruit processing, but all other processing operations are privately owned and operated.

B. NATURE OF CONSUMPTION

About 80% of Sri Lanka's population consists of people with an annual income of $285 per capita, who consume fruits and vegetables largely as fresh products near the area of production. The quantities

TABLE 1

FRUIT AND VEGETABLE INDUSTRY STRUCTURE

GROWERS	-	Approximately 500,000 to 950,000 private small land-holders, controlling about 500,000 acres, and employing approximately 250,000 additional farm laborers.
PRIMARY (Farm)-LEVEL ASSEMBLY AGENTS/TRADERS/ COMMISSION AGENTS	-	Large number of private traders/agents serving small land-holders (estimated to be 50,000).
FRUIT PROCESSING INDUSTRY	-	Approximately 15 private processing firms and one government-owned firm (two plants), producing approximately 5,000 MT processed fruit products annually.
WHOLESALE TRADERS	-	Private wholesalers, operating principally in Colombo, Jaffna, and Kandy markets, controlling almost 100% of fresh fruit and vegetable trade.
RETAILERS	-	Large number of private stall-holders and pavement vendors, selling to consumers at market centers, fairs, and roadside stalls.
EXPORTERS	-	Approximately 105 private shippers or processors who control virtually all fruit and vegetable exports, and several government-owned exporting organizations.

Source: Arthur D. Little, Inc., estimates

and types of fruits and vegetables consumed are difficult to estimate in the Sri Lanka context, particularly because total production and acreage of individual fruits and vegetables are not known. It is known, however, that an estimated two-thirds of the vegetables consumed are indigenous varieties, and that papaya and banana are the major fruits consumed domestically. It has been estimated[1] that the per capita net availability of vegetables was 93 grams per day in 1976, and this figure slowly but significantly decreased during the 1970s (the latest available figures). The decreasing trend in per capita availability suggests an increase in demand due to population increases while production and acreage remained relatively static. Other estimates have suggested that daily per capita consumption of vegetables is 62 grams[2], and of fruits, 15 to 20 grams[2]. The optimum daily per capita requirement of vegetables, according to nutritionists at the Medical Research Institute of Sri Lanka, is 157 grams. It is evident that there is a considerable gap between optimum requirements and availability for consumption of vegetables, and undoubtably, fruits as well.

There is little market demand in Sri Lanka for processed fruits and vegetables. Approximately 370 MT of processed fruits and vegetables were imported in 1982, indicating a small domestic demand for fruit and vegetable products of a type or quality not produced in the country.

C. RECENT TRENDS AND EVENTS IN FRUITS AND VEGETABLES INDUSTRY

Fruit and vegetable producers are moving toward more organization, with an increased awareness of its potential for greater profitability and efficiency in meeting market demands. Farmers are forming loosely bound groups to carry out monoculture on extended land areas (100-150 acres).

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[1] Annual food balance sheets, 1976, Department of Census and Statistics.

[2] Consumer Finance Survey, Central Bank of Ceylon, 1973.

Such groups will be in a better position to negotiate prices and ascertain the quantity/quality requirements of the market before beginning cultivation. The trend away from the home garden concept and into co-operative and organized growing is an indication of development of the industry, putting it in a better competitive position.

Producers are becoming aware of the quality and variety requirements of urban markets, the markets provided by processing operations, and export markets. This increasing awareness is apparent in the recent production of such green chillies instead of red chillies and the production of such export crops as okra, bull-nose capsicums, gherkins, and purple passion fruit, which were unfamiliar to many farmers even as recently as a year ago.

Landholders who have traditionally grown plantation crops, e.g., coconut growers are experimenting with intercropping of vegetables and fruits, and developing fruit orchards, e.g., mango, using budded/grafted planting materials. Intercropping of short-term cash crops, such as pineapple and passion fruit, to maximize earnings is increasing.

Sizeable increases in the overall acreage under production are expected in the near future, resulting in increased production. Utilization of the 350,000 acres that the Mahaweli Development Authority is opening up and other "low" lands (or paddy lands) for vegetable cultivation present increasing opportunities.

D. GOVERNMENT PARTICIPATION

Until recently, the government had taken little interest in fruits and vegetables, compared with its support of tea, coconut, rubber, and paddy cultivation in terms of expenditures, extension personnel, and research facilities. The government's Marketing Department played a significant role in the past as the only coordinating organization or structured group of technical personnel to support the development of the fruit and vegetable processing

industry. The department was dissolved several years ago, however, after becoming a "quasi-private sector" processing operation.

The present policy of diversifying agro-based exports and attaining a level of self-sufficiency in rice has resulted in the government's increased awareness of the potential for fruits and vegetables. Positive trends include increased expenditures for research and development, programs to improve product quality, and programs to support the industry through the development of infrastructure, such as tissue culture laboratories. Limited agricultural extension services through the Ministry of Agriculture, and limited microbiological testing services through the Ceylon Institute for Scientific and Industrial Research (CISIR) are now available, although they still are inadequate to meet the needs of the industry. No extension services to the processing industry are provided. The Bureau of Ceylon Standards must be responsible for consumer protection, which is important for the developing image of the industry, in addition to food product standards, such as basic grades and export quality standards.

The processing industry does not have any resource support; there is no trade or industry association, and no education and training facilities in food science and technology. The government will need to provide technical personnel services for this underdeveloped industry.

E. MARKET DEVELOPMENT

Export sales of fresh vegetables and fresh and processed fruit have generally quadrupled in volume over the past five years (see Tables 12-19) and the trend is expected to continue. Most of these goods have gone to the Middle East. The growth potential is virtually unlimited in these markets, if the Sri Lankan industry develops its understanding of market requirements and the essential linkages between production, processing, and marketing activities.

II. NATURE OF PRODUCTION

Because there are no official statistics on fruit and vegetable production in Sri Lanka, the data and estimates presented in this profile must be treated with caution. The focus, therefore, should be on the trends in production, and the implications of those trends for private enterprise.

A. ACREAGE, LOCATION, AND OUTPUT OF PRODUCTION

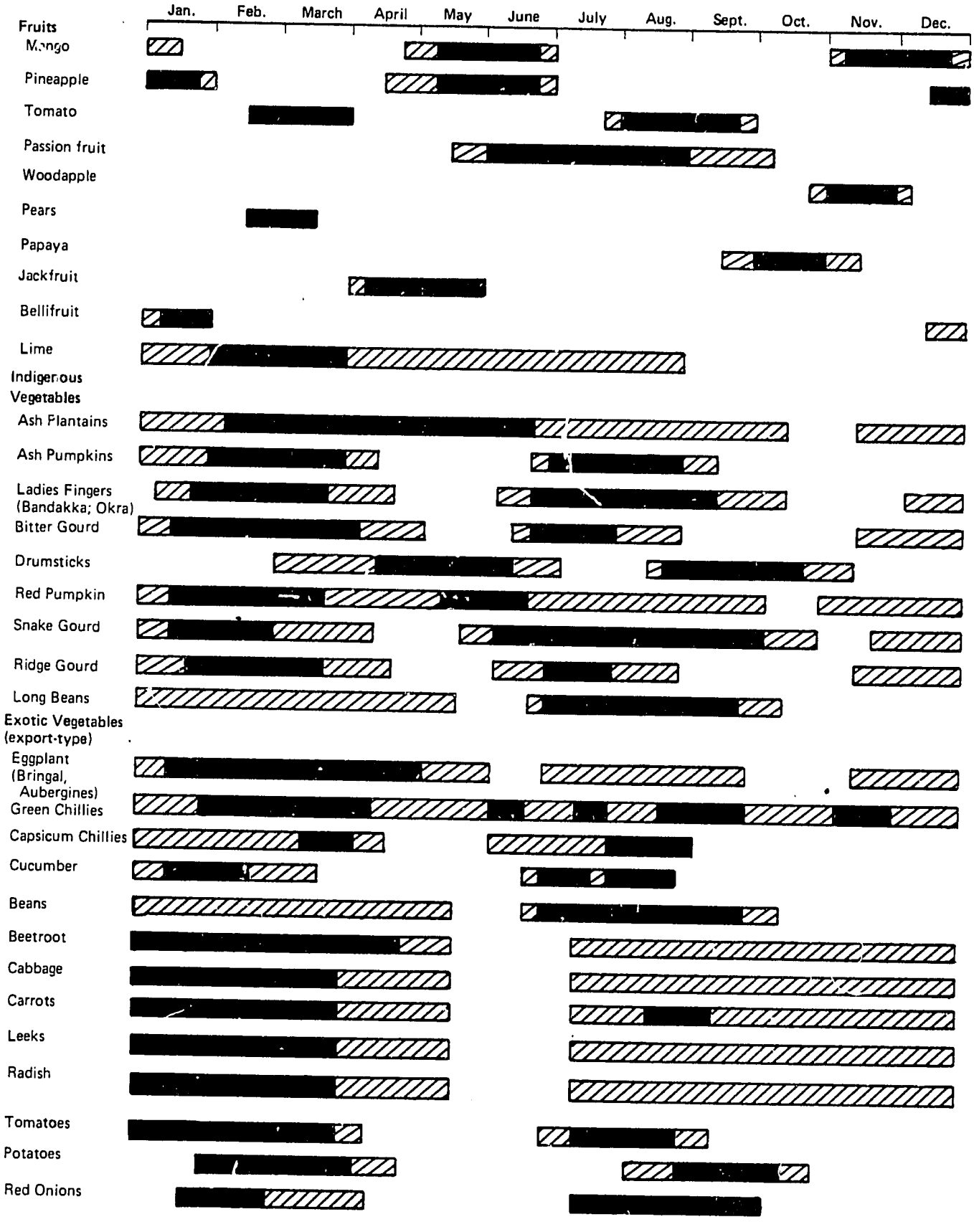
A wide variety of fruits are grown in Sri Lanka, mostly in home gardens, where banana, mango, guava, jakfruit, and avocado are commonly found. Production methods are haphazard and subsistence production is the main objective. Vegetables grown are traditionally separated into two classes: indigenous varieties (so-called "up-country vegetables") and exotic vegetables ("low-country vegetables"). Although 10 years ago there was a marked difference between the areas in which the two categories of vegetables were cultivated, almost all vegetables are grown in all localities today. Vegetable production is somewhat more organized and market-oriented than fruits, and earlier studies have shown that vegetable farmers in Sri Lanka respond positively to price increases. Table 2 lists the indigenous and exotic vegetables and fruits grown in Sri Lanka, with the main agro-climatic zones of their production (Figure 1 displays Sri Lanka's agro-climatic zones).

The total acreage devoted to fruits and vegetables is roughly estimated to be 500,000 acres[1] (200,000 hectares), out of which about two-thirds, or 333,000 acres, are in vegetables and about 167,000 acres are devoted to fruit. Primary areas of cultivation are Hambantota, Anuradhapura, Jaffna, Badulla, Kandy, and Nuwara Eliya districts.

[1]Based on figures from Ministry of Agricultural Development and Research, Agricultural Implementation Programmes; Dept. of Census and Statistics; and Export Development Board.

TABLE 2

FRUIT AND VEGETABLE SEASONS IN SRI LANKA



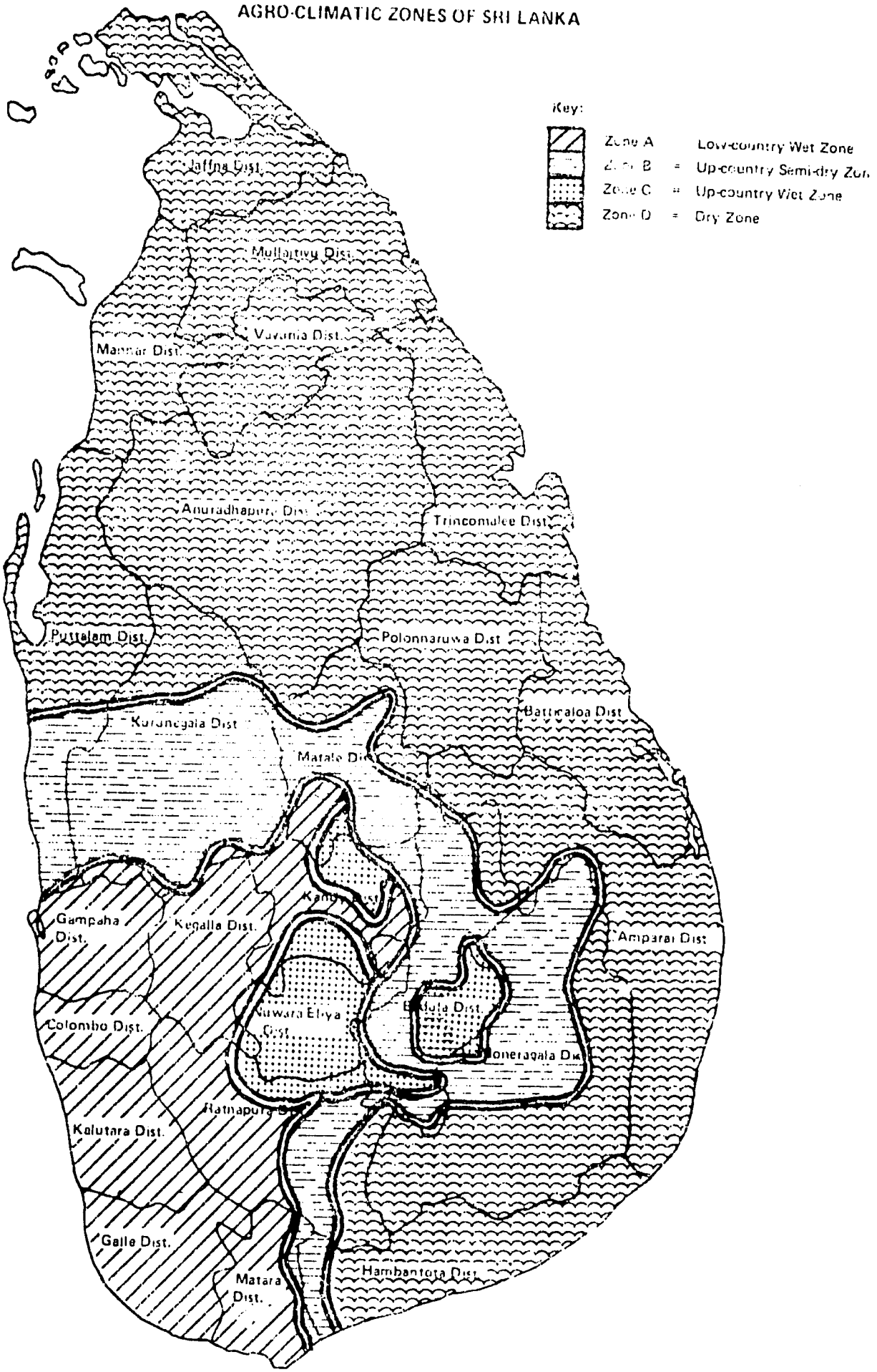
Key:

Peak Season

Moderate Production Period

FIGURE 1

AGRO-CLIMATIC ZONES OF SRI LANKA



In 1981, Sri Lanka produced about 200,000 metric tons of fresh fruit, and about 600,000 MT of vegetables; about 25% of the vegetables were exotic varieties.[1] Annual production of some of the most prevalent vegetable, root, and fruit crops is shown in Table 3. Total estimates of production and acreage of vegetables have not shown large changes over the past 15 years;[2]. Production estimates suggest, however, that there were increases reported for some important crops, e.g., onions and garlic, during the mid-1970s[3]. These production increases were stimulated by the tight surplus when imports were curtailed. With the trade liberalization initiated in 1977, imports increased and prices leveled off or declined, reducing returns to local farmers.

Because there were no yield data for fruits and vegetables, the Agricultural Research Station at Garnoruwa estimated yields, as presented in Table 4, for the purposes of this study. Several exotic vegetable crops, including beans, cauliflower, tomatoes and melon, have yields very close to those of the United States; these comparisons are of importance for Sri Lanka because the cost of production for California vegetables is frequently the basis of competition in an export market. Given the availability of inexpensive labor and irrigation, and the labor-intensive operations of private small-scale farmers, Sri Lanka's yields and quality could well be at least as high as those of the United States.

Table 5 compares Sri Lanka's yields for potato and red onion with yields in other parts of the world. They are in the same range as those of other developing countries.

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[1] Source: EDB

[2] Factors influencing vegetable prices. A study of the vegetable economy of Sri Lanka - P. J. Gunawardena and Athula Chandrasiri. Agrarian Research and Training Institute, Colombo February, 1980.

[3] Sri Lanka: Key Development Issues in the 1980's. World Bank, 1980.

TABLE 3

AREA, YIELD, AND PRODUCTION OF MOST PREVALENT VEGETABLE, ROOT, AND FRUIT CROPS[1] IN SRI LANKA, 1980-81

Crop	Area[1] (Hectares)	Yield per hectare (Metric tons)	Production (Metric Tons)	Farmgate Price ($US/kg)
Chillies	24,815	0.86	21,411	0.24
Red Onions	8,420	9.76	92,164	0.31
Sweet Potato	22,140	3.50	77,440	0.19
Manioc	38,151	11,54	440,090	0.19
		(no. of fruit)	(million fruit)	
Mangoes[3]	8,130	6.10	403	0.37
Papayas[3]	2,720	8.52	63	0.21
Pineapple[3]	3,930	2.01	31	0.22

[1]The crops presented here are the only ones for which actual production data are available.

[2]Total of Maha and Yala seasons

[3]There is some question as to the accuracy of the data on fruit, obtained from the Department of Census and Statistics. They should be viewed as estimated in the absence of any other data that would indicate fruit production in Sri Lanka.

TABLE 4

YIELDS OF SELECTED VEGETABLES AND FRUITS IN SRI LANKA AND THE U.S.

	Variety	Estimated Yield[1] MT/ha.	U.S. Yield[2] MT/ha.
1. Exotic Vegetables			
1. Red Cabbage	Red Ruby	20.00	NA
2. White Cabbage	Kay Cross	60.00	28.46
3. Leeks	Large Long Summer	10.00	NA
4. Carrots	Cape Market	15.00	30.25
5. Beans (bush)	Top Crop	10.00	7.52
6. Radish	Japanese Ball	70.00	NA
7. Lettuce	Grand Rapids Great Lakes	10.00	29.24
8. Tomatoes	T146, T244, T245	40.00	50.59
9. Capsicum	Hungarian Yellow Wax	12.00	NA
10. Cauliflower	Ca 8 Early Patna	20.00 10.00	11.00
11. Onions	Phenomenal Early	30.00	
12. Melon	Red Creole Sugar Baby	8.00 14.00	27.70 13.78
2. Indigenous Vegetables			
1. Drumsticks	No Data Available		
2. Ash Plantains	Alukehel	20.00	--
3. Gourds	Bitter Gourd MC43	20.00	--
	Snake Gourd TA2	40.00	--
	Luffa LA33	30.00	--
3. Yams			
1. Diasvoreas, Coco Yams		30.00	NA
2. Sweet Potato	Georgia Red	10.00	11.88

TABLE 4
(continued)

YIELDS OF SELECTED VEGETABLES AND FRUITS IN SRI LANKA AND THE U.S.

4. Fruits	Variety	Estimated Yield MT/ha	U.S. Yield MT/ha
1. Bananas, dessert	Ambul	40.00	7.28
2. Mango	Velai - Colombian	40,000 fruits/yr/ha.	NA
3. Pineapple	Kew	70.00	
	NA		
4. Passion Fruit	Yellow	30.00	NA
5. Strawberries	Kendhall	15-18	
		18 mo. season	22.07
6. Rambutan	Malwana	Highly variable/	NA
		approx. 5-8	NA
7. Mangosteen	Unselected	Highly variable/	NA
		2000 fruits/tree	
8. Guava	Saffeeda	Highly variable/	NA
		approx. 6	

[1] Yield data presented here are estimates by the Agricultural Research Station, Gannoruwa, based on actual production.

[2] 1980 USDA averages, not variety-specific

Arthur D. Little International, Inc.

TABLE 5

POTATOES AND RED ONIONS:
YIELD PER HECTARE IN SRI LANKA AND SPECIFIED COUNTRIES

	Sri Lanka		India[1]	Total Asia[1]	South America[1]	U.S.[1]
	79/80	80/81				
	MT/HA	MT/HA	MT/HA	MT/HA	MT/HA	MT/HA
Red Onion	11.24	9.76	10.4	11.9	14.7	27.7
Potato	14.14	13.25	13.1	15.1	10.6	19.2

[1] 1980

Source: Agricultural Statistics 1981, United States Department of Agriculture

B. PRODUCERS

Market-oriented vegetable production in Sri Lanka is carried out mostly on small landholdings. Overall the quantity of vegetables produced on large farms is very small compared with the quantities produced on the scattered small holdings throughout the country.

Some large-scale fruit production takes place, however, on a few large private landholdings not exceeding the government-established limit of 50 acres in Kurunegala, Anuradhapura, Jaffna, Kandy, Matale, Nuwara Eliya, and Badulla districts. Here passion fruit and pineapple are being intercropped under coconut palms. Larger areas are expected to come under cultivation as part of approved Foreign Investment Advisory Committee (FIAC) projects. The Mahaweli Development Authority is also considering the establishment of large-scale fruit orchards, and will lease land to growers/firms interested in such cultivation for export or import substitution purposes. Several private canneries/exporters, e.g., Pearl Island Products and Consolidated Business Systems, also grow fruits and vegetables in monoculture on holdings of 20-50 acres.

According to a the Agrarian Research and Training Institute's recent survey[1], the average size of a vegetable farm varies according to locality, with an overall average of 0.48 acre. In no locality covered by the survey did the average vegetable farm exceed one acre.

Approximately 500,000-950,000 private farmers employ approximately 250,000 (full-time equivalent) additional farm laborers.

In the wet zone areas and in the Jaffna peninsula, small parcels of land are intensively cultivated. Particularly in up-country wet zone areas, the population pressure on land is very high and the cultivation of vegetables has been carried out on minute land-holdings for decades. Further fragmentation with each new generation continues to shrink the average farm size.

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[1] Factors influencing vegetable prices: A Study of the vegetable economic in Sri Lanka. P. J. Gunawardena & Athula Chandrasiri. Agrarian Research and Training Institute. Feb, 1980.

C. MAHAWELI DEVELOPMENT PROGRAM

The Mahaweli Development Program plans to open up about 350,000 acres of land for cultivation in the north central regions of the country between 1983 and 1986. Farmers will be resettled on this land, most of which is irrigated, and will be given 2 acres of irrigable land and 0.5 acre of highland to use as homestead. The Mahaweli Authority is encouraging settlers to grow vegetable crops because some of the land is not suitable for rice, irrigation is costly, especially during April to July, and the country has almost attained self-sufficiency in rice. There is clearly an opportunity for large scale production of fruits or vegetables for export or for large commercial processing operations. The Mahaweli Economic Agency is looking for investors in processing operations or exporters to take advantage of opportunities for mutual gain, thereby providing a market for the resettled farmers' produce. The Authority is also willing to provide a certain amount of land (no more than about 500 acres) to permit investors to establish a larger volume of their own supply. The Authority is also willing to invest in operations to process the output of the resettled farmers, as has already done for a soymilk processing firm.

D. AGRICULTURAL INPUTS FOR FRUIT AND VEGETABLE PRODUCTION

1. Availability of Fertilizer for Fruits and Vegetables

The State Fertilizer Corporation (SFC) is the major supplier of fertilizer to fruit and vegetable growers. The SFC imports raw materials--primarily muriate of potash, sulfate, ammonia, and triple superphosphate--and uses locally mined urea and rock phosphate to prepare six formulations for use for specific fruits and vegetables. Table 6 shows price and formulation information.

From 1964 to 1979, the SFC monopolized fertilizer imports, but imports were liberalized in 1979. The major private sector importers and distributors deal primarily with the plantation segments of the industry and supply less than 25% of the total fertilizer used by the fruit and vegetable industry.

2. Fertilizer Prices

Imports of raw material for fertilizers are subsidized by the Treasury with S.F.C. and private sector firms registered as importers of fertilizer benefiting from the subsidy. The annual amounts for the subsidy to be set aside by the Treasury are recommended by the S.F.C. For 1983, as the Treasury subsidy will be approximately Rs. 1000 million.

Subsidy on Imports by the Treasury

		Percentage of C & F Value
1.	Urea	65
2.	N.P.K. (5:15:15)	52
3.	Potash	40
4.	Triple Super Phosphate	65
5.	Rock Phosphate	30
	Average	50.4%

The S.F.C. mixes raw materials into the six formulations given in Table 6 and sets maximum retail prices for various districts for these and for urea and ammonia "home garden fertilizer packages" (Table 7). The average current retail price of the S.F.C.'s formulation is Rs.3049, or $134/MT. Private sector firms are not bound by law to

TABLE 6

1983 RETAIL PRICE[1] PER METRIC TON OF FERTILIZER MIXTURES

Leguminous and Leafy Vegetables	Fruits and Root Vegetables	Citrus	Vegetables and Minor Crops	Potatoes and Onions	Chillies
N:P:K 14:21:14	N:P:K 16:20:12	N:P:K 9:21:20	N:P:K 14:10:10	N:P:K 9:10:12	N:P:K 13:11:0
123.25	123.25	125.71	112.84	152.55	168.44

[1]Prices, given in $U.S., based on an average of retail prices in the district stores in each of the 29 districts

Source: State Fertilizer Corporation

TABLE 7

WHOLESALE AND RETAIL PRICES OF HOME GARDEN FERTILIZER PACKETS[1]

	Wholesale Price[2] per Kg (Rs)		Retail Price per Kg (Rs)	
	Urea	Ammonia	Urea	Ammonia
1 Kg Packet	3.75	4.50	3.75	4.50
2 Kg Packet	3.12	4.00	3.50	4.37
5 Kg Packet	3.05	3.95	3.35	4.25
10 Kg Packet	2.92	3.85	3.17	4.10

[1]Packets are used for a range of home garden vegetable and fruit produce.

[2]Based on discount rate of State Fertilizer Corporation to authorized dealers, cooperative societies, and Agrarian Service Centres, for purchases of over 25 packets.

retail similar products at the same price, but because a number of firms compete for a small share of the fertilizer markets, prices actually do not vary greatly from those set by the S.F.C. Prices of branded fertilizer formulations of the private sector firms and imports under international brand names are competitive for the same reasons.

3. Availability of Pesticide for Fruits and Vegetables

Herbicides, fungicides, and insecticides are available to fruit and vegetable farmers through imports of branded names and local formulations of locally and internationally branded names. Table 8 lists seven major private-sector firms that supply pesticides. Table 9 lists the major products they offer. The S.F.C. does not deal in pesticides.

4. Agricultural Input Distribution System

The S.F.C.'s and the private sector's distribution systems for fertilizer and agricultural chemicals are outlined in Figures 2 and 3. A fruit or vegetable farmer is able to purchase fertilizers from the S.F.C. through the following retail points of purchase:

- Cooperative societies - 400 branches
- Agrarian Service Centres (ASC) of the Department of Agriculture
- Authorized dealers - 600

Private sector firms also have branch offices in major producing areas, provide traveling salesmen services and local agents, and also retail through the multipurpose Cooperative Societies and the A.S.C. The A.S.C., particularly, are located near fruit and vegetable farming communities and have close contact with farmers, providing some advisory and extension services.

TABLE 8

MAJOR FIRMS DEALING IN HERBICIDES, INSECTICIDES AND FUNGICIDES FOR FRUITS AND VEGETABLES OTHER THAN STATE FERTILIZER CORPS.

NAME	APPROX. PERCENTAGE SHARE OF MARKET
1. Haychem	23
2. Lankem	20
3. Harrisons and Crossfields Ltd.	14
4. Hoechst (Ceylon) Ltd.	11
5. A. Baur and Company	NA
6. Ceylon Petroleum Company	11
7. J. L. Morrison Sons and Jones	NA

Source: Export Development Board

TABLE 9

MAJOR PRODUCTS FOR FRUIT AND VEGETABLE PRODUCTION AVAILABLE THROUGH PRIVATE SECTOR INPUT SUPPLIERS

Fertilizers

Shell Foliar Fertilizer

Maxicrop

Insecticides

Aldrex 25

Methamidophos

Dimetheate 40

Elsan

Sumicidin

Lannate 90% SP

Lannate L

Phoscrin 24% EC

Fungicides

Benlate

Manzate 200

Detsene X

Herbicides

Roundup

Larox

Lasso

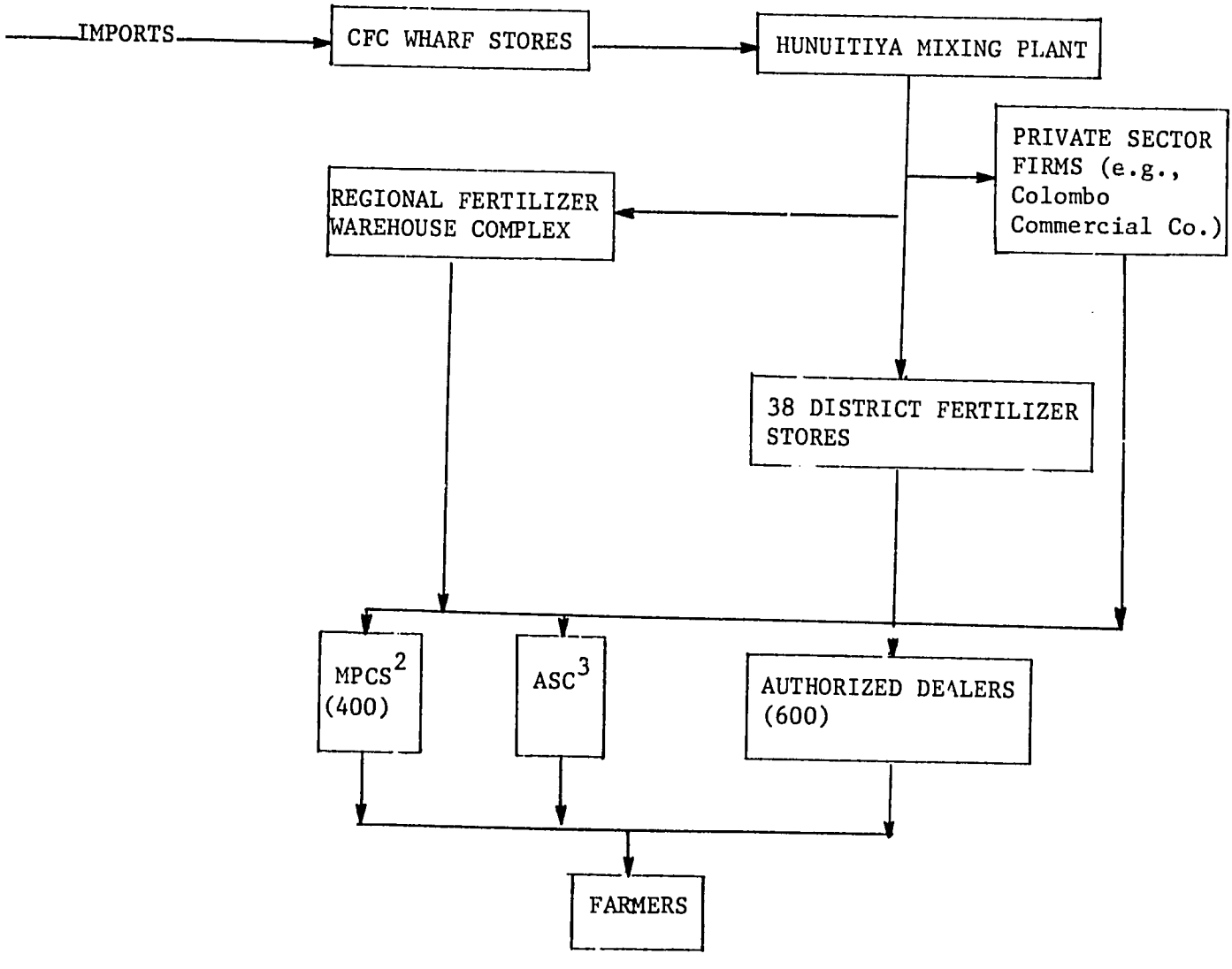
Agricultural Surfactant N

Karmex

Source: Export Development Board

FIGURE 2

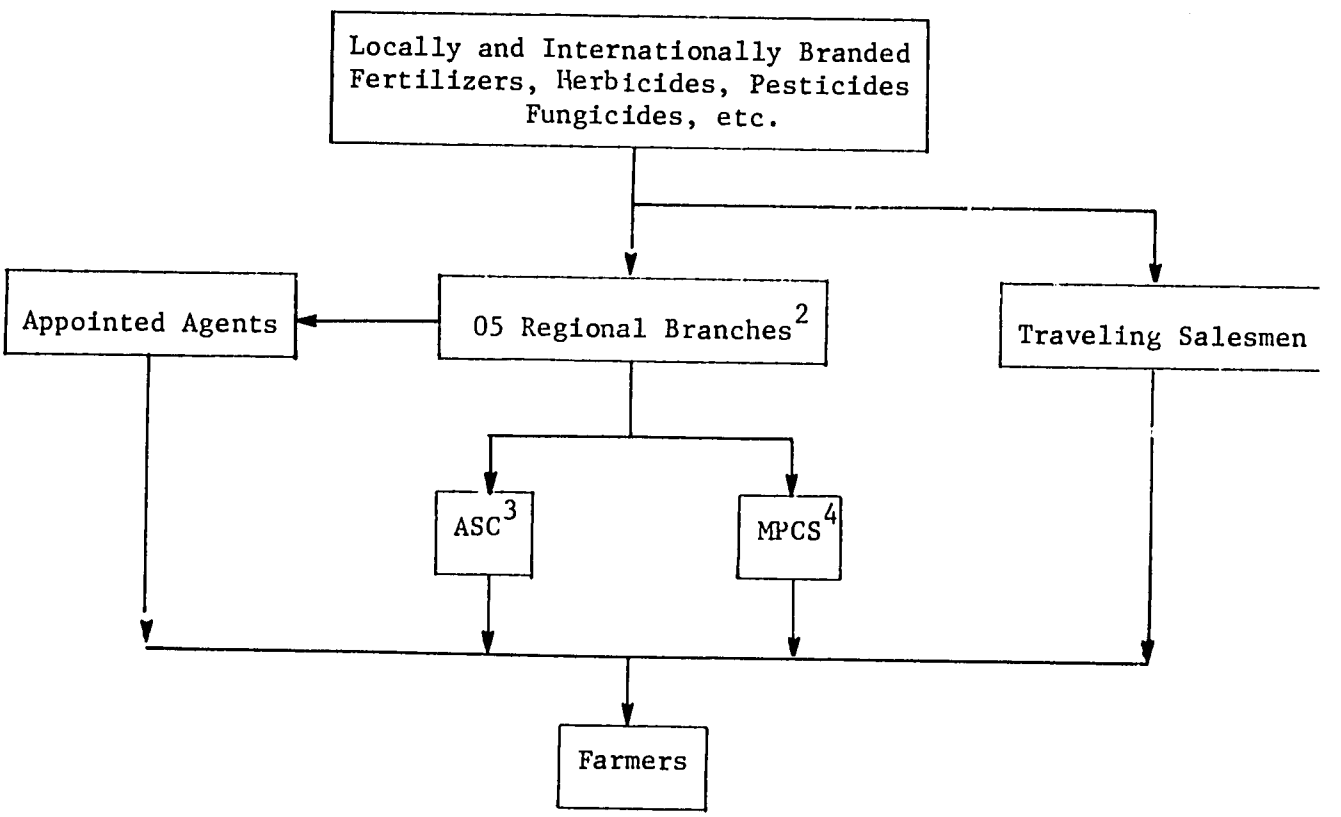
AGRO-INPUTS DISTRIBUTION CHANNEL
OF THE STATE FERTILIZER CORPORATION



[1]Located at Maho, Weligama, Anuradhapura, Polonaruwa
[2]MPCS - Multi-purpose Cooperative Society
[3]ASC - Agrarian Service Center

FIGURE 3

AGRO-INPUTS DISTRIBUTION SYSTEM
FOR A PRIVATE SECTOR FIRM[1]



[1] Lankem Ceylon Limited
[2] Located at Anuradhapura, Jaffna, Kalmunai, Kurunegala, Matara (main centers of production)
[3] ASC - Agrarian Service Center
[4] MPCS - Multi-Purpose Cooperative Society

E. PRODUCTION INFRASTRUCTURE

Sri Lanka has little infrastructure for the production of fruits and vegetables because this industry group has had little attention. The inadequacy of collection points and transport facilities is a real obstacle for producers.

The Mahaweli Development Program is an exception; the Mahaweli areas have a localized collection center to serve several hamlets, within several miles of every small landholding. Here the farmer can bring his output to be collected, assembled, packed and temporarily stored, and can also borrow community-owned farm implements, purchase inputs, etc. Moreover, a bank branch near the collection center provides efficient credit and contracting payment logistics.

F. STORAGE AND HANDLING

Sri Lanka has no cold storage facilities for fruits and vegetables, either in the private sector or in government organizations. This lack obviously affects the retail/wholesale end of the industry, which must operate much less efficiently without the benefit of scheduling flexibility. The lack of such facilities also contributes to wide price fluctuations, considerable waste (at least 20%, perhaps 40%), seasonal gluts followed by periods of unavailability, and tremendous losses to farmers. Furthermore, the export trade is hampered because produce quality suffers. Some Sri Lankan produce is seasonal; without cold storage facilities, daily purchases must be made to meet export needs, often with fairly sizeable price fluctuations.

The seafood industry has frozen storage facilities, and one public sector facility is also being used to freeze and store frozen passion fruit juice. The possibility of expanding such cross-industry uses should be examined further. For example, if there is refrigerated storage space at the new dairy product repacking plant

that is not fully used, it might be used by the fruit or vegetable industry.

The handling of produce involves harvesting by hand, packing in gunny sacks and trucking to the major market. Produce is still frequently exported from Sri Lanka in cane baskets.

G. PRICING

It is not possible to review price trends and farmer returns for fruit and vegetable crops in detail because of inadequate cost and price information. Nevertheless, a general picture of trends emerges from a review of the existing available production, trade, and price information. For fruits and vegetables, planted area, rather than yields, responds to price incentives, because cultivation practices and yields have changed very little over the years.

In terms of farmgate price, fruits and vegetables have not had significant increases, especially relative to subsidiary food crops[1] which are the main competition for the farmers' land. The incentives and government credits for subsidiary food crops, which result in relatively higher returns to farmers, as well as the government's greater attention to the marketing channels for subsidiary food crops, have blocked the expansion of fruit and vegetable production. Although retail prices for fruits and vegetables have increased, with increasing consumer demand of a growing domestic population and relatively constant production, the farmers production costs have also increased.

Table 10 presents estimates of farmers' production costs and net returns per hectare for several vegetable crops. The higher returns for potato and red onion reflect the benefits from the government's subsidiary food crop schemes.

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[1]The term "subsidiary food crops," as used in Sri Lanka, includes potatoes, cowpea, green gram, chillies, red-onions, ground nuts, kurakkan, and maize.

TABLE 10

PRODUCTION COSTS AND RETURN PER HECTARE
FOR SELECTED VEGETABLES IN SRI LANKA

	POTATO[1] (irrigated)	RED ONIONS[2] (irrigated)	RED ONIONS[2] (rainfed)	CHILLI[3] (rainfed)	CABBAGE[4] (irrigated)	LEEKS[4] (irrigated)	BEAN[5] (irrigated)
Input Costs (Rs.)							
- Seed	22,223	17,846	20,049	343	600	707	1,870
- Fertilizer	12,792	10,011	8,302	177	8,744	21,447	2,752
- Pesticides	3,491	4,337	1,724	272	2,040	3,448	193
- Irrigation	1,835	2,213	---	---	613	2,364	193
TOTAL INPUTS	40,341	34,407	30,075	792	11,997	27,966	5,072
Equipment Costs (Rs) (plowing, cultivation, supports)	--	--	--	--	--	--	2,075
Labor Costs (Rs.)							
- Preparation & planting	4,180	6,620	4,513	2,356	4,695	7,682	3,142
- Cultivation	2,397	2,757	1,828	1,719	1,484	3,199	1,195
- Pest Control	1,021	756	521	90	1,102	1,415	198
- Irrigation	1,227	1,111	---	---	361	931	1,193
- Watching	3,111	---	---	---	---	---	---
- Harvesting	1,139	2,013	697	961	803	1,309	1,488
TOTAL LABOR	13,075[6]	13,317[6]	7,559	5,126	8,445	14,536	7,216
Hauling - Marketing Costs	1,025	5,227	3,977	---	867	882	62
TOTAL PRODUCTION COSTS	54,441	52,951	41,611	5,918	21,309	43,384	14,425
Average Yield (cwts per ha)	269	212	192	5	470	768	123
Average Price of Product (Rs/cwt)	419	551	468	1,384	92	128	181

Arthur D. Little International, Inc.

TABLE 10
(Continued)

PRODUCTION COSTS AND RETURN PER HECTARE
FOR SELECTED VEGETABLES IN SRI LANKA

	POTATO[1] (irrigated)	RED ONIONS[2] (irrigated)	RED ONIONS[2] (rainfed)	CHILLI[3] (rainfed)	CABBAGE[4] (irrigated)	LEEKS[4] (irrigated)	BEAN[5] (irrigated)
GROSS RETURN PER HECTARE (Rs.)	112,751	116,812	89,856	6,920	43,239	98,304	22,193
NET RETURN PER HECTARE (Rs.)	58,310	63,861	48,245	1,002	21,930	54,920	7,768

Source: Cost of Cultivation of Agricultural Crops - 1981/82: Volume II. Agricultural Economics Study No. 33. Department of Agriculture. Peradeniya, Sri Lanka, August 1982.

[1] Grown in Bandulla and Nuwara Eliya.

[2] Grown in Jaffna peninsula.

[3] Grown in Anuradhapura.

[4] Grown in Nuwara Eliya.

[5] Grown in Badulla.

[6] Approximately 46% of total labor in potato and onion farming is cost of family labor.

Table 11 lists average current prices paid to farmers in Sri Lanka. As a basis for assessing whether vegetables at these prices could potentially be competitive in export markets, U.S. farmgate prices are listed for comparison. Some vegetables, i.e., beans, beets, and tomatoes, may be competitive, but the costs of carrots and cauliflower are probably too high for export.

Prices and costs of produce at various points in the marketing channel will be addressed as part of the marketing issues in Section V of this report.

H. PRIMARY CONSTRAINTS

The primary constraints on the production of fruit and vegetable crops are:

- Lack of knowledge of market requirements. Most producers of fruits and vegetables cultivate under homestead or home garden conditions, predominantly for their own use. They lack knowledge of the requirements of the market, varieties with better yields, etc., and tend to have little familiarity with such cultivation techniques as intercropping, rotational programs, etc., which would give them an economic advantage. This is particularly true for export crops, where farmers know very little about quality requirements.
- Inadequate research and development/extension services. There is not enough work being done on quality and production improvement, particularly for export varieties.
- Lack of scheduling of collection, production, storage, and processing so that the market can coordinate itself. The predictable seasonal gluts in the market result in considerable waste and inefficiencies. Growing, storage, and processing must be scheduled, a responsibility the government should take. The grower needs to know where the

TABLE 11

AVERAGE PRICES PAID TO FARMERS IN SRI LANKA FOR SELECTED FRUITS AND VEGETABLES, AND AVERAGE 1980 U.S. FARMGATE PRICE

CROP	AVERAGE PRICE PAID TO FARMERS IN SRI LANKA[1] $US/kg	U.S. FARMGATE PRICE[2] $US/kg
VEGETABLE/VEGETABLE ROOT		
1. Green Chillies	.24	NA
2. Red Onions	.31	NA
3. Bombay Onions	.32	.25
4. Potato	.31	.13
5. Manioc	.19	NA
6. Sweet Potato	.19	.26
7. Dioscorea	.20	NA
8. Innala	.26	NA
9. Long Leaved Yams	.25	NA
10. Ginger	.59	NA
11. Bush Beans	.24	.59
12. Pole Beans	.27	NA
13. Capsicum	.15	NA
14. Tomato	.31	.46
15. Cabbage	.10	.19
16. Carrot	.26	.18
17. Beetroot	.26	.52
18. Radish	.33	NA
19. Kholkhol	.28	NA
20. Leeks	.14	NA
21. Cauliflower	.56	.50
22. Long Beans	.20	NA
23. Bushitavo	.27	NA
24. Okra	.32	NA
25. Snake Gourd	.17	NA
26. Bitter Gourd	.21	NA
27. Cucumber	.12	.22
28. Pumpkin	.12	NA
29. Brinjal (Eggplant)	.21	.32
30. Winged Bean	.27	NA

TABLE 11
(continued)

AVERAGE PRICES PAID TO FARMERS IN SRI LANKA FOR SELECTED FRUITS AND VEGETABLES, AND AVERAGE 1980 U.S. FARMGATE PRICE

CROP	AVERAGE PRICE PAID TO FARMERS IN SRI LANKA[1] $US/kg	U.S. FARMGATE PRICE[2] $US/kg
FRUITS		
1. Banana	0.30	0.65
2. Pineapple	0.22	NA
3. Passionfruit	0.23	NA
4. Mango	0.37	NA
5. Avacado	0.34	0.47
6. Lime	0.56	0.35
7. Grapefruit	0.74	0.12
8. Orange	1.09	0.13
9. Lemon	0.60	0.23
10. Woodapple	0.49	NA
11. Beli Fruit	0.49	NA
12. Papaw	0.21	0.45
13. Jak	0.49	NA
14. Breadfruit	0.22	NA
15. Durian	0.26	NA
16. Custard Apple	0.37	NA
17. Rambulton	0.39	NA
18. Mangosteen	0.41	NA
19. Sapadilla	0.30	NA
20. Nelli	0.39	NA
21. Pears	0.58	0.22
22. Strawberries	0.62	0.58

[1] 1982
[2] 1980, last available USDA statistics

Source: Export Development Board

market is, when it is, and what its size is, and the processor needs to know where the growers are and have information about inputs, crops, and markets. Furthermore, the collection and transport systems need to be coordinated with production. Farmers have produce that is wasted because no trucker-buyer or collector-agent comes to pick it up. Buyers need to know where and how much produce is available.

- Lack of seed/planting material. Although the Department of Agriculture's Division of Farms supplies seeds to farmers, it can supply only 10-15% of the demand; seeds are sometimes available to farmers only after the cultivation season has begun. There appears to be a greater shortage of planting material for fruit crops and of seeds for varieties of vegetables for export markets, than for indigenous vegetables. Currently, seed supplies are so limited that many farmers collect seeds from the vegetables which they can not sell at the end of the season, saving the best for the own use, and selling the rest to other farmers.
- Land unavailability and instability. A significant portion of the rural population are homesteaders on government land as encroachers or leasees. Many more producers have been settled as leasees under the major irrigation schemes. Total land available per family unit is approximately 2.5 acres. Such conditions contribute to very limited expansion and a tenure policy that contributes to instability in cultivation patterns, leading to a lack of investment in permanent cultivation or homesteads. Government policy does not allow an investor to obtain more than 50 acres. It is not clear, however, if the government will allow the leasing of large tracts of agricultural land, or will support and aid the private sector in obtaining the use of such tracts. This lack of clarity in government land policy is a problem for private enterprise development, increasing

the risks for potential investors in agribusiness in Sri Lanka.

- Plant Quarantine Regulations. The government's quarantine regulations, introduced in 1981, prohibit the entry of produce and any vegetative parts of fruits or vegetables, and severely hamper the introduction of any new varieties. It is extremely difficult and time-consuming to introduce new varieties particularly adapted to market requirements if they cannot be imported as vegetative material.

III. PROCESSING

Because there are no vegetable processors in Sri Lanka, discussion in this section refers to fruit processing firms only. Since the available information on the fruit processing industry is extremely limited, much of the information presented in this section is based on industry interviews and observations at the processing firms visited.

A. PROCUREMENT OF RAW MATERIALS FOR PROCESSING

Fresh fruit is generally procured by processing firms either by purchase from small-scale farmers at the plant-gate, or through specific fruit dealers/agents who collect from farmers and supply the processor year after year at his plant-gate. Several processors informally contract with farmers and brokers before the crop is planted, establishing the price to be paid and volumes required. Under this arrangement, farmers generally jointly hire a lorry to transport their produce to the plant-gate. One factory manager explained that if the processor is in urgent need of raw materials, as happens about twice a season, he hires a lorry and goes to the farmer.

A mango processor in Jaffna has a collection/procurement system that appears to function efficiently, which is worth considering as a model. This firm has its own harvesting crews, who select the appropriate quality fruit for processing, and its own lorries. The farmer's mangos are purchased in the field, and the harvesting crew goes from farm to farm--allowing for scheduling to integrate the producer and processor.

Some processors, including Pearl Island Products and Arasco Industrial Exports, own some land themselves, so they have a certain basic level of self-supply to help stabilize their raw material costs and volume requirements. Processing firms are increasingly trying to develop some of their own production, although the government limits land ownership to 50 acres per person.

The supply of fresh fruit is in such excess during the appropriate season that processing firms have not established formal contract purchasing agreements with farmers. From discussions with processors, it appears that close working relationships with supplier agents/dealers, or with local farmers where word-of-mouth communication is effective, have provided the scheduling needed for the processor's operation. In instances where processors complain about the unavailability of fruit, it is generally because they do not have a procurement system that includes a flow of information between producer and processor to allow scheduling of processing operations and collection. No processors interviewed purchased their fruit on the open market, in what would be a substantially outmoded and inefficient method of procurement

B. PROCESSING TECHNOLOGY AND OPERATIONS

The processing of foods involves conversions concerned primarily with physical changes and those in which there are irreversible chemical changes. Physical conversions, such as size reduction and masceration, are conventionally regarded as unit operations. Conversions in which the main effects are chemical in nature, such as pasteurizing and freezing, are referred to as unit processes. This section will discuss the processing technology of the fruit processing industry in Sri Lanka in terms of those two general conversions, in the general order in which they are encountered.

1. Cleaning

In the processing firms observed, fruit is cleaned by manual operations (haphazard spraying or dipping in water), which provides the opportunity for very effective cleaning, but also requires considerably more emphasis on quality control and consistent procedures than a mechanized operation. In many firms, no cleaning of the fruit was done. A lack of technical/managerial understanding of the critical factors in a cleaning operation is apparent; this clearly

affects the final quality of the product and would affect the product's safety were it not for the acid conditions of processed fruit. Inefficient removal and disposal of contaminants (mineral, plant, animal, chemical, or microbial) results in recontamination of the product. The condition in which the cleaning operation leaves the fruit surface is important in controlling the effectiveness of the subsequent preservation operations. Canning processes, for example, are conventionally calculated assuming a standard initial microbiological load (although only one or two firms in Sri Lanka base their heat processing on these calculations rather than on chance or a "cookbook" procedure).

2. Sorting and Grading

Sorting and grading are separation operations; sorting is separation into groups with differing physical properties and grading separation into groups with differing quality characteristics. In a basic fruit processing industry such as Sri Lanka's, where the subsequent unit operations of size reduction and mixing are also manual, the main functions of sorting and grading are to control product damage and its consequent spoilage, and to make products that are attractive to consumers. Damage during growing, harvesting, transport to the factory, and raw material storage is transmitted to the finished product, affecting its quality and the effectiveness of the following processes. Therefore damaged fruit must be separated out. Grading depends on an overall assessment of the properties of the fruit that influence its acceptance, including maturity or ripeness, color, texture, size and shape, flavor and aroma.

Manual sorting and grading is carried out in some processing firms in Sri Lanka. The availability and low cost of labor make it possible to use trained operators able to assess a number of grading factors simultaneously. Such operators may select daily for optimum ripeness and grade fruits efficiently, an essential factor in the production of high quality processed products. Most firms do not

follow established procedures for sorting and grading and there is much room for improvement of management in this area.

At its simplest, manual sorting and grading can be carried out on an inspection table, where each piece of fruit is individually assessed by the trained grader. This operation should be physically located between the raw material intake and cleaning, and the size reduction and mixing operations. More sophisticated devices - inspection belts, roller tables, and sorting machines - are certainly not relevant to the Sri Lankan industry; most plants visited in Sri Lanka do not even have basic sorting tables. Clearly, a lack of sorting and grading affects the finished product quality, its consumer acceptability, and market value.

3. Size Reduction

The breakdown of fruit through the application of mechanical cutting forces is generally done to reduce the size, aid in the extraction of juice, or reduce the fruit to the uniform shape and specific size range required for a specific product, e.g., 1/2-inch chunks for a tropical fruit salad mixture. The size reduction or disintegration operations carried out in Sri Lankan firms include peeling, slicing, dicing, and pulping and sieving (for jam manufacture, purees, and to separate skins and seeds from pulp for juice manufacture). Most peeling, slicing and dicing is done by hand labor; pulping and sieving are done in basic pulpers or comminutors. The common form of pulper observed in Sri Lanka consists of a cylindrical perforated screen containing rotating brushes or paddles. Fruit is fed to the inside of the cylinder, the brushes/paddles force pulped material through the perforations, and skins and seeds pass over the screen surface as reject. This pulper is quite adequate when made of stainless steel; some Sri Lankan firms are using aluminum pulpers constructed by local machine shops, however. Aluminum is entirely inappropriate for use in food equipment, particularly for fruits. Additionally, these pulpers were frequently observed to be poorly designed, i.e., intake spouts too narrow, etc.

4. Mixing

Mixing operations in the processing of fruit in Sri Lanka generally involve mixing sugar and water to form a syrup, mixing syrup and fruit pieces for a canned product, mixing fruit juice and sugar to form a cordial, mixing water, juice, sugar and flavoring to form a drink beverage, etc. This mixing involves either manual stirring or use of a simple impeller agitator in a stainless steel open, jacketed kettle.

5. Filtration and Expression

Separation of solid and liquid are accomplished by filtration or expression operations. During the plant visits associated with this study, no filtration operations were observed although this unit operation is important in the processing such of fruit beverages such as mango nectar. The poor quality and low consumer appeal of many fruit beverages, and the resulting failure to compete with imports in the market are largely attributable to processing without filtration or a more complex step that includes stabilizers. A simple vertical plate pressure filter or horizontal plate filter would meet the needs of processing firms, would be flexible enough to handle a wide variety of applications, and would substitute relatively inexpensive capital investment for high labor input.

Expression of juice from the solid-liquid matrix of fruit is carried out to a limited extent in the Sri Lankan processing industry. Of the three basic methods - hydraulic pressing, roller pressing, and screw pressing - only screw pressing was observed. Again, expression is important to the production of marketable fruit juices, particularly for export-quality juices, and the lack of this operation presents a gap in the industry's processing technology.

6. Heat Processing

There are two main methods of preserving foods by heating - sterilization and pasteurization. Absolute sterility is neither

obtainable nor necessary in these processes, but the preserved food must be free from pathogenic organisms, and have an acceptable storage life. The extent to which heat processing is necessary to preserve food is profoundly affected by the presence of acid. For low-acid foods, with pH values above 4.5, sterilization is necessary to manufacture a safe food; for acid foods (pH below 4.5), pasteurization is adequate.

Sulfite is added to fruits/fruit purees stored in bulk by many fruit processors in Sri Lanka, up to a level of about 1,000 ppm (0.1%). It is known to effectively inhibit enzymatic action in fruits which causes browning, and the growth of microbes. Although 0.1% is higher than the maximum level allowed in foods in the U.S., 0.035%, and West Germany is trying to ban its use totally within their foods, sulfite addition is an adequate way for Sri Lankan firms to preserve fruits stored in bulk and processed several months later, during the off-season, in cans for greater storage life.

The Sri Lankan processing industry uses pasteurization as the basic method of preservation. With few exceptions, the industry does not appear to have the capability to process fruits by other methods. In most plants, fruit juices and fruits in syrup are pasteurized by heating in individual batches in stirred, jacketed, stainless steel kettles, after which cans are filled and sealed. It appears that factory personnel and managers lack basic technical understanding of the heating process being carried out. Fortunately, because the fruits grown and processed in Sri Lanka are fairly acidic, food safety is not at risk. Obviously, low-acid fruits (pH above 4.5) and most vegetables are outside the industry's capability.

A number of the food processing firms visited have installed retort sterilizers, the critical piece of equipment necessary to carry out a sterilization process, but only two firms were using them. Small vertical non-agitating batch retorts were observed most frequently; Pearl Island Products uses a larger horizontal batch sterilizer. Both types are entirely adequate for Sri Lanka's situation.

7. Evaporation

The primary potential application of evaporation in the fruit industry in Sri Lanka is the reduction of the volume of liquid in juices or purees to reduce storage, packaging, and transport costs, which are particularly applicable to export situations. Evaporation is essential to have the capability to produce juice concentrate, which may be the only economical way to export fruit juices, and to produce fruit pastes or purees, e.g., tomato paste.

Lanka Canneries (Attangalla factory) has the only three industrial vacuum evaporators on the island, none of which have been used since they were installed about five years ago, because of management weaknesses and a lack of understanding of how to use them. Two of them, each with a capacity of 5,000 kg/18-hour day, can concentrate to 45° Brix (tomato paste would be a possibility). The third, larger evaporator, is a falling-film type. Passi Ltd. is leasing it from Lanka Canneries and will use it to concentrate passion fruit.

These three vacuum evaporators, which are owned by the government, are a significant technological resource from which neither the fruit industry nor the government has benefited to date. The effective use of the evaporators could allow production of high-quality fruit juices/pastes/purees for export.

8. Freezing

At least one fruit processor, Pan-M Foods, is involved in freezing fruit juices. Fairly simple, but adequate, processing technology is utilized in the freezing of passion fruit juice, following which the frozen chunks are packed in 55 gallon drums and exported.

C. CHARACTERISTICS OF PROCESSING FIRMS - NUMBER, SIZE, PRODUCTS

Sri Lanka's fruit processing industry consists of an estimated 15-20 firms. All of them except Lanka Canneries Ltd., are private companies, and only one, Kelani Valley Canneries, has a significant percentage of foreign ownership.

Most processing firms operate with fewer than 20-25 permanent, year-round management and production staff, with seasonal employees to work when fruits are ripe. Even the larger firms have only 30-100 full-time employees. Although few of these employees are technically trained, most have worked for the same firm for some time. Women constitute 42% of the workers in the food processing industry. Wage rates for seasonal labor in fruit processing plants are roughly U.S. $1/day.

The annual production of major processors is estimated at 100-500 MT; with 2100 MT reported for Pan-M Foods, which brought in U.S. $2.5 million. The industry produces cordials, nectar, juices, jams, canned fruits in syrup, and, to a very limited extent, pickles, chutneys, tomato puree, grape juice, palmyrah pieces, belicream and woodapple cream.

D. INTEGRATION OF PROCESSORS WITH PRODUCTION AND MARKETING

Sri Lanka suffers from a lack of scheduling of production and processing activities. For the processing industry to develop and become important to the national economy, it needs to integrate its operations with primary production. Procurement arrangements need to be developed to link the farmer and processor so their activities will be coordinated to meet the needs of each. The farmer must see the processing firm as a reliable market for his produce so that he can assess trade-offs in price for consistency of a market. On the other hand, processors working closely with growers could establish better scheduling and more efficient production planning. Closer ties would also allow the processor's quality specifications to be met.

The greatest problem facing processing firms in Sri Lanka is lack

of integration with the market. Managers of processing firms are generally not oriented to market demand as a basis for their operation. Processors interviewed as part of this study, frequently lamented their surplus inventory of finished products, the underutilization of their facilities, and small sales volume.

E. FRUIT PRICES AT PROCESSOR LEVELS

Processors' average costs of raw fruit per kg. of product are estimated at U.S.$ 0.10 to US$ 0.27,[1] lower than the average price paid to farmers for fruits for the fresh produce market (see Table 10).

Raw fruit and packaging are the largest costs of production for the Sri Lankan processor. Rough estimates place the fruit raw material costs at approximately 25-55% of the value of the finished product. The value-added component (value of output less cost of inputs) ranges between 18 and 42 % of the output value; the larger percentages are seen in smaller, more labor-intensive firms.

F. PRIMARY CONSTRAINTS

The fruit processing industry is primarily constrained by the following factors:

- Lack of understanding of the market and marketing requirements. Processors do not focus on assessing the market demand for their products, in terms of product type, quality, and packaging. They are therefore unable to increase their sales, and are left with huge inventories of finished product. Managers are unaware of marketing requirements, and the need to be familiar with them.
  A poor understanding of such factors as packaging, types of shipping, sales terms and conditions, etc., limits sales and prevents the industry from broadening its markets.

[1] Based on information gathered during interviews with processors during this study.

- Lack of scheduling of processing with production. As discussed in Section II, the government should play a role as "coordinator" within the fruits and vegetables industry, so that processors know where growers are and what products they have. Processors need to take the initiative in establishing relationships and procurement arrangements that will provide the basis for scheduling.
- Lack of technical support to the industry Absence of an extension service to the processing industry, inadequate quality control laboratory support, inadequate pilot plant facilities for research and development, and inadequate base of food processing expertise limit development of the industry. There is no coordinating organization or personnel to serve as a resource base, and thus, no bank of processing information is available to the industry. Education and training facilities in food science and technology are poorly developed. The constraint that faces processors, therefore, is that each must start from "ground-zero" and pave his own way.
- Lack of quality standards/grades. The establishment of quality standards and grades, no matter how basic, should be part of the government's "coordinator" role in assisting industry to organize itself. Quality and grading standards are important in bolstering consumer perception of the industry's products, and as a consumer protection measure.
- High import duties and costs of packaging, lack of local packaging manufacturer capable of producing the required quality, inadequate packaging technology.

  Packaging costs are reported to be up to 40 to 50% of finished good costs for many processors. Duties on the imported cans, about 55%, which are required by processors for any export-quality products, are a severe constraint. The government and the industry must recognize that packaging is a critical component of any processed food product, both in quality and cost.

IV. MARKETS AND MARKETING

A. DOMESTIC MARKET

1. Market Size and Characteristics

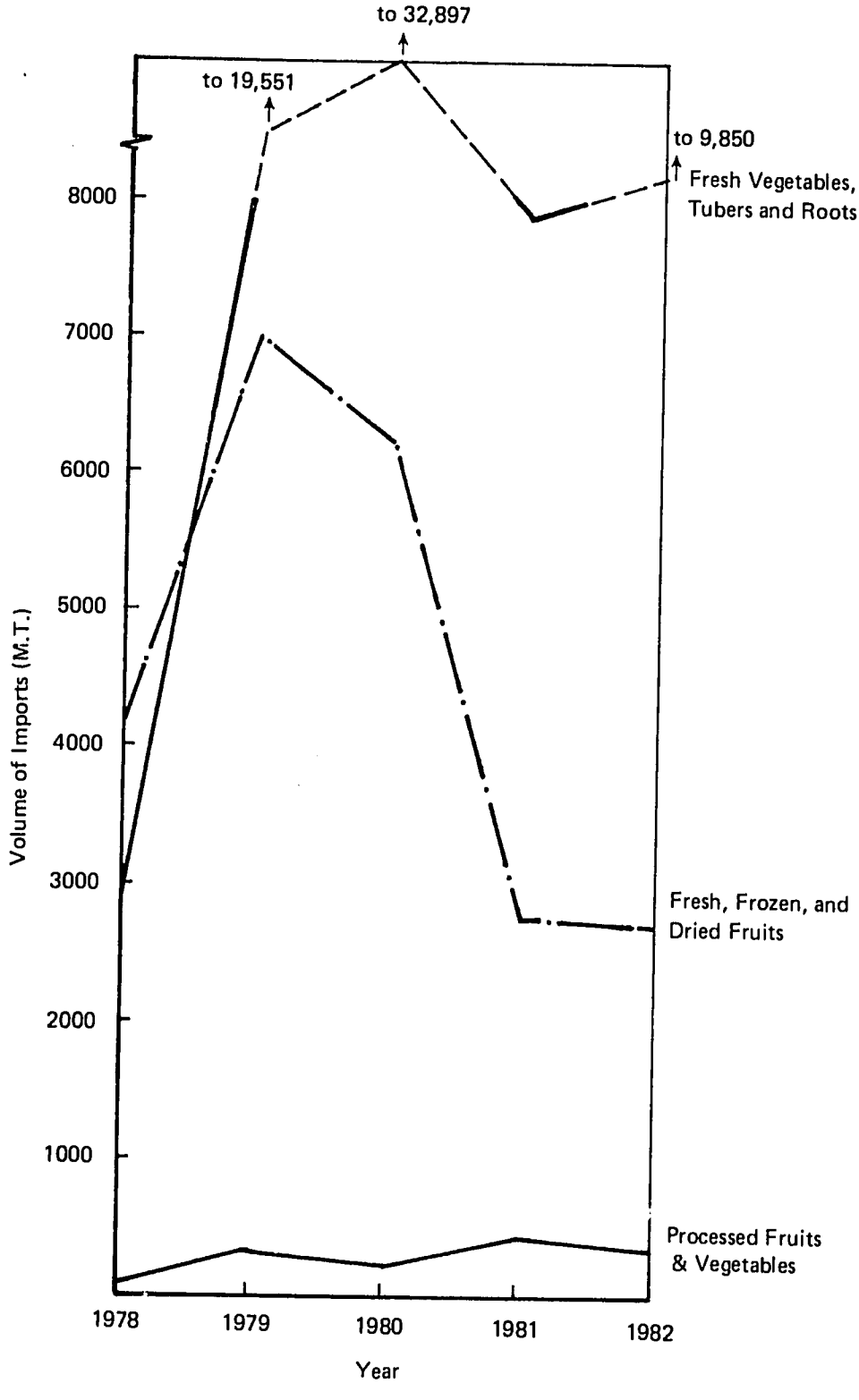
Because it is not possible to estimate the production or domestic consumption of fruits and vegetables in Sri Lanka in detail, it is difficult to estimate market demand. The domestic market demand for fruits and vegetables, particularly processed products, is simply not known. The availability of processed fruit and vegetable products is very limited, no marketing studies have examined the domestic market, and domestic processors, constrained by their lack of orientation to innovation, product development, and marketing, have not tested the domestic market.

The domestic market is characterized by weak consumer purchasing power. Nevertheless, a total of U.S.$ 4.7 million (Rs. 106,000,000) was spent on imported fruits and vegetables in 1982--only 20% of it for products that could not be produced domestically. Obviously there is a domestic demand for fruit and vegetable products of a type or quality not produced in the country. (Figure 4 shows recent trends in fruit and vegetable imports).

Imports of fruits and vegetables have been controlled by government policy; it is therefore impossible to estimate demand directly from the level of imports. The decrease in volume of imports in 1981 and 1982 from 1979/1980 should not be interpreted as a decline in the market demand, but rather a change in policy.

2. Collection/Marketing Systems for Fresh Produce

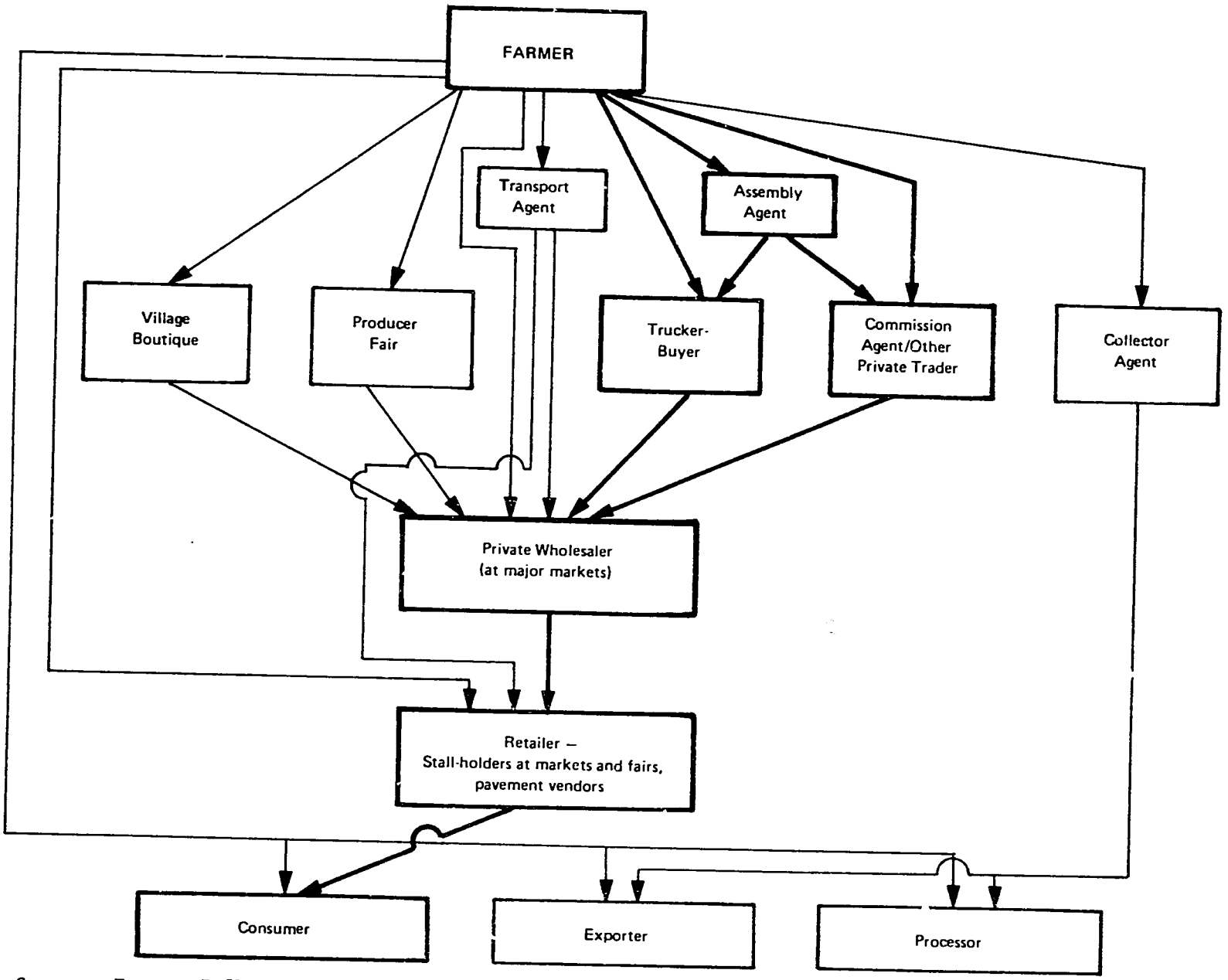
The movement of fresh fruits and vegetables from farm to the market is accomplished by different collection systems operating in different districts. Figure 5 shows the many channels of the marketing system, with the most common outlined in bold type. One of the systems operates as follows. Farmers carry their produce on their heads to the village fair in gunny sacks, each containing



Source: Sri Lanka Customs Statistics

FIGURE 4 FRUIT AND VEGETABLE IMPORTS, BY SRI LANKA, 1978-1982

FIGURE 5 FRUIT AND VEGETABLE MARKETING SYSTEM IN SRI LANKA



Source: Factors Influencing Vegetable Prices. P.J. Gunawardena and Athula Chandrasiri. Agrarian Research Training Institute, Colombo. February 1980.

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approximately 15-20 kg; frequently, the whole family must come to the fair to transport the goods. Middlemen/wholesalers collect the produce at the fairs, which are generally held on the main route between two large towns, on specific days of the week. The supply of produce is always greater than the demand. In some cases, the wholesalers agree among themselves on a price, thus eliminating competition[1].

Probably the most important village-level marketing outlets are assembly agents[2], commission agents[3], and trucker-buyers[4], who then move the produce on to wholesalers at the major markets, as shown in Figure 5[5]. In most cases, a single outlet dominates the village-level produce collection, but this primary outlet varies for different villages.

The collection system operating in Nuwara Eliya, Budulla, and Kandy is different because of the hilly terrain, which makes it difficult to transport goods long distances on foot. In these districts, trucker/buyers visit the farms and collect the produce. Small landholders bring their produce to the closest road (average distance 0.25 to 0.5 mile) in the early hours and send it to Colombo or other major towns on passing lorries. The lorries charge a piece-rate, e.g., per gunnysack or box, and the farmers have middlemen in the markets who sell the produce on a commission basis (10%), or the trucker/buyers purchase the produce directly. The produce of the small landholders is purchased competitively by traders in the market.

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1 Source: Sarvodaya Shramadana Movement, which has village centers active in about 6,000 villages in Sri Lanka.

2 Agents or brokers who collect the produce from the farmers for the commission agents or trucker-buyers. They are essentially agents of the traders. Generally, their margin is about 5%.

3 Wholesalers who undertake selling the produce for the farmers on a commission basis. Their margin is approximately 10%.

4 Traders who come in lorries or vans and purchase the produce from the farmers directly or through assembly agents. They may be retailers or wholesalers.

5 Factors Influencing Vegetable Prices. A study of the vegetable economy in Sri Lanka. P.J. Gunawardena and Athula Chandrasiri. Agrarian Research and Training Institute, Colombo. February 1980.

Large landholders sometimes have their own connections to wholesalers or retailers at the main markets; these farmers sometimes operate collecting centers at their farms, buying the produce of villagers.[1]

In some instances, wealthier middlemen visit small landholders before the harvest, pay them an advance, and then collect the produce after being informed of the harvesting day. In some parts of Puttalam and Badulla districts, vegetable assembly agents at the village level supply another trader, who has several such collectors.

In the Moneragala district most farms are located in areas not accessible by a motor vehicle. Farmers carry their produce on their heads to the main road and sell to the trucker/buyers who pass by in their lorries. As there is no communication between the middlemen and farmers, and thus no scheduling, the lorries may be full, and the farmer may not be able to sell his produce. In such instances, the farmer dumps his produce, resulting in a total loss, taking his empty gunny bag, worth about 10 Rs., home with him.[1]

3. Cost at Various Points in the Domestic Market Channels

The distribution of the price of vegetables between producers and various marketing intermediaries is shown in Table 12. Farmers typically receive between 18 and 44% of the consumer price of vegetables, as shown.

B. EXPORT MARKETS AND MAJOR COMPETITORS

1. Market Size, Share and Constancy; Major Competition

Sri Lanka's exports of fresh fruits and vegetables are principally to the Maldive Islands and the Middle East. Processed fruits and passion fruit juice are exported mainly to Switzerland, the Netherlands, and West Germany.

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[1]Source: Sarvodaya Shramadana Movement

TABLE 12

ANALYSIS OF MARKETING COSTS AND MARGINS FOR SELECTED VEGETABLES

Marketing Channel: Farmer ⟶ Commission Agent ⟶ Retailer ⟶ Consumer

Description	Percent of Consumer Price					
Crop:	Beans	Beet	Cabbage	Leeks	Tomatos	Capsicum Chillies
1. Producer	44.3%	32.5%	19.8%	30.6%	17.8%	31.4%
2. Commission Agent's Margin	6.2	4.9	3.4	4.7	2.6	4.3
3. Retailer's Operating Costs & Margin	12.7	23.3	37.5	24.5	51.2	34.6
TOTAL TRADERS' MARGIN (2+3)	18.9	28.2	40.9	29.2	53.8	38.9
4. Wastage	21.9	20.9	19.7	20.8	19.1	20.4
5. Cost of all other marketing services	14.9	18.4	19.6	19.4	9.3	9.3
Consumer Price	100.0	100.0	100.0	100.0	100.0	100.0

Based on data provided by Agrarian Research and Training Institute

Tables 13 through 21 and Figure 4 summarize import/export trade statistics for fruits and vegetables; it is clear that Sri Lanka has no established export markets, nor are there any consistent trends. Obviously, the industry is at the embryonic stage of its development.

The trade statistics indicate a deeper issue, however; without a market, the industry cannot grow. The market must be developed through a planned strategy that entails consistency, gradual growth, and the development of a supplier/buyer relationship. Once an export market is lost, it is difficult to regain. In 1978, Sri Lanka shipped 100 MT of fresh vegetables (one third of total fresh vegetable exports) and 70 MT of fresh mangoes (70% of total mango exports) to Kuwait, but virtually none thereafter. Most of the fresh mango exports went to the Maldive Islands and Singapore in 1980, but neither of these markets had follow-up shipments of any significance. Half the fresh vegetable exports went to Dubai in 1979, 1980, and 1981, but none in 1982.

Dubai may be Sri Lanka's largest relatively consistent export market for fruits and vegetables; thus, it may serve as an example of Sri Lanka's importance and growth opportunities in export markets. Table 21 shows Sri Lanka's share of Dubai's market for imported fruits and vegetables; Sri Lanka's 954 MT of fresh vegetables represented 18% of the total. Although Dubai's imports in this category are shrinking, Sri Lankan exports could grow by taking market share away from its major competitors, India, Egypt, and Pakistan. In all other product categories, except for miscellaneous unspecified vegetable products, Sri Lanka's share of the market is virtually negligible. The major competitors in these product categories are Pakistan, India, and other Asian and Southeast Asian countries, with which Sri Lanka should be able to compete, given its similar growing conditions and transport distance, as well as favorable labor rates and irrigated land conditions. Sri Lankan farmers are quite successful at growing onions, yet despite Sri Lanka's share of the fresh vegetable market, no onions are exported to Dubai. Pakistan, with which Sri Lanka

TABLE 13

EXPORTS OF FRESH VEGETABLES FROM SRI LANKA, 1978-82

Destination	1978		1979		1980		1981		1982	
	kg	%	kg	%	kg	%	kg	%	kg	%
MIDDLE EAST										
Bahrain	6	-	255	-	4,442	1	10,587	1	204,545	17
Kuwait	100,000	32	4	-	1,819	0.3	6,854	0.6	19,979	2
Muscat & Oman	16,510	5	8,630	3	12,351	2	104,364	8	51,596	4
United Arab Republic	-	-	3,920	1	-	-	4,500	0.4	-	-
Saudi Arabia	-	-	6,767	2	13,491	2	16,760	1	27,936	2
United Arab Emirates	-	-	-	-	-	-	-	-	601,578	50
Abu Dhabi	12,255	25	96,373	29	94,597	16	179,255	15	-	-
Dubai	114,251	37	150,066	44	302,725	52	654,754	53	-	-
EUROPE										
United Kingdom	460	-	-	-	533	-	17,223	1	19,831	2
Netherlands	13,123	4	-	-	495	-	2,743	0.2	4,730	0.3
Other European Countries	1,103	0.3	-	-	17	-	2,999	0.2	1,456	-
ASIA										
Malaysia	-	-	-	-	10,758	2	-	-	122	-
Pakistan	3,861	1	7,380	2	-	-	8,460	0.7	5,144	0.4
Maldive Islands	49,292	16	63,873	19	140,330	24	217,467	18	264,664	22
U.S.A.	-	-	-	-	-	-	840	-	2,605	0.2
OTHER COUNTRIES	-	-	374	-	1,228	0.2	2,255	0.2	1,274	-
TOTAL	310,861	100	337,641	100	582,786	100	1229,061	100	205,278	100
TOTAL VALUE OF EXPORTS ($US)	137,819		229,735		416,250		873,063		2,471,805	

Source: Sri Lanka Customs Statistics

TABLE 14

FRESH AND PROCESSED FRUIT EXPORTS FROM SRI LANKA, 1978-1982, OTHER THAN PASSION FRUIT JUICE, FRESH MANGO, FRESH PINEAPPLE, AND FRESH/DRIED CITRUS FRUITS

	1978		1979		1980		1981		1982	
	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
Passion Fruit, fresh	--	--	1,340	0.2	--	--	980	--	626	--
Stone Fruit, fresh	--	--	--	--	1,225	--	1,950	--	--	--
Other Fresh Fruits	59,750	7	82,589	12	135,786	8	11,604	--	1,705	--
Fruit, Fruit Peel with Sugar	1,591	0.2	--	--	--	--	4,425	--	666	--
Dried Fruit	--	--	2,200	0.3	751,353	45	23,295,872	99	3,222,031	92
Jams, Jellies	4,537	0.5	449	--	3,396	0.2	2,170	--	2,529	--
Mango, canned & bottled	68,170	8	3,471	0.5	12,045	0.7	4,216	--	33,566	1
Pineapple, canned & bottled	597,672	70	467,469	68	236,317	14	1	--	--	--
Mango, other preparations	17,640	2	8,868	1	4,422	0.2	27	--	15	--
Pineapple Juice	444	--	637	--	67,041	4	15,827	--	--	--
Other Fruit, canned, bottled, & other processed[1]	106,425	12	122,641	18	456,715	27	236,347	1	236,376	7
TOTAL	856,229	100	689,664	100	1,668,300	100	23,573,419	100	3,497,514	100

[1] Includes Fruit cocktails, fruit salads

Source: Sri Lanka Customs Statistics

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TABLE 15

EXPORTS OF FRESH OR DRIED CITRUS FRUITS FROM SRI LANKA, 1978-1982

Destination	1978		1979		1980		1981		1982	
	Kg	Percent	Kg	Percent	Kg	Percent	Kg	Percent	Kg	Percent
Dubai	-	-	-	-	9,390	100	7,500	91	-	-
Maldive Islands	119	100	164	100	-	-	490	6	3,871	35
Muscat and Oman	-	-	-	-	-	-	-	-	2,202	20
Saudi Arabia	-	-	-	-	-	-	-	-	2,323	21
South Africa	-	-	-	-	-	-	-	-	1,432	13
Other	-	-	-	-	-	-	239	3	1,285	11
Total	119	100	164	100	9,390	100	8,229	100	11,113	100

Source: Sri Lanka Customs Statistics

TABLE 16

FRESH MANGO EXPORTS FROM SRI LANKA, 1978-1982

Destination	1978 Kg	1978 Percent	1979 Kg	1979 Percent	1980 Kg	1980 Percent	1981 Kg	1981 Percent	1982 Kg	1982 Percent
Abu Dhabi	-	-	2,135	100	-	-	-	-	-	-
Bahrain	-	-	-	-	200	6	105	-	1,985	20
Dubai	-	-	-	-	-	-	1,300	7	-	-
Fed. Rep. Germany	-	-	-	-	-	-	-	-	400	4
Kuwait	70,000	71	-	-	-	-	-	-	445	4
Maldive Islands	9	-	-	-	1,805	51	70	-	131	1
Muscat and Oman	-	-	-	-	-	-	-	-	875	9
Saudi Arabia	-	-	-	-	-	-	5,000	26	873	9
Singapore	3,340	3	-	-	1,525	43	-	-	200	2
South Africa	-	-	-	-	-	-	1,710	9	-	-
United Arab Emirates	-	-	-	-	-	-	-	-	4,086	41
U.K.	25,000	25	-	-	10	-	11,500	58	9	-
U.S.A.	-	-	-	-	-	-	-	-	1,055	10
Total	98,349	100	2,135	100	3,540	100	19,685	100	10,059	100
Total Value of Exports (U.S.$)	47,837		1,172		3,596		15,263		10,067	

Source: Sri Lanka Customs Statistics

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TABLE 17

FRESH PINEAPPLE EXPORTS FROM SRI LANKA, 1978-1982

Destination	1978 Kg	1978 Percent	1979 Kg	1979 Percent	1980 Kg	1980 Percent	1981 Kg	1981 Percent	1982 Kg	1982 Percent
Belgium	-	-	-	-	-	-	-	-	20,000	7
Dubai	-	-	750	2	100	-	761	-	-	-
Fed. Rep. Germany	-	-	-	-	-	-	-	-	26,505	9
France	-	-	-	-	-	-	23,000	27	-	-
Kuwait	160,000	98	4,550	10	515	2	-	-	7,536	3
Maldive Islands	4,020	2	9,180	21	8,313	39	3,762	4	19,580	7
Italy	-	-	-	-	-	-	2,000	2	9,000	3
Jordan	-	-	-	-	-	-	-	-	15,000	5
Portugal	-	-	-	-	-	-	-	-	80,500	28
Saudi Arabia	-	-	-	-	-	-	-	-	8,000	3
South Africa	-	-	-	-	-	-	10,000	12	-	-
U.S.A.	-	-	-	-	11,340	53	39,148	47	13,608	5
United Arab Republic	-	-	30,000	67	-	-	-	-	-	-
United Arab Emirates	-	-	-	-	-	-	-	-	54,840	19
U.K.	-	-	-	-	-	-	-	-	11,450	4
Other	27	-	18	-	1,282	6	5,505	8	21,580	7
Total	164,047	100	44,498	100	21,550	100	84,176	100	287,599	100

Source: Sri Lanka Customs Statistics

TABLE 18

EXPORTS OF DRIED VEGETABLES FROM SRI LANKA
1978-1982

Destination	1978 Kg	1978 Percent	1979 Kg	1979 Percent	1980 Kg	1980 Percent	1981 Kg	1981 Percent	1982 Kg	1982 Percent
Japan	12,000	100	775	50	-	-	10,000	65	-	-
Maldive Islands	-	-	779	50	5,129	97	110	1	10,005	38
United Arab Emirates	-	-	-	-	-	-	-	-	6,192	23
Bahrain	-	-	-	-	-	-	-	-	6,505	25
Muscat and Oman	-	-	-	-	-	-	-	-	2,983	11
Saudi Arabia	-	-	-	-	-	-	-	-	660	2
Singapore	-	-	-	-	-	-	5,000	33	-	-
Other	-	-	-	-	180	3	224	2	91	0.3
Total	12,000	100	1,554	100	5,309	100	15,334	100	26,436	100
Total Value of Exports (US$)	5,167		1,050		1,995		6,127		13,470	

Source: Sri Lanka Customs Statistics

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TABLE 19

EXPORTS OF MANIOC (CASSAVA), SWEET POTATO AND OTHER ROOT VEGETABLES FROM SRI LANKA, 1978-1982

Destination	1978		1979		1980		1981		1982	
	Kg	Percent	Kg	Percent	Kg	Percent	Kg	Percent	Kg	Percent
Bahrain	-	-	-	-	-	-	-	-	20,858	55
Kuwait	-	-	-	-	-	-	-	-	15	-
Maldive Islands	7	-	-	-	-	-	-	-	435	1
Muscat & Oman	-	-	-	-	-	-	-	-	5,021	13
Saudi Arabia	-	-	-	-	-	-	-	-	1,784	5
United Arab Emirates	-	-	-	-	-	-	-	-	9,698	26
Abu Dhabi	-	-	3,215	18	-	-	-	-	-	-
Dubai	7,750	100	14,500	82	10,000	100	10,060	100	-	-
Other	2	-	30	0.2	-	-	-	-	90	0.2
Total	7,759	100	17,745	100	10,000	100	10,060	100	37,901	100
Total Value of Exports (U.S.$)	3,479		7,727		4,611		2,903		34,872[1]	

[1] It is not clear how the value of exports increased to this extent, relative to the increase in volume. Without any other source to verify this figure, it should be treated with caution.

Source: Sri Lanka Customs Statistics.

TABLE 20

EXPORTS OF PASSION FRUIT JUICE FROM SRI LANKA, 1978-82

Destination	1978		1979		1980		1981		1982	
	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
Australia	24,156	4	-	-	313		475	-	35	-
Fed. Rep. Germany	129,683	24	141,005	14	250,770	18	538,658	28	152,183	5
Japan	-	-	90,000	9	-	-	-	-	31,620	1
Netherlands	261,343	48	701,563	71	297,004	22	248,610	13	456,120	16
Switzerland	-	-	-	-	777,000	58	1,163,235	-	2,199,811	77
USA	117,120	22	25,920	3	-	-	-	-	28,125	1
Yugoslavia	-	-	18,600	2	-	-	-	-	-	-
Other	10,470	2	9,545	1	23,809	2	513	-	2,627	-
Total	542,772	-	986,633	-	1,348,896	-	1,951,491	-	2,870,521	-
TOTAL VALUE OF EXPORTS (U.S.$)	372,658	-	776,621	-	1,205,687	-	2,332,008	-	3,384,904	-

Source: Sri Lankan Customs Statistics.

TABLE 21

SRI LANKA'S SHARE OF DUBAI MARKET
FOR SELECTED FRUITS AND VEGETABLES

	Trends in Imports	SRI LANKA'S SHARE OF TOTAL IMPORTS 1980 By Weight (%)	1980 By Value (%)	1981 By Weight (%)	1981 By Value (%)	COMPETITORS
Bananas	↑	0.10	0.3	---	---	Philippines India Pakistan
Mangoes	↑	0.03	0.05	0.02	0.04	Pakistan, India Australia United Kingdom Japan
Fruit & Vegetable Juice	↓	<0.01	<0.01	---	---	Pakistan Thailand, India
Canned Fruits	↑↑	<0.01	<0.01	---	---	Taiwan, Singapore, Malaysia
Potatoes	↓	<0.01	<0.1	0.03	0.2	Pakistan, India
Dried Leguminous Vegetables	↓	0.1	0.1	0.2	0.2	Thailand, USA Australia
Fresh Vegetables	↓	11.0	19.0	18.00	18.0	India, Egypt Bangladesh
Garlic	↑	<0.01	<0.01	---	---	India, Iran, Pakistan, Taiwan
Other Veg. Products	↑	9.0	6.0	26.0	2.0	

Source: Dubai External Trade Statistics, 1981

should be able to compete favorably, exported 24,523 MT of onions in 1981, valued at three times Sri Lanka's total fresh vegetable exports to Dubai.

Sri Lanka does not export to Dubai several categories of products that are produced in excess in Sri Lanka. Jam, marmalade, and jelly, for example, represent a market opportunity; Pakistan exported 19 MT of these products to Dubai in 1981, capturing 1% of the market, 10 times Sri Lanka's total exports in this product category. The canned fruit market is also growing rapidly in Dubai. Sri Lanka should be able to compete with Singapore, Malaysia, India, and Thailand, the major suppliers, for a share of this market.

Sri Lanka has an advantage in the Maldive Islands in that it is closer to the market than India, its major competitor.

In the Middle East, Sri Lanka's Chinese ginger, green chillies, gourds, drumsticks, and yams are reportedly[1] of better quality than India's, giving Sri Lanka a comparative advantage.

Sri Lankan exporters generally extend 30-90 days' credit to their Middle Eastern buyers. Since India's trade regulations do not allow export on a credit basis, Sri Lankan exporters have used this flexibility to their advantage.

Sri Lanka's Asian neighbors exported a total of 8360 MT of fruit products to the EEC in 1980, compared with Sri Lanka's 1700 MT. If Sri Lanka were to take all this market of 8,360 MT, it would expand foreign exchange generation by U.S.$ 2.3 million, fruit production by 250 hectares, and provide direct employment for approximately 250 farmers.

2. Middle East Export Market Demands

With oil revenues increasing the standards of living in the Gulf countries to among the highest in the world, the demand for such consumer goods as fresh fruits and vegetables has increased

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[1] Opinion of Sri Lanka Export Development Board

tremendously. Expatriate laborers, many of them South Asians with relatively high salaries, have become an important segment of the economy. Their different eating habits and preferences have influenced the local Arabs resulting in an increased demand for imported non-traditional fruits and vegetables. Furthermore, these countries are able to supply little of their demand with their own production. Fruit juice and drink products are in especially great demand because of the scarcity and price of water in Middle Eastern countries.

Several years ago, as these consumer markets were developing, there was a significant demand for lower-grade fresh produce, supplied by such countries as Sri Lanka, India, Pakistan, and Bangladesh. Now the requirements of these markets have increased tremendously as consumers' have become more conscious of quality. In order to meet the present demands of the Gulf markets and establish and maintain its position, Sri Lanka must supply produce that meets the quality, variety, and packaging specifications of the importing country.

Sri Lanka's geographical location near the Middle East, its capability to supply the fruits and vegetables which are demanded by those markets, and its limited entry already into Middle East markets place Sri Lanka in a prime position to capture much more of the Middle East market. Commercial joint ventures with Middle Eastern firms for the production, processing, and marketing of fruit and vegetable products from Sri Lanka for Middle Eastern markets are potential opportunities.

3. Seasonal Advantages

Sri Lanka's chief competitors, other South Asian countries, export their vegetables between March and October, but have limited supplies from November to February. Sri Lanka, on the other hand, has many fruits and vegetables available during this period. For example, India's mangoes are harvested in April through July. Sri Lanka produces mango then but also during November to January. This

seasonal market clearly provides an opportunity for Sri Lanka, which can be capitalized on further as an export marketing strategy.

4. Export Market Pricing

Sri Lanka's main markets, the Maldive Islands and the Middle East, both buy produce at an average price (no grading is done). Frequently, they purchase an assortment of vegetables, i.e., ten different types in one cane basket, at a simple arithmetic average price.

Most Sri Lankan exporters quote Cost and Freight prices on produce, rarely insure their goods, and frequently extend 30-90 days credit to the purchaser. The f.o.b. prices for produce average approximately U.S.$ 0.50 per kilogram, the air freight rate is approximately US$ 1.00 per kg for all types of fresh produce to the Middle East, ad US$ 1.50 is the most frequently quoted C&F price.

C. PRIMARY CONSTRAINTS

The primary constraints on marketing Sri Lanka's fruits and vegetables include the following factors:

- Lack of marketing strategy, either on an industry-wide basis or by individual firms. The production and processing of fruits and vegetables must be "pulled" by the market and its demands. Unless operations are oriented by a specific market strategy, they have difficulty in selling their product and tend to be inefficient and unprofitable. The establishment of long-term relationships with buyers/importers in export markets or joint-venture relationships with firms with access to a market are critical to Sri Lankan producers and processors.
- Unavailability and high cost of air cargo space. Exporters of fresh produce are being increasingly constrained by a

lack of available air cargo space and the high air freight rates, especially to the Middle East, relative to competitive supplying countries. Air Lanka and the government must give priority to air freight for produce exports, instead of considering them on a low priority, space-available basis on passenger flights. In addition to adequate space and competitive rates, the scheduling of air freight is important. Produce exports to the Middle East, need to arrive on the best market days.

- Lack of appropriate collecting, handling and packing systems and grading standards for fresh fruits and vegetables. Sri Lanka needs more efficient collection and packing systems and handling procedures for the industry to be able to export higher-quality products at competitive prices. Grading standards are needed to assure that a product of consistent quality is exported to meet specific market requirements.

V. GOVERNMENT POLICIES AND INCENTIVES IMPINGING ON THE FRUIT AND VEGETABLE INDUSTRY IN SRI LANKA

A. GOVERNMENT POLICY

Government policies on agriculture and agro-based products are focused on local production and agricultural exports.

From the viewpoint of local production, policies and programs have been aimed primarily at reaching self-sufficiency in paddy cultivation. Much effort has gone into research and development, extension services, etc. and creditable achievements have been recorded; Sri Lanka is now over 90% self-sufficient in its rice requirements.

Policy toward exports, on the other hand, has been one of diversification; dependence on tea, rubber, and coconut is being decreased through development of other sectors, including fruits and vegetables.

1. Government Policy - Fruit and Vegetable Production

In the past, there has been less government interest in fruits and vegetables than in tea, coconut, rubber, and paddy cultivation. Now, however, as paddy cultivation has reached a level of adequacy in terms of production and research, the government is looking actively into the fruits and vegetables sector as a means of diversifying agro-based exports. The government policy in this area is one of raising quality and increasing total production.

a. FAO/UNDP/Ministry of Agriculture - Horticulture Project (Fruit Crops)

This two year project, started in 1980/81 and extended for another two years, is the basis for further development of fruit crops in Sri Lanka. The project work includes germ plasm collection,

establishment of a tissue culture laboratory (the first of its kind for fruit crops in Sri Lanka), varietal testing, introductions for new crops, and establishment of nurseries/plant material centres, for a range of fruit crops. The project envisages detailed studies on fertilizers; pathology, entomology and cropping patterns for the economically important fruit crops, and the development of more export-oriented produce. The project is also the research base of the Rural Integrated Development Program.

b. Rural Integrated Development Program

This program operates in several districts, e.g., Jaffna, Kurunegala, Vavuniya, Puttalam, and Hambantota, and is a medium-long-term program funded by a number of agencies, e.g., World Bank, SIDA, NORAD. It develops both production and such infrastructure as roads and irrigation networks, etc. In districts where fruit/vegetable crops are important, the program funds a number of research and development programs, intensive inter-cropping programs, and subsidized agro-input schemes.

c. Ministry of Agricultural Development & Research/Department of Agriculture

This Ministry is concerned with all crops - except the plantation sectors of tea, rubber and coconut - and is the major policymaker in the fruit and vegetable sector. Fruits and vegetables are still of lower priority than rice and spice cultivation, but some vegetables, e.g., potatoes, onions, chillies, receive much attention.

During 1978-1979 the Ministry subsidized fertilizer and seed material for fruits and vegetables, but there are now no subsidies given for fertilizer or seed materials.

Private land ownership is now restricted to 50 acres, but private enterprises may apply to lease land for agri-business ventures through the Land Reform Commission (LRC) or JEDB (Janatha Estates Development Board).

It is not clear, however, if the government will actually allow lease of tracts of agricultural land greater than 50 acres. This uncertainty and lack of clarity in the government's land policy is a constraint to private enterprise development. It is perceived by potential investors as increasing the risks associated with investing in agri-business in Sri Lanka.

e. Quarantine Regulations

The government (Ministry of Agricultural Development and Research) amended the quarantine regulations in November 1981, specifically prohibiting or severely restricting the entry/import of certain horticultural produce and planting material. Imports are allowed only in limited quantities and quarantine must take place over six months--two years before release. Fruit/vegetable seeds are generally allowed, but vegetative parts are usually restricted or prohibited. All new varieties must be introduced with the concurrence of the Department of Agriculture.

While the regulations may seem prohibitive, their basic aim is the protection of the plantation sector. However, any introductions of new agro-industries (e.g., strawberries, asparagus, mushrooms, citrus) or new varieties particularly suitable for export may be time consuming. The regulations make it almost impossible for agribusinesses to respond effectively to many changing export market conditions.

f. Major Irrigation Schemes (Mahaweli, Uda Walawe, etc.)

Initially, the government's major aim in irrigation of these areas was to increase paddy cultivation. With the introduction of high yielding rice varieties, however, there appears to be excess land; paddy cultivation in Maha, November through February, and Yala, April through July, is no longer necessary. Furthermore, there may not be enough water in the dry season, even with irrigation schemes. Thus, a large amount of land is available and the government is interested in cultivation of vegetables.

g. Model Export Village

The Model Export Village is a scheme put forward by the Minister of Trade and Shipping.

Fruits and vegetables are generally grown at the home garden level in Sri Lanka. Under the home garden/settlement schemes a farmer would cultivate a variety of staples because it is not possible to designate large extents of acreage to monoculture of fruits or vegetables. Under this scheme, however, selected export quality crops are grown in monoculture through cooperative efforts of neighboring farmers. Marketing arrangements for their produce are arranged with exporters prior to production. In the fruit and vegetable industry, such schemes operate for chillies, onions, mangoes, and yams in Rajangana, Killinochchi, Puttalam, and Mahaweli areas, and Jaffna, Kurunegala districts.

2. Government Policy - Exports of Fruit and Vegetable Products

The government policy is one of diversification of agro-exports, and fruits and vegetables have been designated as a priority for this development. The Sri Lanka Export Development Board, the main implementing agency, sees government policy as directed toward adapting

diversifying export markets, encouraging foreign collaboration and joint venture participation, improving quality of exports, expanding the product range, and improving present packing and packaging. A host of incentives are given for both production and exports.

Government policy, while supporting increased exports in this sector, does not allow exports at the expense of local consumption needs. That is, a specific item could not be exported if there were none for the local market.

Exports in this sector are also governed by the government's policy toward freight rates. Air freight rates are governed by the national carrier, Air Lanka, and tend to be high, although to Middle East destinations they are competitive. The government does not allow air cargo carriers to compete with Air Lanka, although it would reduce air freight costs and increase the available freight capacity.

Sea freight rates are set by the Central Freight Bureau and also tend to be high.

B. GOVERNMENT INCENTIVES

1. Incentives for Producers

a. Fruit Subsidy Scheme

The Ministry of Agricultural Development and Research has allocated Rs. 10 million as a subsidy for fruit crop cultivation in 1983. The scheme subsidizes farmers at a rate from Rs 500 to 4,000 per acre, depending on the type of fruit cultivated (see Table 22 for subsidy rates per acre). The subsidy covers the more important fruit crops, and all the districts in Sri Lanka, but some crops are limited to specific districts. Table 23 lists the acreage expected to benefit under the subsidy scheme in each district for the selected crops.

TABLE 22

FRUIT SUBSIDY SCHEME 1983
CROPS COVERED UNDER THE SCHEME
AND SUBSIDY PER ACRE

Crop	Subsidy/Acre (Rs)
Lime	2,792
Orange	2,497
Mango	1,748
Banana	1,998
Pineapple	3,496
Passion Fruit	3,995
Avocado Pears	2,247
Rambutan	499
Mangosteen	1,998

Source: Ministry of Agricultural Development and Research

TABLE 23

FRUIT SUBSIDY SCHEME 1983[1]

District	Lime	Orange	Mango	Banana	Passion Fruit	Avocado	Pineapple	Rambutan	Mangosteen
Amparai	700	600	100	-	-	-	-	-	-
Moneragala	600	400	100	-	-	-	-	-	-
Badulla	250	100	50	-	300	15	-	-	-
Puttalam	-	-	150	50	25	-	50	-	-
Vavuniya	50	25	100	100	-	-	-	-	-
Mullaitiva	-	-	50	-	-	-	-	-	-
Hambantota	100	25	50	50	-	-	-	-	-
Kurunegala	50	50	500	3500	25	-	200	-	10
Trincomalee	-	-	100	50	-	-	-	-	-
Jaffna	50	25	100	100	-	-	-	-	-
Colombo	-	-	-	100	25	-	25	05	-
Gampaha	-	-	-	150	250	-	300	30	03
Kalutara	-	-	-	400	500	-	-	-	05
Kandy	-	-	-	100	-	25	-	05	03
Kegalle	-	-	-	150	-	-	25	05	-
Matale	25	25	100	100	-	10	-	-	-
Ratnapura	50	25	100	100	25	-	-	05	02
Galle	-	-	-	100	25	-	-	-	-
Matara	-	-	-	100	25	-	-	-	-
Batticaloa	-	-	150	50	-	-	-	-	-
Mannar	25	25	100	-	-	-	-	-	-
Anuradhapura	-	-	100	-	-	-	-	-	-
Polonnaruwa	-	-	100	-	-	-	-	-	-
Nuwara Eliya	-	-	-	100	-	-	-	-	-
Total	1,900	1300	1,950	5,300	1,200	50	600	50	23

[1] Acreage by district expected to come under the benefit of the scheme.

Source: Ministry of Agricultural Development and Research

Arthur D. Little International, Inc.

The subsidy is usually given in three stages and may be used for land preparation, fencing, fertilizer, agro inputs, purchase of planting material, etc. Its major objectives are to increase present holdings under these fruits, and to give an incentive for replanting with selected varieties recommended by the Agriculture Department.

b. Subsidies for Agroinputs/Planting Materials

There are no monetary incentives for inputs and planting materials for fruits and vegetables. The Department of Agriculture retails the necessary planting and fertilizer material and is an important outlet. Limited extension services related to the application of inputs and planting materials are provided by the Department of Agriculture.

c. Agricultural Credit

Loans are offered to producers of fruits and vegetables through the Bank of Ceylon, People's Bank, and private banks, e.g., Hatton National Bank, at 7-9% interest.[1] The credit required for vegetable crops, based on past credit demands, is listed in Table 24.

2. Incentives for Export Production and/or Processing of Fruits and Vegetables

The following schemes provide tax and investment incentives.

a. EDB Scheme - Credit Scheme for the Development of Exports from Sri Lanka

Formulated by Sri Lanka Export Development Bank (EDB) and central banks, this program provides financing for production and processing

[1] Source: Export Development Board.

TABLE 24

CREDIT REQUIREMENTS FOR VEGETABLE CROPS[1]

(Rs 000)

District	Chillies		Onions		Legumes		Potatoes		Vegetables		Total		People's Bank		Bank of Ceylon		Other Banks	
	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala
Colombo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gampaha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalutara	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Matara	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattalam	-	-	-	-	-	-	-	-	-	-	-	-	125	-	125	-	-	-
Kurunegala	-	-	-	-	-	200	-	-	-	-	-	-	-	-	-	1,000	-	-
Kegalle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ratnapura	70	70	70	35	-	-	-	-	04	03	144	108	94	68	50	40	-	-
Kandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Matale	469	412	210	180	170	304	-	-	570	1,220	1,399	2,116	284	1,081	1,135	1,035	-	-
Nuwara Eliya	-	-	-	-	-	-	10,700	3,530	678	1,428	11,378	4,958	-	-	11,378	4;955	-	-
Badulla	-	-	-	-	-	-	5,100	3,000	3,125	230	8,225	3,230	5,700	1,720	2,525	1,510	-	-
Moneragala	150	-	-	-	90	-	-	-	-	-	-	-	50	-	200	-	-	-
Jaffna	-	75	-	500	-	-	575	-	20	-	595	575	85	150	510	425	-	-
Vavunlya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mullativu	-	-	-	-	-	-	-	-	-	-	-	-	2,000	-	65	-	-	-
Mannar	400	-	250	-	50	-	-	-	-	-	700	-	-	-	-	-	-	-
Anuradhapura	1,500	-	-	-	4,000	-	-	-	-	-	5,500	-	2,750	-	2,750	-	-	-
Polonnaruwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	-	-
Trincomalee	200	100	1,000	200	-	-	200	-	-	-	-	-	700	150	700	150	-	-
Batticaloa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ampara	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hambantota	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Walawe	10	10	-	-	10	15	-	-	-	-	-	-	20	50	-	-	-	-
Kalawewa	-	19,500	-	2,995	-	11,590	-	-	-	70	-	34,155	-	22,005	-	3,440	-	8,710
Sri Lanka	2,799	20,167	1,530	3,910	4,320	12,109	16,575	6,530	4,397	2,951	27,941	45,142	11,808	25,224	19,438	13,055	-	8,710

[1] Short-term loans, due at end of season, at 7-9% interest.

Source: Department of Agriculture

at 13% interest/annum through a commercial bank. The basic objective is to expand production for export (normal interest rates are approximately 18-24%). Maximum loan amount is Rs. 30 million. Assistance is given for up to 80% of total project cost, and the investor must provide at least 20% equity. Repayment is over a 3-15 year period, with a 3-year grace period. At least 25% of volume produced/processed must be exported. Foreign Investment Advisory Committee (FIAC) ventures are also eligible for assistance under this program.

b. Other Incentives Offered to Processors:

Processors of fruits and vegetables, especially those producing for the local market, are entitled to take advantage of incentives under the Industrial Development Board (IDB) and National Development Bank (NDB) Concessionary Finance Schemes.

The IDB operates a scheme for small and medium sized industries whose total project costs are under Rs. 2 million (U.S.$ 88,100). This scheme is similar to the EDB scheme outlined earlier. Concessionary finance is available at 18% through commercial banks for both working and fixed capital on projects approved by IDB.

For projects above Rs. 2 million, the NDB operates a similar scheme where approval by IDB is not necessary. Rates of interest are similar to that of the IDB scheme.

Profits from export sales of processed fruit and vegetable products are exempt from taxes for 5 years, beginning 31 March 1983.

C. EDB INCENTIVES TO EXPORTS OF FRESH FRUITS AND VEGETABLES

1. Financial Incentives

a. Duty Rebate Scheme

A rebate on import duty for packing and packaging materials and tin can imports used for exports are given to processor-exporters. Duty

rebates of 16% and 19% of FOB value of exports are given to processor-exporters of canned passion fruit juice and pineapple products, respectively. These rebates cover only about half of the cost of the duty to the processor.

b. BTT Certificates

In addition to import duty, a business turnover tax (BTT) is payable to the Sri Lanka customs on import of packing and packaging materials (direct inputs into manufacture or export). An exemption is given toward payment of the BTT through a certificate issued by the EDB on request by a processor-exporter.

c. Working Capital/Discounting of Promissory Notes

EDB/Central Bank Scheme makes working capital available at 16% interest.

d. Export Expansion Grant

A tax-free grant for efforts expended to increase exports, such as quality improvement and marketing, are given on the basis of export performance over three years. Exporters are entitled to a grant based on a percentage of the increase in FOB value of exports. This program is being reformulated. The new grants scheme will be export investmentoriented, with the objective of assisting exporters to invest in product/market development and capital development activities.

Basically, a grant would be given that would be a percentage of the FOB value of exports over a year, e.g., 5% of total FOB value of exports during 1983. If the grant, which is tax free, exceeds Rs. 100,000, 25% would be given in cash and the rest as an investment certificate, to be cashed through commercial banks for carrying out the investment.

2. Freight Subsidies

Payment of a part of the freight rates may be considered.

3. Other Incentives

EDB assists exporters participating in trade fairs, buyer/seller meetings, promotional tours; establishing sales offices; advertising and publicity; equity participation in projects for cultivation and processing; product development, improvement in design and packaging; market research and test marketing; and product and quality control.

VI. OPPORTUNITIES FOR PRIVATE SECTOR DEVELOPMENT

Taking into consideration the background of the fruit and vegetable industry, the existing production, processing and marketing activities (Sections II, III & IV), and government policy issues relevant to this industry group, there are specific opportunities for private sector development and expansion. It is important to keep in mind that the fruit and vegetable industry includes agricultural sector operators (firms or individuals) involved in the production (growing), processing, and marketing of fruits and vegetables, and in the support (transportation, collection, extension, research and development, consulting assistance, financing) of activities within this industry.

A. COMMUNITY PROCESSING

1. Concept

A series of small processing and packing operations at the community level in the Mahaweli area, utilizing production from home garden plots.

These small operations present an opportunity for a joint venture between community ownership (or a producer association) and a private sector processor presently involved in marketing or distributing food products in Sri Lanka. The operations would process fruits and vegetables, as a method of preserving surplus home-garden production, both for the community's own consumption during the off-season, and for the domestic urban market. Basic preservation methods and labor-intensive processes would be used, such as bottling/canning, milling, solar or air drying, and extrusion. Although a domestic market is indicated by existing domestic processing operations and imports, the size of the market is not known.

The commercial attractiveness of this opportunity is largely that the produce collection system is set up in the Mahaweli Development Project where the hamlets are organized, raw materials are available,

and bank branches in each "operational unit" of several hamlets are available and can be involved in joint farmer-processor-marketer payment schemes. Furthermore, the Mahaweli Authority is interested in supporting such a processing industry by providing the land required for a plant.

Such a series of small operations throughout Mahaweli, linked to the domestic urban market by a joint-venture partner with an established marketing system, has potential for broad impacts. Waste resulting from the inefficiencies of the distribution system in Sri Lanka would be reduced by preserving surplus fruits and vegetables near where they are produced. The operations would be labor-intensive, providing needed employment for the second generation of settlers. Revenue would be generated by the community, which would help them move into a trading economy. Increased availability of low-cost food to rural populations during produce off-seasons could have significant impacts on the quality of life and the nutritional status of these groups.

Potential products might be tropical fruit salad (canned), tropical fruit juices and juice blends of mango, papaya, soursop, and jackfruit, extruded snack foods from rice and corn, dried chillies, eggplant, and other vegetables, and jams and chutneys.

An essential factor for success of such a project is that an experienced private sector processor/marketer must take the initiative of developing the concept and organizing the joint venture with a community organization. The processor must provide guidance and management on technical, marketing, and financial aspects of the operation. Appropriate technology/basic food processing technology must be applied, requiring skilled technical professionals at the design and training stages.

2. Action Steps

- Determine fruits and vegetables grown in home gardens that yield surpluses at a hamlet level, and that can be processed

and marketed in domestic urban centers. Establish seasonality of these surpluses.

- Evaluate processing requirements (canning and bottling) for preservation of fruits and vegetables that have a seasonal surplus. Determine if processing can be carried out through labor-intensive and low-volume operations, using labor available in hamlets.
- Determine whether volume of production and processing can be increased, and establish optimum size of operation to turn out a product that is competitively priced on the domestic market.
- Determine the logistics and costs of assembling processed products and transporting them to domestic urban markets.

B. SEED AND SEEDLING PRODUCTION

1. Concept

Commercial production of seed for fruits and vegetables and multiplication of seedlings for nontraditional and exportable varieties.

The domestic demand for seed presently exceeds supply by nine times, and is particularly high for varieties demanded in export markets. Limited amounts of seed are now supplied by the Ministry of Agriculture and by farmers with surplus produce from which they gather seeds to dry and sell. These seeds are of low quality. Greater availability of fruit and vegetable seeds is not only needed, but would have significant impacts on productivity, and income generated.

The most critical factor for success of this project would be adjustment of regulatory/quarantine/tariff restrictions placed on the import of fresh parent stock of seeds and planting materials. At present, the government has such tight restrictions, that few importers/agribusiness firms have been able to obtain seeds/seedlings. A private sector investor interested in this opportunity would need to

investigate and discuss governmental restrictions in depth with Ministry of Agriculture and Customs officials.

2. Action Steps

- Determine demand for fruits and vegetable in export markets presently being supplied from Sri Lanka. Define the varieties presently consumed and the schedule of consumption. Describe characteristics of product as found on market, such as color, size and freshness. Determine amounts presently consumed and the potential of the market for growth.

- Review the logistic, institutional, and tariff constraints faced on import of planting materials (seeds and seedlings). Determine procedures required to obtain fresh planting materials from international sources in the short to medium-term, to undertake trials for domestically multiplying these materials, and to grow products at costs competitive for export.

- Obtain planting materials for varieties that are presently being grown or could be grown in Sri Lanka, that have good export markets. These seed materials should be field-tested to determine cultural practices, costs of production, and potential for scheduling production to meet market requirements.

- Complete a full technical and economic feasibility study for domestically multiplying planting materials, using field tests, for crops presently grown in Sri Lanka and being supplied by imported planting materials. Requires evaluating the size of domestic market and distribution requirements.

C. JAFFNA MANGO PROCESSING

1. Concept

Expansion of an existing mango processing operation, Arasco Industrial Exports in Jaffna, based on a unique raw material supply situation and a unique product for which there is a domestic and probably an export market demand.

A surplus of good quality fresh mango is available in a localized area of Jaffna, providing a raw material supply. Products produced, mango nectar, cordial, and pieces in syrup are sold on the local market and high-quality versions of these products are in fact, imported for the domestic market.

The existing operation is labor-intensive, and any expansion would have further impacts on employment. Hand-selection and handling of the fruit provides an opportunity for a high-quality product. There is a small investment in the existing processing operation; with an additional investment of less than Rs. 400,000 (U.S.$ 18,000) for equipment, and some technical assistance, the potential production of the plant could increase annual sales to Rs. 20 million.

Successful development of this opportunity depends on marketing and technical assistance to the existing private sector firm.

2. Action Steps

- Compare present formulations for nectar and other mango products, with those presently imported into Sri Lanka. Reformulate products to be equal or superior.

- Undertake engineering and technical audit of existing plant to determine modifications in the equipment and process needed to produce reformulated products and process increased volume of mangos. Evaluate technical options economically available to store semi-processed product for future reprocessing.

- Undertake a marketing, distribution and commercialization study to determine the packaging necessary to compete with imports and sell the product nationally, principally in Colombo. Develop a full distribution and commercialization program for marketing nectar and juice at a national level.

D. LARGE-SCALE PRODUCTION IN MAHAWELI

1. Concept

Development of large-scale production in Mahaweli area, by increasing linkages between producers, processors, and marketers through joint ventures or contract arrangements between farmers or producer associations, processors, wholesalers, and exporters.

A large-scale venture in the Mahaweli area - where land under irrigation totals close to 350,000 acres - presents opportunities for crops that can be grown under irrigated conditions in large quantities for processing or export.

This opportunity is particularly attractive because of the potential for contracting with farmers to devote large areas to one crop. The availability of the collection system and infrastructure in the Mahaweli area makes working with small farmers viable. Furthermore, the Mahaweli Authority has indicated that they would consider giving plots of land up to approximately 500 acres to a private sector firm interested in establishing some of its own production to go along with production from contract farmers. Some level of self-supply would be necessary for the opportunity to be attractive to most private-sector investors. The availability of land for ownership by a private company would need to be discussed in detail directly with the Mahaweli Authority.

This opportunity would be most attractive if an overseas joint-venture partner were involved, to provide greater access to export markets. The initiative would have to come from a processor, wholesaler, or exporter on the Sri Lankan side who can investigate linkages to export markets and also organize the production side.

The development of a large-scale commercial venture would clearly have significant impacts, by providing a market for production of all 140,000 farmers in the Mahaweli area.

2. Action Steps

(This assessment assumes that the cost of land, labor and water give Mahaweli a comparative advantage over California, the growing area whose production is largely responsible for controlling the world market in vegetables).

- Determine which fruits and vegetables are grown in California under irrigation and which could be grown in Mahaweli.
- Undertake field tests in Mahaweli to determine whether production costs and production schedules can compete with those of California. The evaluation should allow for cost of transporting processed products from Sri Lanka to market.
- Given competitive production (growing) costs, determine optimum size of processing facility and formulation of semi-processed or finished products that can be exported in bulk.
- Undertake full feasibility study required to finance the production, processing, and exporting operation.

E. AIR FREIGHT JOINT VENTURES

1. Concept

Joint venture between existing groups of fresh fruit and vegetable exporters and Air Lanka or other air services for purchase of aircraft to provide air freight service for fresh produce exports, primarily to Middle East markets.

Air freight rates and space availability are major constraints to exporting fresh fruits and vegetables. As exports grow, these constraints will intensify because of the monopoly control which Air Lanka has on air transportation. Air Lanka considers fruit and

sufficient volume (exports of Rs. 33 million of fresh fruits and vegetables to the Middle East in 1982) to consider a joint venture with Air Lanka or another air service. Exporters could build on their increasing export volumes by integrating forward and gaining more control over scheduling, space, and cost in the marketing channel.

2. Action Steps

- Determine total volumes of fresh fruit and vegetable exports from Sri Lanka to Middle East. Determine potential growth in demand for these Sri Lankan products. Define scheduling and seasonal demands of the market, according to exact location.
- Develop estimates of fixed and operating costs, expected sales volumes. Determine estimated return on investment.
- Discuss possible joint venture arrangements with Air Lanka. Determine possible operating relationships between produce exporters.

F. JOINT VENTURE CONSULTING ASSISTANCE

1. Concept

Joint venture of private sector consulting firm with Ceylon Institute for Scientific and Industrial Research (C.I.S.I.R.) to provide technical assistance to the food processing industry in Sri Lanka.

There is no public or private sector entity currently providing technical assistance to the industry, and there is a lack of trained, experienced technical resources (i.e. food technologists, microbiologist, processing engineers) available to the industry from any source. Consequently, product quality, food safety, plant productivity and profitability, and development of the industry as a

whole are affected. There appears to be a demand in industry for assistance in product development/formulations, process development, packaging, plant design/layout, quality control, profitable use of by-products, and training of plant staff.

C.I.S.I.R. is interested in providing technical consulting assistance to the industry, and such a service would be consistent with this mandate. Through a joint venture with an established consulting firm with technical strengths in the above areas, it may be possible to change C.I.S.I.R. staff's mode of operation to a private-sector approach--one which would provide results which industry is willing to pay for. Because of the time required to build a working relationship with processing firms, and for them to see tangible results from buying technical assistance, this must be viewed as a long-term opportunity.

2. Action Steps

- C.I.S.I.R. identifies potential joint venture partners and approaches them to undertake the required feasibility study.
- C.I.S.I.R. and joint venture partner undertake a feasibility study: define the scope of activities it would perform, determine the market for such activities, establish the cost of providing this service, and identify the means of payment.

CHAPTER 4

COCONUT PRODUCTS SECTOR

I. SUMMARY

Major opportunities for entry and expansion in Sri Lanka's coconut industry lie in three types of activities:

- Integrated coconut processing to produce coconut milk
- Industrial processing of green coconut husks into white fiber or coconut yarn
- Refining and packaging of coconut oil. All three opportunities will contribute to export earnings and import savings, generate and preserve employment in the industry, contribute to increasing the returns to the industry from the nuts harvested, and add value to coconuts and/or coconut products presently produced. The employment and value-added aspects of these opportunities will have a positive impact on the sector of the rural economy presently dependent on growing and processing coconuts.

Integrated processing of coconuts into coconut milk will provide a substitute for home-processed coconut milk, which is a staple of Sri Lankan households. Industrial processing will bring a greater number of coconuts to the industry for production of oil and desiccated coconut, recovering raw material that has been lost to market as population has grown and the supply of nuts has remained fixed or declined. Industrial processing of coconuts into milk allows for the recovery of at least one-third of the raw material wasted in home processing. Integrated processing gives a better milk yield than home processing; dehydrated coconut milk is cheaper to market and has longer shelf-life than whole coconuts. Moreover, the product is better (a lower fat content and higher protein content) than the household can produce. Many of the labor-intensive practices of the desiccated coconut industry can be used for processing coconuts into milk. Industrial processing can increase the production of white fiber from green coconut husks, which are presently discarded, thereby increasing overall industry revenues.

Sri Lanka exports a small amount of coconut oil. Refining and packaging this product for export would increase value added and foreign exchange earnings. Refined and packaged oil is at least twice the price of the raw oil presently produced and sold on the domestic market. A higher quality product than that of other oil exporters will increase Sri Lanka's potential for retaining market share. A small plant with a capacity to refine 15 tons/day would require an estimated Rs. 15 million investment. One plant of this size could process about 3,000 MT of oil/year, equal to about 8% of average annual exports over the period 1971-81.

The major constraint faced by the industry has been and continues to be the government's export duty policy.[1] If adequate incentives are to be restored to coconut growers (and processors), a greater liberalization of the export prices of nuts and nut products is required. The wholesale price of nuts on the domestic market has been kept low through high export duties on both fresh nuts and coconut products. Higher returns to growers and processors will allow for greater investment and increase production and processing yields.

Growers need to invest in fertilizer and seedlings to increase yields from existing coconut lands. Increased use of of fertilizer could increase production by 50% in the short run (see Appendix 5). Greater use of seedlings could increase production by an additional 25% over the longer term (10 years). Assuming that all of the extra production were processed for export, the higher revenue to the government would more than cover the investment (see Appendices 3 & 5).

A second major constraint facing the industry is in the area of product and processing technology. Since there has been little incentive for investment the adoption of new technology has been

[1] See Appendix 3 - with decreasing prices on international markets. the present sliding scale (November, 1981), through the "base export duty" has the same negative impact on producer prices as pervious duty schemes.

blocked, as has the development of expertise. Thus, while industry experts in Sri Lanka are aware of technology developed and adopted in other countries of the world, the feasibility of adopting them commercially in Sri Lanka has not been examined. The new products and markets made possible by new technology are not well known to the Sri Lankan industry and thus the opportunities they offer have not been assessed.

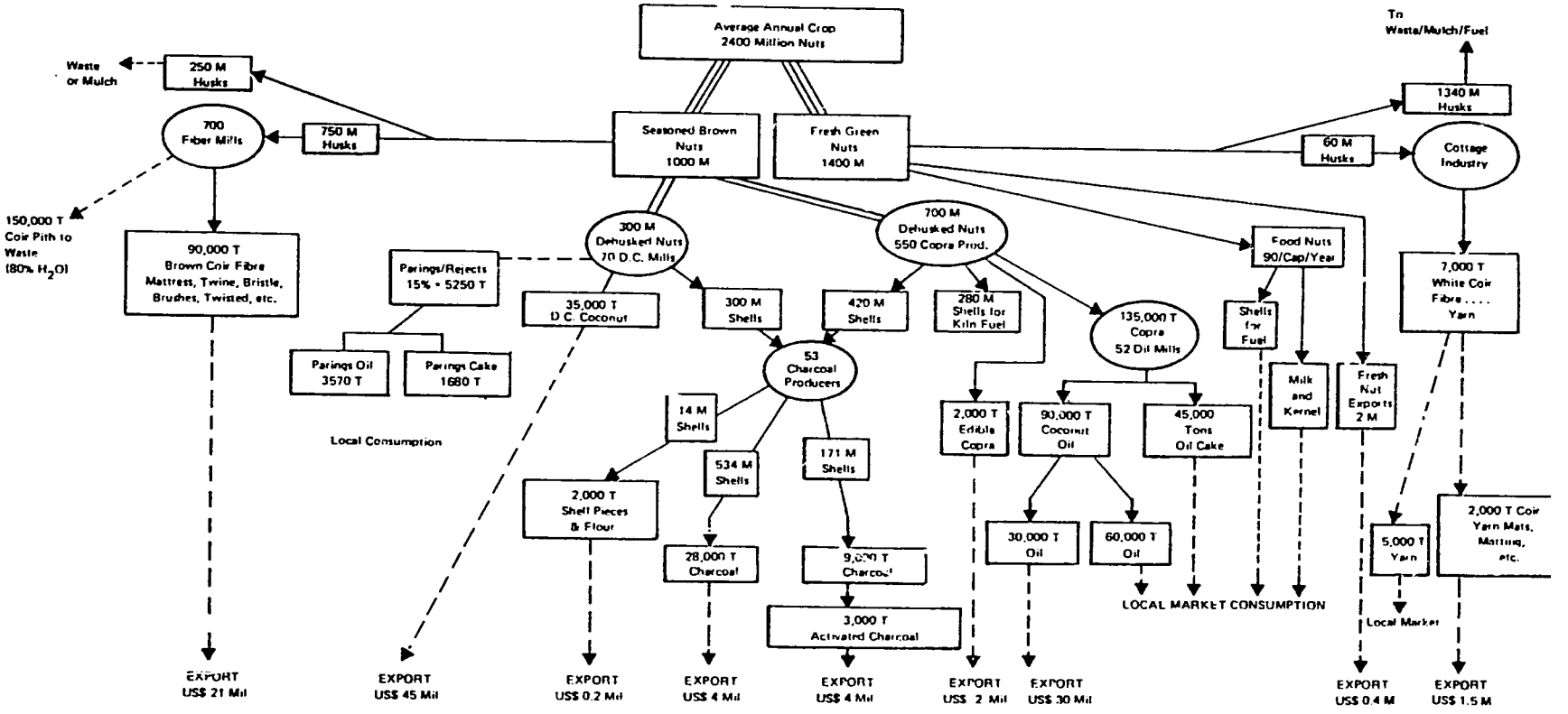
II. COCONUT INDUSTRY CHARACTERIZATION

The coconut industry is made up of operators involved in the growing (production), processing, and marketing of coconuts and coconut products. It is the third largest industry in the agricultural sector, after tea and rubber. Coconut utilization can be divided into six major groups, the largest being fresh coconuts followed in decreasing order of importance by copra, oil, desiccated coconut, brown fiber, and white fiber. Figure 1 shows the relative importance of each product group within the industry as well as the interrelationships as products move from production to consumption.

Coconuts are native to Sri Lanka, which provides ideal growing conditions. Table 1 shows that Sri Lanka, with the smallest land mass among the major coconut growing countries, is the fourth largest coconut growing country in the world; production over the period 1971-80 averaged about 6% of world production, or about 1,737,000 MT per year. Nevertheless, this represents a decrease of about 13%/year in the face of increasing world production. Sri Lanka's position as a major growing country is being threatened by rapidly increasing production in Malaysia.

Coconuts are grown on about 22% of the total arable land of the island, concentrated in 10 of the country's 22 districts. Three districts -- Kurunegala, Puttalam and Colombo/Gampaha, which make-up the "Coconut Triangle" -- have about 66% of the total coconut acreage. While Table 2 shows that the 451,486 hectares recorded by the 1973 Agricultural Census are estimated to be in coconuts in 1983, many experts in Sri Lanka argue that the area is closer to 433,000 hectares. The 1973 Agricultural Census noted a decrease of 7531 hectares during 1962-72, and urbanization rates during the last 10 years have been greater than in previous periods. Other factors that support the lower estimate are: the 1978 cyclone, which destroyed more

FIGURE 1
COCONUT INDUSTRY IN SRI LANKA



Based on estimated nut utilization in 1987 and 1982 prices.

Source: Arthur D. Little, Inc.

TABLE 1

COCONUT PRODUCTION - ANNUAL AVERAGE FOR PERIOD 1971-1980, BY REGIONS OF THE WORLD AND MAJOR GROWING COUNTRIES

	MT (000)	Percent	Average Percent Change	Size Sq. Mi. (000)
1. Regions				
World	31,369	100	+6	
Africa	1,533	5	+7	
Central America, Mexico and Caribbean	1,452	5	-6	
South America	549	2	-9	
Asia	25,628	81	+14	
Oceania	2,207	7	+6	
2. Major Growing Countries				
Philippines	9,897	32	+25	116
Indonesia	7,770	25	+35	735
India	4,369	14	-4	1,266
Sri Lanka	1,737	6	-13	25
Malaysia	950	3	+14	127
Mexico	926	3	-13	761
Papua New Guinea	796	3	+6	183
Thailand	753	2	-12	198
Mozambique	410	1	-0.5	302

Source: Ministry of Coconut Industries and FAO

TABLE 2

LAND AREA IN COCONUTS AND DISTRIBUTION

BY MAJOR GROWING DISTRICTS (1983)

	Hectares	Percent	Percent of Total Arable Land
Total Districts (22)	451,486	100	22.2
Kurunegala	161,285	36	58.8
Colombo and Gampaha	77,838	17	46.0
Puttalam	57,788	13	64.7
Hambantota	24,329	5	34.0
Kegalle	20,836	5	16.5
Galle	18,189	4	18.5
Matara	16,346	4	18.0
Matale	12,836	3	19.0
Ratnapura	12,529	3	8.5
Kalutara	11,838	3	11.7
Other Districts (12)	37,676	7	1.9

Source: Ministry of Coconut Industries

than 12,000 hectares on the East Coast; the agrarian reform, which redistributed 126,000 hectares of coconut growing lands; and lack of new plantings since the last census. While the total area may be lower than that shown in Table 2, the distribution of land across districts is considered representative. As the land of the Mahaweli Project (about 140,000 hectares) comes into agricultural production, the relative importance of coconut lands within total agricultural lands will decrease slightly from 22.2% to 20.8%.

The coconut industry is traditional and established, with more than 200,000 operators involved in growing, processing, and marketing of coconuts and coconut products (see Appendix 2). Most operators can be classified as private enterprise controlling most of the land and capital in the industry. The largest group of operators is the estimated 150,000 growers, each with more than a fifth of a hectare of land but less than 21 hectares, who control about 90% of the coconut land. The estimate in Table 3 is based on the assumption that holdings of less than 0.2 hectares are homes rather than commercial farms and that a large number of holdings are grouped and operated as single holdings. Of the total land in coconuts, only 6 - 8% is held and operated by the government as estates.

The second largest group of operators are the estimated 20,000 collectors who purchase the nuts from growers and sell to dealers/wholesalers. About 4,000 dealers/wholesalers constitute the third largest group; they are a major source of credit to growers and are major producers of copra. They also store, dehusk, and distribute nuts and husks, supplying fiber mills, copra producers, desiccated coconut mills, and fresh nut retailers. Exports are handled by some 154 exporters/shippers. All operators are estimated to employ directly some 80,000 to 100,000 laborers; indirectly, the industry accounts for the employment of at least another 100,000 operators and laborers who support the industry as suppliers of inputs, of transportation and

TABLE 3

ESTIMATED NUMBER OF GROWERS*

Size of Holding (ha)	Total Land Area (ha)	Percent Total	Median Size of Grouping	Estimated Growers
<0.2[1]	10,006	2.2	0.1	100,060
0.2 <0.4	17,226	3.7	0.3	57,420
0.4 <1	64,750	14.0	0.7	92,500
1 <2	72,574	15.7	1.5	48,382
2 <4	72,058	15.6	3.0	24,019
4 <10	65,960	14.3	7	9,422
10 <	41,795	9.0	15	2,786
20[2]	77,466	16.7	20	3,873
Government Estates	40,928	8.8		
Total	462,763[3]	100		338,462

* Based on the Distribution of Coconut Holdings in 1962 and the median within size groupings of holdings as representative of the average size of holding.

[1] Assumed to be homes rather than growers in the market economy.

[2] Land in coconuts of size 20 > in 1962 = 126,009 has.
Lands vested under 1972 and 1975 land reform low = 48,542 has.
Difference represents land which could be kept by original owners = 77,467 has.

[3] Estimate based on 1962 census, total land area in coconuts today is estimated to be 433,000 has.

Source: Arthur D. Little, Inc.

other services. The industry also generates employment for a significant number of public sector employees.[1]

Figure 1 shows the flow of coconuts from production to consumption. About 60% of annual production goes into the fresh nut market for household consumption, principally as coconut milk and the rest is processed. Half of these processed nuts go into export products, principally desiccated coconut and oil. Major by-products are shells, used for fuel, charcoal, and oil cake or poonac, used by the animal feed industry.

Export earnings from coconuts and coconut products are third after tea and rubber. Table 4 shows that 1981 exports were US$71 million, about the annual average for the period 1978-81. The major export earners in the industry are desiccated coconut products, 55% of the value of industry exports; fiber products, 18%; and coconut oil, 17%. Both desiccated coconut and oil are internationally traded commodities. Table 5 shows that during the period 1978-81, Sri Lanka was the second largest exporter of desiccated coconut in the world, with an average annual tonnage of about 36,000 MT, accounting for 27% of the world supply. The percentage of the crop that goes into production of desiccated coconuts in Sri Lanka is higher (15%) than that of its competitors, suggesting that it is no threat to the share of the market controlled by the Philippines, the leading producer. The average annual change shown in desiccated coconut

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[1] a. Ministry of Coconut Industries
- Coconut Development Authority
  -- Coconut Marketing Board
- Coconut Cultivation Board
- Coconut Research Board
- Government Owned Business Undertakings of British Ceylon Corporation (largest oil milling operation in country).

b. Ministry of Rural Industries Dev.
- Ceylon Oils and Fats Corp. (Feed Mill)

c. Ministry of Janatha Estates Development
- Janatha Estates Development Board. (Estates)

TABLE 4

SRI LANKA - EXPORTS OF COCONUT PRODUCTS - 1981

	U.S. (000)	Percent
Total	71,072	100
Coconut Oil	11,963	17
Desiccated Coconut	39,180	55
Copra[1]	2,279	3
Fresh Coconut	374	0.5
Fiber (Mattres, bristle and coir yarn)	12,503	18
Coconut charcoal	2,797	4
Shell pieces and flour	44	0.06
Ekel	852	1.2
Other (includes activated carbon)	1,080	1.5

[1] Principally edible copra not used for oil extraction and commands a much higher prices.

Source: Sri Lanka Coconut Trade Directory 1981, Coconut Development Authority

TABLE 5

DESICCATED COCONUT EXPORTS BY MAJOR GROWING COUNTRIES
ANNUAL AVERAGE FOR PERIOD 1978-1981

	MT	Percent	Average Percent Change	Percent Of Average Annual Nut Harvest[2]
World[1]	134,051	100	-2	3
Philippines	89,632	67	-8	7
Sri Lanka	36,119	27	+19	15
Tonga[3]	953	1	-10	7
Malaysia	908	1	+182	1
Indonesia	869	1	-42	0.08

[1] Major growing countries like India, Thailand, Papua New Guinea, Mexico, and Mozambique do not export desiccated coconut.

[2] 1 MT Desiccated Coconut = 7.39 MT nuts.

[3] Tonga is not a major growing country with only 0.3% of annual world production or 102,000 MT average per year, but it is third in desiccated coconut exports among growing countries. Several European countries produce more desiccated coconut than Tonga but they do not grow coconuts and are not listed in this table.

Source: Ministry of Coconut Industries

exports from Malaysia, suggests, however, that if Malaysia maintains its growth, it could increasingly threaten Sri Lanka's market share. Table 6 shows that Sri Lanka was the fifth largest exporter of coconut oil during the period 1978-81, accounting for about 2% of world exports. Oil exports showed a significant decrease during the period, even though world supplies increased slightly.

While the industry's operations are very much in the hands of private enterprise, the government has traditionally exercised heavy control and regulation of its activities through the Ministry of Coconut Industries. The main policy toward the industry has been to control exports of coconuts and coconut products through export duties to ensure their availability for the domestic market at low consumer prices and maximize foreign exchange revenue for the national budget. Four duty schemes have operated since 1963 (see Appendix 3). In 1980, the World Bank concluded that "production incentives have been eroded due to heavy export taxation." A thorough review of the impact of these on the industry is beyond the scope of this study, nevertheless the tendency of these duty schemes has been to deprive the industry of revenue that could have been invested in expansion of production and improvement of productivity.

Through the Ministry of Coconut Industries, the government has undertaken various subsidy schemes to stimulate investment by growers. These subsidies have focused on use of fertilizer, replanting of old low-yielding palms, and planting of palms on new lands. Some subsidies have gone to processors in the form of rebates to cover wages when processing has been temporarily stopped because of export restrictions. Over the period 1960-1981, the government spent between Rs. 10 - 20 million annually on subsidies to the industry. (See Appendix 6.)

The numerous duty schemes, export restrictions and subsidies, agrarian reform and political shifts have not helped the industry. As the government has gained export revenues, investment within the industry has dwindled, production has remained at best constant, and

TABLE 6

COCONUT OIL EXPORTS BY MAJOR GROWING COUNTRIES - ANNUAL AVERAGE FOR PERIOD 1978-1981

	MT (000)	Percent	Average Percent Change	Percent of Average Annual Nut Harvest[1]
World	1,228.8	100	+2	34
Philippines	944.5	77	-7	83
Malaysia	53.3	4	+149	49
Papua New Guinea	31.4	3	+18	34
Indonesia	21.6	2	+4	2
Sri Lanka	20.8	2	-31	10
Ivory Coast	12.9	1	+25	112
Mozambique	4.0	0.3	NC	8

[1] 1 MT coconut oil = 8.69 MT nuts

NC - No change

Source: Ministry of Coconut Industries and FAO

processing capacity and efficiency have decreased. With population growth, processors and consumers bid against each other for the inelastic supply of coconuts on the market. Revisions in the government's duty and pricing policies are needed if the industry is to maintain its important position in both the domestic economy and the export market. (See Appendix 3.) In light of the weak market faced over the past two years the government needs to question the wisdom of continuing to use export duties as a revenue base. The resulting increase in the relative price of Sri Lankan coconut products could continue to contribute to an eroding market position. Economic theory on comparative advantages and on the optimum taxation of exports is well developed and offers an ample selection of techniques which could be considered in restructuring the government's duty policy towards the industry.

III. NATURE OF COCONUT PRODUCTION

Table 7 shows that the annual nut harvest was 15% lower in 1971-80 than during 1961-70, but about the same as in 1951-60. Production for 1981 and 1982 has risen and is equivalent to the long-term average annual production of the 1951-80 periods.

Production is presently calculated by adding the purchases of nuts reported by the processing industry and an estimate of total fresh nut consumption. This estimate is based on a 1969-70 socio-economic survey, which indicated that annual consumption was 90 nuts per capita. This method of estimation makes no allowance for substitution affects in consumption, tends to make fluctuations in production appear more pronounced than they in fact are and reflects fluctuations in world market prices as fluctuations in production.

The government's use of export duties to collect revenue has tended to place a ceiling on the return to processors limiting their ability to bid prices up as an incentive for growers to produce more. As low prices have prevailed, growers have been unable to maintain their crops. The effect has been a downward spiral in production. Because coconut palms produce for 60 years or more, as long as the price of nuts is enough to cover harvesting and transportation growers will offer nuts for sale. The large number of growers in the industry has meant that the reduction in acreage, in the light of low prices, has also been slow.

In spite of the many factors that have had negative effects on production (agrarian reform, weather, reduced acreage, scarce inputs, low prices, changing subsidy programs and uncertainty over government policy), the productive base, involving a large number of operators/growers, has the physical and technical resources to increase production significantly over present levels. Appendix 5 makes a conservative estimate of production and the potential which exists for increases.

TABLE 7

COCONUT PRODUCTION 1951-1982

	Average Annual Production Million Nuts	Percent Change Over Previous Period	Percent Change Over 1951-80 Average
1951-80	2,381	-	-
1951-60	2,269	-	-5
1961-70	2,606	+15	+9
1971-80	2,271	-15	-5
1981-82	2,389	+5	No change

Source: Ministry of Coconut Industries

Increased investment in replanting and fertilizing could produce average annual crops that adequately meet the demand of domestic households and processors, with a small surplus for the fresh coconut export market. Table 8 shows production and input availability for the period 1971-81. As wholesale prices for coconuts increased, off-take of seedlings and fertilizer also increased. An additional average annual off-take of 26,000 MT would increase average annual production about 25%.

Some industry representatives argue that input use and production have both decreased because of lowered rainfall. Table 9 shows average annual rainfall for the period 1951-1980. The data for Chilow, Kurunegala, Gampaha and Colombo adequately represent the Coconut Triangle which contains 66% of the arable coconut land. Rainfall was lower in the 1970s than in the 1960s, and is comparable with that of the 1950s. Nevertheless, Figure 2 shows that most of the Triangle area is in the Kurunegala District where rainfall has been relatively stable over the past 30 years.

In 1979, the World Bank, did a detailed study of the returns to coconut growers for 1973-80.[1] This study determined that it was uneconomical for coconut growers to apply fertilizer unless the ratio of net returns to total cost of fertilizer application was at least 2.5:1. The ratio was below this in all but one year (1979). The study concluded that adequate incentive to growers would require 1980 prices (cost of fertilizer Rs. 1194/ton) to be at least Rs. 1350-1400/1000 nuts (1,242-1,288/MT) at the farmgate or a market price at least 10% higher. Wholesale prices in Table 8 suggest that 1980 and 1981 prices were just short of the mark.

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[1] Sri Lanka: Key Development Issues in the 1980's, Agricultural Producer Incentives, World Bank Report No. 2955-CE, May 29, 1980.

TABLE 8

COCONUT PRODUCTION, WHOLESALE PRICES AND INPUT AVAILABILITY, 1971-1981

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Million Nuts Production	2,610	2,963	1,935	2,031	2,398	2,330	1,821	2,207	2,393	2026	2,258
Wholesale price Rs./MT	145.62	119.79	229.31	409.40	191.36	333.04	598.00	586.50	747.50	1,109.75	1,228.20
Seedlings - 1000	1,598	1,187	905	909	1,116	839	875	948	2,463	2,565	3,238
Fertilizer- MT	60,094	45,553	26,942	39,500	26,630	30,690	29,100	42,550	49,590	55,774	37,710
Rainfall - inches	86.67	89.70	70.90	73.01	84.46	61.96	88.69	78.53	73.53	63.93	71.52
Drought Months	1.02	3.06	3.11	1.95	1.72	4.09	6.29	3.56	3.18	2.92	2.12

Source: Ministry of Coconut Industries

TABLE 9

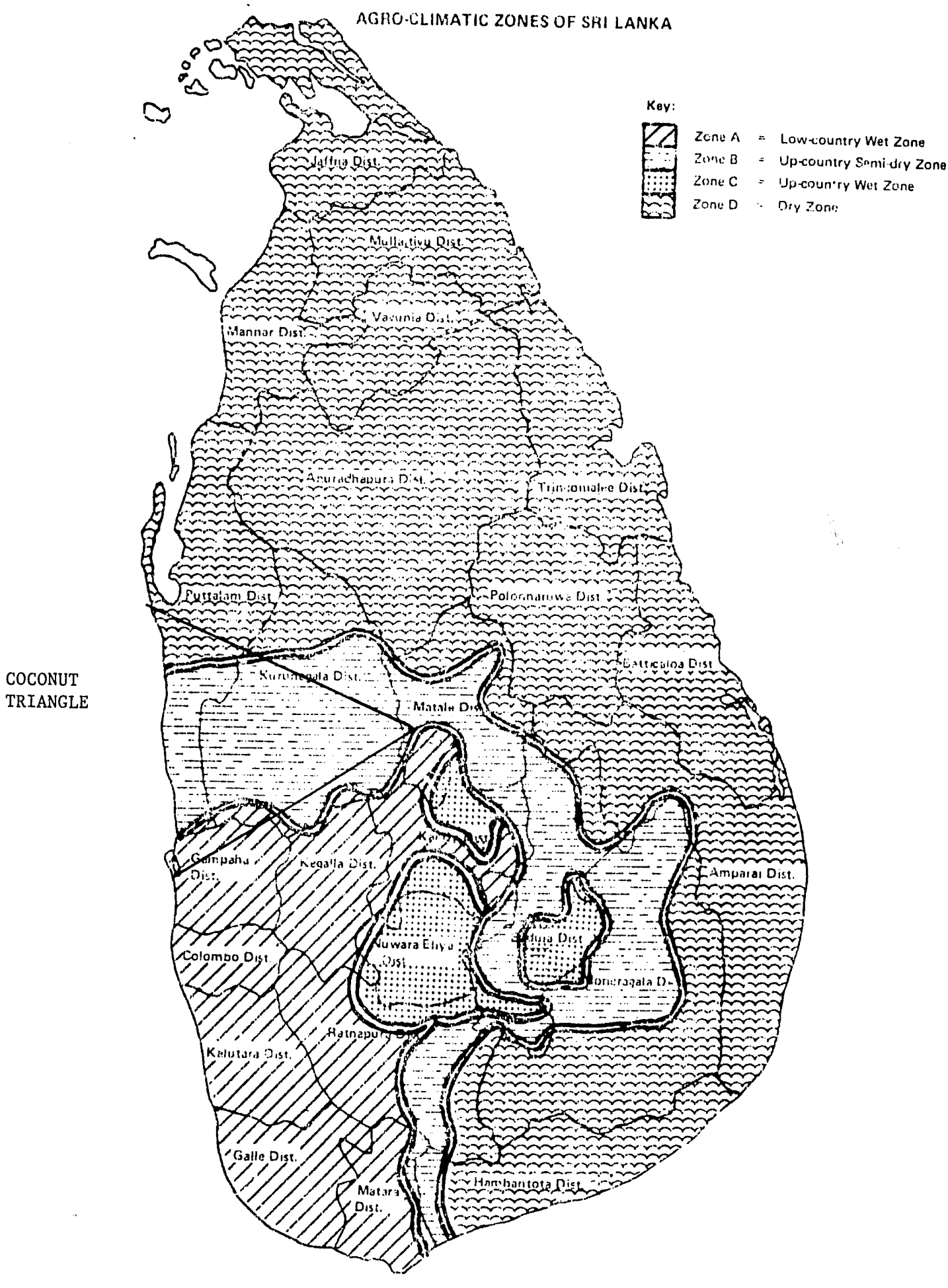
AVERAGE ANNUAL RAINFALL IN INCHES FOR PERIOD 1951-1980
COCONUT TRIANGLE (SEE FIGURE III -1)

Period	Chilow	Kurunegala	Gampaha	Colombo	Sri Lanka
1951-60	43.21	82.29	96.60	97.50	80.87
1961-70	60.36	85.76	110.99	109.91	84.47
1971-80	55.41	82.70	88.75	90.76	77.14

Source: Arthur D. Little, Inc.

FIGURE 2

AGRO-CLIMATIC ZONES OF SRI LANKA



COCONUT TRIANGLE

IV. COCONUT PROCESSING

Coconut processing is organized into six major product areas: copra, oil, desiccated coconut, charcoal, brown fiber, and white fiber (see Figure 1). About 40% of all nuts are processed; 70% of them for copra and oil and the remainder for desiccated coconut. About 75% of the husks from the seasoned or brown nuts that go into processing are used for mattress and bristle fiber; 4% of the green husks from nuts going to the fresh market are used for white fiber production. In terms of tonnage, copra is the largest product area (140,000 tons per average year) followed by oil, fiber, desiccated coconut, and charcoal. In terms of value of production, oil is the largest product group (about US$90 million per average year), followed by copra, desiccated coconut, fiber, and charcoal. Desiccated coconut has the greatest value added of all coconut products and provides the greatest monetary return per coconut processed.

The processing segment of Sri Lanka's coconut industry can be evaluated internationally in terms of the size of copra activities. With average annual production of 187,000 tons of copra over the period 1971-80, Sri Lanka ranked fourth after the Philippines, Indonesia and India (see Table 10). Sri Lanka's processing segment is half the size of India's but less than one-tenth that of the Philippines. Sri Lanka is one of four countries with very similar coconut processing industries in terms of capacity, but the Sri Lanka processing sector declined over the 1971-80 period (see Table 11). The leading cause of the decline appears to be the scarcity of fresh nuts. Table 12 shows that for the period 1971-80 the average number of nuts processed per year was 34% lower than during the 1960s, and was the lowest for any period between 1951 and 1980.

TABLE 10

COPRA PRODUCTION - ANNUAL AVERAGE FOR PERIOD 1971-1980, BY REGIONS OF THE WORLD AND MAJOR COCONUT GROWING COUNTRIES

	MT (000)	Percent	Average Percent Change	Percent of Average Annual Nut Crop[1]
1. Regions				
World	4,315	100	+11	NA
Africa	160	4	+30	NA
Central America, Mexico and Caribbean	195	5	-8	NA
South America	31	1	+3	NA
Asia	3,609	83	+13	NA
Oceania	302	7	+5	NA
2. Major Growing Countries				
Philippines	1977	46	+22	1.07
Indonesia	822	19	+13	88
India	348	8	-1	43
Sri Lanka	187	4	-19	58
Malaysia	154	4	+3	87
Mexico	142	3	-7	82
Papua New Guinea	140	3	-1	94
Mozambique	67	2	+8	87
Thailand	41	1	+24	29

[1] 1 MT Copra = 5.35 MT Coconuts

NA - Not applicable

Source: Ministry of Coconut Industries & FAO

TABLE 11

COCONUTS PROCESSED AND COCONUT KERNEL PRODUCTS PRODUCED 1971-1981

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Copra Production MT (000)	226	255	99	108	203	162	79	130	163	101	122
D.C. Production MT (000)	54	49	37	42	51	46	30	41	49	31	40
Oil Production MT (000)	131	132	61	64	120	100	49	80	100	62	75
Oil Exports MT (000)	70	86	18	21	54	60	9	30	32	3	17
Domestic Oil Consumption MT (000)	61	46	43	43	66	40	40	50	68	59	58
Coconuts processed (million nuts)	1,480	1,589	739	817	1,346	1,110	593	919	1,067	708	872
(Percent of total harvest)	(57)	(54)	(38)	(40)	(56)	(48)	(33)	(42)	(45)	(35)	(39)
Fiber production MT (000)	103	105	118	113	77	97	104	98	102	97	85
Percent of Coconuts Processed (husks)	(54)	(51)	(123)	(107)	(45)	(67)	(135)	(83)	(74)	(106)	(76)

Source: Ministry of Coconut Industries

Arthur D. Little International, Inc.

TABLE 12

FRESH NUTS PROCESSED - ANNUAL AVERAGES

1951-80

Period	Million Nuts	Change Over Previous Period	Change Over 1951-80 Average
1951-80	1,363.8	-	-
1951-60	1,464.6	-	:+7
1961-70	1,583.8	:+11	:+16
1971-80	1,043.2	-34	-24

Source: Arthur D. Little, Inc., estimates

Table 13 compares the "standard cost" established by the Coconut Development Authority with the wholesale price of nuts for the years 1963 to 1981. In all but three of the 19 years shown, the wholesale price was above the "standard cost." Every cent paid by a processor above standard cost cuts into his margin, since standard cost rather than wholesale price is what is used by the Coconut Authority to determine the profit margin processors will be allowed before paying duty. The difference between standard cost and wholesale price in the 1970s was significantly greater than in the 1960s, and the volume of nuts processed decreased sharply in light of raw material costs which averaged 182% higher than the cost being used by the Coconut Authority to estimate returns to processors. In 1977, production was at the lowest point in the 1971-80 period; the same year wholesale prices to processors were the highest, 550% higher than the accounting price.

TABLE 13

COMPARISON OF "STANDARD COST" AND WHOLESALE PRICE OF FRESH NUTS

Year	Standard[1] Cost Rs.	Wholesale Price Rs.	Difference Percent
1963	80	140.	75
1964	80	143.74	80
1965	80	176.25	120
1966	80	177.50	122
1967	80	170.00	113
1968	80	230.00	188
1969	80	228.33	185
1970	80	237.81	197
1971	80	158.28	98
1972	80	130.21	63
1973	80	249.25	212
1974	80	445.00	456
1975	80	208.00	160
1976	100	362.00	262
1977	100	650.00	550
1978	650	637.50	-2
1979	850	812.50	-4
1980	1,000	1,206.25	21
1981	1,450	1,335.00	-8

[1]Accounting cost used by the Coconut Authority in calculating margins to processors.

Source: Arthur D. Little, Inc., estimates.

The processing segment of the industry has about 1,424 operators, more than 99% of them in the private sector, who provide jobs for about 22,500 laborers. Most of the installed capacity is within the Coconut Triangle area.

The technology used in processing is generally labor-intensive, with few changes having been made in equipment or facilities in the last 15-20 years. Industry experts in Sri Lanka are of the opinion that the processing efficiency of firms is low, partly because there are no incentives to improve (low margins allowed by government) and the low price of coconuts. The quality of copra and oil produced is highly variable, with no effective premium on quality. The hygiene standards and practices observed at desiccated coconut mills are very high. Investment in updated, more efficient, and even integrated coconut processing technology that maintains the existing high labor-to-capital ratios would increase the segment's yields, add more value, and open new domestic and foreign markets.

V. COCONUT AND COCONUT PRODUCT MARKETS AND MARKETING

There are two major markets for coconuts. The fresh green nut market consumes about 60% of the total, primarily in the form of homemade coconut milk. These nuts are transported and distributed to retailers in major urban centers by wholesale/dealers (see Appendix 2). As Figure 3, shows the major growing areas are near the major population centers on the west-central coast around Colombo. Transportation of fresh nuts is mostly toward the north, east and south.

The other major market for coconuts is the brown seasoned nut which is processed into oil and desiccated coconut within the "triangle" region, principally in the Gampaha/Colombo area. Copra, which is processed in most growing areas, would tend to flow from outlying areas toward the triangle region. Most copra movement is carried out by wholesale/dealers. Fiber processing is concentrated along the west coast between Hambautota and Gampaha.

As was observed in Section IV, the number of nuts going into processing and the export of coconuts and coconut kernel products peaked in the period 1961-70. Recent reductions in processing and exports stem from the government's policy of giving preference to the domestic market. Nevertheless, coconuts and coconut products remain the third largest export from the agricultural sector. Table 14 shows that for the period 1977-81, the major markets for desiccated coconuts were the United States and the United Kingdom, which took 32% and 13%, respectively, of the world supply. While the world market appears to have expanded slightly, the two major buying countries show a slight contraction. Major growth is now in Asian and Middle East Markets.

Table 15 shows that Sri Lanka's major markets in 1971-81 were the United Kingdom, West Germany, the Netherlands, and France. Of these, only France has shown growth in recent years. Sri Lanka's market has been well-defined and stable as is indicated by the number of years in

FIGURE 3 DISTRIBUTION OF PRODUCTION AND CONSUMPTION OF COCONUTS

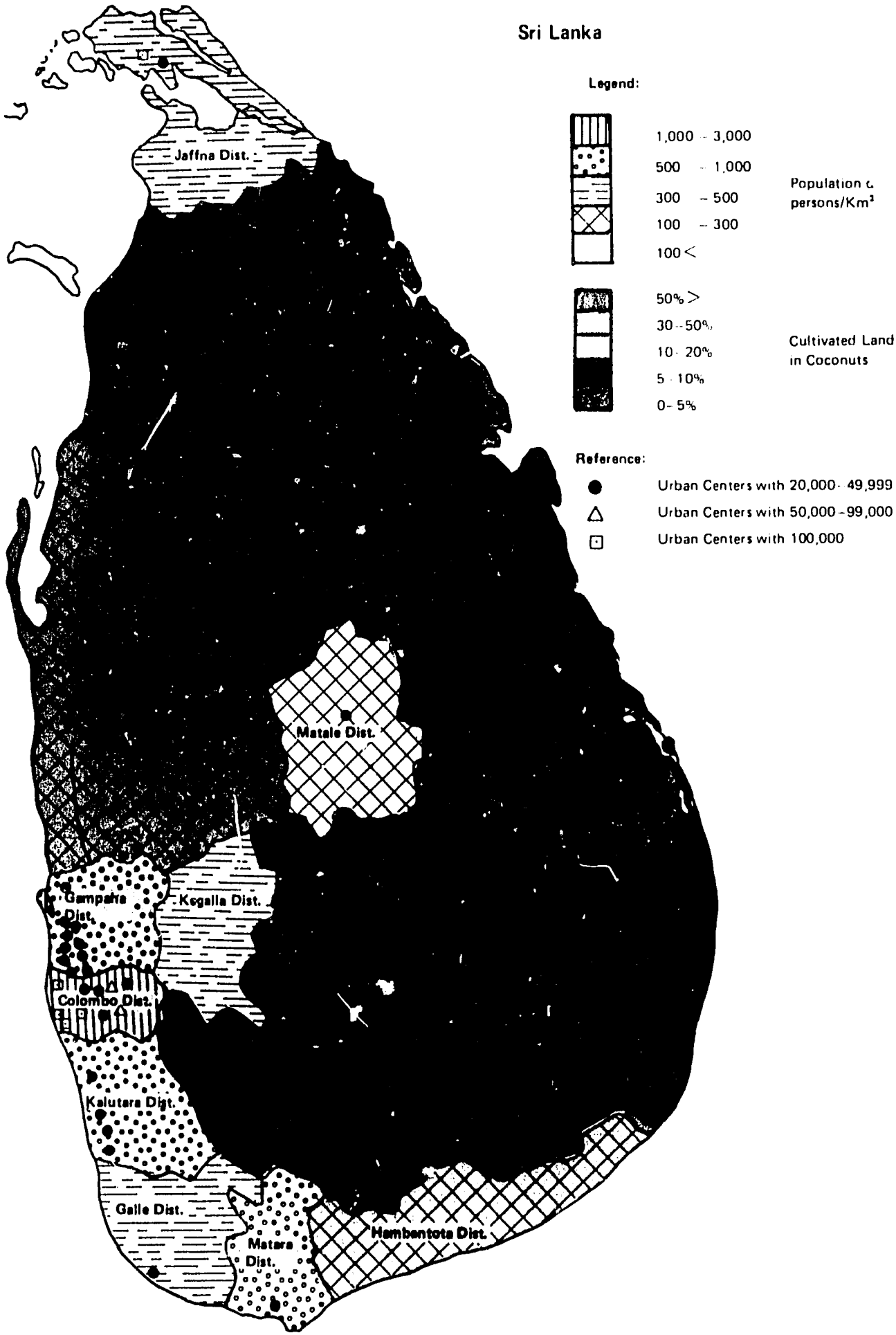


TABLE 14

DESICCATED COCONUT IMPORTS BY MAJOR IMPORTING COUNTRIES
ANNUAL AVERAGE FOR PERIOD 1977-1981

	MT	Percent	Average Percent Change
World	130,761	100	+3
United States	41,508	32	-3
United Kingdom	17,089	13	-3
W. Germany	9,561	7	NC
Netherlands	7,572	6	-1
Australia	6,475	5	+16
Canada	5,554	4	+7
Spain	5,100	4	+10
France	4,410	3	+11
S. Africa	2,251	2	-13
Japan	2,158	2	-16
U.S. Emirates	1,904	1	+100
Argentina	1,625	1	+7
Sweden	1,765	1	-5
Belgium-Lux.	1,546	1	+13
Saudi Arabia	1,432	1	+78
Singapore	670	0.01	+242

NC - No Change

Source: Ministry of Coconut Industries & FAO

TABLE 15

SRI LANKA EXPORTS OF DESICCATED COCONUT BY MAJOR MARKETS FOR PERIOD 1971-1981

	Total 1971-81		Annual Average	Export Years	1971-76 Average		1977-81 Average			1982	
	MT	Percent	1971-81	No.	Average	MT	Percent	MT	Percent	MT	Percent
Total Exports	478,141	100	43,467	11	43,467	48,005	100	38,022	100	42,393	100
United Kingdom	131,545	27.5	11,958	11	11,958	14,382	30	9,050	24	8,589	203
W. Germany	58,158	12.2	5,287	11	5,287	5,397	11	5,155	14	6,306	14.9
Netherlands	31,061	65	2,823	10	3,106	2,592	5	3,102	8	4,605	10.9
France	27,099	5.7	2,463	11	2,463	2,617	5	2,279	6	1,693	4.0
Czechoslovokia	12,250	2.6	1,113	11	1,113	1,580	3	554	1	-	-
Poland	11,435	2.4	1,030	11	1,030	1,460	3	534	1	-	-
Belgium	11,015	2.3	1,001	11	1,001	1,166	2	803	2	-	-
Yugoslavia	10,981	2.3	998	11	998	1,133	2	836	2	719	1.7
S. Africa	10,970	2.3	997	5	2,194	627	1	1,441	4	2,003	4.7
E. Germany	9,763	2.0	887	6	1,627	1,389	3	285	1	-	-
Others	163,524	34.2	14,865	NA	NA	15,662	33	13,983	37	18,478	43.6

NA - Not Applicable

[1] The 1982 data available at this writing did not have information for the countries where no information is listed (a dash used). This does not mean that exports were not made to them, but rather that the amounts exported were not significant and are therefore included under others. The data for 1982 offers a grouping for the Middle East, which had not been used previously and shows 4,956 MT or 11.7% of exports to this market.

Source: Ministry of Coconut Industries

which exports have gone to the same markets. Data for 1982 shows that the "Middle East" took 11.7% of exports which may mark a shift to this market.

Table 16 shows that the major markets for coconut oil during 1978-81 were the United States and West Germany, taking 38% and 13%, respectively, of the world supply. The world market for oil grew slightly more than the market for desiccated coconut. The U. S. market has contradicted slightly, while there was major expansion in West Germany, Russia, Japan, and Belgium. Most coconut oil traded internationally is used for industrial purposes.

Sri Lanka's markets for coconut oil do not show the same degree of stability as markets for desiccated coconut, possibly because supplies of coconut oil have been erratic. Table 17 shows that Sri Lanka's most consistent markets have been Pakistan and Bangladesh, which purchase edible oil in small quantities. In terms of volume, the major buyers have been Canada, Italy, and Russia. Russia made major purchases of oil between 1971 and 1976. Since 1977 the pattern of buyers has changed. The United States, Italy and Bangladesh were the major buyers for the period 1977-81; in 1982 the major buyers were India, the United States, and South Africa.

Coconut fiber products are not traded as commodities internationally. Table 18 shows that fiber products are under considerable pressure from synthetic substitutes. The major markets for fiber products showed significant contraction during 1971-81. The United States, which has not been a major buyer in terms of volume, is the only market with significant growth. Most fiber exports are for mattresses and car seats, but the high dust content of coconut fiber has increasingly facilitated the acceptance of synthetic fibers for these applications.

Table 19 shows that domestic prices for coconuts and coconut products have risen consistently over the period 1971-82, with a significant increase for fresh coconut and coconut kernel products during the second half of the period.

TABLE 16

COCONUT OIL IMPORTS BY MAJOR IMPORTING COUNTRIES
ANNUAL AVERAGE FOR PERIOD 1978-1981

	MT (000)	Percent	Average Percent Change
World	1,215.2	100	+8
United States	458.8	38	-4
W. Germany	153.2	13	+38
Netherlands	65.5	5	+4
U.S.S.R.	60.9	5	+20
United Kingdom	52.2	4	-20
France	51.8	4	-2
Italy	42.0	3	NC
Japan	36.8	3	+28
Indonesia	30.2	2	+10
Belgium	25.3	2	+18
Canada	22.8	2	+2

NC - No Change

Source: Ministry of Coconut Industries and FAO.

TABLE 17

SRI LANKA EXPORTS OF COCONUT OIL BY MAJOR MARKETS FOR PERIOD 1971-1981

	Total 1971-81		Annual Average	Export Years		1971-76 Average		1977-81 Average		1982	
	MT	Percent	1971-81	No.	Average	MT	Percent	MT	Percent	MT	Percent
Total Exports	405,093	100	36,826	11	36,826	52,107	100	18,472	100	36,337	100
Canada	60,558	14.9	5,505	8	7,570	2,210	4.2	1,160	6.3	3,660	9.4
Italy	42,722	10.5	3,883	9	4,747	4,849	9.3	2,726	14.8	1,250	3.2
USSR	41,011	10.1	3,728	4	10,253	6,835	13.10	0	0	-	-
United States	30,620	7.6	2,783	8	3,827	369	0.7	5,681	30.8	4,780	12.3
United Kingdom	21,369	5.3	1,943	6	3,561	3,145	6	500	2.7	2,005	5.2
Bangladesh	18,194	4.5	1,654	10	1,819	1,433	2.8	1,919	10.4	3,193	8.2
Netherlands	14,528	3.6	1,320	6	2,421	966	1.9	1,747	9.5	1,525	3.9
Pakistan	13,593	3.4	1,236	11	1,236	2,098	4	201	1.1	-	-
Czechoslovokia	4,582	1.1	416	3	1,527	764	1.5	0	0	-	-
Peru	3,674	0.9	334	9	408	444	0.9	201	1.1	-	-
W. Germany	3,221	0.8	292	4	805	416	0.8	144	0.8	-	-
India	2,486	0.6	226	2	1,243	1	--	496	2.7	12,837	33.0
South Africa	1,728	0.4	157	8	216	101	0.2	224	1.2	4,004	10.3
Others	146,807	36.2	13,346	NA	NA	21,575	41.4	3,471	18.8	3,083	8.5

Note: A dash does not mean that no exports were made to a given country specified. It is possible that exports were not significant in that year and exports were included with "others."

Source: Ministry of Coconut Industries and FAO

TABLE 18

SRI LANKA EXPORTS OF COCONUT FIBER AND YARN BY MAJOR MARKETS - ANNUAL AVERAGES FOR PERIOD 1971 - 1981

	Mattress Fiber			Bristle Fiber			Coir Yarn			Total Fiber and Yarn		
	MT	Percent	Average Percent Change	MT	Percent	Average Percent Change	MT	Percent	Average Percent Change	MT	Percent	Average Percent Change
Total	54,951	100	-18	13,781	100	-49	2,026	100	+289	70,758	100	-25
U. K.	15,581	28.4	-26	682	5.0	-35	--	--	--	16,263	22.9	-26
W.Germany	11,763	21.4	-20	2,225	16.0	-71	--	--	--	13,989	19.7	-37
Australia	3,434	6.2	-35	103	1.0	-38	--	--	--	3,538	5.0	-35
United States	2,846	5.2	+203	41	0.03	-51	41.7	2.1	-58	2,929	4.1	+185
Netherlands	1,612	2.9	+12	154	1.1	-81	--	--	--	1,766	2.5	-22
Belgium	15,578	2.9	+230	441	3.2	-56	--	--	--	2,019	2.8	+37
Japan	1,521	2.8	+10	4,185	30.4	-45	--	--	--	5,706	8.1	-37
S. Africa	1,515	2.8	-43	--	--	--	--	--	--	1,515	2.1	-43
New Zealand	1,289	2.3	+19	14	0.1	-22	--	--	--	1,303	1.8	+19
France	896	1.6	-26	846	6.1	-3	13.7	0.7	-62	1,756	2.5	-16
Pakistan	752	1.4	-11	61	0.4	-36	--	--	--	813	1.1	-4
Italy	744	1.4	-52	449	3.3	-85	9.2	0.5	-16	1,202	1.7	-73
Denmark	621	1.1	+10	--	--	--	0.2	0.01	-93	621	0.9	+10
Poland	--	--	--	438	3.2	+6	--	--	--	438	0.6	+6
Other	10,876	19.8	-12	4,140	30.0	-7	1,961	96.8	+280	16,977	24.0	-7

Note: Rows with dashes do not indicate absence of trade. It is possible that exports were made to the respective country, but has been recorded in the "other" category. The data available disaggregates only large quantities exported.

Source: Ministry of Coconut Industries

TABLE 19

SRI LANKA AVERAGE ANNUAL PRICES OF COCONUTS AND COCONUT PRODUCTS IN RS./MT PER YEAR FOR PERIOD 1971-1982

	Fresh Coconuts			Copra		Oil		Bristle Fiber		Mattress Fiber		D.C.
Year	f.o.b. Exp.	Retail	Wholesale	Colombo	f.o.b. Exp.	Colombo	f.o.b. Exp.	Colombo	f.o.b. Exp.	Colombo	f.o.b. Exp.	f.o.b. Exp.
1971	414.0	220.8	145.62	837	1,377	1,431	2,109	762	1,004	308	410	1,949
1972	377.2	193.2	119.79	792	1,167	1,153	1,524	857	1,132	294	440	1,606
1973	625.6	294.4	229.31	1,267	1,276	2,064	1,465	1,022	2,616	383	508	2,947
1974	1,426.0	524.4	409.40	1,220	2,234	3,725	6,686	1,103	1,910	709	903	6,168
1975	8,924	312.8	191.36	1,110	4,153	2,042	3,179	835	1,746	591	1,001	3,368
1976	993.6	460.0	333.04	1,828	5,481	2,920	3,249	1,064	1,898	590	840	4,005
1977	NS	846.4	598.00	3,413	7,971	5,686	5,344	2,100	3,752	640	1,015	10,254
1978	NS	809.6	586.50	3,292	10,714	5,248	11,222	2,020	6,927	800	1,820	15,401
1979	2,990.0	920.0	747.50	4,300	16,024	7,158	15,758	1,900	6,326	1,200	2,362	19,615
1980	NS	1,361.6	1,109.75	5,950	16,182	9,419	15,002	2,500	6,715	1,640	3,577	21,208
1981	3,293.6	1,656.0	1,228.20	6,557	21,474	10,874	11,609	3,360	8,806	1,320	3,262	20,352
1982	3,063.2		1,088.08		16,227	9,012	10,087		10,843		3,042	14,029

Note: f.o.b. export prices are based on unit value of exports.

Source: Ministry of Coconut Industries.

As Table 20 shows, the foreign exchange rate has favored exports, especially of desiccated coconut. In 1977, a rising exchange rate and rising prices for desiccated coconut generated considerable revenue for the government. The strong and rising U.S. dollar in the 1980s, has undoubtedly blunted the effect of decreasing coconut product prices, allowing foreign exchange earnings to show increases.

Even though international coconut oil prices have decreased since 1980, and domestic prices have generally followed international prices, domestic prices have continued to increase. Prices and markets for coconuts and coconut products are now showing some softening, however. This suggests the need for careful reconsideration of government policy for the industry. International prices of oil and fats have fluctuated since 1971 (see Table 21). In general, coconut oil prices have remained higher than those of most other vegetable oils, in spite of recent drops.

In summary, the government policy of giving the domestic market priority for coconut oil may have been an expensive decision. Sri Lanka would have benefited from selling coconut oil at high prices and importing cheaper oils, such as palm oil, for domestic consumption. This factor may be worth considering in future years, as the health of the coconut industry is reviewed and the significant employment that an expanding industry offers is recognized.

TABLE 20

SRI LANKA AVERAGE ANNUAL EXCHANGE RATE Rs./US$, BASED ON VALUE OF EXPORTS OF COCONUT PRODUCTS

Year	Rate
1971	5.96
1972	6.41
1973	6.29
1974	6.67
1975	7.00
1976	8.54
1977	8.60
1978	15.51
1979	15.45
1980	15.91
1981	19.99
1982	20.82

Source: Ministry of Coconut Industries

TABLE 21

WORLD MARKET PRICES OF OILS AND FATS
1971-1980 - US$/MT

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Copra cif Europe	190	142	348	670	265	275	402	471	673	453	389	337
Coconut Oil[1] cif Europe	299	215	513	998	393	418	578	683	985	674	583	508
Soybean Oil f.o.b. Europe	304	241	436	832	563	438	575	607	662	598	540	467
Cottonseed Oil cif Europe	392	324	500	939	726	593	622	661	798	657	666	586
Groundnuts Oil cif Europe	417	393	540	1,058	786	692	846	1,079	889	859	1,112	680
Sunflower Oil cif Europe	374	326	481	977	739	581	639	664	762	633	892	619
Palm Oil cif Europe	254	211	390	691	420	405	530	600	654	584	589	488
Tallow cif Europe	195	179	356	448	340	371	421	483	595	487		
Rape Oil f.o.b. Europe	295	232	395	745	551	415	584	597	636	571	510	442

Source: Ministry of Coconut Industries and U.S. Dept. of Agriculture

[1] Prices have been rising since October 1982, and in June 1983 reached U.S.$694/MT.

VI. OPPORTUNITIES AND RECOMMENDATIONS

The previous sections have shown that the coconut industry is well-established, has an adequate growing base, and has strong domestic and international markets. The major constraints are government policy and access to more efficient production technology and integrated processing technology. Once the industry is liberalized to compete freely in both the domestic and international markets, tax incentives can be used to channel investment into production and processing. The three opportunities described below can produce revenue increases as well as increases in employment opportunities and foreign exchange generation.

- Coconut oil refining and packaging in consumer size containers for the domestic and export markets. Refined and packaged oil on the domestic market commands at least twice the price of the raw oil presently produced and sold. The Middle East presents an attractive export market. A small plant with a capacity to refine 15 tons/day would require an estimated Rs 15 million investment. One plant of this size could process about 3,000 MT of oil per year, equal to about 8% of average annual exports over the period 1971-81.
- Integrated coconut processing facilities, capable of producing coconut milk, and all sub-products such as oil, pulp, and water. Coconut milk is a main staple of Sri Lankan households, which uses about 1,000 million nuts for this product. At least some 30% of the oil available in the coconut kernel is wasted in household processing. This represents some 300 million nut equivalents of oil (37,500 MT) per year. An investment of some Rs. 500 million would be required to meet 25% of the retail demand for coconut milk with an industrially processed milk. Domestic nut consumption for milk preparation could be reduced by an estimated 75 million nuts per year, equivalent to 9,375 MT

of oil, a 47% increase in average annual exports, or to 11,029 MT of desiccated coconut, a 31% increase in average annual exports. Before industry operators can invest in integrated technology (for milk processing) as well as the technology to improve processing efficiency (for oil and desiccated coconut), the processes need to be tested and adapted to Sri Lanka. Investment in new processing technology with high labor-to-capital ratios will require technological support, which could be developed at the Coconut Research Institute. Figure 4 shows the structural impact that the adoption of integrated processing technology will have on the industry.

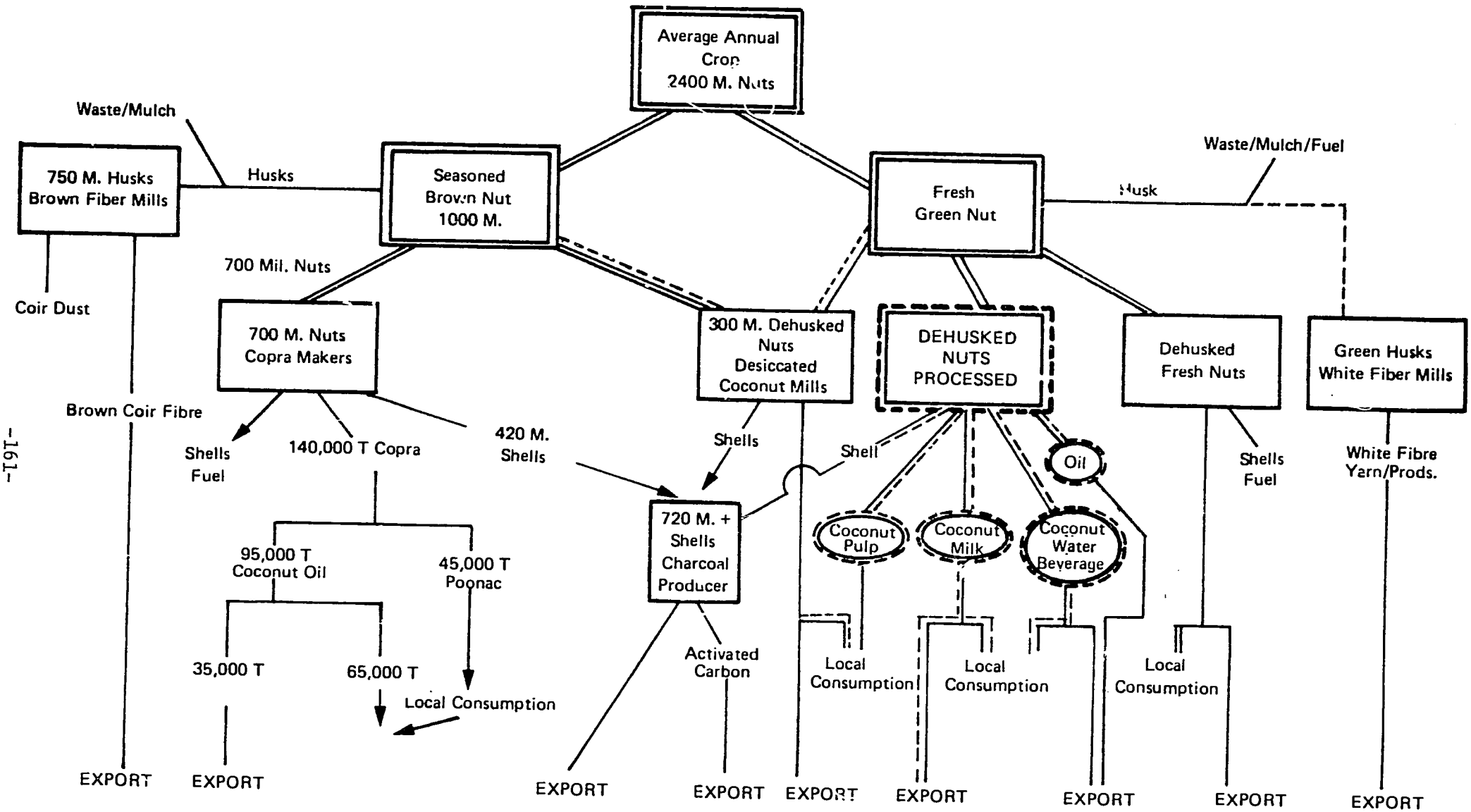
- White fiber or coir yarn processing plants where productivity can be increased and the processing period decreased. White fiber processing is presently a cottage industry that is time-consuming and labor-intensive. Of the coconut fiber products, it has the highest price and the only growing market. Raw material for this product is abundantly available, with only 4% of present supply being used. Investment in this product group will require development and testing of technology with a high labor-to capital ratio that can reduce the processing period.

The major recommendation for the industry, in light of the present production and marketing situation, is to invest the money that has been set aside in industry development funds to test and adapt the integrated processing technology. This approach gives the processing segment an opportunity to increase its output with the lower volumes of nuts presently available. Meanwhile, the government should review its policy and undertake the changes required to stimulate investment in production and more productive processing technology.

The activities the industry must undertake include:

FIGURE 4

PROPOSED COCONUT MILK PROCESSING INDUSTRY



Source: Arthur D. Little, Inc.

Task 1: Evaluation of the homemade coconut milk product presently consumed by households and review of the state-of-the art in integrated coconut processing technology for coconut milk. If nuts are to be shifted from market to processing, the commercial product must be a satisfactory substitute for homemade milk.

Task 2: Technical and economic evaluation of integrated processes that can be adopted in Sri Lanka, while maintaining low capital/labor ratios. Alternative processes must produce coconut milk and extract such byproducts as edible oil, coconut water, shell, and pulp, to maximize the value from nuts processed.

Task 3: Laboratory and pilot plant testing of the technical and economic information collected in Task 2, to select a process and product at a prototype level that meets industry and consumer requirements.

Task 4: Procurement, installation, and operation of a pilot plant in Sri Lanka to provide the industry with the capability to test product and process variations locally before investing in commercial-scale operations and to provide technical support to industry development once private investors have established processing operations. The pilot plant will also support full test marketing of new products and make process variations to maximize the value of byproducts or the acceptability of new products developed.

Task 5: Training of pilot plant staff in product/process optimization. Training should focus on the flow of product development activities from concept, through prototype development and evaluation, to product and process optimization. This expertise will allow the industry to stay abreast of technological changes that can benefit all aspects of processing.

Task 6: Test marketing of coconut milk products, including the placement of samples and evaluation of market results. Development of a marketing program to support the efforts of commercial investors as their operations come on line. The marketing program should include recommendations for promoting the products developed, consumer use suggestions, guidance or product distribution, and market positioning.

Task 7: Preparing scale-up specifications for commercial operations. Expansion of the feasibility study from Task 2 to include financial information developed during pilot plant and test market operations.

All these tasks can be developed within an 18-month period. The cost of technical and professional activities and related operating expenses is estimated at about US$250,000. The capital investment in pilot plant equipment and facilities is estimated at about US$300,000. This investment would provide a plant capable of processing 2,500 coconuts/hour, producing approximately 550 liters of fluid coconut milk or 215 kg of powdered milk per hour.

APPENDIX 1

COCONUT EQUIVALENTS AND PERCENTAGES

1. Equivalents

Copra	4,925 nuts	- 1 MT
Desiccated Coconut	6,800 nuts	- 1 MT
Coconut oil	8,000 nuts	- 1 MT
Charcoal	20,000 nuts	- 1 MT
Poonac or cake	16,000 nuts	- 1 MT
Husks	4,200 nuts	- 1MT
Shells	6,150 nuts	- 1 MT
Activated Carbon	60,000 nuts	- 1 MT
Shell Flour	5,500 nuts	- 1 MT
Whole fresh nuts	920 nuts	- 1 MT
Coconut water	1,000 nuts	- 140 liters
Brown husk fiber	1,000 nuts	- 130 Kgs
First squeeze milk	1,000 nuts	- 221 liters
Toddy	1 palm tree	- 300 liters/yr
Work day	1 day	- 8 hours
Work year	1 year	- 220 workdays
Fresh nut consumption	2 nuts/family/day	
	90 nuts/capita/year	

2. Percentages

Nut composition
- 33% husk
- 15% shell
- 30% meat (including testa)
- 22% water

Source: Ministry of Coconut Industries and FAO.

APPENDIX 2

SRI LANKA COCONUT INDUSTRY STRUCTURE, ESTIMATED NUMBER OF OPERATORS

Growers	Private growers control 90-94% of lands in coconut cultivation (Table 3). Holdings of 0.2 to 20 hectares could number about 150,000, and supply the bulk of coconuts entering the market. Coconut lands vested under the land reform laws of 1972 and 1975, and held and operated as government estates control 6-8% of lands in coconut cultivation.
Collectors[1]	Private operators who collect nuts from growers and deliver to dealers/wholesalers. On the average may handle 100,000 nuts per year; 4 to 5 collectors will supply one dealer/wholesaler. Collectors could number as many as 20,000, based on an average annual yield of 2,000 million nuts.
Dealer/Wholesaler[1]	Private operators, who buy from growers and collectors, store and dehusk nuts. Deliver husks to fiber producers and nuts to copra producers, desiccated coconut mills, and the fresh coconut retail market in urban areas. Many produce copra, which is sold to oil mills. On the average they handle about a half million nuts per year. Dealer/wholesalers are a major source of credit to growers possibly as many as 4,000, based on an average annual yield of 2,000 million nuts. Dehusking could employ some 3,000-3500 workers per year, based on an average rate of 1500 nuts per worker per day, and 200 days per year.

[1] Estimate based on field interviews in Puttalam, Kurunegala, Gampaha and Galle Districts, May 1983.

APPENDIX 2
(continued)

SRI LANKA COCONUT INDUSTRY STRUCTURE, ESTIMATED NUMBER OF OPERATORS

Copra makers	There are 310 registered copra makers and some 140-240 non-registered. Most government estates produce copra. The exact number of estates was not obtainable but it is assumed that less than 10% of copra makers are estates. Copra makers supply oil mills and a very small edible copra export market. About 700 million nuts (30% of the total crop) is processed into copra, the average processor handling about 1.3 million nuts per year; 99% of copra produced goes to oil mills. Many kiln owners contract out their operation, since copra processing is a continuous operation taking five to seven days. A contract crew will have 3 to 5 members and can handle about 2 million nuts per year; copra making could employ some 3,000 to 4,000 laborers. On the average, one worker can remove some 3,000 kernels per day; about half of the latter laborers would thus be assigned to this task.
Oil Mills	There are 52 oil mills, which are estimated to employ about 2,033 workers. In 1981 their average production was 1,455 MT, equivalent to about 77% of average installed capacity. Only one mill is state owned and it makes up about 10% of the installed milling capacity. Some mills are owned and operated by grower cooperatives.
Desiccated Coconut Mills	There are 69 mills, all privately owned (some grower cooperatives). In 1981, they produced on the average about 589 MT, using about 67% of average installed capacity and employing some 6,537 workers. About 13% of nuts harvested are processed by these mills.

APPENDIX 2
(continued)

SRI LANKA COCONUT INDUSTRY STRUCTURE, ESTIMATED NUMBER OF OPERATORS

Fiber Mills (white and brown)	There are some 600-700 mills producing mattress and bristle fiber. Average production was about 130 MT. Using conversion figures from Appendix 1, it is estimated that 76% of husks from coconuts that went to copra and desiccated coconut production were absorbed by fiber processors. Fiber processing from retting through to drying and packing is estimated to employ some 8000-10,000 workers. Brown fiber is a "dirty product" with a 10-15% dust content, making it an unattractive product in relation to synthetic substitutes. Processing to reduce dust content is uneconomical. White fiber processing is a cottage industry. Average production per household per year is about 4.4 MT. There are about 1,500 households in this activity.
Charcoal and Flour Processors	Shell processing involves some 53 operators. Average production per operator was about 400 MT. About 40% of nuts processed by the copra and desiccated coconut mills went for charcoal production.
Fresh Nut Retailers	Distribute fresh nuts to urban households (about 500,000, consuming some 360 million nuts per year). Average retailer handles about 100,000 nuts per year; some 3,600 operators required to supply urban households.
Exporter/Shippers	There are 154 firms involved in the exporting and shipping of coconuts and coconut products employing some 350 to 750 workers. On the average each firm shipped or exported US$ 461,000 worth of coconut products in 1981.

APPENDIX 2
(Continued)

SRI LANKA COCONUT INDUSTRY STRUCTURE,
ESTIMATED NUMBER OF OPERATORS

	Firms	Exports US$ (000)	Exports Percent
Total Firms	154	71,072	100
Coconut Oil	38	11,963	17
Desiccated Coconut	58	39,180	55
Copra	12	2,279	3
Fresh Coconut	28	374	0.5
Fiber (mattress, fiber and coir)	45	12,503	18
Coconut Charcoal	16	2,797	4
Coconut Shell Pieces and Flour	12	44	0.06
Coconut Ekel	44	852	1.2
Other (includes activated carbon)	36	1,080	1.5

Summary:

Operators - 150,000 to 180,000
Laborers - 80,000 to 100,000

Excluded - operators and workers involved in transportation of coconuts and coconut products and supplying the industry with inputs.

APPENDIX 3

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

1. 1963 - 1976 - Sliding scale of duties on coconut kernel products, based initially on the London price of Singapore oil and as of August 1964 based on the London price of Philippines copra. The lower limit of the scale was set using an estimate of the cost of production to the grower per 1,000 nuts ("standard cost"); for each kernel product a "cost of nuts" per MT was determined based on the agreed nut-to-product conversion rates (Appendix 1). Thus, for example the "standard cost" of Rs 80 was converted to a lower limit price for coconut oil of Rs 903/long ton or £ 68. (Using a conversion rate of 8,120 nuts/long ton of oil, this meant a "cost of nuts" of Rs 650 plus a parity factor of Rs 253). The following scale was the result for oil:

London Price £	Duty Rate per MT
68-90	33 1/3 percent of excess over 68 £
91-120	50 percent of excess over 90 £ , plus the duty at 90 £ .
121-150	63 2/3 percent of excess over 120 £ plus duty at 120 £ .

If the price per long ton were 85 £ then the duty per ton was: 17 X .333 = 5.61 £. This duty scale allowed for part of the increase in price to be passed on to the operators in the industry.

2. 1976 - 78 - Ad Valorem Duty on coconut kernel products with a sliding scale based on the actual f.o.b. Colombo price. The "standard cost" was raised to Rs 100. Using a conversion of 8,000 nut/MT of oil this meant a lower limit price or "cost of nuts" value for oil of Rs 800/MT. The name "Ad Valorem" suggests that this scheme differed from the initial duty scheme in that it was levied on the total value of the product as measured by the f.o.b. price, rather than on the excess

value. This duty scheme also allowed part of the increased in prices to be passed on to industry operators.

3. August 1978-
Nov. 1981 -

Fixed duties; a fixed profit margin was set for processors and shippers, which was deducted from the f.o.b. Colombo price of the product, along with a cess for a development fund for the desiccated coconut industry, a cess for the coconut industry in general and finally the cost of nuts/MT of the product. Any excess went to the government as revenue. The "standard cost" was initially set at Rs650 and then adjusted upward to Rs 850 (January 79) and Rs1,000 (November 79).

This duty scheme had many serious short comings:

(a) The appropriation by government of the entire surplus after margin, costs and cesses were deducted, eliminated incentives to operators in the industry;

(b) Costs of production and processing were difficult to establish for the setting of "profit margins," and allowed inefficient processors to remain in business keeping costs uncompetitive with other international suppliers;

(c) Once "standard cost" and profit margin to processors were set, the industry's minimum f.o.b. prices could be easily determined by competing international suppliers who wished to underbid the Sri Lanka industry on international tenders; and

(d) insulated the local market from changes in the international market, reducing the ability of the industry to effectively compete with international suppliers and be responsive to market changes.

APPENDIX 3
(Continued)

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

4. Nov. 1981 - to date - A sliding scale of duties was reintroduced for coconut products based on the c.i.f. price of Philippines oil on the London Market. This price is taken as being equal to the f.o.b. price of Sri Lanka oil in Colombo. The higher price thus given to Sri Lanka oil reflects a premium it has "traditionally" enjoyed. The Pricing Committee of the Coconut Development Authority is responsible at the end of each week for calculating an average price for the following week based on prices of the previous week. This information is used by the Principal Collector of Customs to collect export duties.

The "base price" or ex-shippers stores price set by the Coconut Authority determines the price at which the duty scale becomes effective. One of the key factors in setting the "base price" has been the establishment of the "standard cost" or price per 1,000 nuts (Rs 1,450 as of November,1981) which if paid to growers will be equitable and capable of stimulating investment in coconut production (at least replanting and fertilizing). This price multiplied by the number of nuts in a MT of a given product sets the "cost of nuts" of the product. In the case of oil, where 8,000 nuts are required per MT, the "cost of nuts" is Rs 11,600 (8 X Rs 1,450). To this, "Cess and Fund" deductions (Rs 110.20 - see Appendix 4) and an estimate of the costs of processing, domestic transportation and other miscellaneous charges (Rs 1,389.80) are added to arrive at a "base price" or ex-shippers price of Rs 13,100/MT. When the f.o.b. Colombo price of oil is equal to or below this price the duty scale does not apply to exports.

APPENDIX 3
(Continued)

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

Base Price Estimation

	Fresh Nuts Rs/1000 nuts	Oil Rs/MT	D.C. Rs/MT	Edible Copra Rs/MT
Cost of nuts	1,450.00	11,600.00	9,860.00	7,141.25
Deduction for Cesses and Funds[1]	61.00	110.20	162.70	105.50
Processing, handling, and other changes[2]	1,189.00	1,389.80	2,439.24	1,389.80[3]
Ex-shippers cost or base price	2,700.00	13,100	12,461.94	8,636.55

1 See Appendix 6.
2 Assume that Coconut Marketing Board calculates these. It is not clear how these costs can be the same for fresh nuts as oil. The information to evaluate this is not available at this writing.
3 Processing, handling and other charges are assumed here to be the same as for oil.

The duty scale becomes effective at an f.o.b. price of oil of Rs 13,101/MT and applies to increases of Rs 100 in the price of oil. Using the "base price" (Ex-shippers Stores) set by the Coconut Development Authority, each Rs 100 of increase in the price above the base receives a duty of 30% (Rs 30 per Rs 100) up to a total increase of Rs 1500 (Level I). Each Rs 100 of increase in price above the first Rs 1500 increase (Level I), receives a duty of 40% (Rs 40 per Rs 100) up to a total additional increase of Rs 1500 (Level II). Each Rs 100 increase above the latter Rs 1500 (Level II) receives a duty of 50% (Rs 50 per Rs 100 - Level III).

APPENDIX 3
(Continued)

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

Duty Scale

Level	FOB price of oil is above "base price" by Rs	Rs Duty per Rs 100 increase within level			
		Oil	D.C.	Copra	Fresh Nuts
I	1-1500	30	25.50	18.45	3.75
II	1501-3000	40	34.00	24.60	5.00
		(Rs450)[1]	(Rs 382.5)[1]	(Rs276.75)[1]	(Rs56.25)[1]
III	3001 and above	50	42.50	30.80	6.25
		(Rs 1,050[2]	(Rs 892.50)	(Rs 645.75)	(Rs 131.25)

[1] Amounts in ( ) represents duty on portion of price increase within Level I which must be added to duty from Level II.

[2] Amounts in ( ) represent duty on portion of price increase within Levels I and II which must be added to duty from Level III.

The duty is cumulative in that a price increase that falls in an upper duty Level (II or III) also pays the duty on that portion of the price increase that falls in a lower duty Level (I or I & II). Thus for example, a price increase falling in Level II pays the total duty applicable to the Level I portion of the increase (Rs 30 X 15 = Rs 450), and a price increase falling in Level III also pays the total duty applicable to both Levels I and II (Rs 450 plus Rs 40 X 15 or Rs 450 plus Rs 600).

The duty applying to other products is a percentage of the duty applied to oil, and is based on the ratio between coconuts/MT required to produce the product to the coconuts/MT required to produce oil. Thus for example in the case of desiccated

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

coconuts this ratio is 6,800/8,000 = .85. The Level I duty rate per Rs 100 for desiccated coconut is Rs 30 X .85 = Rs 25.5, for level II it is Rs 40 X .85 = Rs 34 and for Level III is Rs 50 X .85 = Rs 42.50.

This duty scale assumes that the prices of all coconut products closely follow the price movements of coconut oil in the international markets. Thus when the price of oil triggers the implementation of the scale, duties are accordingly levied on all other coconut products being exported regardless of whether their price has in fact increased along with the price of oil. Table 19 in Section V, shows that this has not been the case in recent years, and that in fact exporters of copra and desiccated coconut would have benefited in 1980 and 1981 when oil prices dropped, since the prices for these products continued to rise. If the intent of the duty is to collect revenue for the government, it would have in fact deprived it of duty it would be due. Another problem which could develop with this type of duty scale is that if prices for oil were to rise relative to those of other coconut products, these products would be increasingly taxed when in fact their revenue could well be falling, in effect aggravating what could already be a serious negative situation

In addition to the duties levied based on the above scale, the government levies a "base export duty" on all coconut products other than oil, regardless of market price.

Base Export Duty Rs/MT

Fresh nuts	1,000
Desiccated Coconut	3,500
Edible Copra	7,250

APPENDIX 3
(Continued)

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

These duties are used to raise the ex-shippers cost to an export price that has "parity" with the export price of other producing countries. These "base export duties" can be used to raise the export prices of coconut products to levels which make them uncompetitive in international markets in effect curtailing their export. As can be observed below, the export prices in 1982 for desiccated coconut and fresh nuts were above average f.o.b. prices due to the "base export duty."

Export Price of Coconut Products
Rs/MT

	Ex-Shipper Cost		Base Export Duty		Export Price	Average f.o.b. Price 1981	Average f.o.b. Price 1982
Fresh nuts	2,700	+	1,000	=	3,700	3,293	3,063
Desiccated coconut	12,461	+	3,500	=	15,961	20,352	14,029
Edible Copra	8,636	+	7,250	=	15,886	21,474	16,227

The fact that desiccated coconut was exported in 1982 despite these apparently uncompetitive prices suggests that this duty scheme forced processors to incur losses, and as a result pass some of this loss on to growers. In effect, while "standard cost" was to ensure that growers would get a price which would stimulate production, the "base export duty" has ensured that, at least in 1982, this would not happen. The wholesale price for fresh nuts (Average for 1982 Rs 1,088.08) shows that price to growers was below the price of Rs 1,450 determined in November 1981, as equitable and required to stimulate investment. As a result, investment in production went down as evidenced by the off-take of fertilizer; down 20% in 1982 compared to 1981.

APPENDIX 3
(Continued)

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

5. Summary

This duty scheme was designed to overcome defects of the previous one and meet the following objectives: (1) permit coconut products to freely and effectively compete with products of other producing countries; (2) Maximize coconut production; (3) provide a remunerative price to the grower; (4) include a built-in incentive for the export of value added products; and (5) ensure a reasonable margin to processors and shippers.

The brief examination of the presently enforced scheme, using a sliding scale and a base export duty does not appear to meet the above objectives and does not appear to overcome many of the shortcomings of the fixed duties scheme imposed previously.

The sliding scale aspects of this duty scheme did not go into operation until June 1983 when the price of coconut oil on the world market rose to U.S. $694/MT. The price of coconut oil on the world market remained below U.S. $655 since the end of 1980, reached a low of U.S. $406 in October 1982, about 31% below the "base price" at which the scale goes into operation. From the oil exporters perspective exports have appeared as "liberalized". From the growers point of view there is no change with the past. Wholesale prices are still below the "standard cost", not because of the duty scheme, but because market prices are low. Nevertheless, even if prices continue above the "base price" it is not clear that the wholesale price will rise above "standard cost" by enough to help farmers make up for the loses they have personally incurred during the past two years of low prices. The scheme does not address the need of providing a remunerative price to growers which will in turn incentivate growers to increase production (points 2 and 3 above).

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

Undoubtedly, processors have also during the past two years incurred losses due to lower market prices. As prices increased above the "base price", any returns in excess of the amount taken by the sliding scale will go first to cover processor losses, rather than increased prices to farmers. The effect of this duty scheme on growers as prices rise is no different from that of previous schemes in that it places downward pressure on wholesale prices.

The "base export duty" imposed on fresh nuts, desicated coconut and edible copra has made this scheme just as inflexible as previous schemes. In the case of desicated coconut the export price (including base export duty) in 1982 (see above) was higher than the export market price. This means that processors lost on the average Rs 1,932/MT exported or has a cost of production which is higher than that of processors in other producing countries. Maintaining the "base export duty" in light of falling prices forces processors to pass part of their loss in revenue on to growers as lower wholesale prices for nuts. Use of the "base export duty" reduce the ability of processors to freely and effectively compete with products of other producing countries and places downward pressure on growers prices and production. Unless desicated coconut prices rise with oil prices, the implementation of the duty scheme as of June will only increase the losses to processors.

APPENDIX 3
(Continued)

EXPORT DUTIES ON COCONUTS AND COCONUT PRODUCTS

	Value of Exports Rs (000)		Duties Collected Rs (000)		Duties Collected As Percent of Value of Exports
	Total	Annual Average	Total	Annual Average	
1963-1975	3,651,925	260,851	737,500	52,678	20
1967-1977	757,892	378,946	19,300	9,650	3
1978-1981	4,515,075	1,128,768	1,138,900	284,725	25

Source: Sri Lanka: Key Development Issues in the 1980's Agricultural Producer Incentives, World Bank Report No. 2955-CE, May 29, 1980.

APPENDIX 4

CESSES AND FUNDS COLLECTED ON EXPORTS - Rs/MT

	Bristle Fiber	Mattress Fiber	Twisted Fiber	Coir Yarn	Fresh Coconuts	Copra	Oil	Desiccated Coconut
Fiber Cess[1]	2.09	1.04	2.09	2.09				
Research Cess					1.00	5.00	7.40	7.00
Products Cess						0.50	0.80	0.70
Financial Aid to D.C. Millers Cess								5.00
D.C. Dev. Fund[2]								2.00
Industrial Dev. Fund[2]					60.00	100.00	100.00	150.00
Total	2.09	1.04	2.09	2.09	61.00	105.50	110.20	162.70

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[1] Over the period 1972-81 about Rs 900,000 were collected in total cesses. In 1981 the total was Rs 747,000, made up of Rs 115,000 Fiber Cess, Rs 396,000 Research Cess, Rs 40,000 Product Cess and Rs 196,000 Financial Cess.

[2] In 1976-1978 desiccated coconut prices increased very rapidly giving shippers considerable windfall profits. During this period the Coconut Marketing Board established two funds to capture these funds. One was the "Desiccated Coconut Mill Workers Relief Fund" and the other was the "Coconut Development Fund." The D.C. Development Fund and Industrial Development Fund were subsequently established. The balance of funds in each as of 12/31/81 is:

	(Rs Millions)
D.C. Relief Fund	10.5
Coconut Dev. Fund	77.3
D.C. Dev. Fund	11.8
Industrial Dev. Fund	19.7
Total	119.3

(US$5.97 m, at the 1981 exchange rate of Rs19.99/US$)

Source: Ministry of Coconut Industries

Arthur D. Little International, Inc.

APPENDIX 5

COCONUT PRODUCTION

1. Land in coconut production for the market economy.

Size holding in Hectares	Area Hectares	Percent of Total Hectares
0.2 < 10	272,790	63
10 < 20	112,580	26
Estates	38,970	9
Total	424,340	98

Total estimated area in coconuts - 433,000 hectares. Holdings of less than 0.2 hectares (0.5 acres) are not expected to be part of the market economy and make up 2% of total area under coconuts.

2. Average annual production in millions of nuts.

1950-1982	2,370
1960-1972	2,600
1973-1982	2,192

3. Average yields in nuts/hectare:

1950-1982	(451,689 hectares - average of acres for 1960-1972 and 1973-1982)	5,247 nuts/ha
1960-1972	(470,378 hectares)	5,527 nuts/ha
1973-1982	(433,000 hectares)	5,062 nuts/ha

4. Hypothesis that annual production is overestimated by 20 percent, or a portion of domestic consumption which processors can buy away from households by bidding price up.

	Average Production (million nuts	Average Yield (nuts/ha)	Average Yield With Density of 100 palms/ha (nuts/palm)
1950-1982	1,896	4,197	41
1960-1972	2,080	4,421	44
1973-1982	1,753	4,049	40

APPENDIX 5
(continued)

COCONUT PRODUCTION

5. Fertilizer off-take and use.

1968 - Highest off-take recorded under fertilizer subsidy program 66,539 MT represents an average application per hectare (470,378 ha) of 141 Kgs. Assuming an average density of 100 palms/ha fertilizer application per palm averaged 1.41 Kgs.

1973 - Lowest off-take recorded under fertilizer subsidy program 26,942 in 1972 represents an average application per hectare (470,378 ha) of 57 Kgs. Assuming an average density of 100 palms/ha fertilizer application per palm averaged 0.57 Kgs.

1982 - Recommended fertilizer application 4.5 Kgs/palm.

6. Palm density and yields based on fertilizer off-take and recommended application rates. (156 palms/ha., 60 nuts/tree/year and 4.5 Kgs/palm).

		Nuts/ha		
	Palms/ha	Full Fertilizer 60 Nuts/palm	High Fertilizer 45 Nuts/palm	Low Fertilizer 30 Nuts/palm
Density level				
1	156	9,360	7,020	4,680
2	124	7,440	5,580	3,720
3	100	6,000	4,500	3,000
4	75	4,500	3,375	2,100
Fertilizer Application Kgs per palm		4.5	1.41	0.57

APPENDIX 5
(continued)

COCONUT PRODUCTION

7. Production estimates per year assuming:

a. Level 4 density is found mainly on small holdings, half the mid-size holdings are at Level 3 and half at Level 4, and Level 1 is found on estates (average national density 85 palms/ha).

Size Holding (ha)	Millions of Nuts: Full Fertilizer	High Fertilizer	Low Fertilizer	Percent Total Production
0.2 < 10	1,227	921	573	51
10 < 20	675	567	378	33
Estates	365	273	182	16
Total	2,348	1,761	1,133	100

b. Level 3 density (100 palms/ha) is the average for small holdings, Level 2 for medium, and Level 1 for estates (average density 111 palms/ha)

Size Holding (ha)	Millions of Nuts: Full Fertilizer	High Fertilizer	Low Fertilizer	Percent Total Production
0.2 < 10	1,637	1,228	818	57
10 < 20	837	628	419	30
Estates	365	273	182	13
Total	2,839	2,129	1,419	100

c. Level 3 density (100 palms/ha) is the average on the smaller firms; half medium farms are at Level 2 and half at Level 1 and estates are at Level 1 density (average density 115 palms/ha).

APPENDIX 5
(continued)

COCONUT PRODUCTION

Size Holding (ha)	Millions of Nuts: Full Fertilizer	High Fertilizer	Low Fertilizer	Percent Total Production
0.2 < 10	1,637	1,228	818	56
10 < 20	945	709	472	32
Estates	365	273	182	12
Total	2,947	2,210	1,472	100

8. Fertilizer off-take based on above assumptions from item 7 above.

	Palms 1,000	MT Fertilizer/Year: Full Fertilizer	High Fertilizer	Low Fertilizer
Assumption (a)	36,388	163,746	51,307	20,741
(b)	47,318	212,931	66,718	26,971
(c)	49,119	221,035	69,257	27,997

9. Average annual fertilizer off-take for period 1956-1980

Period	MT Fertilizer
1956-80	43,938
1956-60	37,312
1961-70	53,861
1971-80	40,642

10. Seedling off-take assuming 5% replacement per year.

Assumption (a)	2,196,900
(b)	2,365,900
(c)	2,455,950

APPENDIX 6

COCONUT DEVELOPMENT PROGRAMS AND PROJECTS

1. 1956 - 1973 - Coconut Rehabilitation Subsidy -supplied high yielding seedlings and fertilizer to owners of coconut estates and small holdings at subsidized rates. Owners of coconut holdings of 20 acres or more (about 36% of land in coconuts in 1962) received a subsidy equal to 1/3 of the cost of fertilizer they applied, and small holders (less than 20 acres) received a subsidy equal to 1/2 the cost of fertilizer uses. Over the period 1956-73, the government spent Rs 184,610,000 (Rs 10,256,000 per year).

2. 1960 - 1968 - Coconut Planting on Citronella Lands - Applied to 22,000 acres of citronella lands in Matara and Hambantota. Provided: (1) Free seedlings (75/acre), (2) free fertilizer (52 lbs/acre) to holders of 10 acres or less, and 1/2 the cost to holders of more than 10 acres, and (3) a cash subsidy of Rs 0.50 per plant per year (75 X 0.50 = Rs 37.5/acre/year) for eight years. This program cost the government Rs 6,449,000 over the period 1960-1970. (Rs 586,270/year).

3. 1973 - to date - Pasture Subsidy for Coconut Lands has the objective of supplementing the income of coconut growers in areas with over 60 inches of rainfall per year. Growers with 1/2 acre or more of suitable coconut land can receive Rs 800/acre to establish pasture. During the period 1973-81, 10,052 acres had benefited at a cost of Rs 2,526,000. (Rs 280,670/year).

4. 1974 - to date - Coconut Rehabilitation Subsidy provides financial assistance to growers for establishing on coconut lands contour drains, filling of holes and removal of excess palms. Coconut lands of 1/2 acre or more, with a minimum density of 15 palms/1/2 acre and over 1 year of age are eligible. During period 1974-81, 118,937 acres had benefited at a cost of Rs 19,527,000. (Rs 2,440,000/year).

APPENDIX 6
(continued)

COCONUT DEVELOPMENT PROGRAMS AND PROJECTS

5. 1977 - to date - Replanting/underplanting Subsidy has the objective of replacing old coconut plants. Coconut lands of 1/2 acre or more, with a minimum density of 15 palms/1/2 acre over 60 years of age and bearing less than (1000 nuts per acre per year are eligible. Growers can receive up to Rs 3,000/acre for replanting and an equal amount for underplanting. During the period 1977-81, 22,261 acres have benefited at a cost of Rs 10,374,000 (Rs 2,074,000/year).

6. 1977 - to date - New Planting Subsidy to encourage coconut cultivation on suitable lands. Growers with 1/2 acre or more of new land can receive Rs 3500/acre, and owners of home gardens, wishing to plant at least 10 seedlings can receive Rs 35 per seedling. During the period 1977-81, 26,767 acres have benefited at a cost of Rs 27,333,000 (Rs 5,466,000 /year)

7. 1978 - to date - Intercropping subsidy to increase the per acre income of coconut growers and maximize the utilization of coconut lands by promoting the intercropping of perennial crops with coconuts. Growers with 1/2 acre or more of land with a minimum density of 30 palms of 22-45 years of age, and in areas with at least 70 inches of rain per year are eligible. Growers can receive Rs 2,125/acre to intercrop with coffee, Rs 2,250/acre for cocoa and Rs 2,625/acre for pepper. For the period 1978-81, 3,303 acres have benefited at a cost of Rs 2,426,000 (Rs 606,500/year).

8. 1980 - to date - East Coast Rehabilitation Project designed to rehabilitate the coconut plantings damaged by the 1978 cyclone. The cost of this project is estimated at Rs 160 million, Rs 80 million coming from the Government of Sri Lanka and the other half from international grants. Some 30,000 acres are eligible. In 1980 and 1981, a total of 9,472 acres benefited (32 percent). Assuming a 6-year period to rehabilitate the full acreage, this represents Rs 13,333,000 per year.

APPENDIX 6
(continued)

COCONUT DEVELOPMENT PROGRAMS AND PROJECTS

9. 1982 - 1986 - ADB/IFAD Coconut Development Project established to increase coconut production on small holdings. Expects to benefit 44,460 acres at a total cost of Rs 600 million (Rs 13,495/acre) over a 5-year period. The cost per year is Rs 120 million to be loan financed by the government.

10. Summary of Annual Government subsidies to Coconut Growers. Rs(000)/year 1960 - to date.

	1960-1968	1969-73	1974-76[1]	1977	1978-80	1980-81	1982
Coconut Rehabilitation	10,256	10,256	12,793				
Coconut Planting in Citronella Lands	586						
Pasture Subsidy		280	280	280	280	280	280
Coconut Rehabilitation			2,440	2,440	2,440	2,440	2,440
Planting/Underplanting				2,074	2,074	2,074	2,074
New Planting				5,466	5,466	5,466	5,466
Intercropping					606	606	606
East Coast Rehab.						13,333	13,333
ADB/IFAD Dev. Project							120,000
Total	10,842	10,536	15,513	10,260	10,867	24,200	144,200

[1] Public sector expenditures for period 1974-76 totaled Rs 38,380,000
(Rs 12,793,000/year)

Source: Ministry of Coconut Industries

CHAPTER 5

DAIRY SECTOR

I. SUMMARY

A. INTRODUCTION

The dairy sector is an integral part of the overall livestock sector of the Sri Lankan economy and contributes about 2 percent to Gross Domestic Product (GDP). It is a sector that has been highly controlled by government during the past two decades in as such has been subjected to shifts in government priorities for the sector. Presently, the government is interested in removing itself from direct management of activities of the sector which are more appropriately managed by private sector initiative.

Also, dairying is an extremely important activity for many small land holders and landless tea estate laborers. For this reason, development of the sector will have significant impacts on the lower income groups in the economy. Because of these impacts, the sector has been analyzed closely to identify opportunity areas where private sector initiatives could aid in the development of the sector and ultimately the small farmer.

B. OPPORTUNITIES FOR SRI LANKAN PRIVATE SECTOR INVESTMENT IN THE DAIRY SECTOR

The dairy sector offers opportunities for private sector involvement in both production and processing. The key opportunities and principal justification for each are summarized in Table 1. More complete discussion of each is found in Section VI of this chapter.

TABLE 1

SUMMARY OF OPPORTUNITIES, SRI LANKAN DAIRY SECTOR
JUNE 1983

Description of Opportunity	Prinicpal Justification
1. Establish milk collection systems that treat farmers fairly.	• This project could help small farmers receive a greater share of the price paid producers by short cutting the middlemen who presently collect milk at very high cost to the farmer. • A large market for locally produced milk exists. • Establishment of 16 to 17 milk local collection centers can increase the farm income (Rs 214 million/year); create employment (1,400 rural jobs); save foreign exchange (Rs 248 million/ year) and impact positively on regional economic development objectives.
2. Establish commercial dairy herds.	• Entrepreneurs exist with land resources that can be effectively utilized in operations. • Large market demand for locally produced milk exists. • Establishment of 200 commercial dairy production farms can increase incomes to rural commercial farmers (Rs 188 million/year); create employment (1,200 to 1,500 rural jobs); save foreign exchange (Rs 219 million/year) and impact indirectly on regional economic development objectives. • One ice cream plant, if domestically produced milk is used, can increase the farm income (Rs 6 million/ year); create employment (75 jobs); and save foreign exchange (Rs 7 million/year).

TABLE 1
(Continued)

SUMMARY OF OPPORTUNITIES, SRI LANKAN DAIRY SECTOR
JUNE 1983

Description of Opportunity	Prinicpal Justification
3. Establish small-scale regional multiproduct dairy processing plants.	• This project would provide a means for integrating production and process activities together in a local area and create stable businesses. • Several local markets exist that could support this venture. • This venture has potential of yielding a 15-20% return on sales and attractive returns to investment. • Establishment of five regional multiproduct dairy processing plants can increase the farm income (Rs 62.5 million/year); create employment (400 rural jobs); improve hygiene of dairy products in rural market centers; save foreign exchange (Rs 73 million/year) and impact positively on regional economic development objectives.
4. Establishment of new ice cream production capacity.	• The market for ice cream is growing and not effectively served in many cities outside Colombo. • The value added when converting milk to ice cream (Rs 35.3/gallon) seems to be sufficiently high to make it an attractive investment opportunity. • Several entrepreneurs operating in the ice cream industry seem to be interested in expanding their positions in the business; therefore, investors are available.

TABLE 1
(Continued)

SUMMARY OF OPPORTUNITIES, SRI LANKAN DAIRY SECTOR
JUNE 1983

Description of Opportunity	Prinicpal Justification
5. Transfer spray drying plant at Ambewela	• The transfer of the condensary at Polonnaruwa sets a precedence for this move. If it was felt that such a move was good for the condensary it should be equally good for the Ambewela spray drying plant. • The market for spray dried product is the largest market in Sri Lanka and most of the product is presently imported due to a lack of local supply. • Nestles is building a new spray dry plant at Pannala which they expect to be profitable; therefore, the Ambewela plant should offer potential for profitable operations under proper management. A 20% return on sales should be possible. • Bringing the Ambewela plant to full operation two shifts per day can increase farm income (Rs 178 million/year); create employment (1,200 persons in the rural area); save foreign exchange (Rs 205 million/year) and contribute to regional economic development.

C. CONSTRAINTS CONFRONTING REALIZATION OF THESE OPPORTUNITIES

In many situations, opportunities are associated with removal of obstacles or constraints that seem to prevent their development. The key constraints that restrain development of the dairy sector include:

1. Production Constraints

- Milk prices are not based on production cost realities. They are not high enough to attract investment capital into the establishment of commercial scale dairy farms. At present prices, commercial scale dairies do not receive an adequate return on capital.
- Producer associations at the small-farmer level lack management and financial backing to set up collection systems of their own.
- New entrepreneurs cannot operate in milk sheds where NMB collecting centers exist unless they joint venture with NMB or develop their own market.
- Government policy restricts land ownership; therefore, unless some mechanism can be developed to make sufficient land available to support commercial dairy farm development, the expansion of such farms will be slow.
- There are insufficient cows with potential for high yield to build herds rapidly.
- There is a lack of a clearly stated government policy concerning dairy herd development.
- Feed concentrates are in short supply and often too highly priced to be attractive to dairy farmers; therefore, solutions to feed supply problems are essential.
- Prices of imported milk are artificially low since they are in surplus in international markets. This causes unfair competition for local producers and is a deterrent to development of local dairy farms.

2. Processing Constraints

- Present supplies of milk are insufficient to supply existing processing facilities. An adequate milk supply must be assured before a new facility can be justified.
- Lack of a study that properly dimensions the operation and determines its financial viability may prevent finding adequate local funding.
- Lack of a clearly stated government policy with respect to how milk prices will be determined at both farm and consumer levels may deter investors.
- Lack of capital available on terms acceptable to the entrepreneur is often a major constraint to private sector investors.

3. Market Constraints

From a market viewpoint, there is no limitation regarding the size of the market. However, unless a clear pricing policy is established at producer, wholesaler, and retailer levels, many entrepreneurs will refuse to enter the market. While in selected local markets the product mix of a facility may be sufficiently diversified to provide an attractive return on investment, the private entrepreneur is often discouraged from mainstream markets.

II. PROFILE OF DAIRY SECTOR

A. GENERAL OVERVIEW

Although the dairy sector represents only 2% of Gross Domestic Product (GDP), it is an integral part of the overall livestock sector of the Sri Lankan economy. Livestock contributes an estimated 8% to the gross value of agricultural production. The actual contribution is considerably higher, however, since the estimate does not take into account the value of manure, hides and skins, and animal draft power.

Livestock keeping is an important aspect of Sri Lankan agriculture, especially for small land holders and landless tea estate laborers. More than 95% of the cattle are located on farms of less than four hectares and many farmers keep one to three cows to supply milk for personal needs with small quantities for sale. Furthermore, livestock makes a major contribution to the economy by utilizing land that would have very little alternative use because of its topography.

B. NATURAL RESOURCE BASE

Sri Lanka is a small country characterized by a wide range of natural conditions. There are flat coastal areas, rolling hills in the mid-country, and high mountains in the center of the island. In addition, Sri Lanka is characterized by extremes in rainfall, ranging from a few inches per year to well over 300 inches. These extreme variations in topography and climate result in conditions that are more or less favorable to dairy production, depending on location on the island. In 1969 the Ministry of Planning, together with the Survey Department of the Department of Census and Statistics, classified Sri Lanka into five agro-ecological/climatic zones suitable for specific types of livestock development. These zones were classified according to intensity of land use, climatic conditions, and the ability of the area to produce feed. The zones are shown in Map 1.

1. Coconut Triangle (largely Western Province wet zone lowlands, ndicated By II on Map 1)

The Coconut Triangle is characterized by extensive coconut plantations developed during the colonial period. The region is characterized by relatively flat lands, sandy soils, high rainfall during the rainy season, and warm humid climate. Generally, forage is managed as a consortium crop with plantation production in this region, with cattle foraging on the grass among the trees. Zebu and local cattle breeds predominate in this region.

2. Mid-Country (Central Hills, indicated by III on Map 1)

The Mid-Country covers about 1.3 million acres in the central hill zone from 1,000 to 3,000 feet of elevation above sea level. Tea, rice, and several vegetable and food crops predominate in the area, using about 650,000 acres of the total land base. The land is characterized by rolling hills, loam to highly clayish soils, high rainfalls--in some areas as high as 300 inches per year--and moderate temperatures, except in the summer months when it is warm and humid. Rainfall is usually sufficiently abundant in this region to produce good grass for forage year round. Many cattle forage the roadsides along tea plantations as well as other areas where grass is grown. Grass is not generally grown for mechanical harvesting. The region is cool enough to permit raising of European breeds as well as Zebu and local breeds of cattle.

3. Tea Triangle (Central Hill Zone Above 3,000 feet elevation where tea is predominant, indicated By IV on Map 1)

The Tea Triangle is characterized by very steep topography with a few areas of flat, relatively open land that and have been utilized for dairy cattle production. The climate of the region is temperate and conducive to the raising of European breeds of cattle. Soils and rainfall are generally suitable for production of good forage crops,

but because of the steep hills, there are few large expanses of land on which forage can be produced. Therefore, the potential for expanded dairy production in this region is limited.

4. Dry Zone (Rest of the country to the north, east and south; lowlands with rainfall under 70 inches and pronounced dry season; indicated by I, V, VI and VII on Map 1)

The land areas in the dry zones are usually low lying, often characterized by sandy loam, and light loam soils. With proper management and irrigation, these lands can be brought into effective forage production. Because of the extreme heat and often high humidity, cattle of the Zebu and local breed cross are the most appropriate for this region.

In summary, natural resources do exist throughout Sri Lanka that, if properly managed, can be supportive of an expanded dairy industry. In view of the developments since the 1969 classification, however, the Dry Zone can now be divided into four specific milk sheds including:

- Northern Dry Zone - (north of the Coconut Triangle - a line drawn from Puttalam, Galgamuwa, Habarana, Trincomalee), indicated by I on Map 1.
- The milk shed of the condensing plant in Tamankaduwa - (the Mahaweli delta below Trincomalee and east of the Habarana-Tricomalee Road up to Batticaloa, the upper eastern province comprising the Polonnaruwa and Tamankaduwa districts), indicated by V on Map 1.
- The lower eastern province and Uva lowlands - (below the Tamankaduwa milk shed south to the Yala National Park comprising the Maduru Oya watershed and the Gal Oya Valley to the west of the 500-foot contour line), indicated by VI on Map 1.
- The Uda Walawe/Kirindi Oya Milk Shed - (south below the 500 foot contour line of the central hills. To the east it is

bordered by the watershed of Kirindi Oya and the future settlement area and to the west by the watershed and settlement area of Uda Walawe), indicated by VII on Map 1.

5. Southwest Zone (wet zone area in the southwest with no significant livestock potential indicated by VIII on Map 1)

A small portion of the island in the southwest is characterized as being a wet zone with some potential for increased livestock production. It has not been a major livestock producing area in the past and is not expected to be one in the future, because of the climatic conditions and the people's lack of interest in livestock raising.

C. STRUCTURE OF THE INDUSTRY

The Sri Lankan dairy industry was nationalized at the time of independence. Nearly all process-related activities were brought under the control of the Sri Lankan National Milk Board (NMB), which established milk collection centers throughout the country. Farmers bring their milk to these collection centers where the milk is cooled and then transported to processing plants, either for the fresh market, powdered milk market, or some other final dairy product use.

In the past few years, NMB's control over the industry has begun to erode, as several smaller privately held operators have become involved in dairy production and simple dairy process activities such as cheese and yogurt manufacture. Several private groups also have started to process imported powdered milk and imported butterfats to produce locally made ice cream for the Colombo market and other major domestic markets. Further, management of a condensed milk plant that had been previously operated by the NMB has recently been transferred to Nestle for operation on a more privately-oriented, profit-making basis. Nestle will also be operating a new powder reconstitution plant in the Coconut Triangle.

Thus, what had been a state monopoly is now beginning to move in the direction of more free market operation. Private entrepreneurs

will likely further expand their dairy activities and the industry may well become increasingly dominated by private firms.

At the production level, the NMB controls some large dairy farms. These farms have been established primarily to demonstrate new dairy production practices and technology, but have evolved into commercial enterprises selling milk to local fresh milk processing plants and/or milk powder plants. The government has shown some interest in turning these farms over to the private sector for operation as commercial enterprises and keeping only those farms suited for dairy research.

D. CONSUMPTION

Annual milk consumption in Sri Lanka is about 20.63 liters per capita. This milk is derived from domestic production and imports. Local milk finds its way to the consumer through both commercial and non-commercial channels. Most imported milk is based on the import of full fat powder.

Domestic production for the past five years of both collected milk and milk that is consumed on the farm is shown in Table 2. Collections peaked at 306,000 liters per day in 1979, but recently have been as low as 216,000 liters per day, because of low prices to the farmer. Assuming collections are made 365 days per year, present production is 78.8 million liters per year.

Imports of dairy products are shown in Table 3. In 1980, imports were 34,508 tons but this declined to 15,062 tons in 1982. Much of the decline resulted from the fire that destroyed the primary milk powder repacking operation. Recently, Lanka Milk Foods started up a new powder repacking facility with a capacity of 2,000 tons per month. Imports of milk powder are expected to reach at least 30,000 tons per year once again. On this basis, 240.9 million liters of imported milk will be consumed in 1983.

Sri Lanka is not expected to produce milk for export, but may import milk powder and butter fat for some repacked or reconstituted products for other South Asian markets.

TABLE 2

SRI LANKA MILK PRODUCTION PER DAY IN LITERS

A: National Milk Board Collections	1978	1979	1980	1981	1982	Feb. 1983
Hill Country	48,000	56,800	60,000	54,600	48,000	46,700
Mid Country	47,000	58,400	50,800	44,000	40,000	36,600
Dry Zone	17,600	25,900	25,800	32,600	36,800	14,300
Coconut Triangle	15,500	20,000	21,200	17,800	13,500	16,600
Other Areas	9,000	11,000	10,900	9,800	6,900	7,800
Sub Total	136,600	172,100	167,900	158,800	145,200	122,000
B. Estimated local production not collected by the NMB	107,000	133,900[1]	120,000	108,000[2]	102,000	94,000
Total Production	243,600	306,000	287,900	266,800	247,000	216,000

Notes Under B

Estimated increases and decreases on NMB collection assuming equal variation on portion of milk not collected.

[1]Estimated on the per capita consumption levels ref. Reformulated Sri Lanka - IDA Dairy Development Project of NLDB.

[2]Consumption of fresh milk determined by the Consumer Finance Survey 1981, Department of Census & Statistics gives an estimate of 185,000 liters per day uncollected.

Source: Associated Development Consultants Ltd., Colombo, April 1983.

TABLE 3

IMPORTS OF MILK PRODUCTS - PERIOD 1978-1982, SRI LANKA

(C.I.F. VALUE IN MILLION Rs.) (Quantities in M/Tons)

Product Type	1978			1979			1980			1981			1982		
	Importers	Quantity	Value	Importers	Quantity	Value	Importers	Quantity	Value	Importers	Quantity	Value	Importers	Quantity	Value
Full Cream Milk	30	15,813	253.5	32	16,990	360.3	62	28,156	453.5	48	9,428[1]	324.2	34	9,403	387.2
Skim Milk	25	3,277	65.5	21	3,096	30.5	23	2,541	53.9	29	684[1]	14.0	29	2,355	40.6
Condensed Milk	33	6,487	35.3	28	5,237	89.1	20	1,334[1]	16.5	23	1,199[2]	25.3	13	433[2]	10.5
Butter & Ghee	30	1,056	23.0	24	1,387	27.1	24	246[3]	21.4	18	731	31.1	12	522	30.1
Cheese & Curd	34	165	2.9	37	313	5.7	39	116	6.3	41	169	10.5	23	185	13.1
Malt Extract	—	—	—	—	—	—	—	—	—	25	979	41.5	22	1,201	56.1
Infant Feed	10	530	15.5	25	2,220	68.5	27	2,115	74.1	21	2,603	81.5	16	963	37.5
TOTAL		27,382	395.7		29,243	581.2		34,508	625.7		15,793	528.1		15,062	575.1

[1] Reduction in imports due to carry forward stocks.

[2] Imports substituted by local production - Nestle.

[3] Certain import quantities not shown in custom's returns.

Note: 1981 - Price increase. 1982 - B.T.T. introduced.

Source: Department of Customs, from Computer programmed "Returns".

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E. STATE PARTICIPATION IN THE SECTOR

The dairy sector continues to be dominated by government-controlled entities, although the present government is apparently interested in returning all but research and extension activities to the private sector. The National Livestock Development Board (NLDB) now operates several of the largest dairy farms, but its primary objective is livestock development, with breeding and herd improvement an important aspect of its work. NLDB was set up because the Division of Animal Production and Health of the Department of Agriculture (now separate departments) was constrained in achieving these objectives by its government ties.

Similarly, the NMB was set up to operate and manage the production activities related to milk processing, including milk collection stations and processing plants. NMB operated all the larger processing facilities until recently when it turned over the condensed milk plant at Polonnaruwa to Nestle management. Nestle also has permission to establish a large milk reconstitution plant at Pannala. The powder repack operation of Lanka Milk Foods is controlled by a stock company. It is expected that any new ventures will require private sector initiative and ownership.

F. GOVERNMENT REGULATION

In addition to its direct management, the government has also established prices for the milk they collect through the NMB collection centers. While these prices are applicable only to milk sold through the centers, they tend to establish the price for milk in the country because most farmers do not have the infrastructure to do anything with their milk other than sell it to the NMB. Therefore, government influence over the sector is still very pronounced.

III. DAIRY PRODUCTION

A. PRODUCTION AND ITS POTENTIAL

Present milk production is an estimated 216,000 liters per day, down from a peak of 306,000 liters per day in 1979 (see Table 2). The primary reason for the decline is believed to be the unfavorable price paid by NMB.

Milk production potential is limited by the fact that there are few large organized dairy farms and most milk production is extractive. Farmers may or may not milk their cattle, depending on the price being offered or the convenience of a milk collection center. The upside potential from the cattle and buffalo herd combined of about 1.9 million head (Table 4) is estimated to be about 0.9 to 1. million liters per day. This assumes that cows would be milked and that production per cow would average 1.5 to 2 liters.

This estimate is extremely conservative. As farmers begin to focus on dairy as a production enterprise rather than an extractive enterprise, milk production per animal can and will be increased. Already some farmers have herd averages of 8 to 12 liters per day per cow. While this is still low in relation to European or New Zealand standards, it does demonstrate the potential for increasing dairy productivity.

B. SIZE AND LOCATION OF DAIRY PRODUCERS

The distribution of cattle by the five key dairy production zones is shown in Table 5. Also shown in Table 5 is an estimate of the percentage of milk collected in each zone.

Presently more than 60 percent of the milk collected comes from the Hill and Mid Country areas where only 13% of the cattle are located. Milk production in the Hill and Mid Country is based on use of European breeds of dairy cattle (exotics) or their crosses, which

TABLE 4

TOTAL NUMBER OF CATTLE AND BUFFALOES IN SRI LANKA

	Cattle		Buffaloes	
	1972	1982	1972	1982
Cows				
Heifers Over 18 Months	447,087	575,527	134,517	196,804
Heifers Below 18 Months	91,450	117,721	46,120	67,476
Bulls	172,738	222,363		
Bull Calves Over 18 Months	121,933	156,962	134,517	196,804
Bull Calves Below 18 Months	18,289	104,641	34,590	50,607
Total	1,016,108	1,308,016	384,334	562,298

Source: Department of Census & Statistics, 1972 and 1982

TABLE 5

MILK COLLECTION RELATED TO CATTLE POPULATION BY MAJOR DAIRY PRODUCTION ZONES, 1982

Dairy Production Zone	Milk Collection Percent	Cattle Population (Percent of Total Population)
Hill Country (Tea Triangle)	34	6
Mid Country	27	7
Dry Zone	23	60
Coconut Triangle	11	20
Other Areas	6	8

are capable of high levels of milk production provided they are fed continuously on high quality rations. In the Hill Country, nearly all cattle, except for those on large government farms, are maintained either by estate workers or small holders who raise one to three cows and have access to limited areas of land for forage or pasture production. The land available to these small holders for cattle forage is limited to areas such as ravines and marshy areas on tea estates and roadsides. In order to achieve even moderate levels of milk production - 6 to 10 liters/day - a fairly high level of concentrates has to be fed - at least 1 kg concentrate per 2 liters of milk. As the price of concentrates has increased substantially in recent years, the profitability of dairy production has declined and many farmers have given up dairying as an enterprise.

The land constraint in the Hill Country precludes major expansion of dairying unless a grass other than Guatemala (not of much value nutritionally for cattle) can be used to restore soil structure in the tea estates. The Mid Country, however, does have a potential for significant expansion in the near term because more land is available. Also, the zone has relatively high and well-distributed rainfall and a mild climate suitable for cattle as well as for growing a range of cash and forage crops.

The Dry Zone herds are the largest in the country (some in excess of 500 head) accounting for 60 percent of the total herd. These herds are generally zebu and crosses based on local breeds with productivity levels between 1 and 2 liters per day per cow. These herds are managed under a system of low intensity and extensive grazing, which complicates the collection of milk. With the development of Mahaweli and irrigation of more than 400,000 acres in the Dry Zone, the area should play a steadily increasing role in supplying milk for processing. To accomplish this, changes in feeding practices will be required. Many systems of forage/concentrate feeding are being studied in Sri Lanka and several look promising.

The next most important production zone is the Coconut Triangle. This zone has 20% of Sri Lanka's cattle and many farmers have small

herds integrated with coconut plantation activities. The herds consist of zebu and local breeds which tolerate the least, but are low producers of milk. Programs are being funded to support increased production in the Coconut Triangle, which is expected to play a much larger role as milk prices and feeding system improvements combine to result in more profits for dairy farmers in the zone.

C. PRODUCTION INFRASTRUCTURE

Expansion of the dairy sector requires roads be adequate for the transportation of milk from farm to market and feed from manufacturing plant to farms. Also, veterinary services and dairy extension assistance must be provided to assist farmers in keeping cattle healthy and productive.

Generally speaking, Sri Lanka has a reasonable system of roads to connect various parts of the country. Since a large part of the milk production is presently transported by bicycle to collection stations and by lorry from collection stations to chilling plants or processing plants, road infrastructure is not seen as a barrier to expanded dairy production. Also, collection stations are probably adequate if collection routes are properly organized.

The Department of Animal Production and Health (DAPH) of the Department of Agriculture (DA) is responsible for veterinary services. The system is reportedly not adequate and requires strengthening. A veterinarian is often given too large an area to cover and it is difficult to make adequate contact with the large number of farmers with only a few cows. Larger farmers will provide transportation to and from the farm and pay a small sum for the veterinarian's services. The larger farmers are thus better served than the small farmers who are frequently neglected.

Dairy farming is a complex system that involves extension assistance from cattle specialists, agronomists, and agricultural economists. At present, the number of extension personnel is not

adequate to cover the needs of all dairy farmers. The system requires strengthening, which can be done via the cooperative collection systems being established in small milk sheds. In each cooperative an extension person with a broad background in dairy farm management -- backed by a staff of specialists -- could provide advisory assistance to farmers.

Infrastructure to support dairy development activities also needs strengthening, but the basics of the support systems are in place and it should be possible to upgrade without major difficulty.

D. PRINCIPAL INPUTS

The primary inputs purchased by the dairy production sector include feed, veterinary supplies, and milk handling equipment.

Feed is an important input to the dairy sector. In 1982, two manufacturers supplied 7,000 metric tons of feed to the sector, or nearly 85% of all feed used. This feed sold at an average price of Rs 2,687 per ton for a total value of Rs 18.8 million ($835,500). It is recommended that feed concentrate at the rate of 1 kg of concentrate be fed in the dry season to supplement forage. If this recommendation were followed, the amount of feed sold would supply the herd needs for 65 days at present levels of milk collection. Thus, while supplementary feed is important, it is still being used very sparingly, primarily because most farmers do not realize a net benefit from using it. At Rs 1.6 per kg, the cost of feed can equal the price received for the milk if sold through collection agents.

Most veterinary supplies can be obtained from the DAPH veterinarian. If he does not supply what is needed, most farmers have no other alternative. The larger farms can buy imported veterinary supplies and keep their own stocks on hand.

Milk handling and processing equipment is available in the country and was not mentioned as a problem.

E. STORAGE AND HANDLING

Milk is an extremely perishable product and must be consumed quickly or transferred to chilling centers for storage. Most farms do not have on-farm storage facilities, and the farmers m take their milk to the NMB collection stations to be tested and a ted. This milk is then taken to a chilling center or directly to a processing facility within a few hours of milking. This system seems to work reasonably well and is by far the most practical storage system for Sri Lanka.

F. PRICING

The NMB guaranteed price to producers reigns as the farm gate price in the country as shown in Table 6. The producer price is not determined as a function of milk production costs, but is based on the price set by the government to provide consumers with a subsidized product. Over the years, the retail price has carried consumer subsidies, agents' commissions, NMB diseconomies and collection agent fees. The balance became the guaranteed price to producers and was generally extremely low.

It should be pointed out that NMB's guaranteed price applies only to producers who market milk through NMB's collecting centers. Others are free to market milk at any price they can obtain.

In such a system, price adjustments generally lag behind increases or decreases in production costs by many months. Price adjustments serve mainly to save the industry and hardly ever to promote it. When domestic milk production falls by about 25 percent, the public, the media, and NMB (in this order) agitate for change. The authorities then review the claims, deliberate, and finally act. Generally, prices paid producers decline to 50 percent below production costs before they are increased to correct the situation.

A system should be established to provide continuous monitoring of the producer price in relation to costs of production and the

TABLE 6
NATIONAL MILK BOARD
PRICES PAYABLE TO FARMERS FOR MILK BASED ON FAT CONTENT -
WITH EFFECT FROM MARCH 1, 1983

Fat Percent	Price Payable Per Liter	Fat Percent	Price Payable Per Liter
2.5	2.75	6.1	5.27
2.6	2.82	6.2	5.34
2.7	2.89	6.3	5.41
2.8	2.96	6.4	5.48
2.9	3.03	6.5	5.55
3.0	3.10	6.6	5.62
3.1	3.17	6.7	5.69
3.2	3.34	6.8	5.76
3.3	3.31	6.9	5.83
3.4	3.38	7.0	5.90
3.5	3.45	7.1	5.97
3.6	3.52	7.2	6.04
3.7	3.59	7.3	6.11
3.8	3.66	7.4	6.18
3.9	3.73	7.5	6.25
4.0	3.80	7.6	6.32
4.1	3.37	7.7	6.39
4.2	3.94	7.8	6.46
4.3	4.01	7.9	6.53
4.4	4.08	8.0	6.60
4.5	4.15	6.1	6.67
4.6	4.22	8.2	6.74
4.7	4.29	8.3	6.81
4.8	4.36		
4.9	4.43		
5.0	4.50		
5.1	4.57		
5.2	4.64		
5.3	4.71		
5.4	.78		
5.5	4.85		
5.6	4.92		
5.7	4.99		
5.8	5.06		
5.9	5.13		
6.0	5.20		

market price for imported milk. Producer prices should be disassociated from those set to provide welfare assistance to consumers.

On the other hand, since the guaranteed price is not mandatory outside the government system, there is nothing to stop establishment of a project in a milk shed where the investors offer their own incentive price to support and stimulate milk production. Projects focusing on diversification of the product line can be successful even with higher priced milk. Also, with growth of personal income and general socio-economic development, the demand for various milk products will continue to increase. At the moment, the market is captive to a few products but the potential for diversification is high.

G. PRIMARY CONSTRAINTS

Some of the primary constraints to expanded dairy production and milk collection in Sri Lanka are:

- Milk prices are not based on production costs; they are not high enough to attract investment capital to establish commercial scale dairy farms. Present prices do not give commercial scale dairies an adequate return on capital.
- Producer associations at the small farmer level lack management and the financial backing to set up collection systems of their own.
- New entrepreneurs cannot operate in milk sheds where there are NMB collecting centers unless they enter a joint venture with NMB or develop their own market.
- Government policy restricts land ownership; unless some mechanism can be developed to make sufficient land available to support commercial dairy farm development, the expansion of such farms will be slow.
- There is an insufficient number of cows with potential for high yield to build herds rapidly.

- There is no clearly stated government policy concerning dairy herd development and milk pricing.
- Feed concentrates are in short supply and often too expensive to be attractive to dairy farmers; therefore, forage programs need to be developed.
- Imported milk products which are in surplus in international markets are sold in Sri Lanka at "dumped" prices. This subsidy to Sri Lankan consumers causes unfair competition for local producers and is a deterrent to development of dairy farms.

IV. DAIRY PROCESSING

A. MILK COLLECTION AND TRANSPORT

As indicated in Section II, most milk is brought to local collection or chilling centers by the farmers themselves. NMB takes the milk by bulk lorry from the collection centers to the processing facilities. If routes are properly established, the system seems to be adequate.

B. MILK PROCESSING TECHNOLOGY

The principal processing operations use the latest technology available when built. In fact, the Lanka Milk Foods plant, which went into operation in April 1983, is one of the most modern facilities of its kind in the world. While the technology is up to date, the production lines are generally set up to provide a good balance between use of capital intensive machinery and low cost skilled labor.

Alfa Laval, one of the world's leading suppliers of dairy equipment and process technology, is active in the market and is providing advice to investors in the sector.

C. EXISTING DAIRY PROCESSORS

The Sri Lankan dairy processing sector is controlled essentially by three groups - NMB, Nestle and Lanka Milk Foods. Several smaller groups process milk into ice cream, yogurt, and cheese. The largest of these groups is Ceylon Cold Stores. The primary milk processing plants are located as indicated in Table 7 and on Maps 1-5.

Sri Lanka will have installed processing capacity to handle approximately 835,000 liters of fluid milk per day when Nestle completes its drying and reconstitution plant at Pannala (see Table 7). This total represents an excess capacity of about 625,000 liters;

EXISTING PROCESS CAPACITY AND ITS UTILIZATION IN SRI LANKA, MAY 1983

Company/Location	Existing Capacity	Present Production	Planned Capacity
	Liters per 16 hour day		
NATIONAL MILK BOARD			
Narahenpita	160,000	52,000	-
Pallekelle	40,000	9,300	-
Ambewela (Spray Dry)	240,000	68,400	-
Kilinochchi	-		20,000
Galle	-		10,000
NESTLES			
Polonnaruwa (Condensary)	50,000	26,800	-
Pannala (Recons & Drying Plant)		4 months from opening	240,000
LANKA MILK FOODS			
Colombo (Repack Plant)	1,120,000	375,000	-
OTHERS[1]	75,000	50,000	-
TOTAL	1,685,000	581,500	270,000

[1] Arthur D. Little Estimates

present production/collection is about 216,000 liters per day.

With proper incentives, milk collection could rise to 900,000 to 1,100,000 liters per day. This would be only slightly more than presently installed capacity, but this estimate is probably optimistic.

Even though present capacity is underutilized, additional milk processing capacity should not be discouraged. Present capacity is highly oriented toward production of condensed milk and spray-dried powder. Therefore, smaller dairies supplying regional markets with a broad range of liquid or fresh products (pasteurized milk, flavored milks, yogurts, ice cream, and cheese) could still find attractive markets and build local milk sheds.

D. PRODUCTS

Presently the largest volume of milk is produced as condensed, powder, or sterilized products (Table 8) but other product categories are rapidly growing, particularly ice cream. In NMB's largest fluid milk plants at Pallekelle and Colombo, the principal product is bottled, pasteurized, or sterilized milk. Butter, yogurt, ice cream, cheese, and ghee are also produced.

E. INTEGRATION OF PRODUCTION WITH PROCESSING AND MARKETING

Most milk is produced by small farmers who milk one to three cows. Most of these farmers sell milk to NMB, but are not shareholders of a processing or marketing operation. Producers are not integrated into processing or marketing via a contract.

A few of the larger government farms are integrated with the government-owned processing facilities. Some private groups own modest dairy herds (30-40 cows) and produce cheese or yogurt for direct sale, but they represent a small percentage of the total dairy sector.

TABLE 8

ESTIMATE OF MILK PRODUCTS PRODUCED PER DAY IN SRI LANKA, MAY 1983

Product	Liters/Day
Powdered Milk (Local & reconstituted)	443,400
Condensed Milk	26,800
Sterilized Milk	37,540
Pasteurized Fluid	47,500
Ice Cream	7,000
Yogurt	2,500
Cheese and Curd	7,500
Butter	7,000
Other	2,260
Total	581,500

Source: Arthur D. Little estimates based on interviews.

F. PRICES FOR PROCESSED PRODUCTS

The NMB has dominated the dairy industry in Sri Lanka for the past 25 years. NMB establishes the price for milk paid to producers who in turn supply their collection centers. This price tends to become the accepted reference price for the country even though it is not a ceiling price. Similarly, NMB sets prices for its products to the consumer (see Table 9); these prices tend to become the norm for other processors of similar products. The exception is powdered milk. Lanka Milk Foods is the largest single supplier of powdered milk and their product sells for Rs 24.80/500 ml sachet. Other suppliers sell powdered milk for Rs 21.00/500ml to Rs 29.00/500 ml. Generally the price difference reflects the fat content of the product.

G. PRIMARY CONSTRAINTS

Expansion of processing activities using locally produced milk is constrained by the following factors:

- Present supplies of milk are insufficient to supply existing processing facilities. An adequate milk supply must be assured.
- Lack of a study that properly dimensions the operation and determines its financial viability to attract adequate local funding.
- Lack of a clearly stated government policy concerning milk prices at farm and consumer levels to encourage investors.
- Lack of long-term capital available on terms acceptable to the entrepreneur.

TABLE 9

NMB WHOLESALE & RETAIL PRICES FOR SELECTED DAIRY PRODUCTS, SRI LANKA, APRIL 1983

Item	Wholesale (Rs)	Retail (Rs)
Pasteurized Milk:		
Plain (568 ml bottle)	3.04	3.20
Plain (500 ml sachet)	2.75	2.90
Plain (284 ml bottle)	1.52	1.60
Flavored (284 ml bottle)	2.25	2.50
Flavored (liter bottle)	4.75	5.00
Sterilized Milk:		
Plain (600 ml bottle)	3.42	3.60
Plain (568 ml bottle)	3.27	3.45
Plain (500 ml bottle)	2.85	3.00
Plain (284 ml bottle)	1.66	1.75
Plain (500 ml sachet)	2.85	3.05
Flavored (284 ml bottle)	2.30	2.50
Flavored (500 ml bottle)	2.65	2.80
Ice Cream:		
Gallon	58.00	68.00
800 ml family block	14.75	16.75
1 liter plastic box	26.00	30.00
2 liters plastic box	45.50	52.50
1 liter plastic box with fruit	30.25	35.00
Other Products		
Butter (200 gr)	13.75	14.75
Cheese (kg)	94.75	104.75
Yogurt (112 gr)	2.25	2.50
Ghee:		
568 ml bottle	32.75	35.50
284 ml bottle	16.75	18.50
1 gallon can	225.00	

V. MARKETS AND MARKETING

A. MARKETS

1. Size

Sri Lanka, with its population of 15.5 million, can be an important market for domestically produced dairy products. The annual import of dairy based products is now an estimated 224-245 million liters liquid milk equivalent per year. At Rs 4/liter, imports of dairy products are costing Sri Lanka about Rs 1.0 billion ($44 million) annually. Sri Lanka is also using about 78.8 million liters of locally produced milk per year. Thus, Sri Lanka's present consumption of dairy products is estimated at 323.8 million liters per year, or a per-capita consumption of 20.8 liters. (Per-capita consumption in the United States is 124 liters.)

Only 24% of the Sri Lankan market is served by locally produced dairy products. If the government provides proper support to stimulate the dairy sector, markets for a significantly expanded local industry do exist.

Consumption of dairy products will expand through population growth, income growth, and increases in per capita consumption. A conservative estimate is that consumption will be 450 million liters per year in 1993.

2. Composition

The Sri Lankan dairy market is summarized by produce category in the government statistics shown in Table 10. Unfortunately, these statistics are somewhat suspect, particularly for 1981 and 1982. The government arranged for Nestle to take over the condensing facility, but did not have Nestle's production statistics. Therefore, the 1981 and 1982 figures have been estimated using information provided by

TABLE 10
MILK CONSUMPTION BY PRODUCT TYPE, BASED ON COMMERCIAL CHANNELS
FOR THE PERIOD 1978-1982

Product Type	Unit	1978	1979	1980	1981	1982
Sterilized Milk	Lts	6,576,000	8,542,000	9,045,000	8,823,000	9,718,000
Pasteurized Milk	Lts	10,719,000	10,447,000	11,140,000	10,714,000	11,987,000
Full Cream Powder	Kgs	18,551,500	21,069,000	32,348,500	13,174,800	13,006,400
Skim Milk Powder	Kgs	3,227,000	3,090,000	2,542,000	684,000	2,355,400
Condensed Milk	Kgs	11,578,600	11,346,400	5,310,000	6,700,000	7,300,000
Butter & Ghee	Kgs	1,175,400	2,100,000	309,900	874,850	724,215
Cheese & Curd	Kgs	196,000	328,000	125,600	175,200	190,000
Infant Food	Kgs	530,000	2,200,000	2,115,700	2,603,117	963,295
Yogurt	Cups	2,102,000	1,324,500	894,000	967,000	2,543,000
Ice Cream	Lts	405,000	392,000	141,000	138,000	442,000

Source: National Milk Board Department of Customs and Arthur D. Little estimates.

Nestle during interviews. Also, the Lanka Milk Foods plant was destroyed by fire during this period. Lanka Milk Foods management indicated that they would import at the rate of 24.0 million kgs per year in 1983.

Accepting these limitations, the information in Table 10 provides a reasonable indication of the importance of various products. Yogurt and ice cream in the past few years seem to be the fastest growing categories while the fluid and powdered milk categories are by far the largest.

B. MARKETING AND DISTRIBUTION CHANNELS

The National Milk Board, Nestle, Lanka Milk Foods, and Ceylon Cold Stores are the principal organizations marketing dairy products. These groups market milk and dairy products in the same way they are marketed in most countries of the world; i.e., through supermarkets or small groceries. Pasteurized and sterilized milk is sold in bottles and in tetra-pak containers. Powdered milk is sold in hermetically sealed foil pack containers; ice cream is packed in cardboard and plastic containers; yogurt is packed in inferior plastic cups (the quality of these cups could be improved).

Dairy products are generally distributed by lorry to the wholesale and retail outlets. Refrigerated lorries are used where required. Some products, such as ice cream, yogurt, and cheeses, are often distributed through specialized dairy stores; but push cart and delivery in the street is not as common for this kind of product.

Any marketing plan must take into consideration that few consumers have home refrigerators and therefore require sterilized or powdered milk. Products that require refrigeration should generally be marketed for on-site consumption.

C. PRICING

Government pricing policy requires careful thinking if an indigenous dairy industry is to be promoted to reduce imports and thus

contribute to cutting the $44 million foreign exchange outflow.

Wholesale and retail prices established by NMB have been discussed in Section III. The NMB retail price quoted for pasteurized milk is Rs 5.80/liter (Table 9), which is Rs 1.30 lower than the price for reconstituted powdered milk. The price for locally pasteurized milk should equal the price of powder to induce processors to promote local pasteurized milk. If the price is kept low as a consumer subsidy, the government should pay the difference between the subsidized price and the cost-based price to the processor. At present, the processor must absorb the subsidy. When the government is the processor, such a system is adequate, but private sector firms cannot absorb the subsidy and stay in business.

With proper pricing at the wholesale/retail level, the processor can pay the farmer a fair price. Present milk pricing policy results in importation of powder at Rs 4.00/liter of fluid milk equivalent standardized to 3.5% butter fat. For locally produced milk, standardized to the same fat basis, the farmer receives Rs 3.45/liter from the NMB. Again, pricing policy is resulting in a disincentive for the local dairy sector.

Although private sector firms do not have to abide by the price schedule of NMB, their product must compete with NMB, and the NMB price establishes a norm around which they must price their product. This norm, at subsidy levels, is too low to permit private sector expansion.

D. PRIMARY CONSTRAINTS

From a market viewpoint there is no limit to the size of the market, but unless a clear pricing policy is established at producer, wholesaler and retailer levels, many entrepreneurs may be discouraged from entering mainstream markets. In selected local markets, the product mix of a facility may be sufficiently diversified to provide an attractive return on investment.

VI. OPPORTUNITIES

A. REGIONAL PRIORITIES

It was pointed out in Section II that Sri Lanka can be divided into five basic zones with respect to livestock and dairy development. Those zones are:

- Coconut Triangle
- Tea Triangle
- Mid Country
- Dry
  - Northern
  - Condensary/Tamankaduwa
  - Lower Eastern Province and Uva Lowlands
  - Uda Walawe/Kirindi Oya
- Southwest

The study team considers some zones more likely to be of interest to private sector investors than others. In order of priority each zone is discussed below:

1. Mid Country (Maps 1 and 3)

The Mid Country is ranked as the highest priority area for expanded dairy development because:

- Climatic conditions are favorable to dairy cattle, particularly the more productive European breeds.
- European dairy breeds have been raised successfully for a number of years and a good base of knowledge exists.
- Farmers of the Mid Country presently produce one-third of all milk in the country.
- Rainfall is abundant and forage crops generally produce stable supplies of needed roughage throughout the year.
- The principal agricultural university is located in this zone and infrastructure of veterinary services, transport,

communications, etc., is good, capable of supporting expanded dairy development.

- The zone's principal dairy processing plant at Pallekele will be submerged by the Victoria Reservoir soon. A private group could undertake to establish a new facility with minimum risk.
- Several financing and technical assistance programs are on-stream in this zone and will help to promote and support the necessary farm developments.

2. Lower Eastern Province and Uva Lowlands (Maps 1 and 5)

This zone ranked second in priority because:

- The local zebu type cattle are numerous, well adapted to the climatic conditions of the zone, and underutilized with respect to their potential for dairy production.
- The zone has a few milk collection centers. If a processor establishes and treats farmers fairly, milk supplies would be readily available, with relatively little competition.
- Feed can be produced from present acreage, as well from new irrigated lands and from existing rice and sugar lands.
- Farmers have a livestock management tradition and a dairy consciousness. If given the right support, they will milk their cattle for commercial operations.
- A new animal science and veterinary program at the university in Batticola should provide greater support to the farmers of the zone. Also, a Swiss Aid program is supporting dairy in the region.
- New roads are being constructed which will facilitate milk collection and transport.

3. Uda-Walawe/Kirindi Oya (Maps 1 and 6)

This zone ranks high for all the same reasons cited for the Lower Eastern and Uva Lowland zone. In addition, this zone has a settlement program underway and many of the settlers can support a dairy development effort either as producers of milk or suppliers of fodder and/or grains.

4. Northern Dry Zone (Map 1)

The Northern Dry zone may offer some potential for development because:

- People in the area are skilled in animal husbandry .
- Land is available for expanded cattle development.
- Appreciable concentrations of cattle exist.

This area is not ranked as high as the Lower Eastern and Uda-Walawe zones because:

- NMB is already planning to build a small multipurpose processing facility at Kilinochi; there may not be room for a second facility.
- Social unrest in the north may imply more risk than a private investor may want to accept.

5. Southwest (Map 1)

The Southwest is not of high priority interest because:

- The cattle population is of low potential and the farmers are not interested in livestock husbandry.
- NMB is already planning a small processing plant for Galle; further expansion is not advisable.
- The area's heavy rainfall is not conducive to cattle production.

6. Condensing Facility/Tamankaduwa (Maps 1 and 4)

Nestle has been authorized by the government to manage the condensing plant in this zone. Supplies of NMB and Nestle have been earmarked for this plant. It would not seem advisable to encourage others to enter into direct competition with NMB and Nestle in this zone.

7. Tea Triangle (Maps 1 and 3)

The Tea Triangle is a climatic zone favorable to development of European dairy breeds, but its restricted land area precludes expansion of the herd. NMB has set up collection centers throughout the region to supply a large spray drying facility in this zone at Ambewela. Expansion of additional processing facilities in this zone would be difficult because milk supplies are limited.

8. Coconut Triangle (Maps 1 and 2)

The Coconut Triangle does offer potential for expanded dairy production, but it is least attractive as an area for expanded process capacity because:

- It is the primary supply area for the NMB's Colombo milk processing plant. NMB has milk collection stations throughout the region and most farmers sell to NMB.
- This zone is also the primary supply area for the new Nestle milk powder plant at Pannala in the heart of the dairy district. With NMB and Nestle both working to increase milk collections in this zone, it is futile to interest still other processors at this time. If an investor is interested in developing a farm in the region, however, this may offer potential.

B. SPECIFIC PROJECT OPPORTUNITIES

Careful review of the dairy sector reveals several potential production and process related opportunities for the private sector. Clearly, the most interesting opportunities should be subject to pre-feasibility studies.

1. Establish Milk Collection Systems

a. The Concept

The basic concept for this project is similar to the concept used by the World Bank under Credit 504CE to set up Milk Producer Cooperative Unions at Kuliyapitiya in the Coconut Triangle, and at Nowalopitiya and Rikiligaskade in the Mid Country. The idea is to set up a producer-owned and controlled organization that assures the farmer the maximum return on his milk rather than the partial return he currently receives when selling milk to middle men.

Clearly this is an investment opportunity for farmer groups that can organize themselves. The milk could go to a small local processing plant owned and controlled by the farmers cooperative union. Such a venture could also gain support from the large processors who need milk to operate their facilities.

b. Market

The output from this project would go to the domestic market. Most cooperatives would sell their milk to a local processor, who in turn would market the product.

c. Commercial Attractiveness

The primary commercial attractiveness for this activity is to assure that farmers obtain their maximum share of the price paid

processor, very little value is added, but the farmer may receive an additional Rs 1/liter.

The venture should be set up with the objective of collecting at least 10,000 liters per day. If this can be done, it will open horizons for further processing by the farmers cooperative itself.

An investment of Rs 10 to 12 million will be needed to establish the required extension service, milk collection points, and chilling factories to handle 10,000 liters per day. If farmers can rent space for collection points, the investment might be reduced to Rs 4-5 million. Much of this investment can be amortized over 25-30 years, as a large portion of it will be in buildings.

About 80 collecting points will be needed for 10,000 liters of milk daily. Each collecting point needs to have a tally man; these tally men are now paid Rs 175-200/month. Another three or four people are needed to operate the chilling plant; these people are paid considerably more than the tally men. These salaries and the transport costs associated with collection points and chilling stations will likely be Rs 2.5 to 3 million/year. If farmers deliver 10,000 liters of milk per day and are paid Rs 3.45/liter (the NMB price) they will receive Rs 12.6 million per year. On this basis the farmers will receive 75-80% of the milk revenue for themselves, instead of the 50% typically received from collecting agents at the present time.

d. Factors Required for Success of Project

For this project to succeed the following should be assured:

- Farmers should participate on an equitable basis and be permitted representation in management of the group.
- The group should be headed by an individual who can effectively represent the group with buyers, government officials, the farmers themselves, and others who may deal with the group on a business and political basis.

- The collection stations should provide standard butterfat tests of each farmer's milk and assure that he receives proper payment immediately.
- The technology employed at the collection and chilling centers should be good state-of-the-art technology operable by people with average skills.
- A local or foreign partner is not essential. A group interested in establishing a small dairy processing plant could enter a joint venture with a producers cooperative union that would provide an assured supply of milk. In turn, the processor could help the producers' cooperative add value to their milk and enhance the farmers' return.
- The government's primary effort should be to provide a line of credit to those producer cooperative unions through the National Development Bank at favorable interest rates. It should review producer prices for milk to assure that the NMB price relates to the cost of production.

e. Broad Impacts

Several of these projects could be organized throughout the country. For example, if local milk production reaches only half its potential, production will rise from the present 216,000 liters per day to 550,000 liters per day. If 50% of the increase comes from producer cooperative unions, 16 or 17 cooperative unions will be needed. These unions would:

- Put Rs 214 million per year into the hands of farmers belonging to the cooperatives. This is Rs 214 million of rural farm income not there now.
- Create full-time or supplemental employment for about 1,400 people in the rural areas.
- Increase local milk production and directly displace imported dairy products. The saving in foreign exchange through effective implementation of 17 projects is estimated at Rs 248 million ($11.0 million) per year.

- Have some impact on regional development since the projects would be located throughout the country, several of them in the more depressed regions.

2. Establish Commercial Dairy Herds

a. The Concept

The basic concept for this project is the establishment of commercial size dairy farms (50 milking cows per unit) similar to those found in most dairy regions of the world. The operation would be owned and controlled by a single entrepreneur to produce milk for sale to local processors. This project would be of interest to local entrepreneurs with an interest in cattle, especially those people who have land or can obtain land.

b. Market

The market for the milk output from this project will be domestic. The farm owner will seek to sell his output directly to NMB, Nestle, or another established dairy, or may want to integrate into processing himself. If so, the milk would go to a captive market and the processed products would be sold locally.

c. Commercial Attractiveness

The commercial attractiveness of this project must be derived from the sale of milk and sale of non-productive cattle. Such a farm can be established for about Rs 27,000 per milking cow or about Rs 1.3 million for a 50 cow dairy herd. Estimated operating costs for such a venture at present are Rs 4.25-4.50/liter. Since the current NMB price is 3.45 Rs/liter for milk standardized to 3.5% fat, a commercial dairy farm is not an attractive investment if it depends on the NMB

price. Most commercial dairies find other outlets such as selling direct to hotels, or processing into cheese and /or other dairy products, which can obtain prices much higher than the NMB price. If the government will permit NMB to increase prices to levels that reflect actual production costs plus a reasonable margin for profit, it will stimulate, rather than discourage, local dairy production.

d. Factors Required for Success of Project

For this project to succeed the following should be assured:

- The entrepreneur should be committed to dairy cattle production and be available to oversee operations frequently.
- The farm should be located within a reasonable distance of a collection station or have its own process capability.
- The technology used by the farm operator should be state-of-the-art. However, since skilled labor is reasonably priced, the Sri Lankan farm will use more labor than farms in other dairy countries.
- A foreign partner is not needed, although if a local entrepreneur is interested in integrating into processing, he may want to seek a partner to share the responsibility of the processing portion of the venture.
- To encourage the development of commercial dairy farms, the government should provide a line of credit through the National Development Bank at concessionary interest rates. The government should also review producer prices carefully to assure that NMB is establishing a price related to the cost of production.

e. Broad Impacts

As with the previous project, several commercial dairy farms could be established throughout Sri Lanka with each farm producing

about 500 liters of milk per day. For example, if 300 farms were producing at this rate, an additional 150,000 liters of milk per day would be available, representing 10-15% of present consumption in Sri Lanka. An additional 300 dairy farms would:

- Put at least Rs 188 million per year into the hands of rural entrepreneurs.
- Create full-time or part-time employment for 1,200- 1,500 people in rural areas.
- Increase local milk production and directly displace imported dairy products. (The savings in foreign exchange from 300 commercial dairy farms is estimated at Rs 219 million ($9.7 million) per year).
- Have a favorable impact on regional development since many such farms would be located in the regions where expanded economic activity is sought.

3. Establish Small Scale Regional Multiproduct Dairy Processing Plants

a. The Concept

The basic concept of this project is to select regional markets that can support a small dairy processing facility. The facility would be set up to supply a range of dairy products - pasteurized milk and/or sterilized milk, yogurt, ice cream, curd and cheese, butter and ghee.

The processing group would integrate with local producer cooperative unions for a milk supply. The processing group would work with the producers to assure that they are properly set up to meet the needs of the plant. Fair prices between the producers and the processor would be established.

b. Market

Processing about 10,000 liters of milk per day would be necessary for such a facility. Presently the average consumption is .06 liters of milk per day per person in Sri Lanka. Assuming a lower rate in the rural areas, it will be necessary to locate a processing plant in an area where it can serve a population base of 250,000 to 300,000 people. It is possible to locate a new processing plant in up to five such areas in the country.

c. Commercial Attractiveness

Through the integration of milk production/ collection activities with processing activities, it is possible for the venture to add substantial value to milk production. It is estimated, based on price information gathered in Sri Lanka, that a proper mix of products could result in an average price per liter much higher (Rs 8.5 per liter) than the NMB price of Rs 3.45/liter. It is estimated that process costs and delivery and marketing costs will range between Rs 3.00 and 3.80/liter depending on the capacity utilization. Using these gross assumptions, this venture would yield a revenue before taxes of Rs 1.25 to 2.05/liter.

The order of magnitude for investment in a small (10,000 liter/day) multipurpose dairy processing plant in Sri Lanka using Alfa Laval technology is estimated to be Rs 6 to 6.7 million. This would include building and equipment for the plant as well as transport equipment required and working capital. It would not include setting up milk collection centers. It is anticipated that existing collection centers will be used or modest facilities rented for such collection.

d. Factors Required for Success of Project

A small scale multipurpose regional dairy processing plant can be successful in Sri Lanka if:

- The supply of milk to the plant can be identified and confirmed.
- The market in a regional area is large enough to justify the sale of a mix of products that will yield a revenue stream sufficient to cover the costs associated with purchase of milk, processing, and marketing.
- The processor assures proper treatment of the farmers supplying the milk. This includes setting up a system that provides each farmer proper butterfat tests and payment to him at time of delivery.
- The technology employed in the collection, chilling, and processing facilities is state-of-the-art and balanced to utilize capital and skilled labor effectively.
- An innovative manager capable of understanding the technology, marketing, and administrative aspects of the business can be found, backed up by a dairy product technologist.
- Government establishes policies that promote rather than discourage dairy development.

e. Broad Impacts

It is estimated that up to five projects of this type can be implemented in Sri Lanka. If five projects are implemented it would:

- Put supplemental income of about Rs 62.5 million/year into the hands of farmers supplying milk to the projects.
- Create full time or supplemental employment for about 400 persons in the rural area.
- Supply a regional population with a broader base of hygenic dairy products.
- Increase local milk production and directly replace imported dairy products. The savings in foreign exchange represented by effective implementation of five multipurpose dairy processing plants will be at least Rs 73 million ($3.2 million) per year.

- Contribute to regional development objectives by supporting farmer incomes, employing rural people and generally increasing economic activity of the region where the plant is located.

4. Establishment of Additional Ice Cream Capacity

a. The Concept

This project involves the establishment of new processing facilities to make ice cream. The ice cream can be made from domestically produced milk. Initially, however, it may need to be based on the import of milk powder and domestically produced vegetable fats. This would be the case until a stable local supply of milk is secured.

b. Market

Ice cream is popular among higher income Sri Lankans. Several small firms have emerged to produce for this market. In interviews with the supplier of nearly 70% of the country's ice cream, it was stated that they could sell much more if they had production capacity. At the moment, their supplies are exhausted about mid afternoon each day.

It has been estimated that about 1,000 gallons of ice cream is produced each day now, but accurate statistics are unavailable. The majority of the ice cream is produced in Colombo area and sold in the Colombo market. Since it is a relatively high priced product, its market is restricted. It is expected that 10% of the population has incomes high enough to permit purchase of ice cream on a regular basis. In the United States per capita consumption is 17.8 lbs. of ice cream per year. If we assume that 10% of the Sri Lankan population will consume just 10 lbs of ice cream per year, a consumption of 650,000 gallons of ice cream per year seems possible.

At present the consumption is estimated at about 250,000 gallons per year, assuming that 1,000 gallons are produced each day 250 days per year. Therefore, a three-fold expansion in this market seems possible.

c. Commercial Attractiveness

The commercial attractiveness of this venture derives from the value that can be added by converting milk to ice cream. Presently milk can be bought for Rs 3.45 per liter and ice cream is selling wholesale for Rs 58 per gallon. To make a gallon of ice cream, the milk input is estimated to cost Rs 22.70; therefore, Rs 35.30/gallon remains to cover the cost of its production.

To construct an ice cream plant capable of producing 500 gallons of ice cream per day, it will require a batch freezer, storage facilities for milk, pasteurizer, finished product storage and systems for distribution. It is estimated that such a facility should be possible to construct and equip for Rs 5.75 to 6.25 million. In addition working capital requirements will be on the order of Rs 0.5 million. Therefore, for an investment of about Rs 6.25 to 6.75 million an ice cream plant to produce 500 gallon per day can be established.

It is estimated that the ice cream can be processed and marketed for Rs 20 to 23 per gallon. On this basis Rs 12 to 15 per gallon would represent a gross profit for the venture.

d. Factors Required for Success of Project

An ice cream processing plant can be successful in Sri Lanka if:

- Either a domestic or imported supply of milk can be obtained on a regular basis.
- The technology employed in the collection, chilling, and processing facilities is state-of-the-art and balanced to utilize capital and local labor effectively.

- An innovative manager with good marketing skills is hired to manage the venture.

e. Broad Impacts

More than one 500 gallon per day ice cream plant may be possible, but if only one such plant were constructed it could:

- Put supplemental income of about Rs 6.0 million per year into the hands of farmers supplying milk to the project.
- Create full time or supplemental employment for about 50 persons associated with supplying milk and another 15 to 25 persons processing and delivering the ice cream.
- Increase local milk production (if domestic milk and not imported milk is used) and directly replace imported dairy products. The savings in foreign exchange represented by effective implementation of one ice cream plant will be at least Rs 7 million ($315,000) per year.

5. Transfer the Spray Dry Plant of NMB at Ambewela to Private Sector Management

a. The Concept

Similar to the transfer of the condensary at Polonnaruwa to Nestles management, the concept of this project is to transfer the spray drier at Ambewela to private sector management. This would continue the process of getting NMB out of the production business and back to basic research and other support function activities necessary to foster a strong dairy sector.

b. Market

The largest market for dairy products in Sri Lanka is the spray dried powder market. The consumer seems to prefer the powdered

product because it can be stored without refrigeration, and most consumers do not have refrigerators in their homes. At present Lanka Milk Foods is selling about 335,000 liquid liter equivalents of whole milk powder per day. This accounts for about 58% of daily milk consumption in Sri Lanka. All Lanka Milk Foods powder is imported. In addition Nestles and several other international dairy firms export to Sri Lanka. In fact Nestles believes the spray dried powder market is attractive enough to permit construction of a new plant. Clearly a large market for powder does exist in Sri Lanka and local spray drying plants should have first opportunity to supply the market.

Presently the spray drying plant at Ambewela is supplying 68,400 liters per day to the local market. The plant has a capacity to supply 240,000 liters per day in 16 hours. Since about double this quantity is presently being imported into the country, it seems that a properly run plant should be able to find a market for its product.

c. Commercial Attractiveness

The commercial attractiveness of the Ambewela plant will depend on NMB and the government. The government must decide on the value of the plant and how it will be transferred to a new owner or management team. Third party valuation of the facility is needed.

Nestles is about to finish a plant equal in size to the Ambewela plant. This plant is claimed to cost Rs 575 million in fixed assets. If working capital of Rs 57 to Rs 70 million is added, a total investment of Rs 633 to Rs 644 million will be required. Since the Ambewela plant is older and needs certain repairs, it should be transferred to a new owner for a value depreciated to reflect the age of the facilities and equipment. It is estimated that Rs 345 to Rs 414 million should be a fair investment base.

Presently powdered milk is selling for Rs 6.80 to 7.00/liter liquid equivalent. If milk is being bought at the NMB price of Rs 3.45/liter from the farmer, a margin to cover operating costs and

amortization of the investment of Rs 3.35 to 3.55/liter is obtained. In gross terms, Rs 1.95 to 2.15/liter should cover the cost to process and deliver the product. This would leave a before tax profit of Rs 1.40/liter. These estimates are extremely gross and should be confirmed via a careful prefeasibility study.

d. Factors Required For Success Of Project

To assure success of the project it will require that:

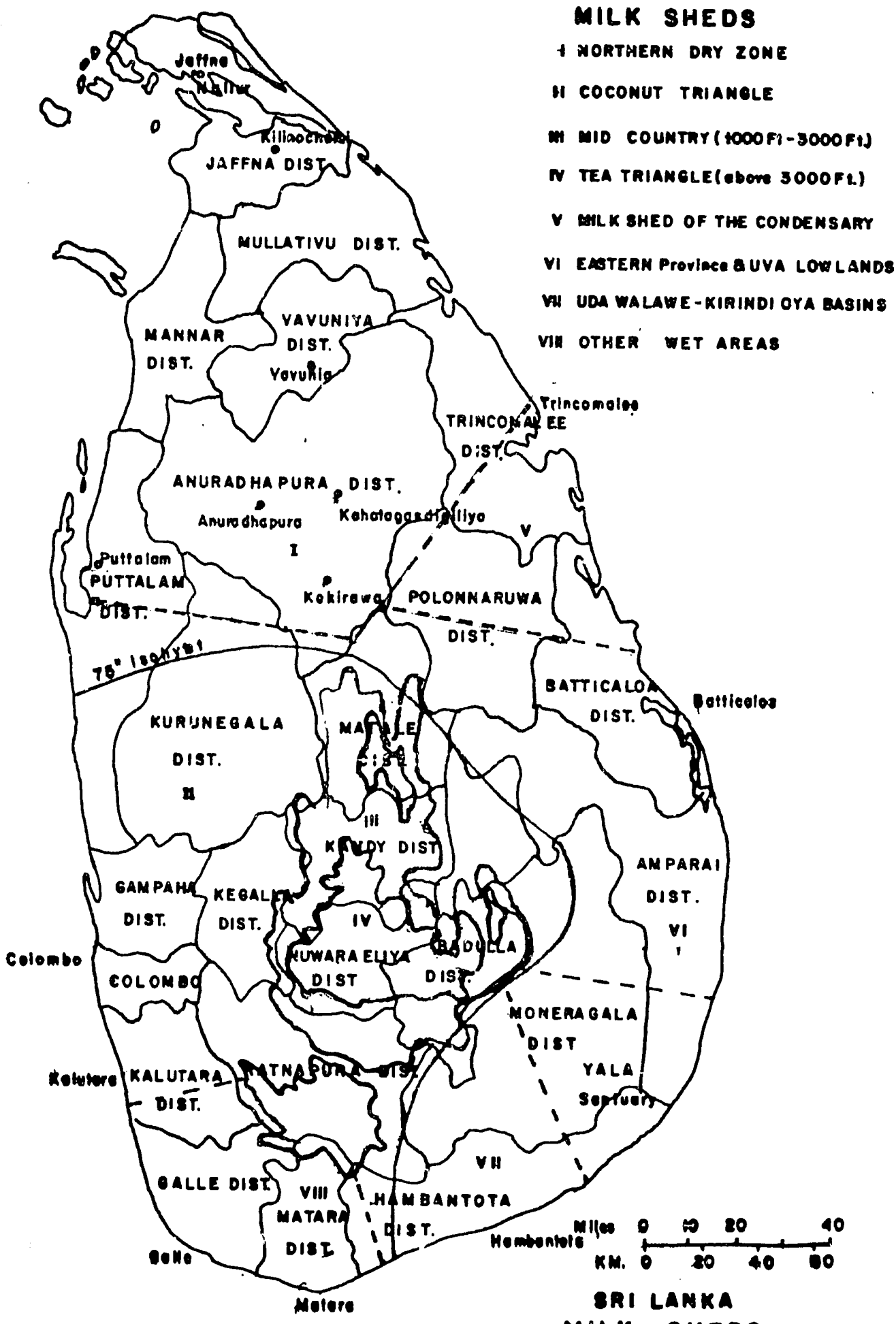
- A careful independent evaluation of the plant be made to determine values, investment needs, as well as product line potentials.
- A careful review of the milk shed be made to determine how the required milk supply can be obtained at favorable prices to the farmer and the plant.
- The management of the spray drier assure proper treatment of the farmers supplying the milk. This includes setting up a system that provides each farmer proper butterfat tests and his money at time of delivery.
- This project may be large enough to warrant seriously considering a foreign partner that has the skills necessary to compete effectively with Nestles in the market. In fact a partnership of Lanka Milk Foods and an international dairy firm such as Carnation, Beatrice, etc., could result in a good partnership.

e. Broad Impacts

This project is already on stream in the country, but at present the plant operates well below capacity. If the plant can be brought up to capacity it would:

- Put supplemental income of about Rs 178 million per year into the hands of farmers supplying milk to the project.
- Create full time or supplemental employment for about 1,200 persons in the rural area involved in collecting milk.

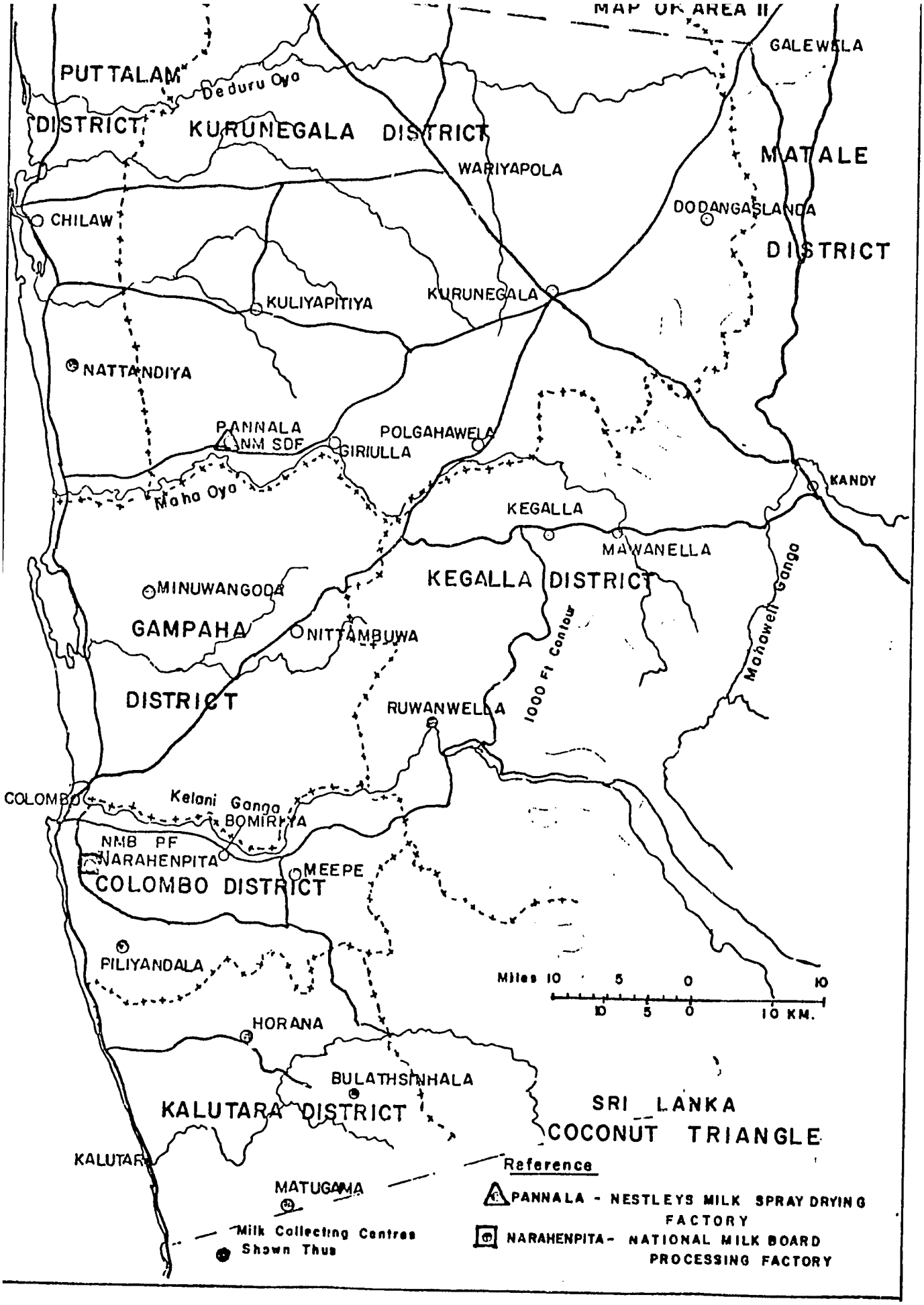
- Increase local milk production and directly replace imported dairy products. The savings in foreign exchange represented by effective implementation of the plant for two shifts daily will be at least Rs 205 million ($9.1 million) per year.
- Contribute to regional development objectives by supporting farmer incomes, employing rural people and generally increasing economic activity of the region where the plant is located.



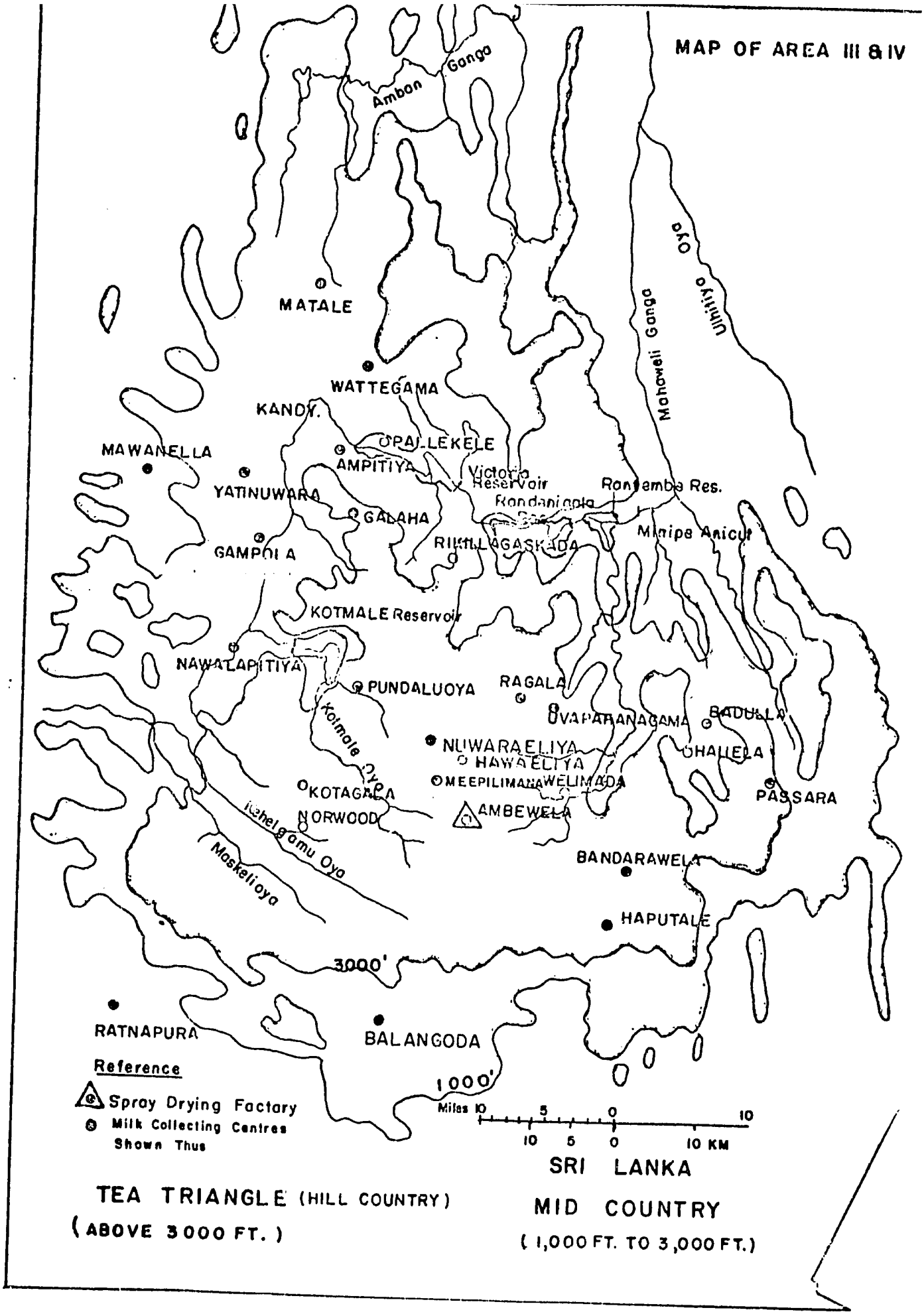
SRI LANKA
MILK SHEDS
KEY MAP

MAP 1

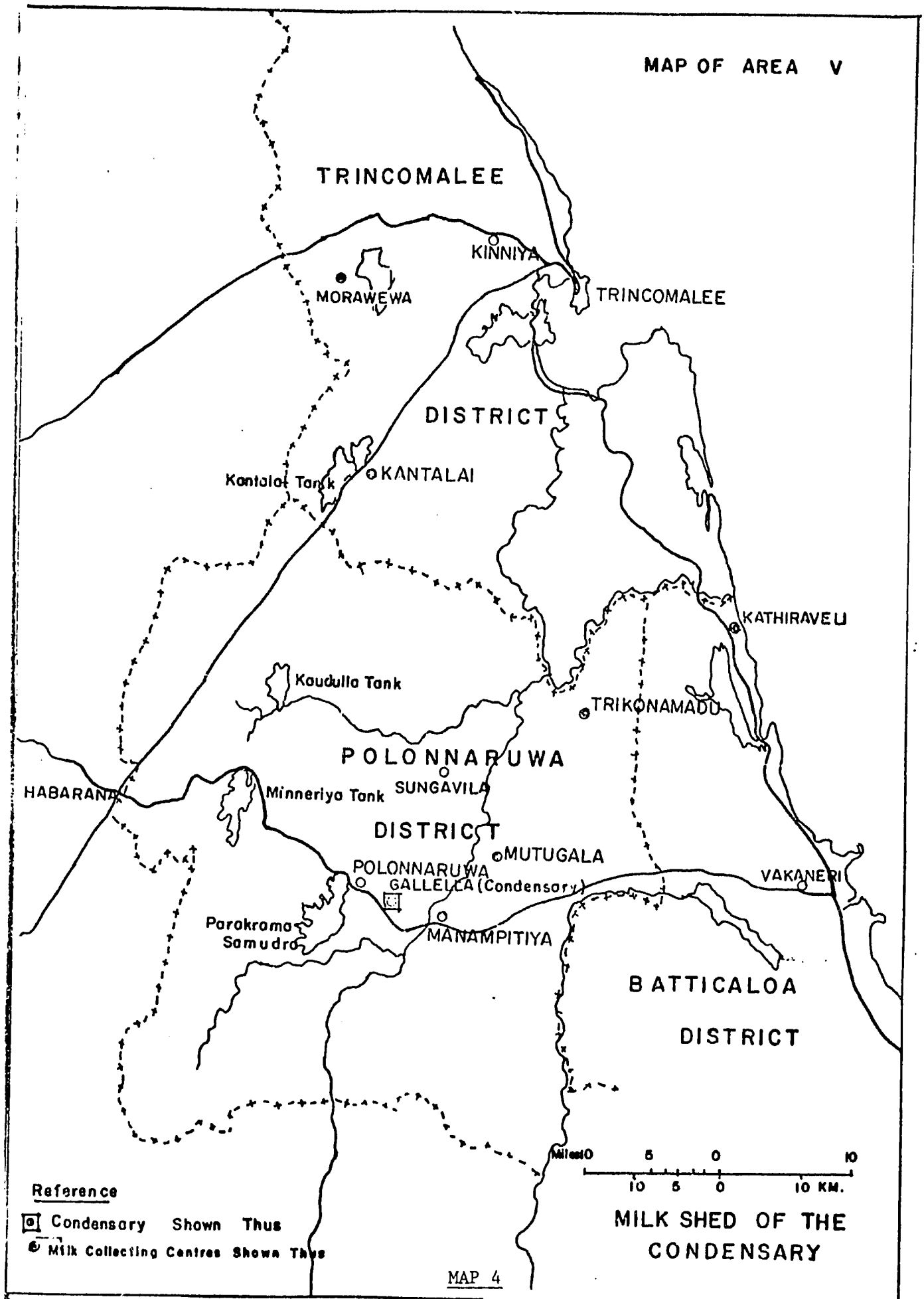
Arthur D. Little International, Inc.


MAP OF AREA II
GALEWELA
PUTTALAM
Deduru Oya
DISTRICT
KURUNEGALA DISTRICT
WARIYAPOLA
MATALE
DODANGASLANDA
DISTRICT
CHILAW
KULIYAPITIYA
KURUNEGALA
NATTANDIYA
PANNALA
NM SDF
POLGAHAWELA
GIRIULLA
KANDY
Maha Oya
KEGALLA
MAWANELLA
KEGALLA DISTRICT
Mahaweli Ganga
MINUWANGODA
GAMPAHA
NITTAMBUWA
1000 Ft Contour
DISTRICT
RUWANWELLA
COLOMBO
Kelani Ganga
BOMIRIYA
NMB PF
NARAHENPITA
MEEPE
COLOMBO DISTRICT
PILIYANDALA
Miles 10 5 0 10
10 5 0 10 KM.
HORANA
BULATHSINHALA
KALUTARA DISTRICT
SRI LANKA
COCONUT TRIANGLE
KALUTARA
Reference
MATUGAMA
PANNALA - NESTLEYS MILK SPRAY DRYING FACTORY
Milk Collecting Centres Shown Thus
NARAHENPITA - NATIONAL MILK BOARD PROCESSING FACTORY

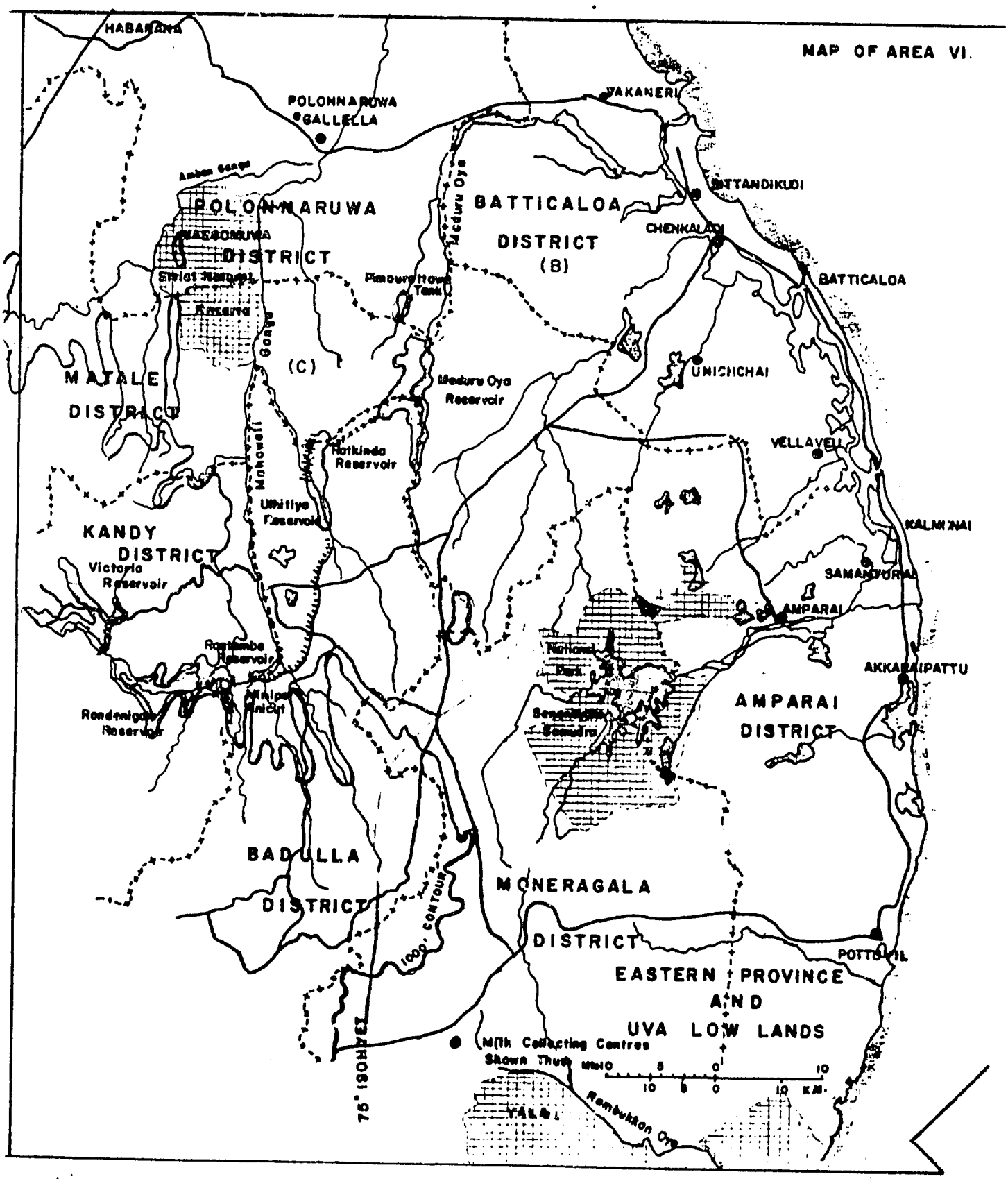
MAP 2


MAP OF AREA III & IV
Amban
Ganga
MATALE
WATTEGAMA
KANDY
MAWANELLA
YATINUWARA
AMPITIYA
GALAHA
GAMPOLA
Victoria Reservoir
Randenigala Res.
Mahaweli Ganga
Uhiliya Oya
Minipe Anicut
KOTMALE Reservoir
NAWALAPITIYA
PUNDALUOYA
RAGALA
Kotmale Oya
NUWARAELIYA
HAWAELIYA
MEEPILIMANA
WELIMADA
KOTAGALA
NORWOOD
AMBEWELA
BADULLA
HALELA
PASSARA
Kehelgamu Oya
Maskeliya
BANDARAWELA
HAPUTALE
3000'
RATNAPURA
BALANGODA
1000'
Reference
Spray Drying Factory
Milk Collecting Centres Shown Thus
Miles 10 5 0 10
10 5 0 10 KM
SRI LANKA
TEA TRIANGLE (HILL COUNTRY)
(ABOVE 3000 FT.)
MID COUNTRY
(1,000 FT. TO 3,000 FT.)

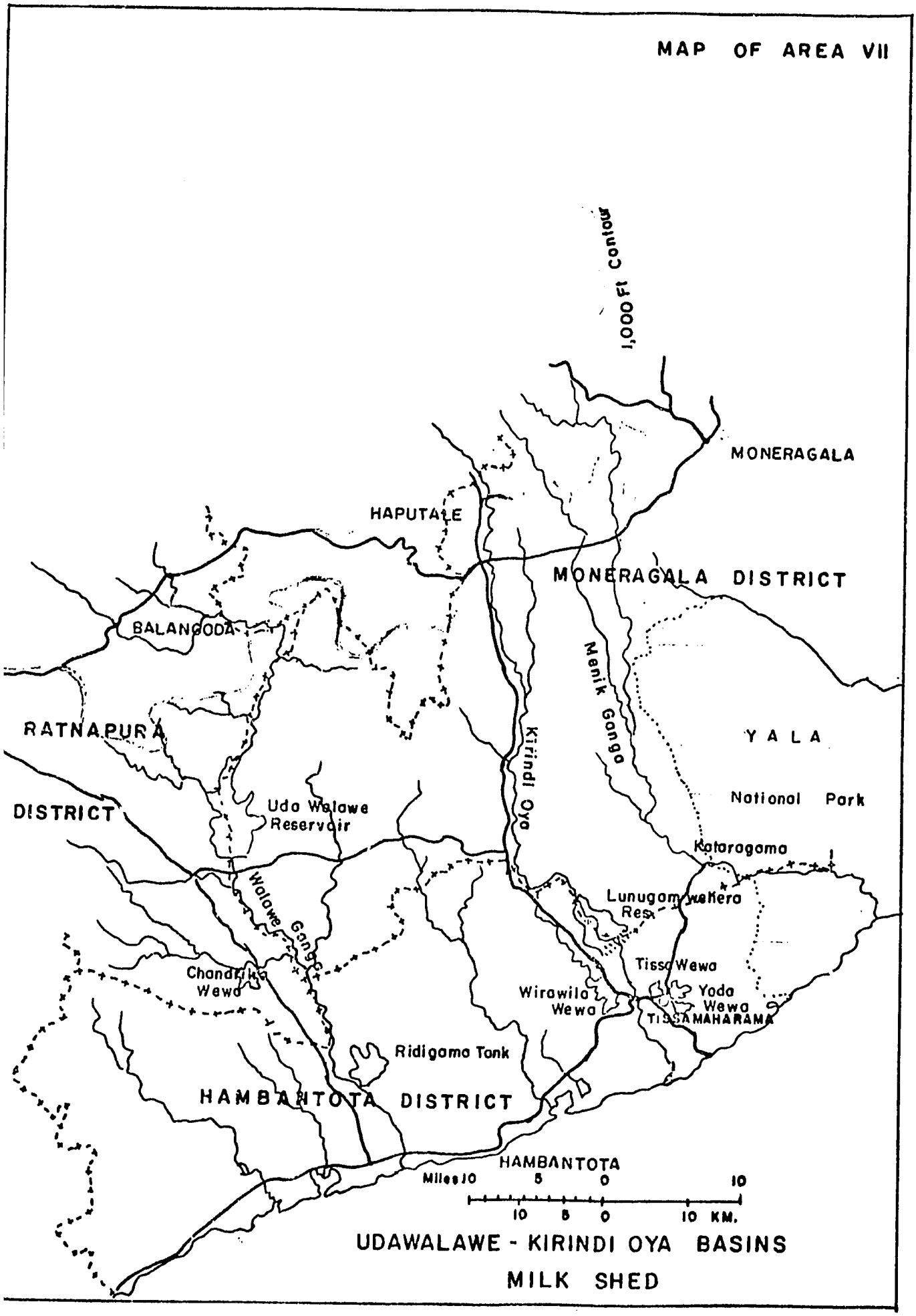
MAP 3


MAP OF AREA V
TRINCOMALEE
KINNIYA
MORAWEWA
TRINCOMALEE
DISTRICT
Kantalai Tank
KANTALAI
KATHIRAVELI
Koudulla Tank
TRIKONAMADU
POLONNARUWA
SUNGAVILA
HABARANA
Minneriya Tank
DISTRICT
MUTUGALA
POLONNARUWA
GALLELLA (Condensary)
VAKANERI
Parakrama Samudra
MANAMPITIYA
BATTICALOA
DISTRICT
Miles 10 5 0 10
10 5 0 10 KM.
Reference
Condensary Shown Thus
Milk Collecting Centres Shown Thus
MILK SHED OF THE CONDENSARY

MAP 4


MAP OF AREA VI.
HABARANA
POLONNARUWA
GALLELLA
VAKANERI
MITTANDIKUDI
CHENKALADI
BATTICALOA
POLONNARUWA
DISTRICT
BATTICALOA
DISTRICT
(B)
Medura Oya
Amban Ganga
Pimburuttowa Tank
Reserve
Gonga
(C)
MATALE
DISTRICT
Medura Oya
Reservoir
UNICHCHAI
Mahaweli
Ganga
Hatkinda
Reservoir
VELLAVELI
Ulhitiya
Reservoir
KANDY
DISTRICT
Victoria
Reservoir
KALMUNAI
SAMANTURAI
AMPARAI
Rantambe
Reservoir
National
Park
AKKARAIPATTU
Randenigala
Reservoir
AMPARAI
DISTRICT
BADULLA
DISTRICT
MONERAGALA
DISTRICT
1000' CONTOUR
POTTUVIL
EASTERN PROVINCE
AND
UVA LOW LANDS
Milk Collecting Centres
Shown Thus
Rambukkan Oya
81° 15' 30"

MAP 5


MAP OF AREA VII
1,000 Ft Contour
MONERAGALA
HAPUTALE
MONERAGALA DISTRICT
BALANGODA
Menik Ganga
RATNAPURA
DISTRICT
Kirindi Oya
YALA
National Park
Udo Walawe
Reservoir
Kataragama
Walawe Ganga
Lunugamwehera
Res
Tissa Wewa
Chandrika
Wewa
Wirawila
Wewa
Yoda
Wewa
TISSAMAHARAMA
Ridigama Tank
HAMBANTOTA DISTRICT
HAMBANTOTA
Miles 10 5 0 10
10 5 0 10 KM.
UDAWALAWE - KIRINDI OYA BASINS
MILK SHED

MAP 6

CHAPTER 6

FISHERIES SECTOR

I. INTRODUCTION

The fisheries sector in Sri Lanka was divided into ten subsectors to rank their individual potential to attract increased private sector investment as well as their potential for increasing export sales, employment, and resource utilization. Appendices at the end of this chapter illustrate the specific considerations that went into the ranking of the individual subsectors. On the basis of this evaluation, one subsector--prawn (shrimp) mariculture production for export--was selected as the most promising opportunity and was subjected to more detailed analysis.

The remainder of this chapter describes the present status of prawn production for export in Sri Lanka and provides an analysis of the opportunities for increased private sector investment in this sector. The factors desicussed include the resource base, production, processing and marketing requirements, and principal opportunities and constraints affecting new private sector investment. The resource requirements and economics associated with a prototypical new prawn mariculture venture are presented, along with estimates of the potential overall impacts of increased prawn products on export earnings and employment. Finally, the immediate need for a master planning activity to focus on mariculture facility siting and technology transfer is identified and discussed.

II. DESCRIPTION OF SECTOR

A. NATURAL RESOURCE BASE

At least four species of prawns of demonstrated commercial value occur naturally in Sri Lanka. These include three marine species of penaeids, *Penaeus monodon*, *P. indicus*, and *P. semisulcatus*, and the giant freshwater prawn, *Macrobrachium rosenbergii*. Naturally occurring populations of the marine species have traditionally been harvested from coastal lagoons and nearshore marine waters using a variety of small craft. The consensus among the Ministry of Fisheries, fishermen/processors, and other resource agency personnel, e.g. FAO, is that the naturally occurring stocks are presently being exploited at or above their maximum sustainable yields.

B. STRUCTURE OF INDUSTRY

About a dozen "packers" are in the business of processing and exporting frozen prawns from Sri Lanka. Most of them depend upon the traditional network of local (village) fishing cooperatives and middlemen/distributors for their supply. A couple of the larger exporters are "vertically integrated", with their own fishing vessels, collection and processing infrastructure, and marketing/distribution operations.

These exporters constitute the major group within the Sri Lanka private sector presently oriented toward forward integration into prawn mariculture opportunities, in most cases with some foreign joint-venture participation. At least one major multi-national (Unilever) in Sri Lanka has also been actively developing prawn mariculture plans, and other individual entrepreneurs have already pursued some mariculture production initiatives.

C. NATURE OF CONSUMPTION

Domestic consumption of prawns produced in Sri Lanka is relatively minor, limited by high price and consumer preference to the public food service (hotel/restaurant) sector of the economy. According to Ministry of Fisheries statistics, domestic consumption may take about 30% of the domestic harvest, with the remainder going to export. Prawns have not been imported into Sri Lanka for domestic consumption in recent years.

D. PUBLIC COMPANY PARTICIPATION

Although a few public and quasi-public companies, e.g., the Ceylon Fisheries Corporation, play a major role in the Sri Lankan fisheries sector in general, their present role in prawn production, processing, and distribution is quite limited and of no apparent significance to private sector investment. As noted below, public sector involvement, particularly in the form of hatchery operations and land management, could have an important effect on future mariculture activities.

E. GOVERNMENT REGULATION

Prawn exports, like other seafood exports, are subject to a 5% export duty. Other government constraints on prawn production by natural harvest are minimal. The government, as land manager, reviews and approves the proposals of the private sector for new coastal mariculture ventures. There is a general sense that the number and size of potentially suitable prawn mariculture sites are limited; therefore, the government's role in establishing and implementing policies for site allocation is expected to assume major importance.

The government traditionally provides major production subsidies in the fisheries sector which tend to circumscribe private sector

investment opportunities. Thus far, subsidies applicable to prawn production have been for purchase of harvest vessels and gear. Subsidies of mariculture activities through hatchery production and supply of postlarval prawns would significantly reduce the entry requirements (capital and know-how) for the private sector entrepreneur. Thus, the number of prospective indigenous private sector investors might well increase from fewer than ten to well over one hundred.

Another policy factor that should benefit prospective prawn mariculture entrepreneurs is their eligibility for the relatively low-interest financing (interest rates in the 12-15% range) available to export production ventures.

F. RECENT TRENDS AND EVENTS

At least two of the larger, more vertically integrated seafood exporters in Sri Lanka are actively pursuing the establishment of commercial-scale prawn mariculture production ventures. One of these, for production on a 1,000 acre site, was being reviewed by a commercial bank during the course of this study. A small businessman from Colombo had established a small (approximately 3 acre) prawn mariculture venture near Batticaloa on the East Coast. Initial success led him to propose an expansion to a 10-20 acre operation based on joint venture/subsidy with the government. At least one other small-scale venture was beginning operations near Batticaloa. Unilever was actively pursuing near-term commercialization of its pilot Macrobrachium culture project, possibly with re-orientation toward production of the marine penaied species. Other medium-sized export companies had conducted detailed feasibility studies and made specific project proposals based on varying degrees of foreign joint-venture participation, but these projects have been held in abeyance for various reasons relating to site selection and/or capital formation. At the same time, the Ministry of Fisheries, working with

U.S. AID, was considering studies focused on the technology and economics of penaeid mariculture, looking toward subsequent establishment of hatcheries and other facilities related to subsidized production.

III. PRODUCTION

A. SIZE AND LOCATION OF PRODUCTION ACTIVITIES

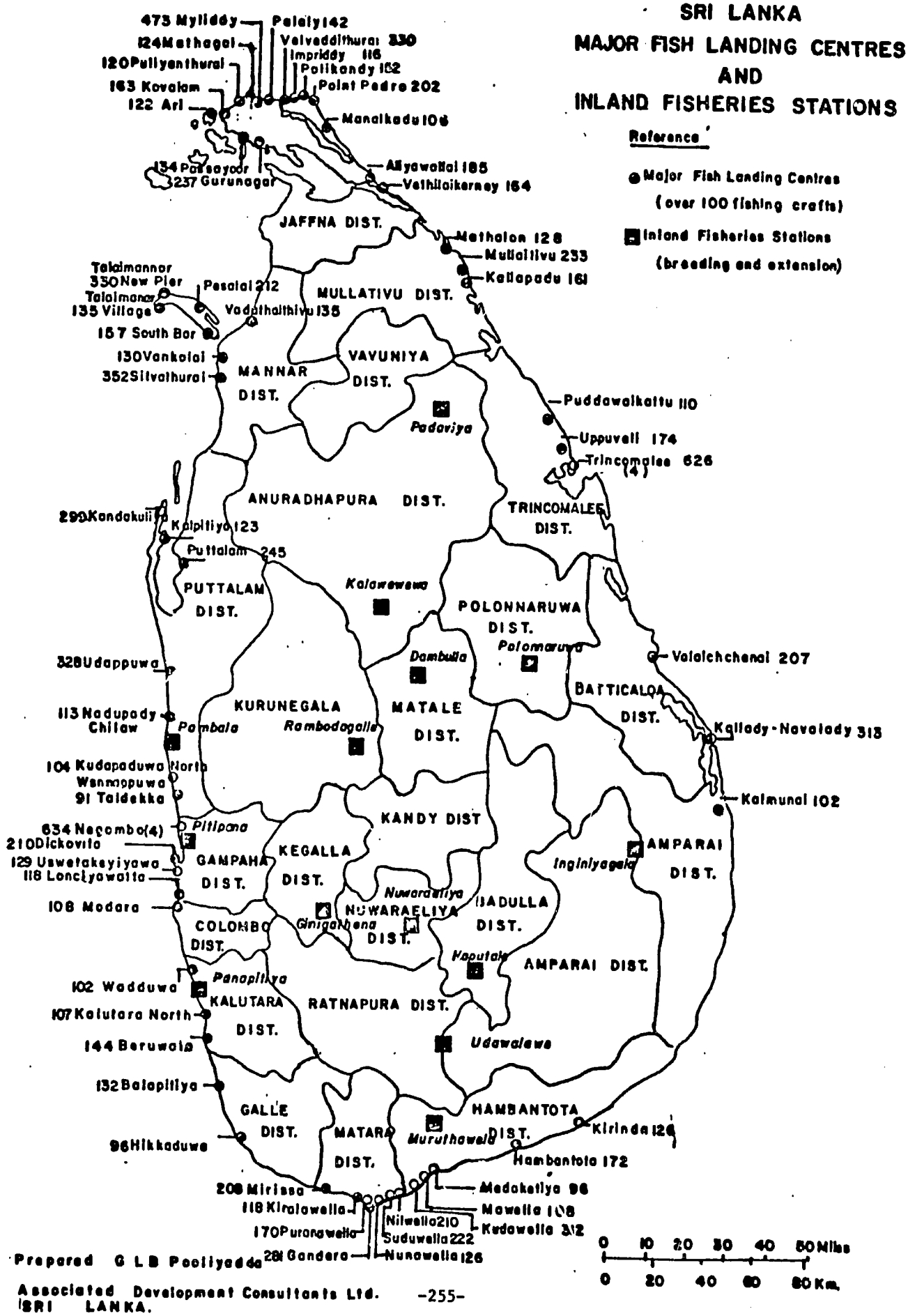
Sri Lankan prawn production based on harvest of naturally occurring populations has recently been 5,000-6,500 tons per year. Harvesting is by trawl-netting from numerous small to medium-sized craft in the coastal lagoons. Subsequent off-loading is to iced lorries with same day transport to processing facilities, mostly in the northern and western coastal communities.

Figure 1, the map of major fish landing centers, includes illustration of the present major prawn harvest areas, which contain significant coastal lagoons. These include Gampaha, Puttalam, and Mannar on the west coast, Jaffna in the north, and Batticaloa and Trincomalee on the east coast. Prospective mariculture site selection studies have examined various coastal areas, and small pond culture ventures are operating near Batticaloa. Soil and hydrologic conditions appear to favor coastal sites in the Puttalam District as the immediate target for private sector prawn mariculture entrepreneurs.

B. PRICES

"Dockside" prices for prawns vary with the size composition of the catch. This problem would be mitigated (possibly eliminated) with mariculture. The price paid by processors is about 30% of the CIF price of the processed, frozen product. Because some of the processor/exporters have their own harvest vessels, there appears to be reasonable price consistency and relatively less opportunity for wholesale distributor price control in prawn production than in some other agricultural sectors.

As detailed in Section VI, it is expected that mariculture production costs would be highly competitive with present and anticipated costs of natural harvest.



Arthur D. Little International, Inc.

C. CONSTRAINTS

There are now two major constraints confronting prawn production by natural harvest in Sri Lanka:

1. Resource supply - there simply are not enough prawns in the coastal waters to supply the existing processing capacity and export demand.
2. Environmental quality - in isolated instances restrictions of water movement and/or industrial water pollution in coastal lagoons have limited natural prawn production.

Prawn mariculture could be designed to eliminate the first of these constraints, but would be limited by the availability of suitable sites.

The second constraint could also limit site suitability for mariculture ventures. Protection/improvement of water quality would be an important factor in the development of a plan to facilitate private sector mariculture.

IV. PROCESSING

A. PROCESSING ACTIVITIES

Prawn processing for export first involves cleaning of the individual prawns by hand, including (in order of decreasing frequency) de-heading, peeling, and de-veining of certain types. The cleaned prawns are then quick-frozen in packages suitable for wholesale or retail distribution. The technology is quite simple, but adherence to rigid sanitation and cold storage protocols is essential to maintenance of acceptable product quality for the U.S., Japanese, and Australian markets. The larger of the approximately one dozen process/export operations can handle 2-3 tons of prawns per day.

B. INTEGRATION PROCESSING COSTS, AND CONSTRAINTS

As noted above, most prawn processors are also exporters, and some are producers (fishermen) as well. They are extremely well-integrated with distribution/marketing systems, and are hoping to forward-integrate into more reliable resource supply by mariculture.

Processing costs are about Rs. 12/kg for the smaller, less valuable prawns, or about 10-15% of the selling price. The profit margin is higher for the easier to clean and more highly-valued larger prawns, as would be produced in mariculture operations.

The shortage and general instability of the resource supply by natural harvest leads to chronic underutilization of processing capacity. Increased production volumes and relatively reliable and steady supplies are major factors favoring mariculture as a potential means of mitigating/eliminating supply constraints on processing activities.

V. MARKETING AND DISTRIBUTION

A. EXISTING MARKETS

About 90% of Sri Lanka's prawn exports go to Japan, which imports about twice as much prawns every month as Sri Lanka produces in a year. Most of the remaining 10% goes to the United States, which imports about 15-20 times as much frozen prawns as Sri Lanka can presently produce. Marketing connections to Japan are well-established and could be expanded in the U.S. with little difficulty if enough prawns were available. Other potential markets, presently ignored because of the inability to satisfy the high-priced Japanese demand, include the Middle East and Western Europe. As noted above, marketing and distribution are already extremely well-integrated with production, and would enhance the likelihood of success of mariculture ventures.

B. DISTRIBUTION COSTS AND MARKET PRICES

The Japanese market is favored by Sri Lankan prawn exporters because it pays premium prices and offers far lower freight rates than the U.S market. Distribution is accomplished by container ships, with costs around Rs 8/kg to Japan. The Japanese pay between Rs 100 and Rs 300/kg of frozen prawns, with the larger prawns commanding the higher prices. The average price is roughly Rs 200/kg. The vertically integrated producer/exporter can presently realize profit margins of 50% on prawn exports to Japan.

The U.S. market pays somewhat less (averaging about Rs 150 per kilo) and is somewhat more expensive to serve, with freight rates of about Rs 12/kilo. Nonetheless, the U.S. market remains both large and profitable for the prospective private sector prawn producer.

C. CONSTRAINTS

The three principal constraints on marketing/distribution of Sri Lankan prawns, are:

1. Supply - the demand in the major developed markets (Japan, U.S.) continues to grow for the type of prawns Sri Lanka can produce, and Sri Lanka can presently supply less than 3% of that demand.
2. Quality control - representatives of the various prawn exporters acknowledged that the quality of product exported by the dozen "packers" is variable. The lack of export quality control has made market development quite difficult in some geographic areas, e.g., Australia. Quality control could become an increasingly important factor if government production subsidy allowed many new, inexperienced entrepreneurs to begin producing prawns by mariculture and exporting it.
3. Freight rates and duties - the higher freight rates to serve the United States and Western Europe constrain, but certainly do not prevent, the development of those markets by Sri Lankan exporters. The 5% export duty likewise is viewed as a constraint/nuisance by Sri Lankan exporters, but it was never cited during this study as an important decision criterion.

VI. OPPORTUNITIES IN PRAWN (SHRIMP) MARICULTURE

A. GENERAL DESCRIPTION

Sri Lanka is already an important producer and exporter of prawns, with a steady demand in both domestic and foreign markets. Sri Lankan prawns command a premium price, especially in Japan. The technology of prawn mariculture ("shrimp farming") is rapidly developing; commercial prawn mariculture ventures are being undertaken in other countries. Sri Lanka has the resources necessary for successful prawn mariculture--a warm climate, and flat terrain with appropriate soil characteristics and ready access to warm, relatively clean seawater.

For this report the study team used a large hypothetical Sri Lankan prawn farm as the base case. This farm would occupy an area of roughly 200 hectares; 80% of this land area would consist of shallow ponds. The project would yield more than 250,000 kg of marketable prawns annually by mixed culture of P. monodon and P. indicus. Revenue would be about Rs 500,000/hectare. Such a project would employ about 500 people, most of whom would be unskilled laborers. The new agricultural skills introduced to the local population would be transferrable either to similar large projects or to much smaller family or community undertakings. The project would be extremely profitable.

B. MARKETS

Sri Lankan prawn production is valued at roughly Rs 200 million/year, with about 70% attributable to foreign sales. Local trading companies have established access to foreign markets for themselves and future local producers. For continued and increased success in this market, Sri Lanka must remain a reliable source of supply and keep its prawn production costs within a reasonable range.

The market for prawns is strong and demonstrates considerable growth potential if the supply can be increased. As noted in Section V, present Sri Lankan prawn production satisfies less than 3% of the demand in the major established export markets (United States and Japan), and has not even scratched the surface of potential Middle Eastern or European markets. Therefore, new producers can enter the market easily.

C. COMMERCIAL ATTRACTIVENESS

The base case project would realize sales revenue of about Rs 100 million annually. The profit margin could be on the order of 30%, suggesting a cash flow of approximately Rs 33 million annually. Most of the operating costs are attributable to labor and amortization of the capital investment. Raw materials, principally prawn feed, would take less than 10% of total revenue.

As shown in Table 1, the capital investment is Rs 97 million, nearly half of which is to construct the prawn ponds. Large investments are also associated with working capital, auxiliary facilities feed preparation, prawn processing and storage, and security systems.

Assessment of annual operating costs is shown in Table 2. This is a simplified picture, characteristic of the situation at some early point in the project life but after full production has been established. Assuming that 75% of the capital investment has been financed by a loan and is amortized over 5 years at 13%, nearly 40% of operating costs would go to loan amortization. The next largest operating cost elements are prawn feed and labor.

Larger projects should show improved profitability from economies of scale in the prawn hatchery, feed preparation, and final processing and storage facilities. Such projects will also make better use of highly paid technical staff. An unsubsidized prawn farming enterprise would be only marginally profitable, however, if reduced from the base

TABLE 1

ESTIMATED CAPITAL INVESTMENT - PRAWN MARICULTURE

Cost Component	Million Rupee	
Pond Construction, including seawater supply	40.7	
Hatchery & Laboratory Facilities	5.0	
Feed Preparation	5.8	
Prawn Processing & Storage	4.1	
Utilities	0.9	
Office & Support Facilities	4.7	
Fence & Security Systems	4.1	
Vehicles, including boats	2.5	
Subtotal - Direct Costs	67.8	
Engineering & Construction Management	5.4	
Contingency	11.0	
Subtotal - Fixed Capital Investment		84.2
Working Capital		12.5
TOTAL CAPITAL INVESTMENT		96.7

TABLE 2

ESTIMATED OPERATING COST - PRAWN MARICULTURE

	Million Rupee
Variable Production Costs	
Prawn Feed (1364 tonne @ R. 5.1/kg)	6.90
Packaging Materials (220,000 boxes @ R. 2.3/box)	0.51
Contract Hauling & Waste Disposal	0.16
Subtotal	7.57
Semi-Variable Production Costs	
Labor, including skilled and unskilled	8.85
Labor Overheads, including meals	3.38
Maintenance Labor and Materials	1.69
Fuel	.41
Subtotal	14.33
Fixed Production Costs	
Land Rental (202 ha @ R. 739/ha-yr)	.15
Insurance	1.69
Depreciation (20 years - straight line)	3.38
Loan Amortization (75% of TCI, 5 years @ 13%)	24.43
Subtotal	29.65
Selling (Export) Expenses	
Export Fee (5% of Export Value, see note)	4.67
Shipping (R. 7.61/kg)	2.07
Selling Expense (R. 7.61/kg)	2.07
Subtotal	8.81
TOTAL COSTS	60.35

Note: Revenues estimated on basis of 136,000 kg (indicus) prawn tails sold at R. 300/kg plus 136,000 kg (monodon) prawn tails sold at Rs 390/kg.

case size (162 hectares of ponds) to only 50 hectares of pond area. On the other hand, much smaller projects can also be profitable under the right circumstances. If, for example, the government or some other responsible organization provided a reliable supply of postlarval prawns and technical expertise, and if rapid iced transport to central processing facilities were available, then prawn farms as small as one hectare in size might be economically attractive.

D. FACTORS REQUIRED FOR SUCCESS

The principal requirement for a successful prawn mariculture operation is an adequate area of flat, clay soil adjacent to warm, fresh seawater. As illustrated in Table 1, the major capital investment in such a project is for pond construction. The base case assumes--that the project can be built on level, lightly vegetated areas at original elevations within one foot of the high tide level. Heavy vegetation and uneven terrain--requiring very extensive grubbing and grading for site preparation--will significantly increase the capital costs above the level suggested by the base case study. If the soil is such that simply constructed ponds will not hold water, pond linings will also quickly push pond costs to unreasonable levels.

In Table 1 little investment is allocated to the seawater supply system. It is assumed that clean seawater is available within 300 feet of shore at a depth of less than 100 feet. If the surrounding sea is polluted, high yield production of marketable prawns will simply not be possible. Ponds elevated much more several feet above sea level will incur unreasonably high seawater pumping costs.

To limit depredation of the prawn ponds by people and animals, a security system employing fences and guards has been anticipated. Pond depths were set at 3 feet to reduce prawn loss from wading birds. Poor security, shallow ponds, and poor water supply can have markedly adverse effects on yield, and, hence, on the profitability of a mariculture venture.

Some infrastructure is necessary, although the base case analysis presumes no costs for additional roads or port facilities. The project is assumed to be located adjacent to existing roads and within a short distance of marketing centers so that its products can be shipped economically and rapidly with minimal spoilage. Availability of existing prawn processing and packing facilities or feed preparation facilities could reduce capital investment by several million rupees below the base case. For some of the present exporters planning forward integration into mariculture, precisely such an advantage exists.

As shown in Tables 1 and 2, access to low cost financing can be a significant economic advantage in the first few years of a project. Perhaps even more important is availability of additional working capital in the early years. Several mariculture operations in other parts of the world have gone for several years with yields considerably below expected levels simply because of adverse weather or unforeseen disease problems in the prawn ponds. To overcome such hardships, typical of any agricultural venture, working capital must be available.

As mentioned earlier, the technology of prawn mariculture is rapidly developing, mainly in locations other than Sri Lanka. Access to the best available technology is crucial to a successful operation. Technology may be imported to Sri Lanka through consulting and/or foreign joint ventures. Four areas of expertise are crucial to a self-contained project: water management, prawn reproduction and hatchery operation, disease control, and feeding. If the project is to become a reliable supplier of prawns and be able to stock fully all of the ponds at its disposal, it must be able to breed prawns and operate a successful hatchery. Alternatively (or in addition), the government may breed prawns and supply post-larvae to small or medium-sized private grow-out operations.

Control of disease is crucial if a profitable yield is to be obtained. Base case assumes a yield of 1500 pounds per acre of

marketable prawn tails per year; this is equivalent to 2800 kg per hectare of 15-35 count (per pound) prawns. This yield is within the range presently achievable by commercial prawn mariculture if such techniques as proper pond water turnover and staged grow-out are practiced. A 50% reduction in this yield, which could easily occur for an inexperienced and underqualified prawn farmer, would result in an unprofitable operation.

If a prawn farmer is to be more than marginally successful, he must control feeding, since both underfeeding and overfeeding can have adverse effects on yield. Careful selection of feed ingredients is necessary for high growth rate, low incidence of disease, and reasonable feed costs.

Emerging government policy will have a significant impact on the attractiveness of prawn mariculture as an investment for the private sector. Most importantly, the government must have land use policies that allow favorable sites to be identified and utilized cost-effectively by private mariculture ventures. Of almost equal importance, fouling of the adjacent seawater by hydrologic modifications or chemical or biological pollutants must be avoided. Finally, the availability of government financing and technical support, crucial to smaller prawn farming ventures, is a complex policy issue. It is necessary to consider the pros and cons of subsidized, small-holder production vs larger, self contained private operations, and perhaps a mixture of the two. These pros and cons may be summarized as follows:

- Small-holder production subsidized by government hatchery operations would allow many new participants in prawn mariculture, if there is sufficient suitable land e.g., more than 10,000 acres. This approach might maximize employment.
- If, as is popularly believed at present, suitable land is limited, e.g., 2,000 - 5,000 acres, emphasis on small-holder culture could pre-empt and/or discourage the larger, more cost-effective vertically integrated private sector operations, each of which would need at least 500 acres.

- Larger, privately-financed production facilities would be more profitable and produce greater net earnings for Sri Lanka than operations subsidized by government spending.
- Government subsidy could allow entry of entrepreneurs with marginal technical and financial resources and inadequate quality-control experience or intentions. In this case, of less reliable supply and poorer quality products would be more likely to reach the export market, where such factors have traditionally created major problems.

E. BROAD IMPACTS

The base case prawn mariculture venture would employ approximately 500 people, 400 of whom would be unskilled laborers. This employment would be regular and year around, showing little seasonal variability. If projects already in the advanced planning stages are implemented, some 1500-2000 people could be directly employed in prawn mariculture production in the next few years. Furthermore, an Rs 40 million investment in pond construction represents a significant construction effort with associated short-term employment opportunities.

Because most of the cultured prawns are likely to be exported to foreign markets, such a venture could be a significant source of foreign exchange. Commitment of an additional 2,000 acres to prawn mariculture could essentially double present Sri Lankan prawn exports (if natural harvests are maintained), bringing export sales to Rs 500 million annually. If 10,000 acres were eventually in full production, prawn exports would roughly equal the value of present rubber exports.

Because prawn mariculture depends on a steady supply of fresh salt water, such a project can be a means for regional development of marginal lands.

Prawn mariculture will have some interaction with other existing industries. Prawn feed may use by-products (fish meal) and

agricultural wastes (e.g., rice bran). Furthermore, if prawn mariculture operations are located in such areas as the West Coast for example, they may employ presently underutilized food processing and storage facilities.

F. RECOMMENDATIONS

Private developers have already expressed interest in establishing prawn mariculture ventures in Sri Lanka. The Sri Lankan government should encourage these developers, but see that such projects maximize local benefits. Training local personnel in the technical skills required for a successful mariculture operation will be especially important. Developers may provide the seed for more widespread adoption of this technology and employment of local personnel and resources.

As mentioned previously, availability of clean seawater is crucial. The government should continue and expand efforts to protect the Sri Lankan shoreline from pollution by marine or land-based activities.

It is recommended that the Government immediately initiate a master planning activity for brackish mariculture with the following features:

- Assembly and review of the existing information on site suitability as developed to date by both the public sector and willing participants in the private sector.
- Promulgation of an interim Master Plan based on the above review and technical/economic analysis, providing guidelines for size and location of new prawn mariculture ventures and the extent of government subsidy (if any). This should be a "pessimistic" plan, assuming suitability of sites only where proven by credible empirical data.
- Development and execution of a supplemental data collection plan to provide the additional information on the

suitability of coastal areas where adequate data are not available.

- Periodic update of the Master Plan based on the supplemental data developed in (3) above.

Above all, it cannot be overemphasized that the private sector wishes to deal with a consistent, clearly defined set of policy guidelines that provides entrepreneurs with a reference point for their investment decisions.

APPENDIX A

SUBSECTOR ANALYSIS - PRAWN MARICULTURE PRODUCTION FOR EXPORT

	Potential			
	High	Med	Low	Comments
1. Incentives for private investment	X			-Established, large, growing markets -Linkage to existing processing capacity -High profit margins -Favorable physical and biological conditions
2. Constraints		X		-Site availability/selection -Capital requirement/availability -Technology transfer -Sociocultural issues (role of government, land use, religious tradition)
3. Risk	X ←→	X		-Crop failure potential
4. Impact Potential				
Balance of Trade	X			-Additional $15-20 MM+ in export sales by 1985?
Resource Utilization	X			-Natural harvest cannot match demand
Employment		X		-1 person per 1-2 acres, 2,000+ people by 1985?
5. Overall Potential	X			-Several commercial scale efforts in advanced planning/early implementation -2,000+ acres in production by 1985?

APPENDIX B

SUBSECTOR ANALYSIS - SPECIALTY PRODUCTS FOR EXPORTS

(Bêche de Mer, Sharkfins, Jellyfish, Seaweed)

	Potential			
	High	Med	Low	Comments
1. Incentives for private investment		?		- High value-added exports - Some established markets - Suitable species present - Collection relatively simple and inexpensive
2. Constraints	? ←→	?		- Market size appears limited - Long-term resource availability? - Foreign competition? - Customers prefer to do own processing - Processing scale and capital requirements uncertain - Processing technology transfer required - Sustained resource availability
3. Risks		?		
4. Impact Potential				
Balance of Trade		X←→	X	- High value per unit, but low volume
Resource Utilization	X→	?		- Resource may be small
Employment			X	- Not labor-intensive
5. Overall Potential		X←→	X	- Need foreign joint venture

APPENDIX C

SUBSECTOR ANALYSIS - VALUE-ADDED PROCESSING OF INLAND FINFISH

	Potential			
	High	Med	Low	Comments
1. Incentives for private investment		? ←→	X	- Resource supply increasing with government subsidy - Prospects for market growth? - Possible vertical integration with animal feed production - Testing of production technology and markets underway
2. Constraints	X ←→	?		- High capital investment required, with uncertain market/profit margin and limited capital formation potential - Traditionally low-value species - Market research/development required - Domestic market orientation - Logistics of supply (collection, transportation, seasonality) unresolved
3. Risks	X ←→	?		- Basic marketing information lacking, present risk may change
4. Impact Potential				
Balance of Trade		?←→	?	- Domestic market, but possible substitution for imported fish meal and dried fish
Resource Utilization	X			- Presently underutilized resources
Employment		?←→	X	- Not labor-intensive
5. Overall Potential		?←→	?	- Contingent on market research and development

APPENDIX D

SUBSECTOR ANALYSIS - AQUARIUM EXOTICS FOR EXPORT

	Potential High	Potential Med	Potential Low	Comments
1. Incentives for private investment		X →	?	- Established and potentially larger markets - Access to desirable species - Production technology and skills established in a few operators
2. Constraints	X			- High capital requirement for integrated operation, plus low capital formation - Strong foreign competition with air freight advantages - Domestic resources limited (need Maldives) - Quality control problems - High costs of packaging materials
3. Risks	X			- Shipment losses not infrequent
4. Impact Potential				
Balance of Trade		X←→	X	- High value, low volume
Resource Utilization		X←→	X	- Partly domestic resource
Employment			X	- Not labor-intensive
5. Overall Potential		?←→	X	- Could be higher if favorable air freight arrangements could be made

APPENDIX E

SUBSECTOR ANALYSIS - LARGE MARINE PELAGIC FINFISH (TUNA, ETC.)

	Potential			Comments
	High	Med	Low	
1. Incentives for private investment		X←→	X	- Suitable species present - Existing handling facilities - Known markets - Some history of interested foreign investors
2. Constraints	X			- Market mediocre/unfavorable - Relatively expensive, sophisticated fishing - Strong foreign competition - Long-term yield of resource uncertain - Domestic consumption vs. export priorities
3. Risks	X			- Uncertain market strength - Resource depletion potential?
4. Impact Potential				
Balance of Trade		X←→	X	- Value and volume limited by demand and priority of domestic consumption
Resource Utilization		?		-May be or become overexploited
Employment			X	- Not labor-intensive
5. Overall Potential		?←→	X	- Foreign joint venture required

APPENDIX F

SUBSECTOR ANALYSIS - OTHER MARINE FINFISH (DEMERSAL AND SMALLER PELAGICS)

	Potential High	Potential Med	Potential Low	Comments
1. Incentives for private investment			X	- Significant government subsidies - Well established domestic market - Some room for greater yield from resource base - Possible export market for larger demersals (snapper, grouper) - Vertical integration (equipment supply) possible
2. Constraints	X			- Low profit margins - Limited market growth - Limited export opportunities - High capital costs and mediocre yields for trawl fisheries - Access to some resource areas limited by international agreement - Public and quasi-public investment dominates at present
3. Risks	X ←→	X		- Anything can go wrong and usually does
4. Impact Potential				
Balance of Trade			X	- Heavy emphasis on domestic market, small potential for import substitution
Resource Utilization		X ←→	X	- Limited room for incremental growth
Employment		X ←→	X	- Limited room for incremental growth
5. Overall Potential			X	

SUBSECTOR ANALYSIS - FISHING EQUIPMENT MANUFACTURE (BOATS, GEAR, ETC.)

	Potential			Comments
	High	Med	Low	
1. Incentives for private investment			X	- Large recent government production/ purchasing subsidies - Some future needs for replacement - Some present export demand - Some linkages to other light manufacturing subsectors
2. Constraints	X			- Domestic market and subsidies likely to decline significantly - Lack of reliable demand, market characterization, and market establishment for export - High materials costs significantly reduce profit margins - Strong foreign competition
3. Risks	X			- Declining domestic demand plus export constraints/uncertainty
4. Overall Potential				
Balance of Trade			X	- Low volume, low profit margins
Resource Utilization			X	- Materials import requirements, lack of natural resource consumption
Employment		?←→	X	- Depending on demand
5. Overall Potential			X	- Declining domestic demand plus export constraints/uncertainty

APPENDIX H

SUBSECTOR ANALYSIS - CULTURE OF BIVALVES (OYSTERS, MUSSELS, ETC.)

	Potential High	Potential Med	Potential Low	Comments
1. Incentives for private investment	←	?	→	- Possibilities for multi-purpose operations (meats, pearls, shells) - Potentially suitable physical/ biological conditions - Production technology relatively simple, inexpensive, if adequate natural recruitment - Some active foreign investor interest
2. Constraint	?←	→?		- Market characteristics uncertain market establishment required - Natural recruitment uncertain - Without natural recruitment, production technology relatively expensive; sophisticated transfer required
3. Risks	X			- Anything can go wrong and usually does
4. Impact Potential				
Balance of Trade	X ←	? →		- Market characteristics uncertain
Resource Utilization	X ←	? →		- Productivity/exploitation potential uncertain
Employment			X	- Not labor-intensive
5. Overall Potential	←	?	→	- Need more information on market and resource - Foreign joint venture desirable or required?

APPENDIX I

SUBSECTOR ANALYSIS - SQUID/CUTTLEFISH FOR EXPORT

	Potential High	Potential Med	Potential Low	Comments
1. Incentives for private investment		X		- Some apparent export markets, existing demand - Some active foreign joint venture effort - Desirable species present at least seasonally - Some harvesting possible with available equipment/techniques
2. Constraints	←	?		- Specialized fishery can be expensive relatively sophisticated - Seasonality and long-term productivity of resource uncertain - Market size and foreign competition uncertain
3. Risk	←	?		- Market resource uncertainties at present
4. Impact Potential				
Balance of Trade		?↔	?	- Potential volume uncertain
Resource Utilization	?↔	?		- Degree of present/potential exploitation uncertain
Employment			X	- Not labor-intensive
5. Overall Potential	←	?	→	- Need better market/resource information - Foreign joint venture desirable or required

CHAPTER 7

OTHER SECTOR OPPORTUNITIES

A major focus of this private sector assessment study has been to identify key subsectors with promise and then to elaborate on their potential. Thus, the agro-industrial areas of dairy, fruits and vegetables, coconut products, and fisheries, were selected for detailed analysis and presentation. However, in the course of the study, a number of additional opportunity areas surfaced. While it was not possible to explore these in any detail, it was felt that their inclusion in the report was important so that the government and various donor agencies might consider them for analysis at a subsequent date. In fact, some of these miscellaneous opportunities may hold equal if not greater promise for near-term implementation and developmental impact than some of those presented for the subsectors examined in more detail.

1. Sugar

Four new sugar projects are currently being planned for Sri Lanka. However, the production from these mills will still fall short of demand (both nutritional and market). If Sri Lanka permits demand to be determined by market forces, then two additional mills with associated sugarcane production will be required by 1990 and as many as seven more by 2000. This assumes an average project capacity of 30-40,000 tons annually.

Assuming Rs 13 per kilogram for refined sugar, annual revenues for a project would be Rs 400-500 million. Investment in land development, cane production, and milling would be in the range of Rs 0.9-1.1 billion per project. (The possibility may exist to purchase used mills elsewhere in the world and transport the machinery and equipment to Sri Lanka at a considerably lower initial investment.)

A 30-40,000 ton mill would tend to draw sugarcane from 5-6,000 hectares. If half this land were farmed by the nucleus estate and half by small farms, then each project might support as many as 2,000 small farmers growing 1-2 hectares of cane.

Three main uncertainties face further investment in sugarcane projects: (1) the availability of suitable land (i.e., proper soils, drainage, topography, and rainfall) in a generally concentrated block of 5-6,000 hectares (or 2-3,000 hectares contiguous to small farmers willing to convert to cane), (2) access to the large capital needed for such a project, and (3) medium-to-long term stability in Government policy regarding imports, duties, taxes. financial support and subsidies, guaranteed returns, etc.

2. Corn Sweeteners

Presently in the West, perhaps 75 percent of all sweeteners is cane or beet sugar. The remainder is corn (maize) sweeteners. Sri Lanka can grow corn. In fact, irrigated corn may provide an alternative crop to rice for part of the Mahaweli project. Thus, the possibility exists that a wet corn milling project might be (or eventually be) a viable option for Sri Lanka to meet some of its sweetener needs. Corn sweeteners tend to be priced at about 70-75 percent of sugar.

Due to consumer preference for crystallized (white or brown) versus liquid sweeteners, such as from corn, corn sweeteners tend to be used primarily in food products, e.g., beverages, baking products, ice cream, confectionary. In such products, the characteristic of crystal versus liquid is lost, so price often becomes the determining factor so long as the food product's formulation can be modified to accommodate the corn sweetener. While no estimates are available for Sri Lanka, it is presumed that the percent of sugar used by the food industry (as opposed to home consumption) is considerably less than in the West, perhaps 5-10 percent rather than 25 percent. Thus, the

current market for such a sweetener may presently not exceed 10-20,000 tons annually although this would be expected to grow to 20-30,000 tons by 1990 and perhaps 40-60,000 tons by 2000.

In the West, typical new mills produce 500 tons of sweetener per day, a volume far in excess of Sri Lanka's current or probable future needs for a liquid sweetener, like corn. However, mills one-fourth that size have been built in recent years and smaller ones may be possible. Thus, it is possible that by the end of the decade, a wet corn mill for sweeteners may be viable from a market/mill capacity standpoint. This timing may also fit well with maize production since it is not yet known how successful efforts to significantly expand maize production will be; within five years, the ability of the country to generate sufficient raw materials at a reasonable price for a wet corn mill should be known.

As with cane sugar projects, a corn sweetener project is also large and expensive. For the mill alone (150 ton per day capacity), the investment may be Rs 400-500 million. This does not include the land development and farm production investment required for the 10-15,000 hectares needed to support a mill of this size.

In addition to the corn sweetener, a mill produces several valuable by-products: corn oil, and several grades of animal feeds (gluten meal, gluten feed). On a percentage basis, raw material yield is:

Sweetener	60
High gluten feeds	27
Corn oil	2-3
Moisture, losses	10-11

Thus, a 150 tons per day sweetener facility would also generate about 6.5 tons of oil and 70 tons of high gluten feeds. On an annual basis (operating 300 days per year), this would be 45,000 tons of sweetener; 1,950 tons of oil; and 21,000 tons of feed. The high gluten feed is typically used in the dairy industry and presently has

a generally strong export market. (In the U.S., the sale of by-products generates US$0.40 for every US$1.00 spent on raw materials. Thus, the sale of the primary product - the sweetener - need only cover 60 percent of raw material costs.)

The same uncertainties facing sugarcane projects also would face a wet corn milling venture. In addition, there would be two other possible constraints: (1) the acceptance of corn sweeteners to the Sri Lankan food industry and the size of that market, and (2) the financial viability of irrigated or rainfed corn (maize) as an alternative crop to rice.

3. Power Alcohol

Sri Lanka imported Rs 12.3 billion of petroleum in 1982. The country has the ability to produce a number of agricultural products (sugarcane, maize, cassava) which are satisfactory feedstocks for power alcohol. Provided the economics of production are favorable, blending alcohol with gasoline could eventually result in a ten percent reduction in petroleum imports. Brazil has been the major success story in substituting biomass alcohol for gasoline. Other countries are exploring the possibility; some have already begun programs.

Provided maize can be purchased for Rs 2.75 per kg or less, (the current floor price) and gasoline prices exceed Rs 12 per liter (the current retail price), power alcohol production using maize as a feedstock would probably be financially viable without any significant Government support. (No comparable input-output price spreads were available at this writing for cassava and sugarcane.) Plant sizes for alcohol production range from as little as 10-15,000 gallons (on-farm) to 60 million gallons annually. To meet 10 percent of the country's fuel needs, a single facility of approximately 30 million gallons might be required. Using maize as a feedstock,[1] a single plant of

[1] Sugarcane is generally considered a more efficient feedstock for alcohol production on a per acre basis than is corn. It should also be noted that a 30 million gallon alcohol facility would produce 95,000 tons of distillers wastes useable for livestock feed.

this size would require farm production from 60,000 hectares. Investments in plants of this size range from Rs 1.75 to 2.20 billion.

Small scale (i.e., on-farm or somewhat larger) power alcohol production is often proposed as a means for raising farmer incomes and/or insulating the farmer from high energy prices or fluctuating supplies. However, such projects, on a per unit of alcohol produced basis, are more costly and, in fact, are often economically viable only when feedstock prices for corn, cane, etc., are abnormally low. Given the floor price system in Sri Lanka, such a situation may seldom prevail. Nonetheless, if a power alcohol feasibility study is undertaken for the country, it should examine a range of possible facility sizes rather than simply a single large facility.

The constraints, problems, and uncertainties associated with the development of power alcohol production are: (1) uncertain and potentially volatile world energy prices, (2) floor price policies of the Government for agricultural commodities which might make feedstocks too expensive or cause farmers to shift from their production to more profitable crops, (3) access to the large amounts of investment capital required (if large facilities are felt to be most viable), (4) the possibility of diverting agricultural commodities to power alcohol away from traditional markets leaving the latter without an adequate substitute, (5) the need for blending the alcohol with the gasoline (where and how is this to be done), (6) engine adjustments or modifications if the blends exceed 5-10 percent alcohol, and (7) unused capacity considerations at the Government refinery (may or may not be an issue).

4. Oilseed Processing

By the year 2000 perhaps 125-150,000 tons of soybeans (or other oilseed equivalents) will require processing in order to meet possible demand for soy meal and flour. This is probably 5-10 times the annual volume of soy, sesame, and groundnuts handled by Ceylon Oils and Fats

Corporation (COFC), the only oilseed processor in the country. While the solvent extraction capacity of COFC was not specifically known, it is understood that its existing capacity would not be sufficient to handle projected soybean/other oilseed volumes for either 1990 or 2000. (One estimate placed COFC capacity at 50 tons per day.) Consequently it is possible that two 200-250 ton per day plants or a single 400-500 ton per day plant will be required during the next 10-15 years. Investment in facilities of these sizes would be Rs 100-150 and 200-250 million respectively.

Actual lack of extraction capacity as well as the financial capability of COFC to act as a reliable market for oilseeds may well be a major constraint to expanded soybean production in the country. If no or little processing market exists, farmers will not expand production. However, if no or little production exists private or public money may be hesitant to invest in a facility since the very real possibility would exist that it might operate at a loss for a number of years until production gradually expanded.

The principal uncertainties or problems associated with significantly expanded oilseed processing are: (1) the ability to effectively coordinate processing capacity and farm production, (2) Government policy with respect to wheat flour consumption and imports and the blending of wheat flour with local products and the development of other soy products (see below), (3) the financial competitiveness of soybeans as a crop with alternative crops, (4) the growth in demand for animal/poultry feeds, (5) Government actions regarding COFC (expansion, divestment, operating capital), and (6) the Mahaweli Development authority's efforts to promote soybeans versus other crops.

5. Dehydrated Soy Milk

The Government has just opened a small plant for producing up to four tons per day of dehydrated soy milk. The intent is to market the

product as a substitute for coconut milk in cooking. The product will be sold at Rs 25 per kg which is the equivalent of 22 fresh nuts used as the source for coconut milk for cooking. At current nut prices, dried soy milk at this price would be a 50 percent savings.

It is probable that only one such soy milk facility will be required in Sri Lanka, and it should have its roots in the existing Government pilot plant. At planned capacity of the existing facility, the retail (not FOB plant) value of production would be Rs 30 million annually. Investment in the existing plant was Rs 27 million and is expected to meet two percent of the country's cooking milk needs.

Provided this project proves feasible, it should be divested to the private sector for commercial operation and eventual expansion. The principal uncertainties facing its success are (1) consumer acceptance of a dehydrated milk product in lieu of liquid milk in nuts, (2) consumer acceptance of the flavor characteristics of soy milk versus the familiar coconut milk (some successful test marketing of dehydrated soy milk has apparently already been done by the Soybean Foods Research Centre and Darley Butter & Co., Ltd, in Colombo), and, perhaps most importantly, (3) the probability and speed with which the coconut industry puts a dehydrated coconut milk product on the market and the comparative price of that product.

6. Other Soy Products

In a paper prepared by the Soybean Foods Research Centre (or SFRC, a joint Sri Lankan-FAD project), the following possibilities were suggested for soy products in addition to soy flour and dehydrated soy milk:

a. Weaning Foods

Presently there is no widespread tradition of using weaning foods for children in Sri Lanka although boiled rice in the form of kanjee

is given during the transition (weaning) period. Those weaning foods which are imported into the country are expensive and generally beyond the financial reach of most consumers unless subsidized. However, several locally producible products may have potential for developing this market. These include: (1) thriposha, a supplementary food made with maize and soy which has begun to gain acceptance throughout the country, (2) a dry, formulated, low cost weaning food comprised of rice-soy-green gram was found suitable for feeding 5-11 month old children by the Lady Rideway Hospital in Colombo (this product is being test marketed in four major towns in Sri Lanka), and (3) a moderately priced, drum-dried, soy-cereal-fruit weaning food may have a significant demand among the middle income groups. A drum-dried formulation (approximately 55 percent rice, 34 percent soy, 10 percent sugar, and 1 percent pumpkin, minerals and vitamins on a premix dry weight basis) was developed by the SFRC and found to be acceptable in taste/flavor. Its cost was estimated at about one-half of imported products.

b. Soy Milk Blend

Local production of cow's milk is presently inadequate to meet domestic demand; thus, the bulk of milk consumed is imported, primarily in the powdered form. The possibility exists to extend the fluid milk supply by producing an acceptable soy/cow milk blend. A sweetened, flavored soy beverage produced at the SFRC was found acceptable in a limited taste sample. Ultra high temperature (UHT) treated soy/cow milk blends asceptically packed in flexible pouches have already been introduced successfully in school feeding programs in several Southeast Asian countries. This possibility may also be logical in Sri Lanka in its school feeding programs.

c. Textured Vegetable Protein (TVP)

At present 50-60 tons of TVP per month are being imported into Sri Lanka. The product has been found to be quite acceptable in spite of being expensive (Rs. 55-60/kg). It therefore may be desirable to establish a TVP plant in Sri Lanka. Setting up a TVP plant would eliminate imports of this product and might also reduce consumer prices. The establishment of a 600 ton per annum TVP plant with an outlay of about Rs. 16 million is under active consideration by M/S Forbes and Walkers Ltd., in collaboration with Mysore Snack Foods Ltd., Bangalore, India. A 50 ton per day solvent extraction plant has been set up by Ceylon Oils and Fats Corporation which can be used for the production of defatted soybean meal for use as raw material for TVP production. Since this plant handles other oil bearing materials such as coconut refuse, sesame, and rice bran, there may be scope for another solvent extraction plant in Anuradhapura district, the main soy producing area. (See discussion on oilseed processing above.)

d. Soy Products Summary

While a number of possible opportunities have been identified by SFRC, each appears to have some of the same characteristics or uncertainties regarding their eventual viability: (1) perhaps a single enterprise will be able to meet national demand in each product area; in fact, a single firm might produce several of these products, (2) consumer acceptance of the products is not assured, and (3) initial market penetration might best be promoted through various Government and other institutional feeding programs where nutritional aspects of a product might be of more importance than they would be to the typical Sri Lankan consumer where price would be the major determinant.

7. Seed/Production and Treatment

Presently the Government (through the Department of Agriculture) is responsible for seed imports and production of seed for non-plantback crops. Due to the cumbersomeness of the Government tender procedure for imports and the operating constraints often faced by the Department of Agriculture (hiring, distribution, and financial), seed availability often does not meet farmer requirements (quantity, timing, variety, etc.). There is a general feeling in the Department of Agriculture that its responsibility should probably be confined to (1) research, (2) the production of foundation seed, and (3) the regulation (to include certification) of seed produced by the private sector. Seed production, import, and marketing would best be handled by private firms.

If this change in Governmental responsibility can be brought about, then the opportunity could exist for the private sector to undertake:

- Seed production, packaging and marketing (potatoes, certified seeds [soy, rice], vegetables, hybrids [maize], etc.);
- Seed multiplication for any new crops or plant-back crops expected to expand rapidly (such as possibly wheat and cotton in the future); and
- Seed treatment (innoculation, pesticide, etc.)

In 1981, seed imports were Rs 16 million. Further increases coupled with domestic Government production suggests that the current opportunity for the private sector may exceed Rs 30 million annually. This could be expected to increase by perhaps 10 percent or more annually if agricultural development proceeds as expected (new acreage, new crops, and adoption of more advanced farming inputs). Additionally, given low labor costs in Sri Lanka and the relatively high labor inputs associated with certain seed production, if a seed industry can be established in the country, export possibilities may exist.

If an industry were established, probably no more than 5-10 firms would be required. However, the potential would exist for raising the income of several thousand farmers who could become contract producers supplying product meeting certain specifications.

Presently the issues or requirements facing the establishment of a seed industry are: (1) Government cooperation in transferring its production and import responsibilities to the private sector, (2) the need for the Government to provide basic research, foundation seed, and regulation of the private sector, (3) procurement of technical know-how by the private sector in order to achieve quality production and packaging, (4) the degree to which traditional farmers will switch from plant-back to the use of certified and/or innoculated/treated seed for which they pay more, and (5) the existence of an effective distribution network to all parts of the country. While capital requirements for entry are generally low, foreign participation may be necessary in order to provide the needed quality-control in production and packaging in early years as well as assistance in international marketing if that proves desirable.

(Note: While the size and structure of the existing nursery business for producing seedlings was not documented [no statistical information or previous studies were identified for this subsector], based simply on possible expansions in the minor export crops as discussed in this volume, seedling sales for these crops alone could be Rs 20-30 million annually. This could present a significant opportunity for either new small entrants or expansion possibilities for existing nurseries.)

8. Poultry Industry

By 1990 poultry consumption in Sri Lanka is expected to increase by 40-60 percent; by 2000 it may have increased two to three times over current levels. Over the next 6-8 years this growth translates

to increased poultry sales of perhaps Rs 300 million at the retail level (1983 prices). While much of this growth will be undertaken by existing producers in both the commercial and traditional sectors, there still should be opportunities for new entrants into the poultry industry.

Investment costs, while not insignificant, should not be an obstacle to development. For example, a 50,000 layer operation would require facility capital costs of Rs 3-4 million with another Rs 2 million required to raise pullets to a laying age. Total capital required to finance poultry expansions for the country between now and 1990 might be Rs 100-150 million.

This growth can be expected to occur without incentives or other promotional efforts on the part of Government. Provided the Government pursues policies of relatively stable crop prices (to include feedstuffs), unrestricted imports of needed poultry inputs, reasonable credit availability, and restrictions on international dumping of poultry products in Sri Lanka, expansions in the industry should develop in a fairly orderly manner. No foreign assistance beyond that already received through international breeding firms should be required.

9. Miscellaneous Other Possibilities

a. Pesticide Formulation

As agriculture in Sri Lanka expands and modernizes, pesticide sales should grow at a significant rate. While the manufacture of basic compounds and active ingredients will not likely be feasible in the foreseeable future, pesticide formulation of a number of compounds should be. This might best be accomplished through association with an international firm skilled in this field.

b. Starch Production

Presently Sri Lanka imports starch. While the value of imports is not significant when compared with many agricultural-based products, starch production using cassava (or other agricultural products, e.g., corn) as a base may be financially viable. A single facility of appropriate size would probably suffice for the foreseeable future. Domestic financing and management should be sufficient to implement and operate the facility without a need to resort to any foreign business association (beyond perhaps design and machinery/equipment installation). The major uncertainty will be the ability to provide current starch users with a satisfactory substitute at a competitive price.

c. Molasses Utilization

If sugar production in Sri Lanka expands to meet market demand, by 1990 molasses production (to include refiner's blackstrap) will have increased 75,000 tons over current levels. By 2000 this would have increased to approximately 130,000 additional tons over 1983. While some of this can and should be absorbed by the livestock industry (dairy and beef), the vast majority probably cannot be. While its export in raw form is a possibility, domestic processing of the molasses may prove more attractive. Products typically made from molasses include potable alcohol (e.g., rum), ethyl alcohol (industrial and anhydrous or absolute), vinegar and acetic acid, butanol-acetone, lactic and citric acid, glycerol, yeast, and a number of miscellaneous products (e.g., monsodium glutamate used as a food presservative). The refiner's blackstrap molasses is edible by humans and may best be marketed as a "golden syrup" sweetner for sale both to consumers and the food industry.

Generally, the most likely opportunities will be one of the alcohols, potable or non-potable. Generally, a ton of molasses can be

expected to produce approximately 260 liters of ethanol. Thus, molasses in 1990 would have the potential of generating over 20 million liters of ethyl alcohol and over 35 million by 1990. This can be used for either industrial purposes (domestic and exported) or mixed with gasoline. (If the latter, it could substitute for over 250,000 barrels of imported oil by 1990.)

If the optimal disposition of molasses has not been studied as part of the feasibility of individual sugar projects as they come on stream, then it may be appropriate to commission a study which analyzes the possible options and recommends a national approach to utilization in keeping with expected expansions in sugar production.

d. Government Estate/Company Management

It is generally accepted in Sri Lanka that most Government estates and companies are not efficiently run. In many cases (although perhaps not all) the possibility to increase output and/or reduce costs may only come through transfer of management (if not also ownership) to the private sector.[1] Since Sri Lanka has a relatively restricted resource base and range of development opportunities, it must utilize those that it does have as efficiently as possible consistent with national goals and priorities. Thus, the Government should aggressively explore ways in which the management of appropriate (not all) estates and companies can be turned over to the private sector. The key is designing this transfer so that it is attractive to the private sector managers, is not exploitive of the capital and resource base, and meets Government objectives regarding

[1] Hypothetically inefficient operation need not be inherent in Government ownership and management. However, attaining desired efficiency levels may require unpalatable personnel-related decisions and other steps which may be difficult or impossible to apply consistently over time due to civil service, political, and budgetary realities.

revenues and employment. It is felt that a number of such transfer possibilities definitely exist in Sri Lanka.

e. Private Sector Trading Company

Presently the Export Development Board (EDB) is charged with promoting the international sale of Sri Lanka's agricultural (as well as many other) products. In fact, within the EDB a special body exists for this purpose. However, for a variety of reasons, some of which are touched on elsewhere in this volume, this approach has not been overly effective in many instances. In the future, rather than a continued reliance on the EDB, a new approach might well be the establishment of a private sector trading company dealing primarily in processed and secondary agricultural commodities. Such a firm would actually take ownership or at least control of product (e.g., consignment) and might eventually contract for production. It would have permanent representatives in key markets, perhaps, Abu Dhabi, Saudi Arabia, Japan, the United Kingdom, the United States, and West Germany. Products handled might range from fresh and processed fruits and vegetables to horticultural products, from consumer packaged spices for a specialty market (see below) to bulk sale of nuts. The advantages would be: (1) scale economies and synergies for "minor" agricultural products whose individual volumes could not justify an international marketing effort of any magnitude, (2) foreign representatives truly knowledgeable of agricultural products, appropriate potential customers, and the related distribution system (versus export or marketing generalists), and (3) a higher incentive to sell successfully since continued operation and employment will be a function of effective marketing not Government largesse and subsidies.

f. Minor Export Crop Processing/Consumer Packaging

There are difficulties associated with the further processing of spices and essential oils. However, a bold approach, which if effectively managed could prove highly profitable, would be not only to process but to consumer package under a corporate brand, a line of specialty products for sale in the West. These might include: tea, cocoa, coffee, cashews, cinnamon, cardamon, pepper, cloves, nutmeg, etc. The requirements may simply be imaginative packaging, aggressive consumer and dealer marketing, adequate financing, and nerve to undertake such an approach. It might best be done jointly with a small but successful company in the West which has demonstrated these characteristics. While certain large companies have traditionally dominated these fields, there have been small successful entrants in recent years. Celestial Seasonings (eventually acquired by Unilever) marketing specialty teas is an excellent example. The Western consumers' move to gourmet, specialty foods and susceptibility to imaginative packaging, product names, and advertising makes this an interesting possibility to consider.

g. Spice/Essential Oil Processing

Processing spices and essential oil raw materials into commodity intermediates (versus consumer end products as touched on in the preceding) faces many potential problems as a potential new business venture. Among those are: (1) the dominance of particular firms in some products, (2) the prominence of quality and specified product characteristics in purchasing decisions by end users rather than imaginative advertising and packaging, (3) the need to handle a broad line of products (both for convenience of customers as well as to even out the volatility of earnings which can result from single product concentration), and (4) the location/transportation economics which often favor transport of the raw material rather than processed intermediates.

In spite of these possible disadvantages, a processing venture may still be a viable, attractive possibility. It would likely entail the joint venture participation of a foreign flavor/fragrance house which already carries a broad line of products and is well established in the market. Such a firm might be interested in such a venture to better insure quality, quantity, and margins of some of the products it handles. Volatility of prices and supply has always plagued these international companies.

In order to capitalize upon this possibility, Sri Lanka should prepare a study which (1) documents its spice and essential oil resource base (i.e., production, location of production, structure of local sector [production, collection, handling, marketing], product characteristics [from a technical, commercial viewpoint]), (2) presents the investment advantages and assistance available, and (3) describes the political-economic-social structure of the country in realistic terms. A representative of the Sri Lankan spice/essential oil industry should then research potential joint venture partners and agressively market the idea to the most promising of these. One critical requirement will be the existence of a Sri Lankan firm willing to enter into the venture.

h. Commodity Support Industries

Depending on the direction of Government policy and the success of agricultural research a number of agricultural commodities not referenced elsewhere in this section may be produced in significantly greater volumes. These could include cassava, wheat, and cotton. If such development does occur, then certain support industries and enterprises must develop concurrently if bottlenecks are to be avoided.

If wheat production is successful new milling facilities would not be required (unless local milling in production areas were considered desirable). Facilities currently milling imported wheat

would simply shift to domestic supplies. However, the rapid development of domestic wheat production would likely require storage facilities in the production areas, the addition of appropriate transport vehicles (rail cars and/or lorries), and the development of a supporting certified or hybrid seed business.

Cotton production would require ginning/baling facilities as a minimum. If further use of the raw fiber were intended for domestic cloth production, then thread production and possibly weaving would be needed. The cottonseed, while processable in the existing solvent extraction plant (expansion may be required), would require delinting. Products can be made from the lint.

If produced in large quantities, cassava's processing requirements will depend on the markets it is intended to meet. These could include chips, pellets, flour, starch, and alcohol. Although sometimes similar in the early stages of the processing, each has its unique features. All may be viable in Sri Lanka. However, for production to expand, markets (that is, processing facilities) must first exist. Yet unless processing is integrated with farm production, there is presently insufficient supply of cassava to warrant significant investment in the processing area. This "chicken and egg" dilemma may require Governmental assistance to resolve.