Japan International Cooperation Agency

The Democratic Socialist Republic of Sri Lanka
Ministry of Plan Implementation, Ethnic Affairs and National Integration

# The Master Plan Study For Southern Area Development In The Democratic Socialist Republic of Sri Lanka

# Final Report

**Project Report**



**February 1997**

Nippon Koei Co., Ltd.
International Development Center of Japan
System Science Consultants Inc.

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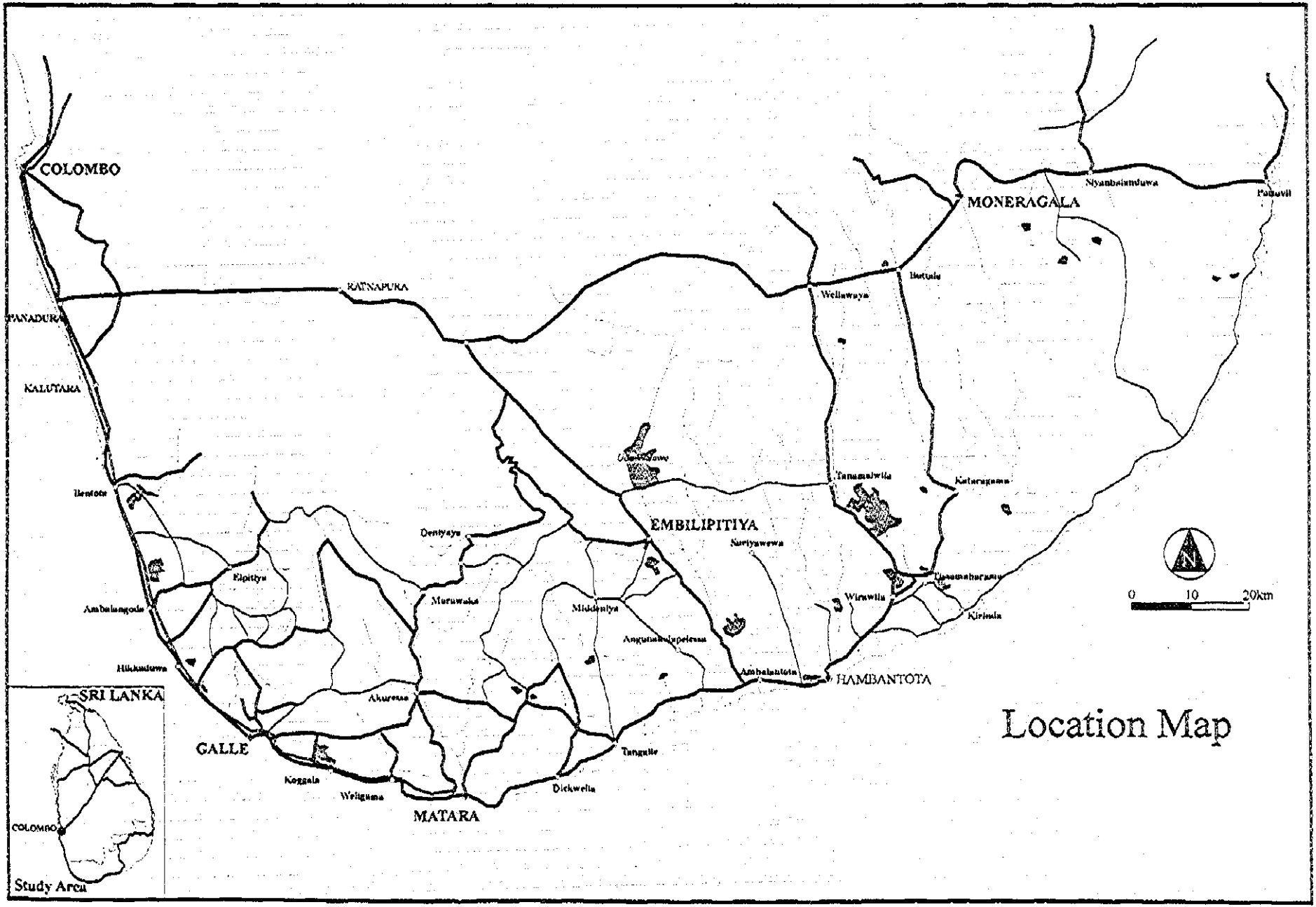
Exchange Rates
(As of November 1996)

US$ 1 = Rs. 55
US$ 1 = ¥ 110


COLOMBO
MONERAGALA
Niyandandeniya
Passara
RATNAPURA
Wellawaya
Buttala
KALUTARA
Tanamalwila
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EMBILIPITIYA
Suriyawewa
Deniyaya
Elpitiya
Ambalangoda
Morawaka
Middeniya
Angunakolapelessa
Wirawila
Kirinda
Hikkaduwa
Ambalantota
HAMBANTOTA
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GALLE
Tangalle
Kotgoda
Weligama
Dickwella
MATARA
SRI LANKA
COLOMBO
Study Area
N
0
10
20km
Location Map

# PROJECT REPORT

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# Pre-Feasibility Studies

# 1. GALLE PORT DEVELOPMENT

## 1.1 Background

The port of Galle will be developed in stages as a key infrastructure project supporting Southern Area. Its first stage is expected to be initiated in the nearest future to establish a regional port. A general/bulk berth and an oil berth may be provided as recommended by the JICA Study in 1991. A better location may be the central portion of the harbor just south of the existing port facilities. This would minimize the length of the breakwater initially.

## 1.2 Project Description

To determine the most desirable yet realistic first stage development, clarifying the need for measures against broad environmental effects of dredging and breakwater construction, a feasibility study should be conducted urgently together with a comprehensive environmental inventory and impact analysis. The Galle port could be a supplement to the Colombo port serving vessels with cargo from/to Southern Area with pleasure boat and fishing boat facilities.

## 1.3 Objectives

The objectives of the project are:

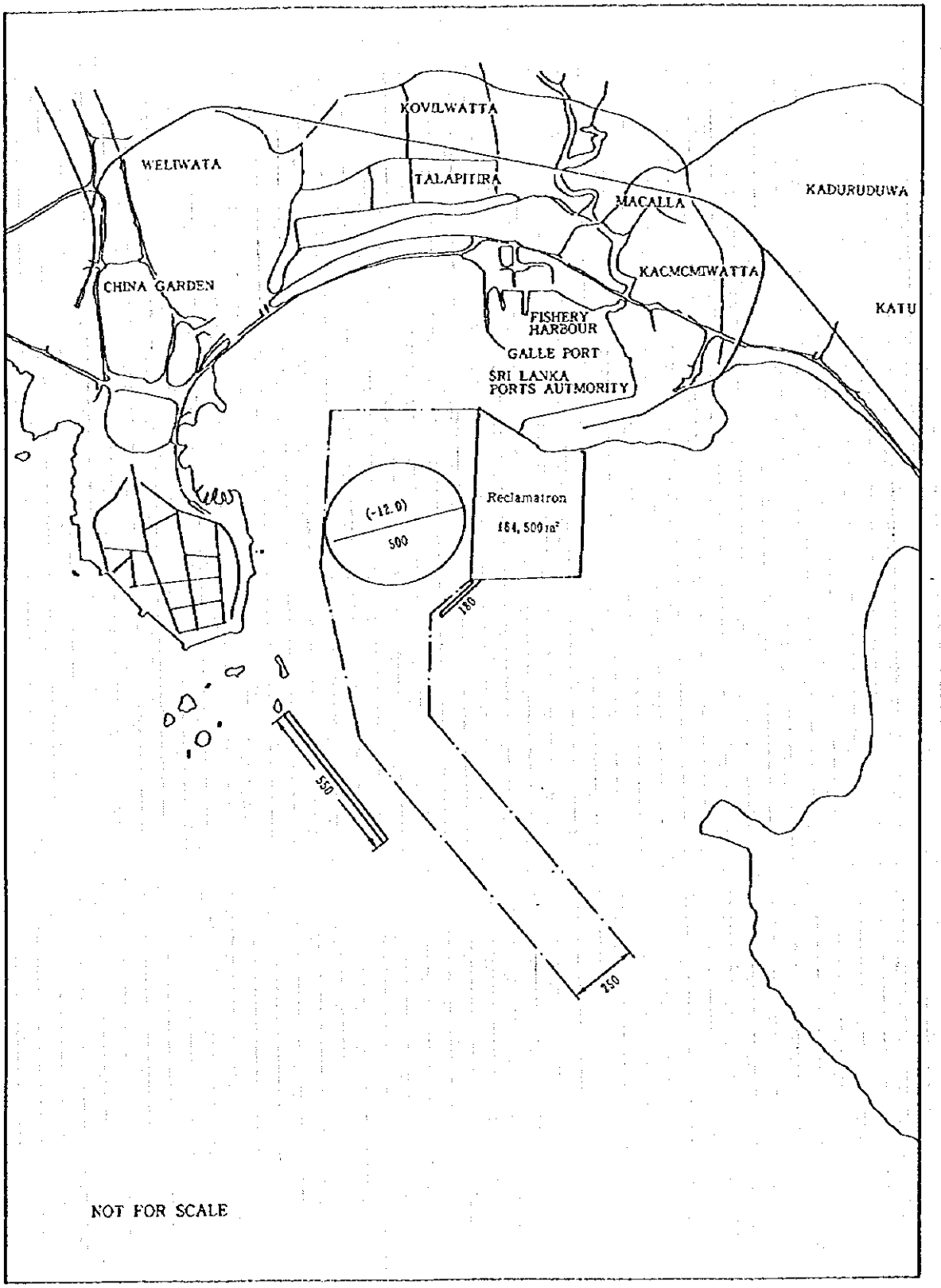
1) to promote regional development of Southern Area;
2) to provide supplementary cargo handling facilities to the Colombo port; and
3) to provide extra container handling capacity at the Colombo port.

## 1.4 Assumptions for the Pre-Feasibility Study

Basic assumptions made for this pre-feasibility are as follows:

1) Project Plan as given in Figure 1.1;
2) Base year: 1996;
3) Project life: 35 years;
4) No overflow container cargo from the Colombo port; and
5) Future economic indicators of Sri Lanka as estimated by the Study Team.

**Figure 1.1 Galle Port Development Plan**



GDP growth rates during 1995-2015 are estimated and shown in the Master Plan Report. A summary table is reproduced here (Table 1.1). Since there is no economic forecast available beyond 2015, it is assumed that the regional GDP will grow at 6% a year until the end of project life.

Table 1.1 Summary of Economic Indicators

(Rs. million)

| Year | Sri Lanka | Southern Area |
|---|---|---|
| GDP (1982 constant price) | | |
| 1996 | 178,429 | 18,058 |
| 2000 | 250,712 | 22,798 |
| 2010 | 302,847 | 34,334 |
| 2015 | 581,956 | 75,977 |
| 2030 | 1,394,691 | 182,083 |
| GDP Growth rate | | |
| 1996-2000 | 5.50% | 6.00% |
| 2001-2010 | 6.50% | 8.53% |
| 2011-2015 | 7.00% | 8.00% |
| 2016-2030 | 6.00% | 6.00% |

Sorce: JICA Study Team

## 1.5 Demand Forecast

The same method is adopted for estimating future cargo volumes as the one used in a similar recent study on the development of the new port of Colombo. Volumes of break bulk cargo are calculated through a micro forecast.

### 1.5.1 Micro economic forecast

#### (1) Agricultural commodities

Cargo volumes of agricultural commodities are based on the estimates made in the Master Plan. The difference between production and consumption in the region should be imported from or exported to other regions or the world through the Galle port. The estimates of agricultural cargo volumes handled at the Galle port are shown in Table 1.2.

Table 1.2 Estimated Cargo Voumes (Agricultural Products) at Galle Port

| Food Demand, Supply and Balance | 1995 (1) Food Demand in the Area (ton) | 2005 (1) Food Demand in the Area (ton) | 2015 (1) Food Demand in the Area (ton) | 1995 (2) Food Production in the Area (ton) | 2005 (2) Food Production in the Area (ton) | 2015 (2) Food Production in the Area (ton) | 1995 (3=2-1) Food Balance in the Area (ton) | 2005 (3=2-1) Food Balance in the Area (ton) | 2015 (3=2-1) Food Balance in the Area (ton) | 1995 (4) Import and Export Volume (ton) | 2005 (4) Import and Export Volume (ton) | 2015 (4) Import and Export Volume (ton) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paddy | 399,006 | 453,794 | 506,256 | 342,624 | 416,480 | 506,256 | -56,382 | -37,314 | 0 | -16,914 | -37,314 | 0 |
| Kurakkan & Meneri | 990 | 1,126 | 1,257 | 2,118 | 2,761 | 3,600 | 1,128 | 1,635 | 2,343 | 338 | 1,635 | 2,343 |
| Maize | 4,301 | 4,892 | 5,457 | 4,275 | 11,631 | 31,645 | -26 | 6,739 | 26,188 | -8 | 6,739 | 26,188 |
| Sorghum | 10 | 11 | 12 | 0 | 0 | 0 | -10 | -11 | -12 | 0 | 0 | 0 |
| Wheat flour | 84,722 | 96,355 | 107,495 | 0 | 0 | 0 | -84,722 | -96,355 | -107,495 | -42,361 | -96,355 | -107,495 |
| Roots & tubers | 48,885 | 55,598 | 62,026 | 57,952 | 48,566 | 40,700 | 9,067 | 0 | 0 | 0 | 0 | 0 |
| Sugar | 68,284 | 77,661 | 86,639 | 71,197 | 125,704 | 221,940 | 2,913 | 48,043 | 135,301 | 1,456 | 48,043 | 135,301 |
| Pulses & nuts | 15,370 | 17,480 | 19,501 | 15,922 | 21,946 | 30,248 | 552 | 4,466 | 10,747 | 0 | 4,466 | 10,747 |
| Vegitables | 88,557 | 100,717 | 112,361 | 292,775 | 492,002 | 826,797 | 204,218 | 391,284 | 714,436 | 0 | 391,284 | 714,436 |
| Onion | 10,748 | 12,224 | 13,637 | 5,759 | 10,758 | 20,095 | -4,989 | -1,466 | 6,458 | 0 | -1,466 | 6,458 |
| Fresh fruits | 3,719 | 4,229 | 4,718 | 809,260 | 1,087,796 | 1,462,200 | 805,541 | 1,083,567 | 1,457,482 | 0 | 0 | 0 |
| Tea | | | | 45,762 | 58,307 | 74,290 | 45,762 | 58,307 | 74,290 | 0 | 58,307 | 74,290 |
| Rubber | | | | 11,811 | 14,540 | 17,900 | 11,811 | 14,540 | 17,900 | 0 | 14,540 | 17,900 |
| Minor export crop | | | | 16,583 | 22,717 | 31,120 | 16,583 | 22,717 | 31,120 | 0 | 22,717 | 31,120 |
| Cashew | | | | 2,088 | 3,901 | 7,289 | 2,088 | 3,901 | 7,289 | 0 | 3,901 | 7,289 |
| Other crops | | | | 1,261,346 | 1,805,064 | 2,644,514 | | | | | | |
| Total | | | | 1,678,126 | 2,317,108 | 3,274,080 | | | | | | |
| Import volume | | | | | | | | | | -59,283 | -135,136 | -107,495 |
| Export volume | | | | | | | | | | 1,795 | 551,632 | 1,026,072 |

Source: Study Team

(2) Other break bulk cargo

Import

Fertilizer: Future consumption of fertilizer for rice, tea, rubber and coconuts is estimated by multiplying the respective commodities' production volume as shown in Table 1.2 with average fertilizer issues per production volume given in Table 1.3. Fertilizer consumption for other crops is calculated using a correlation equation with time series data.

Table 1.3 Average Fertilizer Issues per Production

| Agricultural commodities | Fertilizer issues (kg/ton) |
|---|---|
| Rice | 131.10 |
| Tea | 603.70 |
| Rubber | 174.90 |
| Coconuts | 91.10 |

Source: Study on the Development of New Port of Colombo, Draft Final Report, June 1996

The equation used for other agricultural fertilizer consumption is:

$$Y = 4.5914X - 903.8 \quad (r^2 = 0.95),$$

where X = year, and
Y = fertilizer issues for other crops (1,000 tons).

The estimates of total fertilizer consumption in Southern Area are summarized in Table 1.4.

Table 1.4 Summary of Fertilizer Demand in Southern Area

(1,000 tons)

| | Crop Production | | | Fertilizer Consumption | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 2005 | 2015 | 1995 | 2005 | 2015 | 2030* |
| Paddy | 342 | 416 | 506 | 41.62 | 50.63 | 61.58 | 61.58 |
| Tea | 46 | 58 | 74 | 27.77 | 35.01 | 44.67 | 44.67 |
| Rubber | 12 | 15 | 18 | 2.10 | 2.62 | 3.15 | 3.15 |
| Coconuts | 17 | 23 | 31 | 1.55 | 2.10 | 2.82 | 2.82 |
| Others | 1,261 | 1,805 | 2,645 | 121.98 | 166.02 | 210.06 | 210.06 |
| Total | 1,678 | 2,317 | 3,274 | 195.02 | 256.38 | 322.29 | 322.29 |

Source: JICA Study Team
Note: * It is assumed that the consumption of fertilizer is constant until 2030.

Cement: The total import volume of cement is calculated as the difference between demand and supply in Sri Lanka. Statistics on cement show that cement consumption per capita in 1994 was 60 kg annually. Future cement consumption per capita in the region will increase by 5 kg per annum after 1995. The cement production capacity of Southern Area is 200,000 tons per year. The difference between regional production and consumption and clinker for the cement factory at Galle will be handled at the Galle port (Table 1.5).

Table 1.5 Summary of Cement Import

| | Unit | 1995 | 2005 | 2015 | 2030 |
|---|---|---|---|---|---|
| Population in Southern Area | thousand | 2,660.00 | 3,025.00 | 3,375.00 | 4,036.28 |
| Per capita cement consumption | kg | 60.00 | 110.00 | 160.00 | 235.00 |
| Cement demand | thousand tons | 159.60 | 332.75 | 540.00 | 948.53 |
| Cement production in the Area | thousand tons | 2.00 | 2.00 | 2.00 | 2.00 |
| Clinker | thousand tons | 0.19 | 0.19 | 0.19 | 0.19 |
| Volume handled at Galle port | thousand tons | 157.79 | 330.94 | 538.19 | 946.72 |

Source: JICA Study Team

Note: Population growth in Southern Area is assumed to be 1.2% per annum from 2015 to 2030.

Other break bulk cargoes: Volume of other break bulk cargoes, consisting of all break bulk cargoes other than agricultural commodities, fertilizer and cement, is calculated with a correlation equation:

$$Y = 0.2512X - 1,661.3 \quad (r^2 = 0.987),$$

where Y = volume of other break cargo (1,000 tons), and
X = GDP (Rs. 10 million).

Table 1.6 Summary of Other Break Bulk Cargo Import

| | GDP (1982 constant price) | | As GDP share | Import tonnage |
|---|---|---|---|---|
| Year | Sri Lanka | Southern Area | of the region | (thousand tons) |
| 1996 | 178,429 | 18,058 | 10.12% | 287 |
| 2000 | 250,712 | 22,798 | 10.31% | 483 |
| 2005 | 302,847 | 34,334 | 11.34% | 697 |
| 2010 | 414,927 | 51,708 | 12.46% | 1,133 |
| 2015 | 581,956 | 75,977 | 13.06% | 1,743 |
| 2030 | 1,394,691 | 182,083 | 13.06% | 4,408 |

Source: JICAStudy Team

Liquid bulk: National import volumes of crude oil and oil products are estimated by assuming an average growth rate of 2.53%, the actual average between 1986 to 1994. The national total is then divided among the regions proportionally to regional GDP.

Export

Agricultural commodities: Export volume of agricultural commodities is derived from Table 1.2 above.

Other break bulk: Volume of this type of cargo is related to its value by a correlation equation:

$$Y = 0.008287X + 388.01 \quad (r^2 = 0.847),$$

where Y = throughput of other export break bulk cargo including its containerized cargo (1,000 tons), and

X = value of exports at constant 1985 prices (Rs. million)

The Sri Lanka Export Development Board predicts that the value of export will increase at an average rate of 12% till year 2015. A World Bank study estimates the growth rate of export at 9.5% over the next five to ten years under certain key assumptions that include peace, economic reform, macroeconomic stability and increasing private activities. Accordingly, it is assumed here that the annual export growth rate will be 9.5% until 2015 and drop to 7% after 2016 through the end of project life. The export forecasts are summarized in Table 1.7.

Table 1.7 Summary of Export Volume Forecast

| Year | GDP* | | | Value of export** | | Export tonnage*** |
|---|---|---|---|---|---|---|
| | Sri Lanka | Southern Area | GDP share of the region | Sri Lanka | Southern Area | Southern Area |
| 1996 | 178,429 | 18,058 | 10.12% | 64,906 | 6,568 | 442 |
| 2000 | 250,712 | 22,798 | 10.31% | 102,177 | 10,534 | 475 |
| 2005 | 302,847 | 34,334 | 11.34% | 160,851 | 18,240 | 539 |
| 2010 | 414,927 | 51,708 | 12.46% | 253,218 | 31,551 | 649 |
| 2015 | 581,956 | 75,977 | 13.06% | 398,625 | 52,060 | 819 |
| 2030 | 1,394,691 | 182,083 | 13.06% | 627,531 | 81,956 | 1,067 |

Sorce: JICA Study Team

Note: * 1982 constant price Rs. million

** 1985 constant price Rs. million

*** thousand ton

The results of the above demand forecast are summarized in Table 1.8.

Table 1.8 Summary of Handling at Galle Port

(Unit: Thousand tons)

| | | 1995 | 2005 | 2015 | 2031 |
|---|---|---|---|---|---|
| Break Bulk | Import | | | | |
| | Agricultural Commodities | 59 | 135 | 107 | 107 |
| | Break Bulk Cargo | 641 | 1,284 | 2,603 | 5,677 |
| | Fertilizer | 195 | 256 | 322 | 322 |
| | Cement | 158 | 331 | 538 | 947 |
| | Other Break Bulk Cargo | 288 | 697 | 1,743 | 4,408 |
| | Sub Total | 700 | 1,419 | 2,710 | 5,784 |
| Liquid Bulk | Import | 241 | 300 | 514 | 785 |
| Break Bulk | Export | | | | |
| | Agricultural Commodities | 2 | 552 | 1,026 | 1,026 |
| | Other Break Bulk Cargo | 442 | 539 | 649 | 1,067 |
| | Sub total | 444 | 1,091 | 1,675 | 2,093 |
| **Total Import and Export Cargo** | | **1,385** | **2,810** | **4,899** | **8,662** |

Source: JICA Study Team

### 1.5.2 Container cargo

Container cargo volumes handled at the Galle port are estimated applying the same set of assumptions as used in the 1991 study. The study assumed that all imported agricultural commodities and other break bulk cargoes were container cargoes, while imports of fertilizer and cement were in bulk. Export containerizable cargoes consisted of all agricultural commodities and other break bulk cargoes. The study then assumed that the maximum limits of containerization ratio for import and export cargoes were 85% and 95%, respectively. Given the newly estimated volumes of the containerizable cargo in the previous sections, the container cargoes handled at the Galle port are finally calculated by multiplying the cargo volume by the ratio of containerization. The results are shown in Table 1.9.

Table 1.9 Cargo Volume Handled at Galle Port by Handling Mode

| | Unit | 1995 | 2005 | 2015 | 2030 |
|---|---|---|---|---|---|
| Import | | | | | |
| Bulk | 000 tons | 9 | 20 | 16 | 16 |
| Break Bulk | 000 tons | 398 | 694 | 1,123 | 1,931 |
| Container | 000 tons | 295 | 707 | 1,573 | 3,838 |
| Loaded | 000 TEU's | 22 | 52 | 117 | 286 |
| Empty | 000 TEU's | 11 | 26 | 60 | 146 |
| Total | 000 TEU's | 33 | 78 | 177 | 432 |
| Export | | | | | |
| Bulk | 000 tons | 0 | 28 | 51 | 51 |
| Break Bulk | 000 tons | 22 | 26 | 33 | 57 |
| Container | 000 tons | 420 | 1,036 | 1,589 | 2,170 |
| Loaded | 000 TEU's | 33 | 82 | 127 | 173 |
| Empty | 000 TEU's | 8 | 19 | 30 | 42 |
| Total | 000 TEU's | 41 | 101 | 157 | 215 |
| Total | | | | | |
| Bulk | 000 tons | 9 | 48 | 67 | 67 |
| Break Bulk | 000 tons | 420 | 719 | 1,157 | 1,988 |
| Container | 000 tons | 715 | 1,743 | 3,162 | 6,008 |
| Loaded | 000 TEU's | 55 | 134 | 244 | 459 |
| Empty | 000 TEU's | 19 | 45 | 90 | 188 |
| Total | 000 TEU's | 74 | 179 | 334 | 647 |

Source: JICA Study Team

## 1.6 Existing Port Facilities

The existing port facilities are summarized in Table 1.10.

Table 1.10 Summary of Galle Port Facility

| Berth | Vessel Size | Length | Depth | Number |
|---|---|---|---|---|
| General/Bulk berth (Container) | 30,000.00 DWT | 290.00 | -12.00 | 1.00 |
| General/Bulk berth | 46.00 DWT | 240.00 | -12.00 | 1.00 |
| Oil Berth | 12.00 DWT | 120.00 | -7.50 | 1.00 |

Source: JICA Study Team

## 1.7 Port Capacity

The 1991 study also estimated the future capacity of the Galle port. The study calculated the capacity of the existing berth at 220,000 tons, which is used in this analysis. The study also indicated that the cargo volume to be handled at the new general/bulk berth would be 391,000 tons per year. This figure is given to this analysis as the capacity of the berth since it still appears reasonable in view of recent data. In fact, the general/bulk cargo berth at the Colombo port is handling about 44,000 tons per month or 528,000 tons per year. On the other hand, average handling volume per gang is 14.9 tons per hour at Colombo. If eight gangs are employed at Galle (as later assumed) to handle general/bulk cargoes, more than 700,000 tons can be handled a year assuming the same level of efficiency. Thus the 391,000-ton capacity at the general/bulk berth may well be a fair estimate.

Container berth's capacity is revised as follows. Total containers handled at the Galle port are estimated at 635,000 TEUs in 2030. Average container handling volume is 1,000 TEUs per vessel. Therefore, the number of calling vessels is 635 annually. Necessary days for berth per vessel are assumed to be 0.767 day, including 0.1 non-handling day at berth. Further assuming the maximum occupancy rate of 40% for the container cargo berth, its maximum handling capacity is calculated as 190,000 TEUs annually. Berth capacities as obtained above are summarized below.

| | |
|---|---|
| General/bulk berth (container) | 190,000 TEUs |
| General/bulk berth | 391,000 tons |
| Oil berth | 300,000 tons |
| General/bulk berth (existing) | 220,000 tons |

## 1.8 Cost Estimates

Cost estimates are largely based on the estimates given in the 1991 study. To update local currency unit prices to the 1995 levels, the previous 1990 prices are deflated using consumer price index. Foreign currency unit prices are assumed to be the same as 1990 prices.

### 1.8.1 Construction costs

Construction costs of the project are calculated by multiplying the quantities as given in the 1991 study by the adjusted unit prices. These financial costs are then converted to

economic costs multiplying conversion factors, given also in the 1991 study, of respective items. Table 1.11 summarizes the economic construction costs.

Table 1.11 Summary of Construction Costs

| Description | Quantity | Unit | Economic Cost ( 000 US$) | Remarks |
|---|---|---|---|---|
| 1. Dredging | | | | |
| Rocks | 210,000 | m2 | 16,057 | |
| Other material | 1,030,000 | m2 | 6,333 | |
| 2. Break water | | | | |
| Southwest | 550 | m | 38,545 | |
| East | 180 | m | 17,759 | |
| 3. Quays (-12m) | | | | |
| General/Bulk cargo | 530 | m | 40,939 | |
| Bunker Oil | 120 | m | 4,815 | |
| 4. Revetment | 870 | m | 23,652 | |
| 5. Reclamation | 2,110,000 | m3 | 19,988 | |
| 6. Pavement | 200,000 | m2 | 15,314 | |
| 7. Buliding | 1 | sum | 6,112 | |
| 8. Navigation Aid | 1 | sum | 737 | |
| 9. Utilities (Water and Electricity) | 1 | sum | 8,953 | |
| Sub total (1) | | | 199,204 | |
| 10. Cargo Handling Equipment | | | | |
| Container bulk cargo | 1 | sum | 23,250 | |
| Bunker Oil | 1 | sum | 129 | |
| 12. Port service vessels | 2 | sum | 6,417 | |
| Sub-Total (2) | | | 29,796 | |
| Total (Sub-Total (1) + Sub Total (2)) | | | 229,000 | |
| 13. Engineering Services (Total Foreign x 0.06+Total Local x 0.05)) | | | 13,350 | |
| 14. Physical Containgency (Sub-Total (1) x 0.06) | | | 11,952 | |
| Grand total | | | 254,302 | |

Source: JICA Study Team

### 1.8.2 Operation and management costs

#### (1) Personnel cost

The number of staff for handling general and bulk cargo is based on the 1991 study. The standard number of workers required for cargo handling is 20 persons per gang and eight gangs in total. In addition, 20 workers are needed for port services. The economic personnel costs are calculated as US$ 515,000 per annum.

(2) Operation cost

Operation cost is estimated as 20% of total personnel costs.

(3) Maintenance cost

Maintenance cost is assumed to be 1% of the total construction cost excluding the cost of dredging, rock dredging and reclamation.

1.8.3 Replacement investment cost

Replacement investment is calculated based on the replacement investment schedule shown in the 1991 study.

1.8.4 Residual value

For the economic analysis, value of materials for water/electricity supply, navigation aids and handling equipment are considered as residual or salvage value.

## 1.9 Benefits

1.9.1 Benefit calculation

An assumption made by the previous 1991 study is that the Colombo port cannot be further expanded. However, the Government has since decided to expand the Colombo port to establish it as the "hub" port in South Asia. A new Colombo port study has been carried out and it indicates that container handling capacity of the port would become sufficient for the foreseeable future if the port is expanded as planned. Given this new development, the central question as to the Galle port now is which is better to expand the Galle port or to handle cargoes at the Colombo port.

To estimate the benefits of the Galle port development, the "without" case is assumed as follows:

- No investment is made for the Galle port;
- The Colombo port will be expanded to handle goods/commodities from/to Southern Area; and

- Region's economic growth rate is the same both for the "with" and "without" cases.

There are two types of economic benefits associated with the Galle port development. One is the reduced land transport costs. Without Galle port development, most cargoes will have to be transported by land to and from the Colombo port. One type of benefit of the new Galle port is thus the value of the reduced land transport costs. The other type of benefit comes from an increase in the handling charge revenue at the Colombo port. Given that the handling capacity at the Colombo port is fixed, some transshipment container cargo may be crowded out by cargoes from Southern Area. If the Galle port can handle the region's own cargoes, the handling charge formerly being lost at Colombo will accrue.

### 1.9.2 Changes in inland transport costs

Road transportation is the only mode capable of accommodating extra cargoes because railway freight transport will remain at the minimum level. Assumptions as to the road transport are as follows:

| | |
|---|---|
| Type of truck | 7 tons capacity |
| Empty truck rate | 30% |
| Average loaded weight | 75% of capacity |
| Road distance between Colombo and Galle | 120 km |
| Unit cost of land transportation | US$ 9.26 (with price adjustment) |

The economic benefit of the new Galle port in terms of reduced land transport costs is shown in Table 1.12.

Table 1.12 Impact of New Port on Inland Transport

(unit: 000 ton)

| Year | Inland transport (Galle-Colombo) | | |
|---|---|---|---|
| | With project | Without project | Difference |
| | 1 | 2 | 3 = 2-1 |
| 1995 | 0 | 1,167 | 1,167 |
| 2005 | 291 | 2,568 | 2,277 |
| 2015 | 2,178 | 4,694 | 2,516 |
| 2030 | 6,004 | 8,520 | 2,516 |

Source: JICA Study Team

### 1.9.3 Handling charges

Benefit from the increase in handling charge is calculated as follows. It is assumed that 3% of total container ships calling at the Galle port are newly induced thanks to the Galle port development. Those ships will never come to Sri Lanka without the new Galle port. Handling charges collected from them are thus an extra income to the Country and counted as a benefit of the project.

## 1.10 Evaluation of the Project

### 1.10.1 Comparison of costs and benefits

Results of an economic evaluation of the project are summarized in Table 1.13. As is seen, the net present value of the project is negative US$ 50,884,000 with costs and benefits discounted at 12%. At the same discount rate, the cost-benefit ratio is 1:0.72. The internal rate of return is 8.08%. Consequently, the project is not economically justified unless some major benefits that could not be quantified in this analysis are counted.

Table 1.13 Summary of Economic Evaluation

(US$000)

| Original Case | | | Sensitivity Test (1) (Construction Cost +20%) | | | Sensitivity Test (2) (Demand -20%) | | | Sensitivity Test (3) (Discount Rate 15%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| NPV * | B/C Ratio | IRR(%) | NPV * | B/C Ratio | IRR(%) | NPV * | B/C Ratio | IRR(%) | NPV | B/C Ratio |
| -50,884 | 0.72 | 8.08 | -86,988 | 0.6 | 6.14 | -71,574 | 0.6 | 6.69 | -67,516 | 0.58 |

Source: JICA Study Team
Note * : Opportunity cost of capital is 12%.

### 1.10.2 Sensitivity tests

Sensitivity test is carried out by changing some factors which affect the results. Three cases are analyzed:

Test (1) Construction cost +20%,
Test (2) Demand -20%, and
Test (3) Discount rate 15%.

The test results indicate that the economic evaluation is particularly sensitive to the fluctuation in construction costs of the project (Table 1.13). If the costs are 20% higher than estimated, the net present value is reduced by Rs. 36 million.

## 1.11 Unaccounted Benefits

### 1.11.1 Policy consideration

The preliminary economic evaluation above did not comfortably justify the project. However, the port development should be viewed within a broader national policy framework. If the Colombo port is to establish itself as the "hub" port in South Asia and earn foreign currencies, it should concentrate on transshipment. Without Galle development, some of the additional capacity of the Colombo port should be set aside for handling cargoes to and from Southern Area, while its primary function is transshipment. This is a case for the Galle port development which can be justified at the national policy level.

### 1.11.2 Reduced shipping costs

The benefits of the Galle port should include reduced waiting time of ships at the Colombo port. Lack of information prevented this. To calculate this benefit, information is required on the number of ships expected to arrive, their arrival time, average service time at berth, and the value of ship time at the Colombo port. Even if the benefit is estimated, however, much of it might initially go to foreign shippers. To capture this benefit as a national gain, Sri Lankan shipping industry should grow and compete in the world market. It is again a matter of policy whether to foster the national shipping industry competitive internationally. Given such considerations, it appears difficult to include this benefit into this analysis.

### 1.11.3 Other benefits

Opportunity costs of the additional berths at the Colombo port should have been taken into account as benefit. The Colombo port earns more foreign currencies as the additional

berths handle more transshipment containers. Those incomes are partly forgone when some additional capacity is used to handle goods and commodities from/to Southern Area.

Savings on maintenance and rehabilitation costs of the national highways should also be accounted for as a benefit of the project. Reduction of heavy vehicles on the national highways may reduce maintenance costs and accident costs while saving time on other vehicles. The extra capacity of the national highways may be utilized for the benefit of other economic activities.

The economic analysis has a limitation of being unable to differentiate regional economic benefits *per se* from national gains. Galle port development can stimulate economic development in the region as a whole, yet those regionally differentiated benefits cannot be accounted for in the economic analysis. In fact, if the Galle port is constructed, some factories may decide to locate in the region. Without the port, they may instead locate near Colombo. From the region's point of view, benefits are clearly defined as the differences between the two cases. From the national point of view, however, it does not matter where the factories go as long as they create the same benefits within the Country. Thus the economic evaluation above is unable to justify this regional project which brings significant benefit to the region simply at the expense of other parts of the nation. It may be noted in passing that the regional economic growth rates estimated and adopted in the Master Plan have taken into account the development of the Galle port; therefore, actual growth may turn out much lower if no investment is made in the Galle port.

## 1.12 Recommendations

### 1.12.1 Integrated development of Galle city

Galle port development should be defined as a strategic infrastructure project of the region and be a part of the integrated Galle city development program which intends to transform Galle into an international city. The program includes tourism development, historical conservation, railway station redevelopment, industrial estate, and water front development. The port should be the central and integral part of this city development program.

### 1.12.2 Stage construction

In view of the cargo volume projections above, it is advisable to develop the Galle port in two stages. In the first stage, a new Galle port will be built as a regional port to handle

bulk/break bulk cargoes from/to the region. In the second stage, it will expand its function and capacity according to the trend of regional economic growth and to the progress of Colombo port improvement. A feasibility study is further required to justify this development strategy. Galle port development and Colombo port improvement are tightly interwoven. Coordination is necessary for the Government to decide the optimum timing of Galle port construction.

### 1.12.3 Improving cargo handling productivity

Viability of this project is highly dependent on the cargo handling capacity of the new Galle port. To raise the productivity, port management and operation need substantial improvement.

## 2. SOUTHERN HIGHWAY

### 2.1 Background

One of the transportation problems in Southern Area is poor accessibility by road. The existing national highways cannot fully meet transport needs both of passengers and goods because of weak pavement and bridge structures, untidy road side conditions and inappropriate alignments. The Government has proposed that the Southern Highway, 138 km of length, be constructed with private involvement as a key infrastructure in the region. The highway will be an access-controlled tollway and will help enhance the development potential of Southern Area.

### 2.2 Project Description

The proposed highway is a four-lane, dual carriage-way toll road with 11 interchanges on the route. The highway starts from Mattegoda, at a junction on the proposed Outer Circular Road, and extends to Matara. It crosses 14 divisions and four major rivers. As an access-controlled highway, it can reduce travel time between Colombo and Galle by about one hour to 90 minutes. The highway can carry heavy containers and bulk cargo freighters safely. Construction of service roads already started in January 1996 from the Matara side. The Government plans to construct the service roads as priority with its own funds and seeks private investment for the main highway.

### 2.3 Objectives

The objectives of the Southern Highway project are:

1) to establish a strong linkage between Colombo and Southern Area;
2) to improve road accessibility to the region; and
3) to facilitate the transportation of goods and passengers.

### 2.4 Assumptions for the Pre-Feasibility Study

RDA conducted a pre-feasibility study on the highway in 1991 and 1993 (*An Inland Trunk Road from Outer Circular Road to Galle and Matara*). The preliminary economic evaluation done in the study indicates an economic internal rate of return of around 22%. RDA has since carried out a feasibility study further to examine project viability (*Economic Feasibility*

*Study of Southern Highway*, Draft Final Report, Oct. 1996). This analysis draws on the feasibility report for traffic forecasts and cost estimates. Some key assumptions and dimensions of the project are as follows:

| | | |
|---|---|---|
| 1) | Base year | 1996 |
| 2) | Construction schedule | Four years |
| 3) | Project life | 30 years |
| 4) | Opening year for traffic | 1998 |
| 5) | Project plan | see Figure 2.1 |
| 6) | Typical cross section | see Figure 2.2 |

## 2.5 Traffic Volume Estimation

### 2.5.1 Present traffic volume and road conditions

The existing two-lane national highway (A2) carries 4,000-5,000 vehicles per day on the Bentota-Matara section (see Table 1.8, Part 1: Transportation, Sector Report 4). Its road surface and bridge structures have been rehabilitated with World Bank assistance.

### 2.5.2 Future traffic volume

To estimate traffic volume on the Southern Highway, the past RDA studies carried out several traffic surveys which include traffic count, road inventory, classified bus route survey, road side interview, bus passenger survey and rail passenger survey. The project area was divided into 20 zones and present vehicle O-D matrices were prepared. To estimate future traffic for the existing network, growth rates were estimated for respective vehicle types for different periods based on the past growth trends and future development prospects. The diversion factors, derived from a proportional logit model, were then applied to the estimates to obtain future traffic volumes on the Southern Highway. Four different development scenarios were considered in the estimation:

| | |
|---|---|
| Scenario I | Without project |
| Scenario IIA | Project without the Outer Circular Road |
| Scenario IIB | Project with the Outer Circular Road |
| Scenario IIC | Project with the Outer Circular Road with generated traffic |

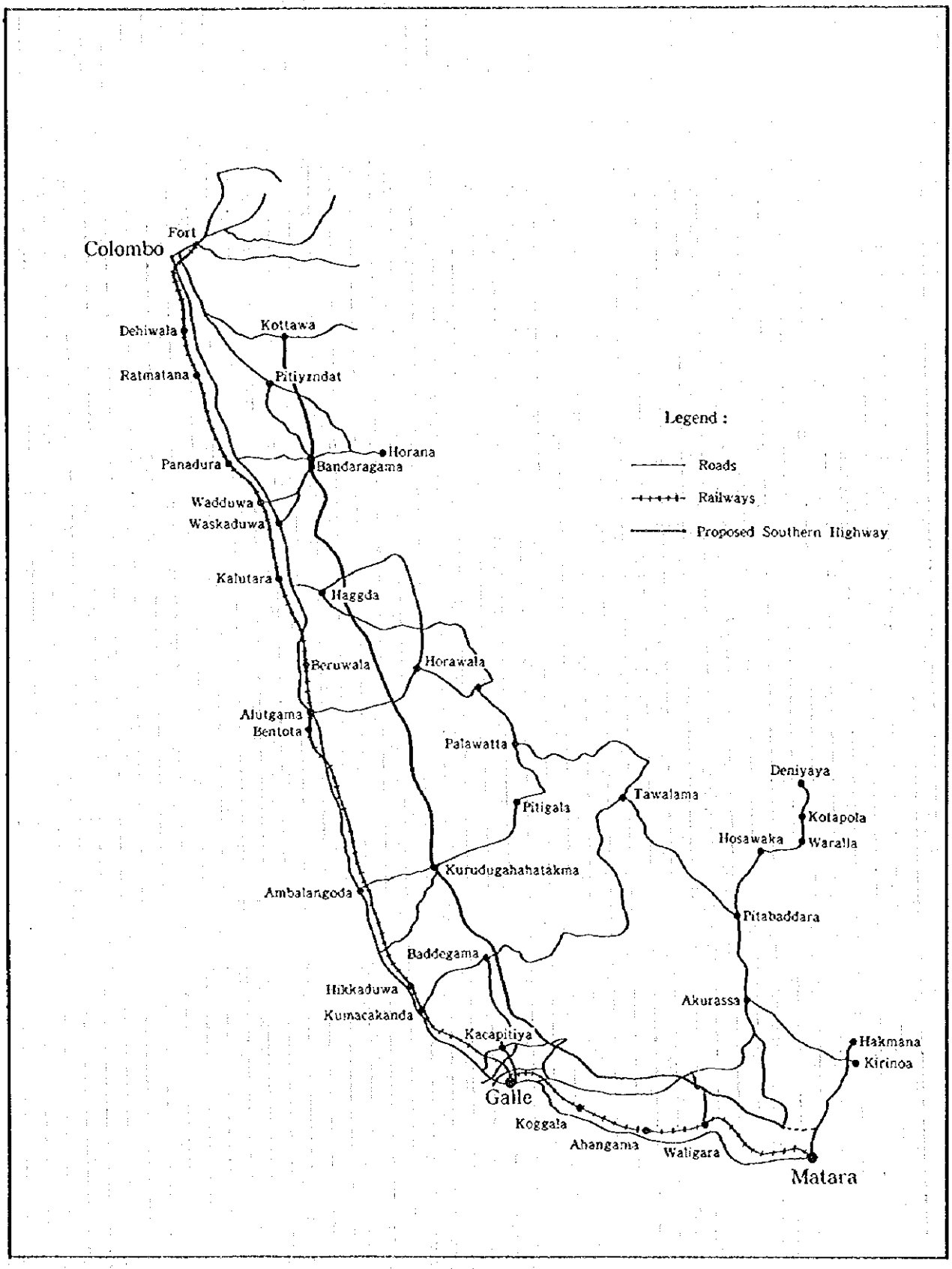



Figure 2.1 Proposed Southern Highway Plan

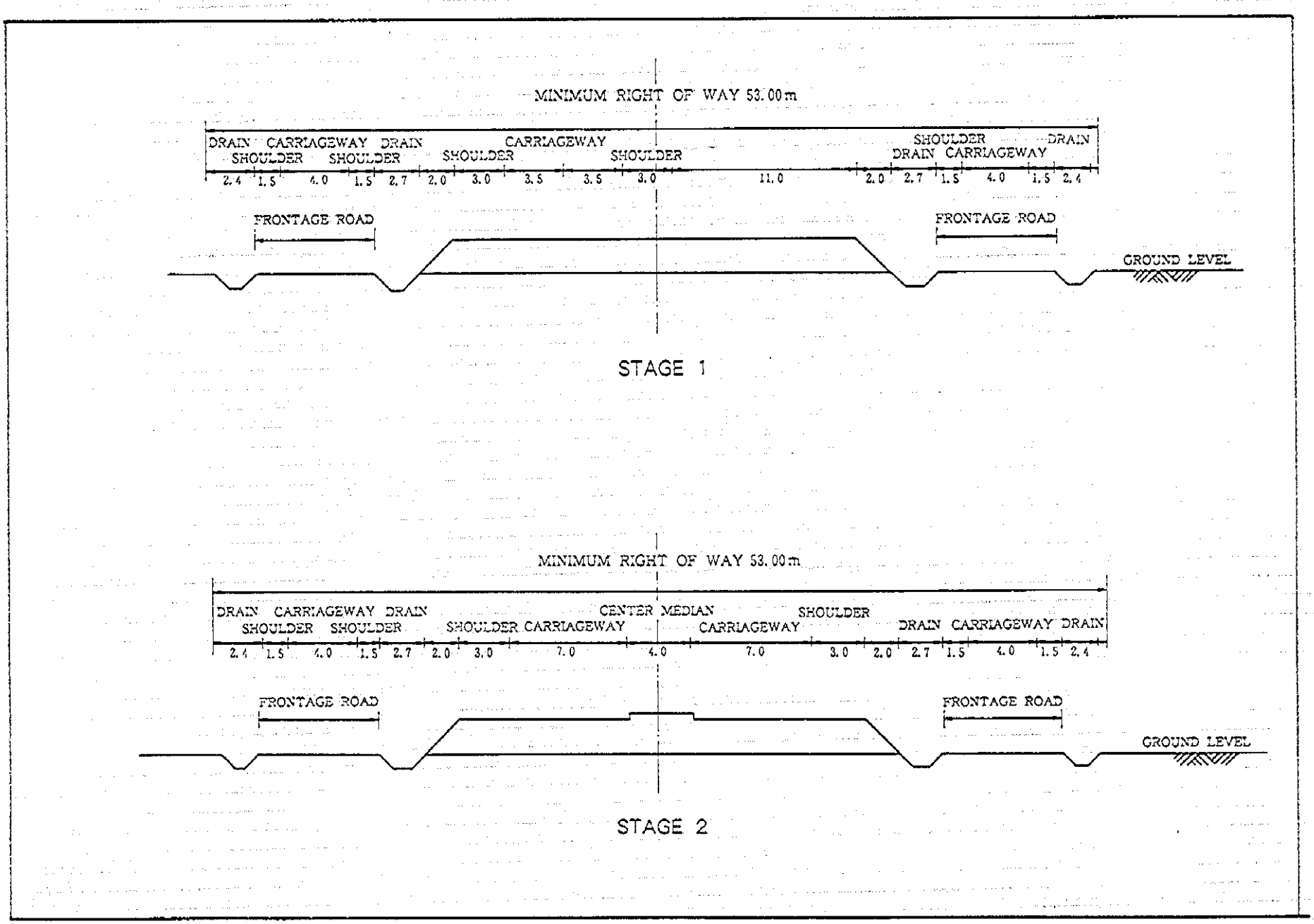



Figure 2.2 Typical Cross Section of the Southern Highway

Since the Outer Circular Road will be completed before the Southern Highway, only Scenario IIB (Project with Outer Circular Road) is taken up here for economic evaluation. Under this scenario, the feasibility analysis provided estimated traffic volumes on the Southern Highway from 2001 to 2026 for each interchange section (Table 2.1).

Table 2.1 Estimated Traffic Volume on the Southern Highway (2001-2026) (Scenario IIB)

(unit: PCU)

| Road Link | 2001 | 2011 | 2021 | 2026 |
|---|---|---|---|---|
| Kottawa-Polgasowita | 3,628 | 6,463 | 13,872 | 18,936 |
| Polgasowita-Bandaragama | 7,259 | 12,555 | 25,913 | 34,982 |
| Bandaragama-Bombuwela | 8,083 | 14,016 | 28,962 | 39,361 |
| Bombuwela-Welipenna | 6,965 | 11,880 | 23,962 | 32,116 |
| Welipenna-Kurundugaha-hatempa | 5,969 | 10,300 | 21,117 | 28,461 |
| Kurundugaha-Hatempa-Baddegama | 6,463 | 11,903 | 22,703 | 29,961 |
| Baddegama-Akmeemana | 6,200 | 10,562 | 21,328 | 27,670 |
| Akmeemana-Habaragala | 5,324 | 8,525 | 16,777 | 20,735 |
| Habaragala-Godagama | 4,934 | 8,119 | 15,620 | 19,463 |
| Godagama-Hakmana | 1,249 | 2,150 | 4,373 | 5,590 |

Source: Economic Feasibility Study of Southern Highway, Draft Final Report, Oct 1996, RDA

## 2.6 Highway Design Standards

RDA used modified design standards for the Southern Highway in conducting the feasibility study and an environmental impact assessment. The design standards are summarized in Table 2.2.

Table 2.2 Highway Design Standards

| Item | Unit | Southern Highway |
|---|---|---|
| Design Speed | km/h | 100 |
| Minimum Radius of Curve | m | 400 |
| Maximum Gradient | % | 3.5 |
| Carriageway | m | 3.5 |
| Median Width | m | 4.0 m for final stage |
| Shoulder | m | 3 |

Source: Economic Feasibility Study of Southern Highway, Draft Final Report, Oct 1996, RDA

According to the Highway Capacity Manual, the capacity of Southern Highway with the above design standards is 3,800 pcu per hour for one direction (1,900 pcu per lane). Given this capacity as well as the traffic estimates, it is seen that the highway can

accommodate all the traffic with only two lanes until 2011. With its four-lane plan, the Southern Highway's capacity will be sufficient until 2026.

## 2.7 Cost Estimate

### 2.7.1 Construction costs

The construction costs estimated by RDA are Rs. 17,236 million, which covers land acquisition, roadway construction, structures, lighting, interchanges, access roads, frontage roads and engineering services. To convert these financial costs into economic costs, a conversion factor, assumed 0.8, is multiplied to the financial costs. The construction will take four years from 1996 and the total construction costs are distributed among the years by 20%, 25%, 25% and 30%, respectively. Table 2.3 summarizes the construction costs.

Table 2.3 Summary of Construction Costs

(unit: Rs. thousand)

| Work Items | Description | Unit | Cost | Remarks |
|---|---|---|---|---|
| Land acquistion | | | 2,693,830 | |
| Work preparation | | | 146,132 | |
| Earth work | Excavation | m3 | 1,562,578 | |
| | Embankment | m3 | 2,281,165 | |
| | Eath moving | m3 | 91,000 | |
| Pavement | Subgrade preparation | m2 | 48,506 | |
| | Subbase | m2 | 167,310 | |
| | Base cource | m3 | 570,375 | |
| | Surface cource (Asphalt) | tons | 705,338 | |
| Miscellaneous | | sum | 1,324,327 | |
| Bridges | | sum | 2,210,263 | |
| Interchange | | sum | 253,660 | 11 interchanges |
| Frontage road | | sum | 1,466,427 | |
| Access road | | sum | 1,467,320 | 151.5 km |
| Sub-Total (1) | | | 14,988,230 | |
| Physical Contingency (10.5% of Sub-Total (1)) | | | 1,573,764 | |
| Feasibility and Environmental Studies (0.5% of Sub-Total (1)) | | | 74,941 | |
| Engineering Services (4% of Sub-Total (1)) | | | 599,529 | |
| Sub-Total (2) | | | 2,248,235 | |
| Total Financial Costs | | | 17,236,465 | Rs.131,175,500 per km |
| Total Economic Costs | | | 13,789,172 | |

Source: RDA

### 2.7.2 Maintenance costs

Maintenance costs consist of annual and periodic maintenance costs. Annual maintenance costs cover resurfacing, clearing of road side, road lighting and others. Periodic

maintenance treats the overlay of carriageway surface every five years after construction. Maintenance costs for the expressway and frontage roads are estimated at Rs. 350,000 and Rs. 40,000 per km per year, respectively. The total periodic maintenance costs are Rs. 705 million.

## 2.8 Benefits

### 2.8.1 Types of benefits

The question on the Southern Highway is whether it is better to build a new highway than to use the existing highway. To evaluate the project, two key assumptions are adopted as follows.

- No investment is made for the existing national highway; and
- The Southern Highway is constructed as a national highway (no tolls or operational costs).

The benefits of the project consist of 1) reduced vehicle operating costs on the new highway for the traffic diverted from existing roads, 2) reduced vehicle operating costs for the traffic remaining on the existing national highway, and 3) time savings of passengers and freight.

### 2.8.2 Reduced vehicle operating costs on the highway

The feasibility study on the Southern Highway used the financial vehicle operating costs (VOCs) calculated in the Colombo Urban Transport Study. The economic VOCs were calculated by converting financial VOCs with conversion factors for each speed category. The travel time cost (TTC) was also estimated for the passengers of each vehicle type. The average TTC was Rs. 44.82 per hour for private vehicles and Rs. 21.81 per hour for bus passengers. The transport costs, which include travel time cost and vehicle operating cost, were calculated in the feasibility study as in Table 2.4.

Table 2.4 Summary of Transport Costs

(unit: Rs. million)

| | 1996 | 2001 | 2006 | 2011 | 2016 | 2021 | 2026 |
|---|---|---|---|---|---|---|---|
| Transport Cost | | | | | | | |
| Scenario I | 12.18 | 16.14 | 22.60 | 42.53 | 94.86 | 163.68 | 244.41 |
| Scenario IIB | 9.70 | 12.19 | 15.93 | 22.43 | 35.83 | 62.06 | 133.91 |
| Saving (per day) | 2.48 | 3.95 | 6.67 | 20.10 | 59.03 | 101.62 | 110.50 |
| Saving (per year) | 818.40 | 1,303.50 | 2,201.10 | 6,633.00 | 19,479.90 | 33,534.60 | 36,465.00 |

Source: Economic Feasibility Study of Southern Highway, Draft Final Report, Oct 96, RDA.

### 2.8.3 Accident reduction

Reduced accidents should be part of the project benefits. However, lack of relevant data precludes this. In fact, road accident rates are high in Sri Lanka. Experiences elsewhere show that highway accidents are reduced by building access-controlled expressways with divided lanes. To measure the economic benefits of accident reduction, a plausible rate of reduction needs to be estimated comparing the Southern Highway with the existing national highways. Unfortunately, since there is no access-controlled highway yet in Sri Lanka, comparable data on accidents on the Southern Highway are not available. Consequently, this analysis does not include accident reduction benefits.

## 2.9 Project Evaluation

### 2.9.1 Comparison of costs and benefits

Results of an economic evaluation of the project are summarized in Table 2.5. The net present value of the project is Rs. 22,213 million with costs and benefits discounted at 12%. At the same discount rate, the benefit-cost ratio is about 2.96. The internal rate of return is 20.39%. If discounted at 15%, the net present value reduces to Rs. 9,742 million with the benefit-cost ratio falling to 1.94. The conclusion of this economic analysis is that the project is economically justifiable.

Table 2.5 Summary of Economic Evaluation

(Rs. million)

| Original Case | | | Sensitivity Test (1) (Construction Cost +20%) | | | Sensitivity Test (2) (Demand -20%) (Demand -40%) | | | Sensitivity Test (3) (Discount Rate 15%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| NPV * | B/C Ratio | IRR(%) | NPV * | B/C Ratio | IRR(%) | NPV * | B/C Ratio | IRR(%) | NPV | B/C Ratio |
| | | | | | | 13,151 | 2.11 | 16.85 | | |
| 22,213 | 2.96 | 20.39 | 19,639 | 2.62 | 18.55 | 6,755 | 1.61 | 14.84 | 9,742 | 1.94 |

Source: JICA Study Team
Note: * Opportunity cost of capital is 12%.

2.9.2 Sensitivity tests

To test project viability under different conditions, sensitivity analysis is carried out for three cases:

Test (1) Construction cost +20%,
Test (2) Traffic demand -20%, -40%, and
Test (3) Discount rate 15%.

The test results show that project viability is easily affected by a decrease in traffic demand. The internal rate of return drops to 14.8% in case of 40% decrease in traffic volume. Even if the capital costs are 20% higher (Test 1) or the benefits are 20% less (Test 2) than estimated, the net present value of either case still exceeds Rs. 10,577 million, discounted at 12%. It is highly likely that the project is still justified under these circumstances.

2.9.3 Some uncertainties

(1) Construction of the Outer Circular Road

The traffic forecast analysis made in the feasibility study shows that future traffic volume will drop by 20% without the Outer Circular Road that will diversify traffic within the Colombo area. Since the construction schedule of the road has yet to be finalized, traffic volume on the Southern Highway may not increase as estimated. As the results of sensitivity test have shown, the internal rate of return is indeed sensitive to the decrease. If traffic demand declines by 20% or 40%, the internal rate of return falls to 16.9% or 14.8%, respectively.

(2) Rehabilitation of railway

The Sri Lanka Railways has a plan to upgrade the Coast line to achieve high speed operation both for cargo and passenger traffic. When this plan materializes, some of the traffic may shift from the Southern Highway to the railway. A comprehensive study on rail and road will be required to decide appropriate development strategy for these competing modes.

### 2.9.4 Other development benefits

The construction of the Southern Highway is expected to bring other development benefits to Southern Area. First, it will enhance the prospects of other development projects, such as the Galle port, industrial districts, and tourism developments. Second, it will solve the problem of poor accessibility to Colombo. In addition as indirect benefits, the living standard of people in the region will improve. These benefits are not counted in the evaluation above.

## 2.10 Recommendations

### 2.10.1 Coordination with other road development projects

Economic viability of the project would much depend on other road projects proposed in the Colombo area. If these roads are not developed prior to the Southern Highway project, economic viability of the project would be marginal.

### 2.10.2 Stage construction

Traffic demand for the highway is closely related to the level of development of the region. As shown in the above analysis, a two-lane highway will be sufficient to accommodate the expected traffic until 2011. The stage construction of carrigeways is therefore recommended to mininize initial investment and to keep pace with the region's overall development.

## 3. Hambantota Hotel Construction

### 3.1 Background

Areas around Hambantota are endowed with rich tourism potential. It is estimated that, in 2015, about 120,000 visitors will come to Hambantota out of 600,000 foreign tourists entering Southern Area. It then requires approximately 3,000 hotel rooms to accommodate them. Currently, a total of 1,615 hotel rooms are either in service or planned in Hambantota district. Accordingly, more than 1,000 rooms need to be added to meet the future demand. Furthermore, this shortage may become even more acute when the airport at Wirawila comes into full operation. This project is therefore proposed to increase the room capacity of the Hambantota area on the one hand and to establish a high-quality tourism base to serve various purposes on the other.

In line with the national policy of increased private sector participation, it is assumed that private investors, both within and outside Sri Lanka, will construct the proposed hotel. Preliminary financial analysis is made on that assumption and results are summarized below.

### 3.2 Project Description

(1) Target markets

The following categories of travelers are assumed to be main targets:

- Travelers landing at the Wirawila airport;
- Optional-tour guests sightseeing in Southern Area;
- Travelers taking part in safaris and bird-watching, mainly in the Yala National Park;
- Those visiting beaches using Hambantota as the base; and
- Asian tourists who travel south from the Cultural Triangle.

(2) Basic dimensions

The hotel has the following dimensions.

- Facilities: 300 guest rooms, barbecue house, restaurant, shopping arcade, etc.
- Total floor area: 27,800 $m^2$
- Site area: 45,000 $m^2$

## 3.3 Preliminary Financial Analysis

(1) Construction costs and yearly distribution

Assuming a five-year construction period, construction costs and their annual distribution are estimated as summarized in Table 3.1.

Table 3.1 Construction Costs

| Item | Total Cost ($1,000) | Yearly Distribution (% of Total) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total (%) |
| Land (Cost of Use) | 278 | 100 | - | - | - | - | 100 |
| Buildings and Equipment | 12,510 | - | 50 | 30 | 20 | - | 100 |
| Landscaping, Exterior Work | 1,001 | - | - | 50 | 40 | 10 | 100 |
| Temporary Work | 1,081 | 30 | 40 | 20 | 10 | - | 100 |
| Furniture, Furnishings, Fittings | 4,500 | - | - | - | 50 | 50 | 100 |
| Value Added Tax | 1,909 | - | 30 | 30 | 30 | 10 | 100 |
| Design and Supervision of Construction | 2,100 | 40 | 15 | 15 | 15 | 15 | 100 |
| Total | 23,379 | (6.2) | (32.4) | (22.9) | (26.3) | (12.2) | (100) |

Source: JICA Study Team

(2) Revenue and operation costs

Revenue and operation costs are estimated based on the following assumptions.

Room occupancy rate will be 40%, 50% and 60% for year 1, year 2 and year 3, respectively. It is assumed constant at 60% from year 4 and thereafter.

Room revenue will be US$ 50, 55, 60 and 62 for year 1, year 2, year 3 and year 4, respectively. The figure will increase by US$ 2 annually in subsequent years.

Revenue composition is assumed to be: 60% from guest rooms, 30% from dining and beverage sales, and 10% from others.

Operating expenses are assumed to be 60% of total revenue. Their breakdown is: 8% of total revenue for guest room maintenance, 23% for dining and beverages, 23% for general management, and 6% for taxes and other miscellaneous expenses.

(3) Financial analysis

Based on the above assumptions and further assuming a project life of 11 years, cash flow is calculated and tabulated in Table 3.2. The internal rate of return (IRR) is then calculated using the following formula:

$$\sum_{t=1}^{n} \frac{(I_t - O_t)}{(1+i)^t} = 0,$$

where

$I_t$ = cash inflow in year t;

$O_t$ = cash outflow in year t; and

$i$ = internal rate of return.

The IRR based on Table 3.2 is 5.1%.

This figure assumes that construction cost is $80,000 per room and room rates are of three-star class. By contrast, the CTB/UNDP-M/P assumes an average construction cost of $60,000 per room. If this lower estimate reflects the region's price levels more

accurately and is adopted instead, construction costs will be reduced by 20% per room. A recalculation yields the IRR at 6.9%.

The cut-off rate used to justify investment varies among international funding agencies. Some current figures are as follows.

| | |
|---|---|
| World Bank | 12% |
| USAID | 8% |
| Asian Development Bank | 10% |
| Japan | 7% |

The calculated IRRs obtained from the preliminary analysis above are lower than the normal cut-off rates applied by international agencies. In order to attract private sector investment to this project, therefore, it will be necessary to improve the investment environment by, for example, offering long-term low interest financing.

Table 3.2 Cash Flow for Hambantota Hotel Construction Project

| | Year | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Construction Cost | 1,442 | 7,575 | 5,357 | 6,148 | 2,856 | | | | | | | | | | |
| Operation Cost | | | | | 2,190 | 3,011 | 3,942 | 4,073 | 4,205 | 4,336 | 4,468 | 4,600 | 4,730 | 4,862 | 4,993 |
| Cost Total | 1,442 | 7,575 | 5,357 | 6,148 | 5,046 | 3,011 | 3,942 | 4,073 | 4,205 | 4,336 | 4,468 | 4,600 | 4,730 | 4,862 | 4,993 |
| Revenue Accommodation | | | | | 2,190 | 3,011 | 3,942 | 4,073 | 4,205 | 4,336 | 4,468 | 4,599 | 4,730 | 4,862 | 4,993 |
| Food and Beverage | | | | | 1,095 | 1,506 | 1,971 | 2,037 | 2,102 | 2,168 | 2,234 | 2,300 | 2,365 | 2,431 | 2,497 |
| Miscellaneous | | | | | 365 | 502 | 657 | 679 | 701 | 723 | 745 | 767 | 788 | 810 | 832 |
| Revenue Total | | | | | 3,650 | 5,019 | 6,570 | 6,789 | 7,008 | 7,227 | 7,447 | 7,666 | 7,883 | 8,103 | 8,322 |
| Balance | -1,442 | -7,575 | -5,357 | -6,148 | -1,396 | 2,008 | 2,628 | 2,716 | 2,803 | 2,891 | 2,979 | 3,066 | 3,153 | 3,241 | 3,329 |

Source: JICA Study Team

# 4 DAIRY PROCESSING

## 4.1 Introduction

This report is one of two in-depth studies undertaken while preparing a Master Plan for Southern Area. The definition of Southern area used in this report is the same as that for which a task force was created by the President. It includes all of Southern province and five adjoining AGA divisions of Uva province.

This report is meant to provide further information on some sectors that are identified to be promising by the Master Plan. Details are provided at a pre-feasibility level. The feasibility studies should be undertaken by interested private investors.

The feasibility study, in addition to the analysis presented, will include information specific to the site where the project will be located. It is strongly recommended that the potential investors should also carefully check the prices of raw milk and products. These prices would be more important in determining the project profitability than the total investment costs. The estimated size of investment, however would be a key determinant of investors' ability to finance the project.

This report is not prepared on assumption that the investor has previous experience in dairy industry. Any interested private individual or company may undertake this project. Experience in milk processing would be a strong advantage. The quality of the products (pasteurized milk) is the key to the success of the venture. The investor must insure that the milk procurement system, processing technology and the marketing chain will allow production and marketing of a high quality product which has the full confidence of consumers.

A key question affecting the location of plant, the likely market size and distribution strategy is the packaging materials for fresh liquid milk. This question needs to be further explored. Financial performance of the plant will be enhanced substantially if the investors can find a low cost package that will provide a shelf life of up to five days with no deterioration in the taste of milk.

The project is highly profitable based on the tentative available information. This is the to be expected. The project will purchase raw milk at the price of Rs. 12.5 per liter. It will sell this

for Rs.20.62 at factory gate by processing it into pasteurized plain milk; and at the price of Rs.30.55 if processed into flavored milk. Butter is also produced as a by-product.

The rate of return to the whole project is estimated to be 41%. The return to equity is even higher. Sensitivity analysis show that the project will remain profitable with an IRR of over 10% under likely adverse conditions: investment cost turn out to be 10% higher than estimated; or revenues are only 90% of the base case. The project looses money if both revenues fall and costs increase. Sensitivity analysis confirm the general impression that key to the success is product quality and the market price that this will dictate.

## 4.2 Background

### 4.2.1 Livestock in Sri Lanka

There are around 2 million farms in Sri Lanka. Of these, two thirds are wholly devoted to crops. The rest are mostly mixed farms with very few specializing in livestock only.

The Ministry of Agriculture estimates that there are around 600,000 milking cows in the Country. Milk production from these cows is estimated at 200 million liters annually. Only half or less of this milk is marketed through formal marketing channels. The rest is either fed to calves or consumed on the farm.

Nationally, 75% of milk produced is from cows and the rest from buffalo. It is estimated that there are 72,000 families selling milk to the formal sector. Average sale per farmer is around 4 liters per day. Such a large number of farmers each producing a very small quantity is one of key constraints to the growth of commercial dairy processing. The logistical problems of milk collection from so many farmers make collection of local raw milk very expensive.

The quality also suffers greatly when shipments of a truck load of milk contains milk collected literally from thousands of farms. Contaminated milk from any one farm will spoil the whole shipment. Because each farmer sells such a small quantity, they are not interested in acquiring the specialized skills that a dairy farmer should have in milk hygiene, management of dairy cows, and forage production. Larger size and specialized production are a prerequisite for building an efficient dairy industry. This in turn depends on farmers' access to land for forage production.

Government policy on land is a major constraint. Most farmers have no land for forage production. The forage is gathered from whatever feed may be available around homes. Concentrates pose no problem as they can be commercially purchased, though too much reliance on concentrates increases costs of production and makes local milk even less competitive than imported milk powder.

### 4.2.2 Livestock in Southern Area

Southeastern parts of Southern Area have a major concentration of livestock in Sri Lanka. Livestock is projected to become a major activity in these parts particularly around Hambantota. Two components where rapid growth in output can be achieved are poultry meat and dairy.

Presently, there is a large number of cattle in Southern Area: around 10% of the national cattle and buffalo herd. Most of these are not milked and those that are milked provide little milk beyond what is fed to calves. As a result, the average milk production per cow is reported to be around 50 liters in a year. This is one fifth of what a good goat would produce.

Cattle and Buffalo population in Southern Area(1995)

| | Cattle | Buffalo |
|---|---|---|
| Galle | 27,500 | 11,700 |
| Matara | 33,500 | 11,000 |
| Hambantota | 93,300 | 95,900 |
| Southern Area | 199,340 | 142,270 |
| (Milking Cows) | 75,101 | |

Source: Study of Raw Materials for Processing in Southern Area, Report submitted by TEAMS consultants, January 1996.

The estimate of the number of milking cows in the South and total milk production vary. According to the consultant's report, referred to above, there were 75,000 milking cows. Milk marketed, net of what is fed to calves, is 3,500 tons. The Department of Animal Production and Health provides a smaller estimate of the size but higher milk production: 43,400 cows producing 22,500 tons per annum. The latter estimate includes milk fed to calves and this would be roughly half of total production.

Annual procurement by Milco and Nestle from Southern Area has varied from 2 to 2.8 million liters. The respective figure for the Country is 80 to 125 million liters. The Southern Area's share of commercial milk of 3% is very small compared with its share of livestock: 10% of the national herd. This shows that the livestock in the Southern Area is much less intensive than the Country as a whole.

This finding is consistent with the industry reports which state that intensive dairy development has occurred in the central highlands where climate is more conducive for livestock raising and farmers are more experienced in feed production. The cattle population in Southern Area is mostly kept for beef production.

The known figures on commercial milk procurement cast some doubt on the production statistics. Actual production may be considerably higher than the estimated production. The actual milk procurement by Milco in Southern Area had exceeded 2 million liters in 1986/87. The procurement declined during the political turmoil of 1989/91 but recovered after that. During the first six months of 1996, Milco procured 1.4 million liters in Southern province. The estimated procurement is 2.9 million liters for the whole of 1996. During the second half of 1996 daily milk procurement by Milco was 8,000 liters. This indicates that actual procurement in 1996 reached 3 million liters in Southern Area.

Within the Southern Area, Hambantota is the dominant production center. Milco operated six milk chilling centers in Southern Area in 1996. These were in Ambalantota, Embilipitiya, Galle, Gonapiniwala, Tihagoda, and Tissaharama. Half the total milk procurement was from Hambantota and the rest from the other two districts. More than half of the total market, in contrast, was in Galle district. Hambantota had a small market share in total consumption.

The low share of milk produced in the region is only partially due to concentration of dairy production in the central highlands where climate is more favorable for dairy production. The low share of Southern Area in national milk production is also affected by its specialization in meat rather than milk production. The cattle cross breeding strategy should recognize this prominence of meat production. Milk production should be targeted to meet the regional demand. The Colombo metropolitan region will continue to rely on supplies from the central highlands.

A cattle development strategy based on dual purpose breeds fits well with existing conditions in Southern Area. It will also have a very favorable impact on farm incomes if

male calves could be marketed. Religion is a major constraint to development of beef industry.

The total commercial milk procurement in the region is very low. It is less than the capacity of a single dairy plant operating at a minimum efficient scale under conditions in Sri Lanka. Such a plant would process at least 15,000 liters a day or close to 5 million liters a year as discussed in detail in Section 4.7. The development of a dairy industry in the region should be accompanied by a major program of milk production.

The increase in milk procurement in 1996 was very encouraging. The industry specialists expect this trend to continue. Within two to three years, the plant will be able to procure sufficient quantities of raw milk from within the region.

This trend needs to be supported by appropriate government actions. It would be useful if the Government encourages the development of a land market. This would apply both to restrictions on ownership as well as leasing.

### 4.2.3 Production systems in Southern Area

Part of the estimated milk production in Southern Area comes from buffaloes. Buffalo milk has a higher solid and fat content and is exclusively used for curd production. The cow milk is used for a variety of purposes. Prominent among these is yoghurt and ice cream production. The demand for curd is presently largely unmet due to local nature of markets and unstable production. It is difficult to industrialized buffalo milk production and achieve yields that would make it profitable.

The present yoghurt market is small but growing much more rapidly than that of curd. In contrast to buffaloes, cow milk production can also be easily industrialized to supply the market with a steady volume of output.

Good cross breeds of both cows and buffalo produce similar quantities of milk per head under the improved practices in Southern Area: around 5 liters per head/day, for an average of 200 days/annum. The average production is thus around one ton per cow milked. This is the upper limit of what can be produced from buffaloes. The cow milk yield, in contrast, can be doubled with cross breeds and reasonable husbandry practices; the Western European and North American average production per cow is around six tons/year.

The cross breeds of buffalo in Southern Area is a cross with improved Indian (Moora) breeds and performs reasonably well in milk production. Its body weight, however, is three times that of the cross-bred local cows and as such requires a proportionately high intake of feed to produce the same level of milk output.

The proportionately more favorable meat production from buffalo is not considered to be an advantage due to religion. Most aged buffaloes are reportedly just buried and not used for meat production. Male calves produced on dairy farms are sold to farmers at very low prices instead of being used as feeder stock in fattening farms. Under these conditions, it is natural that the cattle development in the south will be exclusively milk oriented with no room for dual purpose breeds. Jersey is a common breed in Southern Area and it is a very good single purpose (milk) breed. It is also well suited for rough topography for grazing due to its small size and agility.

### 4.3 Consumption of Milk and Dairy Products

The total milk consumption in Sri Lanka is around 400 million liters per annum (Table 4.1). About a quarter of this is procured from the local farmers through formal marketing channels. The rest is imported as milk powder. In addition, some milk is consumed on farms from own production. The estimates of this component are highly unreliable.

The market has grown rapidly: from a per capita consumption of 15.3 liters in 1985 to 27 liters in 1995. This growth in demand was met by a proportionate expansion in imports with fairly stagnant levels of domestic production.

The domestic commercial procurement was 67 million liters in 1985. It had remained at that level up to 1991. There has been some increase since 1992 with the total commercial procurement of 81 million liters in 1994. A combination of factors have led to a large expansion in commercial milk procurement in 1995, estimated at 125 million liters. This includes the favorable impact of drought, the recent rise in procurement prices of raw milk and the intensified efforts of dairy plants to promote domestic production in the face of rapid increase in prices of imported milk powder (Table 4.2).

#### 4.3.1 National consumption

Milk is processed into four major products in Sri Lanka and Southern Area. Buffalo milk is mainly processed into curd. The process is very simple. Milk is boiled up to 100 degrees

centigrade and cooled to 40 degrees before yeast is added to individual containers. Milk ferments within 12 hours and is retailed in clay pots without refrigeration.

The main use of cow milk are yoghurt and ice cream. Processing of both shows varying degrees of sophistication depending on packaging, additives used and scale. There is very little demand for, and local production of cheese.

The last and dominant use of milk is for powder. In 1994, powder is estimated to account for 338 million liters fresh equivalent of the total estimated consumption of 434 million liters (Table 4.1.) Powder is the preferred form for use with tea. It is simpler to use, it can be kept at home for extended periods without refrigeration, and it is highly unlikely to be spoiled compared with fresh milk. The superior taste of fresh milk is not relevant when added to tea. This segment of the market is likely to continue to rely on the milk powder even if fresh milk is made available.

Though powder is the overriding use of milk, the industry expects the major growth areas to be in other products. The consumption of liquid fresh milk should be promoted to combat child malnutrition. School milk programs were implemented from time to time when the Government had the financial resources. The consumption of yoghurt, fresh drinking yoghurt, and ice cream is also expected to rapidly increase as the income levels increase.

The major growth area is in liquid milk consumption. The demand for both sterilized and pasteurized milk has been growing rapidly. Industry sources expect most of the fresh milk demand to shift from sterilized to pasteurized milk. This milk has a superior taste and is less expensive to process. The major weakness is the need for refrigeration. This will become less of a problem as electrification continues and sales outlets are provided with cold storage chests.

### 4.3.2 Regional processing patterns

The bulk of cow milk produced in Southern Area is purchased by Milco and Nestles. Milco transports milk procured from the Southern Area to its processing plant in Ambewela and the latter to the plant in Pannala (near Colombo). Nestle closed down its procurement station in Southern Area in 1996.

A small proportion of milk produced is used by 15 to 20 local processors in Southern Area. They produce curd, yoghurt and ready to serve drinks. The technology used is very

simple. Milk is flavored with vanilla essences or chocolate powder and is sterilized in 190 ml bottles using retorts or pressure cookers.

In preparation of yoghurt, milk is boiled and fermented after enrichment with sugar. Yoghurt is also modified by adding colors, fruit pieces or agar. All yoghurt produced is sold in 50 ml plastic cups.

Most of yoghurt is presently produced from milk powder. This is cheaper than using fresh milk. The change in milk powder prices in 1996 has already eliminated the cost advantage of powder (Table 4.2 ). The processors will shift to local raw milk if it were available. Main producers are Ranketi industries at Embilipitiya, Sunbean industry at Ambalantota and Dismy industry at Ambalangoda. There are about 10 to 15 small scale yoghurt producers manufacturing around 100 cups per day in the main towns in Southern Area.

Buffalo milk is used for curd making. This is done by cottage industries in Matara, Hambantota and Ratnapura districts. The most common package is a 750 ml clay pot produced in small local units. The major uses of all milk by type are summarized.

Utilization of Milk Produced in Southern Area

(Unit: 1000 Liters/year)

| District | Direct consumption | Consumption by cottage industry (curd-ghee) | Industrial consumption |
|---|---|---|---|
| Galle | 59.8 | 239.2 | 375 |
| Matara | 53.8 | 215.1 | 338 |
| Hambantota | 77.8 | 467.0 | 1,600 |
| Southern Area | 218.3 | 1,211.1 | 2,313 |

## 4.4 Milk Industry in Sri Lanka

### 4.4.1 National industry structure

Formal milk processing and marketing in Sri Lanka is dominated by two companies. The government owned Milco ( the successor to Milk Marketing Board) and Nestles have similar shares, controlling together around 90% of the formal sector. The largest Milco plant is in Ambevela (Norelia) with a capacity of 110 tons/day. This plant produces milk powder. The plant in Colombo has a capacity of 60 tons/day and the one in Digana (Kandy) a capacity of

20 tons/day. The latter two produce a full range of products including sterilized and pasteurized milk. Pasteurized milk is produced only by Milco. Nestles has stayed out of this product. These are four often small producers of pasteurized milk : Kothmale in Angoda, Kotagala Dairy Products, Elephant House, and Agri in Kelaniya. The combined market share of these is reported to be less than 10%. The scale of all four is less than 10 tons/ day raw milk.

Milco's pasteurized milk production in 1995 was 7.1 million liters. Information on capacity utilization on that line is not available. Its total raw milk intake in 1995 was 47,000 tons compared with the total capacity of 190,000 tons: capacity utilization of 25%.

The Nestles plant in Pannela (Krunegala) had a capacity of 300 tons/day and produced full cream milk powder. The other plant in Polanaru (North East) is smaller with a capacity of 50 tons/day. Capacity utilization of Nestles was around 50% in 1995. Both Nestles and Milco can thus double the amount of local milk processed if raw material becomes available.

In addition to these two, there are 8 to 10 small processors of liquid milk. The total capacity of the industry is estimated at 700,000 liters a day. The current capacity utilization rate of the industry is 30%.

### 4.4.2 Dairy processors in Southern Area

There are around 10 local processors in Southern Area. The total output of these is estimated at less than 10% of the formal milk marketed in Southern Area in 1995. Some of these small units of less than 10 tons/day capacity are owned by the Mahawelli Authority and the National Livestock Board. Four of these small units are in Hambantota. All use a small fraction of their capacity. Both limited milk availability and management problems of these state owned units have contributed to low capacity utilization.

One milk plant owned by Milco is in Galle. This facility was closed in 1973 and has not operated since. The machinery has been removed but the building is intact and is currently used as a chilling center.

### 4.4.3 Prices and price formation

Impact of import tariffs

The prices of raw milk and dairy products in Sri Lanka evolve under competitive market conditions. However, the Government influences prices through two mechanisms. One is the ownership of Milco which handles over half of the commercially traded milk. The other is setting the tariff on imported milk powder.

The domestic price of raw milk is largely set by the price of imported milk powder. This in turn depends on the tariff charged as well as the international prices. The Government appears to have a target milk powder price in the domestic market. It levies the difference between this target price and the actual world market price as an import levy. The actual import levies have fluctuated between zero and 35% over the last 10 years. It tends to be low just prior to elections. At present, the milk powder is charged 10% import duty. As in all transactions, imports are also subject to the defense levy (4.5%).

This method of tariff determination stabilizes the domestic prices at around international price levels. The levels, however, tend to be low for protecting the domestic producers against imports, some of which are highly subsidized by the exporting countries. The resulting domestic price levels may not provide the farmers with a strong incentive to increase production. The Government is seeking ways to provide the farmers with a better price while protecting the consumers. One idea being discussed is to force the processors to operate under lower processing/ marketing margins. Such a policy is certain to effectively destroy the domestic processing industry.

It is likely that the Government will keep the import levy at the present levels in the near future. It may even reduce and eventually eliminate the import tariff. This would be a response to the increasing international market prices as the major dairy producers adjust their surpluses under the GATT rules. This adjustment started in 1995 and has led to significant increases in prices.

The increase in international prices will provide improved incentives to Sri Lanka dairy producers if the import levy is not lowered. The relative prices actually observed in the second half of 1996 appeared to provide sufficient incentive for the farmers.

Milco floor prices

Another mechanism through which the Government affects domestic prices is the raw milk procurement price of Milco. Milco buys half of the commercially traded milk and its procurement price becomes the floor price in the market. These prices are reportedly determined by political considerations and may not always reflect market conditions.

The Government has made various attempts to privatize Milco. The initial effort ran into legal difficulties. The present plan is to privatize MILCO by setting up a joint venture with the Amul cooperative movement of India. If these discussions are successful, they will create a monopsony facing the farmers, and the new company will be a monopolist in the market for many products, including fresh milk products.

There may be strong incentives for the two largest producers for collusion in setting raw milk purchase and product prices. The relationship between the two is potentially worrisome. Milco was a business partner of Nestles: it owned 40% of International Dairy Products Ltd. and Nestles owned 60%. This possible forms of cooperation between the two largest market players can lead not only to oligopolistic pricing but may also lead to pricing practices to limit market entry for possible new firms. It is likely that the new bill prepared by the Government to promote competition will prohibit such practices and interlocking ownership.

The present market structure will become even more worrisome if Milco is transferred to Amul of India in totality. In contrast, restructuring Milco prior to privatization would have promoted competition in the market. Milco can be broken into at least three units with each unit containing a milk plant and each could be privatized separately.

A regional producer of pasteurized milk may be able to survive even if there is price collusion between Nestles and Milco. The localized pasteurized milk market is one element. Another one would be the development of a strong integrated model(out-grower system). The dairy plant develops long term supply arrangements with farmers. It provides procurement guaranties as well as key inputs. These include breeding material, veterinary services and concentrate feed. These arrangements will insure raw material supplies for the local manufacturers in the face of competition from the large national producers.

### 4.4.4 Relative product and input prices

In addition to the import levy, dairy products are subject to a turnover tax. These vary widely between different products: there is no tax on most dairy products and milk powder. It is, however 20% for cheese. These differentials in taxation are reported to discourage processing into cheese.

All products are subject to a 4.5% defense levy. This applies to all stages from processing to trade. The retail prices quoted thus include these charges as well as normal wholesale and retail margins.

There are substantial price margins between prices paid to the farmers for fresh milk and the prices of processed products at both retail and wholesale levels. The farm gate price of fresh cow milk in Southern Area varied from Rs. 10 to 12 per liter in July 1996. The retail price of yoghurt and curd was around Rs. 100 and 67 per liter respectively. Yoghurt is generally marketed in plastic cups of 0.08 liter (80 ml) retailing for Rs.8 per cup( or Rs. 100 per liter).

Curd is generally marketed in clay pots of 0.75 liter. These are sold for Rs. 50 each or Rs.67 per liter. The clay pot is not recycled and costs Rs.3.85 to 2.80 each. There are thus substantial margins in processing and marketing of the major dairy products.

There are similarly favorable margins for liquid milk products. Details on these products are given in subsection 4.7.3. below. In all cases, the margins are attractive and can support profitable enterprises in dairy processing.

### 4.4.5 The role of imported milk powder

There are three types of dairy manufacturers in Sri Lanka. Two large companies are involved in imports and packaging of powder only. Beyond this, they undertake no processing. One of these, however, is now planning to invest in reconstituting powder into liquid milk. Another common type of involvement is companies that basically utilize imported milk powder to produce a range of products. These companies also utilize local milk whenever this is offered at competitive prices. The last type is the companies that utilize local milk only. These are at a relative price disadvantage as the equivalent price of fresh milk has generally been higher than that of imported milk powder (Table 4.2).

The proposed project is of the second type. It is recommended that the project should be based on domestic raw milk. It should, however, protect itself against major increases in local milk prices by being able to shift to imported milk powder.

This ability to use imported milk powder is also important during the first years of project operation. Initially, there may not be sufficient local milk for full capacity utilization. Milk powder will be used to achieve higher levels of capacity utilization during that period.

## 4.5 Constraints to Production

Development of an efficient dairy industry in Southern Area depends on increasing local milk production. This in turn requires changes in a host of factors. The local breeds of cows is very poor: most can not be milked at all. They are not fed enough to produce any milk and produce a calf in two to three years because of limited feed. Veterinary services are poor and the local practices basically assume that veterinary care will not be needed. Farmers are not specialized in livestock production and view the cattle as a store of value to be sold at the time of need rather than as a productive asset. The government restrictions on the size of non-paddy land that can be owned by a family make it impossible to produce forage without which dairy farming is impossible.

Clearly all of these factors can not be changed at once. A reasonable livestock development strategy is to tackle the most pressing problems first. Presumably, these components would be the ones with the highest marginal benefit/cost ratios. A reasonable sequence would be to improve breeds, feeding and husbandry practices. Improvements in productivity will result in substantial growth in production while the number of cattle can be reduced to a fraction of the present size.

Production from a small herd at high level of technical efficiency is relatively more profitable. This is true even if this intensification implies a shift from extensive pasture based systems to intensive systems based on purchased feed. The higher overall production from a small herd reduces overgrazing and has a desirable environmental impact as well.

### 4.5.1 Milk collection

Under the present extensive system, the distance between milk collection centers and chilling stations is too long. It takes up to 10 hours to deliver milk to the chilling centers. Milk will normally spoil during this period particularly under the high temperature in Sri Lanka. To

avoid spoilage, farmers add harmful chemicals (hydrogen peroxide) to milk. It is necessary to build new chilling centers to avoid spoilage without using chemicals. Too many chilling centers without a sufficient quantity of milk, however, is uneconomical. It may also be necessary to give priority to promoting dairy units in special production clusters around existing chilling centers or along the main collection routes.

Developing dairy farming in areas adjacent to the dairy plant will reduce transport costs. It will also make it easier to provide inputs and extension services to the dairy farmers. One of the most critical factors in choice of areas where intensive dairying is to be developed is the availability of feed resources for forage production.

The Government is reported to own more than 80% of the land in Sri Lanka. This could be a major asset. The use of this land can be given to the dairy plants and independent dairy farmers, free of rent, for extended periods to encourage forage production. The farmers participating in the scheme should be given the option to buy this land. The size of these plots must also be large enough.

Under the present policy, the Government assigns each farmer no more than 2.5 acres of paddy land and a half acre of upland for home gardens. This half acre land would not produce the forage required to support one cow even if it is devoted entirely to forage production. Because of these restrictions, dairy farmers in the coconut triangle are reported to spend up to four hours/day to collect forage for one cow. The opportunity cost of forage thus collected is prohibitively high. Farmers will stop dairy production as soon as alternative employment becomes available.

### 4.5.2 Marketing

The domestic market for dairy products is very large compared with the present production. Sri Lanka annually imports over 30,000 tons of milk powder. The imports are growing and were 36,118 tons in 1995, equivalent to 353,000 tons of liquid milk. Domestic procurement of the milk by the major processors by comparison was 85,000 tons in 1994 and is reported to have shot up to 125 million liters in 1995.

The domestic procurement by the major processors is reported to be 25% of total milk production with the rest not marketed. The estimate of total production is highly speculative and is based on estimates of herd size and production per cow. The actual amount of production, net of milk fed to calves, is probably around half of the estimates.

The existing capacity in modern dairy units is small compared with the total imports and the domestic production. Milco processes about 47,000 tons of fresh milk annually. Another 41,000 tons is procured by Nestles. Both concentrate on purchase of cow milk while buffalo milk is primarily used by small processors to produce curd.

The present local production in Southern Area is a fraction of the total market. Most of regional consumption is met by imports from other regions and abroad. The only product where there is a semblance of a balance between production and consumption in Southern Area is curd. The major constraint to curd production is limited availability of buffalo milk.

Production of milk from both cows and buffalo , in turn, will not expand until the farmers are provided with reliable marketing outlets for milk. Dairy plants which provide this outlet would not be set up unless the raw material is available. Thus, development of primary production and processing has to occur at the same time.

## 4.6 Demand Projections and Market Size

The size of the formal milk market in Sri Lanka is estimated at 383.2 million liters of liquid milk equivalent in 1995. This formal market is expected to grow by a factor equal to the growth in population and incomes; income elasticities of demand are estimated to be 1.0.

The future demand for dairy products will be determined by three major factors. These are the increase in population, the increase in incomes, and commercialization of the dairy sector. This last refers to the size of commercial sector relative to on- farm consumption and the micro/non-formal sector.

Before the impact of these factors on demand can be quantified, it is necessary to establish the base-year production and consumption levels. Information is available for the formal sector procurement in Southern Area. Data on neither total nor informal sector production/consumption are available.

The size of the present market in Southern Area is estimated by making some simplifying assumptions. Per capita consumption is assumed to be the same as the national average. The total consumption met by the formal sector (excluding consumption out of farmers own production) is estimated to be 14 million liters in 1995. The total consumption in Southern Area was much higher at 72 million liters in 1995 ( Table 4.3).

The per capital consumption in 1995 was the same as the national average: 27 liters of liquid milk equivalent per annum. The same local production to import ratios were assumed as the national average. On this basis, the estimated total consumption in the region is 71.8 million liters in 1995. Of this, 15.6 million liters were met with local (Sri Lanka )production and the remainder by imported milk powder.

The share of national consumption met by local production is projected to increase from 22% in 1995 to 38% in 2015. This ratio is also used for Southern Area. The regional production and consumption estimates thus derived are presented in Table 4.3. The base year estimate of 15.6 million liters is four times the alternative estimates of production in the region: only a fraction of regional consumption is met by regional production. Southern Area (particularly Galle )imports dairy products from other regions.

The size of the regional market supplied by local production is expected to grow by 10 times over the next 20 years. Consumption in Southern Area in 2015 will be one-third of the present national consumption. The expected increase in regional consumption is a combined result of the growth in regional demand, and more importantly, the growing share of local production in total consumption. The size of the market even in 1995 is sufficient to support more than two enterprises of the scale proposed in this report. Over a dozen such enterprises will be needed to process all of the regional production of raw milk by the year 2015.

## 4.7 The Proposed Project

### 4.7.1 Project location

The proposed project may be located in any of the district centers in Southern Area. Galle and Matara are major markets. Hambantota is likely to be the main production center. Production near the market would be attractive because products with a relatively short shelf life are to be produced. Location in the region where raw milk is produced will reduce collection costs of raw milk. This advantage is less important if the plant will rely on imported milk powder.

The distances in Southern area are not very large. Neither raw milk nor product transport is likely to pose major problems. Access to infrastructure and the ability to employ the

necessary technical personnel may thus be more important than the minimization of transport costs. All these suggest that Galle may be the most desirable location.

### 4.7.2 Processing scale

Modern dairy plants in the developed countries rarely have processing capacities of less than 100 tons raw milk per day. Such a plant would normally produce the full range of dairy products: pasteurized and sterilized (UHT)milk, cheese, milk powder and other dairy products. This full range allows the utilization of different quality milk to produce different products in the same plant.

Milk processing plants in Sri Lanka are small by international standards. In recent years, the potential entrepreneurs have been advised to invest in mini dairy plants using one to five thousand liters of raw milk per day to produce fresh products. Both the size of local markets and the limited availability of raw milk have contributed to these recommendations for small plant size.

Sri Lanka also has plants at the other end of size distribution. The Nestles plant in Pannela (Krugale) has a capacity to process 300 tons of raw milk per day. It produces only milk powder with some butter as a by-product. The largest MILCO plant (at Ambevela) has a capacity of 110 tons/day and produces milk powder. The Nestles plant at Polanaru and MILCO plant at Colombo have capacities of 50 and 60 thousand liters/day. These plants produce the full range of products: pasteurized and sterilized milk, yoghurt and ice cream. MILCO has a small plant in Digana with the same range of products as that of the plant in Colombo. The other private manufacturer (Swiss Cheese) in Kandy has a capacity of less than 10,000 liters/day.

A wide range of scales seem to be viable in Sri Lank. Even the small scale plants produce the full product range. This is made possible by the large processing margins due to limited competition. In the long term, the plants have to increase their processing scale and improve their technical efficiency. Flexibility in design to allow capacity expansion should be a major concern for the new dairy plants.

The scale and the product range proposed for this plant is based on milk availability in Southern Area, market size, likely changes in the domestic demand, and technological considerations. All of these assumptions should be fully verified at the feasibility stage.

The proposed plant will process 15,000 liters/day of raw milk into pasteurized milk and will produce butter as a by-product. The pasteurized milk is expected to be split evenly between plain and flavored milk. Both the figures in this report and detailed information provided by Milco suggest that it is much more profitable to produce flavored rather than plain milk. The actual product mix, however, is determined by the market demand. The plant will have some operating flexibility by changing the relative price from those assumed in this report to encourage consumption of products with a more favorable processing margin.

A plant processing 15 tons of raw milk a day will require 5.5 million liters a year of raw milk. It would need to operate everyday, including Sundays and holidays. Southern Area does not produce sufficient milk to supply even one such plant. Even if sufficient production were forthcoming, the company will find that the raw milk prices become intolerably high if it targets purchase more than half of the regional production.

Initially, the company should target procurement of around one million liters a year, increasing by about 50% every year. This is viable if the plant cooperates with government agencies and the Southern Development Authority to promote milk production in the region.

For the interim period, the company would rely on imported milk powder to be reconstituted into liquid milk. Raw material costs will be less if it uses imported milk powder rather than processing fresh milk. This is disregarded in this report and the same high input prices for all milk input are assumed.

For the product range, a simplified set of products are taken consisting of pasteurized plain and flavored milk, and butter. The plant is likely to produce other products as well, but the final product mix will be determined when the full feasibility study is undertaken. Production of sterile milk is not foreseen as the global trend is moving away from this product. Production costs of this are higher than the pasteurized milk, quality is not as good, and its advantage of durability disappears as the cool chain in marketing is established. Sterilized milk may be kept up to six months without refrigeration while this is at most two days for pasteurized milk.

### 4.7.3 Prices

All prices used in this study are those of mid- 1996. These prices are used for fixed capital investments as well as input costs and final product prices. Furthermore, no adjustment is made for price changes in the future. This derives from the expectation that the changes in

the costs of inputs will be the same as those of the products produced in the plant. It would be useful to include analysis of term of trade changes between input and product prices in the feasibility study.

The use of these fixed base year prices require appropriate adjustments in interest costs. Only the interest component corresponding to the real interest costs is included in analysis. The component of interest due to inflation is excluded. It is assumed that the rate of interest will be 3% above that of inflation.

The prices used in this study are the national averages for products sold in the national market. This is the case for packaging materials and most investment goods. The raw milk prices and those of final products vary by location and brand. Most prices adopted for such products are averages of Galle and Hambantota for raw milk.

It is assumed that the project for which this pre-feasibility study is prepared will locate in Southern Area. The raw material and product prices will thus be those observed in the region. The actual prices charged will vary depending on the investor and product quality. In case the project is a subsidiary of one of the established brands, the prices charged can be those of the premium brands. The product may be similarly priced if the manufacturer chooses a strategy of intensive marketing.

The prices adopted assume that the product will be a relatively less known brand marketed only in the region. The nature of products chosen (pasteurized milk) is such that it has a short shelf life and geographically the market area is small. The marketing strategy will also have an impact on the type of packaging that is appropriate: glass, plastic bottle or plastic saches. The product prices will be a little below those of well known brands for the respective package. This study is based on the least cost package of plastic sachet.

The raw milk price is taken to be Rs.12.5 per litre. This is higher than the prices paid to farmers both in Galle (Rs. 11 per litre for average quality) and Hambantota (Rs.10 per liter). The actual price paid by Milco in 1996, after adjustments in fat and solid content, was Rs. 12.57 per liter in Sri Lanka. Thus, the raw milk price used in this study seems to be reasonable.

Initially, the processor would face major problems in acquiring raw milk due to limited production in Southern Area. Therefore, an additional cost of Rs. 2 per litre is included for milk collection. This will apply during the first four years until the plant reaches full capacity

utilization. This allocation may be used to offset the higher collection costs from areas outside the region or they may be used to induce the farmers to increase milk production in the region.

Both estimates of production costs and comparisons of relative prices indicate that, at that farm gate price, milk production is also reasonably profitable for the farmers. In Western Europe and North America, a farmer will need to sell 1.5 to 2 kg of milk to purchase 1 kg of concentrate feed. This ratio is one to one in Sri Lanka and favors the dairy farmers. Farmers will thus have a strong price incentive to produce milk.

This advantage, however, will disappear rapidly if the farm is technically inefficient. A farm with relatively high input costs could make a large profit if it is technically efficient. A low cost operation may in fact lose money. Technical productivity in dairy cow operation could thus be a much more important determinant of profitability than the relative prices of feed and milk. This again emphasizes the importance of establishing specialized dairy farms in contrast with the existing extensive system.

This study assumes the ex-factory price of plain pasteurized milk to be Rs. 10.31 for a half liters plastic sache. The price assumed for plain milk is Rs. 6.11 per 200 gram. These are Milco ex-factory prices for the same type of package. They are derived from retail prices in mid-1996 on the basis of the tax, and trade margins summarized below. Further details are given in Table 4.4. The figures below are converted to the prices of a unit of one liter for comparison with other brands which may be marketed in units of different sizes.

(Unit: Rp. per liter in plastic sachet)

| | Plain Milk | Flavored milk |
|---|---|---|
| Ex-factory | 21.59 | 32.00 |
| Wholesale | 22.70 | 34.50 |
| Retail | 25.00 | 42.50 |
| Ex-factory, net of defense levy | 20.62 | 30.56 |

The ex-factory price was 72% of the retail price for the flavored and 82% for the plain milk. These ratios are applied to the products of other companies and imported products for price comparisons.

Flavored milk can be even more profitable than indicated in this report. A 200ml bottle is expected to be sold for Rs.6.11. The price of imported fresh flavored milk in Colombo was

incomparably higher at Rs.85 for a liter of plain milk and Rs.75 per half liter bottle of flavored milk (Rs. 150 per liter).

A USAID sponsored study in the coconut triangle investigated the wholesale prices of dairy products in the major urban centers. The prices of 100ml vanilla flavored milk varied from Rs.5 to 7 per pack for the local brands. The price of fruit flavored packs was generally about one Rupee higher. These are two to three times higher than the prices assumed here.

Product price information was made available by a new company expected to enter into the market in late 1996. Lanka Dairies Limited will initially start by marketing chocolate and vanilla flavored milk. A 250 ml pack will be retailed for Rs. 15 per pack ( Rs. 60 per liter at retail level, or Rs. 43.1 liter ex-factory). The product will be sterilized and will have a shelf life of six months without refrigeration.

Milco charges a higher retail price in case of more expensive packaging. The flavored milk in 250 ml bottle is retailing for Rs.12 per bottle.

There is no local production of these products in Southern Area for price comparisons. The flavored milk price is generally comparable to that of similar yoghurt. The price assumed for flavored milk in this study is half the price of flavored yoghurt in the region.

Butter prices are fairly standard at Rs. 32.5 per 200 gram pack. The brand recognition is much less pronounced than the other products. The regional producer can thus price his butter at the same price as those of well known brands.

### 4.7.4 Production parameters

The investment period is assumed to be one year. The project will commence operations at the beginning of year two. It will utilize only one-third of its rated capacity during the first year. Capacity utilization will be gradually built up and the project will use its capacity fully in the third year of operation. In practical terms, this would require that the project reaches full capacity utilization at the end of two years after production commences. This is an ambitious target and can be achieved only if the raw milk production and marketing issues are addressed at the same time.

Half of total milk procured will be used to produce flavored milk and the other half to produce plain milk. As is customary in Sri Lanka, the flavored milk will be marketed in packs of 200 grams. Plain milk will be marketed in half kilo packages.

Milk is skimmed to a very limited degree to maintain fat consistency in final products. The total milk fat produced varies from 8 to 15 g per liter of raw milk depending on the end product; more fat is skimmed from milk processed into flavored than plain products. Butter contains 20% fat. This is marketed in 200 gram packs.

The quantity of products produced and packages marketed increase for each year until production stabilizes. This occurs in year four and the parameters are the same thereafter: from year four to the end of project period. Raw milk and packaging costs associated with these levels of output are presented in Table 4.4.

### 4.7.5 Investment costs and financing

Fixed capital investment

The estimate of investment requirements (Table 4.5) is based on actual conditions in Southern Area for local costs. This includes building and utilities. The machinery costs are collected from a variety of sources.

A major source of information is the 1995 sector study of the Asian Development Bank. The Bank's estimates generally are higher than those of alternative sources. In the case of pasteurizing plant machinery, for example, the ADB estimate of costs is Rs. 30 million. This is probably Australian equipment representing the most advanced technology which insures high quality standards. Comparable machinery available from India is reported to cost only Rs. 6 million.

Another source of information has been the Agricultural Enterprise Project of USAID, quoting manufactured equipment for small scale plants. Information has also been collected from Milco about the cost of machinery and plant.

All machinery costs are landed costs in Sri Lanka. They generally represent quotations from manufacturers adjusted for transport to Sri Lanka. Under the present BOI scheme, all machinery will be imported duty free. The exception will be a 4.5% defense levy charged on all imports and this is included in the costs presented in Table 4.5.

The range of alternatives is very wide for costs for all investment components. The investor may choose expensive machinery and building materials to reduce costs of maintaining the equipment and to insure high product quality. It is also possible to choose a low cost investment option and aim to compete on product prices. The prices should be reviewed and finalized at the feasibility stage.

Building costs are those of standard factories built in Hambantota. They include the provision for all utilities in the building. The costs of utilities up to the parameter of the site are rough estimates and are based on representative conditions. They would vary by a large margin depending on the actual location of the plant and whether basic services are available on that site.

All costs of support for the dairy farmers are excluded. Similarly, there is a pressing need to invest in milk collection and storage facilities if the plant wants to insure a steady supply of fresh milk collected in a hygienic manner. These are, however, external to the plant and should be financed separately. The raw milk prices assume that the suppliers will operate these services.

At the marketing end, the possible components of a cold chain are excluded. At the very least, the dairy factory should provide cold storage chests for its dealers. These costs are not included at this stage but should be included in feasibility studies which should also address, in detail, the question of the desired marketing system and marketing strategy.

Total fixed capital investment costs of a plant that may be built in Southern Area are estimated to be Rs. 61 million (US$ 1.1 million). In addition to the fixed investment, financing is needed for the permanent working capital requirements. This will be mostly for the raw milk procurement and will include some packaging materials. The actual permanent working capital needs are heavily dependent on the terms on which milk is purchased and terms extended to the dealers.

Permanent working capital

In Sri Lanka farmers are paid twice a month for the raw milk. Dairy products are sold against cash. The company would not need permanent working capital either for raw materials or finished products. Nonetheless, one month equivalent of raw material procurement costs are included in the permanent working capital ( Table 4.6).

Operating costs

Three major cost components are raw milk, packaging materials and flavorings. Raw milk is 60% of annual operating costs in the first year of operation and 68% at full capacity utilization. These high proportions of variable costs in total suggest that break-even points are at fairly low levels of capacity utilization (Table 4.7).

The profitability of the dairy plant is thus more affected by the relative prices of inputs and products than the full utilization of capacity. The emphasis should be placed on the production of a high quality product at competitive prices rather than full capacity utilization. Cooperation with an established local or international company will thus be highly desirable.

The combined impact of all costs and prices on the pasteurized milk production is compared with available data. The cost structure resulting from the estimates of this study is compared with information provided by Milco for pasteurized milk (Table 4.8). The order of magnitude is similar, but the government-owned Milco has higher labour costs and incidental expenses.

Financing

The size of the proposed investment is probably too small to attract foreign private capital. It is likely to be undertaken by local industrialists. It is assumed that the entrepreneur will provide half of the total requirements as equity and the rest will be borrowed. The cash flow indicates that there should be no repayment on the principal during the first two years (Table 4.9). During that period, interest on the outstanding loan will be capitalized. The principal thus derived will be paid in eight equal installments (Table 4.10).

It is unlikely that commercial banks will provide financing on these terms. Therefore, it is assumed that financing will be provided by a government development bank or through the refinancing facility of the Central Bank at concessional terms.

The rate of interest on the loan is assumed to be 3% above the actual inflation. This convention is adopted to avoid estimates of rates of inflation which could have a major impact on projects. With fixed interest rates, loans can create large distresses if inflation is controlled. The opposite occurs with rampant inflation.

Available incentives

Investments in food processing for the domestic market are eligible for a variety of incentives. The proposed investment is expected to pay no taxed during the first five years under the existing system of Board of Investments incentives.

A food processing project located outside Colombo with a minimum investment size of Rs. 2.5 million and employing more than 50 people will be eligible for a full tax holiday of five years. All inputs will be imported duty free during the project implementation period. The payroll tax for the expatriate staff will be established at the concessionaire rate of 15% for a period of three years.

The dairy project meets all of the requirements for BOI incentives. The actual staff requirement may be less than 50 but this is assumed in the cost calculations to make the project eligible under the incentive system.

### 4.7.6 Project profitability

Base case

The project cash flow for the whole project is given in the first part of Table 4.9. At full development, the project generates revenues of Rs. 153 million and has total costs of Rs.106 million per annum. The gross annual profits are similar to the total amount of financing required for the project (around Rs. 64 million). This results in a very high estimate of IRR at 41%.

Further analysis of profitability are not undertaken to avoid giving a false picture of a high level of precision. Nonetheless, the estimate of 41% is comparable to the financial rate of return. The economic IRR will be even higher if the defense levy and taxes on payroll and other charges are excluded from the total costs.

Sensitivity analysis

The impact of the likely adverse effects of product and input prices on the project IRR shows the project to be fairly risk free. Two cases were investigated. In the first case, increased competition in the future and reduced product prices by 10% were assumed, while all others costs remained unchanged.

Another case represents a situation where costs are actually higher than those assumed in this report. All investment costs were increased by 10%. The impact of these cases on the IRR was as follows :

| | IRR |
|---|---|
| Base Case | 41% |
| Product price fall by 10% | 29% |
| Costs increase by 10% | 30% |

The project continues to be profitable at a healthy rate of 24% even if the two adverse effects occurred at the same time. A slower than expected built up of the project is simulated by leaving the cash out schedule unchanged but pushing the income stream into the future by one year. In this case, the IRR declines to 34%. Some of the other project risks are discussed in the last section of this report.

In the base case, project income is not adjusted for corporate taxes on the assumption that the project will enjoy Board of Investments tax privileges. These will provide corporate tax exemption for the first 5 years. Taxing the project profits at 50% after the fifth year reduces the base case IRR to 34%.

Two further cases could be analyzed. In these, the analysis would include depreciation in project income since it is included in costs (one should include either depreciation or capital outlays, but not both in "cash out" stream). The other adjustment would be inclusion of permanent working capital changes in project income after compounding it by the IRR.

Return to equity

The key measures of profitability in not the IRR of overall project, but the return to equity for the individual investor. A cash flow table is constructed by including loans in "cash in" flow in the first part of Table 4.9. At the same time, operating expenses are increased by interest costs and repayment of the principal. This simulates a case where all charges and income, except owner's equity is taken into account. The IRR in this case becomes very large. The annual profits are similar to the level of equity investment.

It should be stressed that all profits in this report are in real term. They exclude inflation and are expressed in fixed 1996 prices. The nominal return to the investment will be higher by the rate of inflation. The estimates of profitability in this report are thus very attractive.

The unreasonably high IRR's indicate that there are major structural problems in Sri Lanka. Some of these are discussed in the last section of this report. They basically point at non-market entry barriers facing the potential entrepreneurs. There also appear to be substantial unforeseen expenses that must be born by the investor that can not be quantified at this stage. The potential financial rewards, however, are very high if these barriers can be overcome at reasonable cost.

### 4.7.7 Likely risks

The industry structure is the major deterrent to the potential new entrants. The industry is dominated by two companies who could easily undertake predatory pricing to deter competition. Promoting competition should be a major priority of the public policy.

The dairy processor will also face the initial problem of primary production in the region. The farmers will undertake commercial dairy production only if they are assured of a stable market at reasonable prices. At the initial stage, public agencies should share part of costs of primary production and otherwise support dairy farmers.

The other likely problem in dairy development is the development of the market for the processed products. It will take many years to establish a brand name for the new entrant.

The gradual build up of the market and brand recognition may take longer than foreseen in this report. This will result in much lower IRR's than given in this report.

It is very difficult to develop a competitive dairy industry in Sri Lank without a change in the land policy. Dairy farmers must have secure access to enough land on which to grow forages. This may be either leased on owned. In the case of lease, this lease should be long term and freely transferable with no hindrance from the Government.

**Table 4.1 Market for Milk and Dairy Products in Sri Lanka (1994)**

(Unit: 1,000 tons, liquid milk basis)

| | | |
|---|---|---|
| A. | From Local Manufacture | |
| | Pasteurizing milk | 8.1 |
| | Sterilized milk | 5.3 |
| | Condensed milk | 9.5 |
| | Whole milk powder | 63.1 |
| | Butter/ghee | 2.7 |
| | Cheese | 1.1 |
| | Others | 15.800 |
| | Sub-total | 105.6 |
| | Less : Imported LME used | 25.0 |
| | Local milk | 80.6 |
| B. | From Imports | |
| | Whole milk powder | 274.5 |
| | Skim milk powder | 66.8 |
| | Infant milk powder | 0.1 |
| | Cheese and cured | 4.3 |
| | Butter and butter oil | 6.5 |
| | Other (yoghurt, UHT, cream, etc.) | 0.2 |
| | Condensed milk | 0.9 |
| | Sub-total | 353.3 |
| | Total A+B | 433.9 |

**Table 4.2 Relative Retail Prices - Pasteurized Milk and WMP on LME Basis**

| Year | Pasteurized Milk Rs/liter | WMP Rs/liter | Prices of Pasteurized Milk Relative to WMP[1] (%) |
|---|---|---|---|
| 1978 | 2.46 | 1.59 | -35.4 |
| 1979 | 2.46 | 1.74 | -29.3 |
| 1980 | 3.52 | 2.8 | -20.5 |
| 1981 | 3.8 | 3.78 | -0.5 |
| 1982 | 4.2 | 3.78 | -10.5 |
| 1983 | 5.8 | 6.18 | +6.6 |
| 1984 | 7.5 | 7.66 | +2.1 |
| 1985 | 7.5 | 7.66 | +2.1 |
| 1986 | 7.5 | 7.66 | +2.1 |
| 1987 | 7.5 | 7.66 | +2.1 |
| 1988 | 7.5 | 8.18 | +9.1 |
| 198 | 10.5 | 11.35 | +5.1 |
| 1990 | 12.5 | 14.75 | +17.9 |
| 1991(Oct) | 14.5 | 13.6 | -9.2 |
| 1992(Jul) | 17.8 | 15.52 | -8.7 |
| 1994(Apr) | 19.0 | 14.73 | -22.5 |
| 1995(Nov) | 21.0 | 16.31 | -22.3 |

[1] Price difference as % of WMP

## Table 4.3 Demand Projections for Milk 1994-2015 (on Liquid Milk Basis) in Southern Area

| Item | Unit | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Population | | 2,660 | 2,701 | 2,751 | 2,798 | 2,845 | 2,894 | 3,025 | 3,291 | 3,375 |
| Formal market | liter per capita | 27 | 29 | 31 | 34 | 36 | 39 | 56 | 81 | 117 |
| Total | million liters | 71.8 | 78.3 | 85.3 | 95.1 | 102.4 | 112.9 | 169.4 | 266.4 | 395.0 |
| Supplied from local milk | % | 22.0 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 |
| Supplied from local milk | million liters | 15.6 | 18.8 | 22.2 | 26.6 | 30.1 | 76.1 | 57.5 | 95.8 | 150.0 |

| *Assumptions* | 1995 - 2000 | 2001 - 2010 | 2011 - 2015 |
|---|---|---|---|
| Population growth rate | 1.7% | 1.7% | 1.7% |
| GRP growth rate(% per annum) | 6 | 10 | 8 |
| Market growth rate (%) | 6.0% | 18% | 8.0% |
| • Supplied from local milk | | | |

**Table 4.4 Milk Pasteurizing Plant : Basic Parameters**

| | Year | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4... | 20... |
| 1. Production | | 5,000 | 10,000 | 15,000 | 15,000 |
| a. Raw milk intake(liter day) | | 1,825 | 3,650 | 5,475 | 5,475 |
| (000 liters per year) | | | | | |
| b. Quantity produced | | 912 | 1,825 | 2,737 | 2,737 |
| Plain milk (50%)-tons | | 912 | 1,825 | 2,737 | 2,737 |
| Flavored milk (50%)-tons | | 912 | 1,825 | 2,737 | 2,737 |
| Milk fat[1] | | 21.0 | 42 | 62.9 | 62.9 |
| Butter [2] | | 25.6 | 51.2 | 76.4 | 76.4 |
| c. Number of packs produced | | | | | |
| Plain milk | | 1,825 | 3,650 | 5,474 | 5,474 |
| (Thousand half liter pcs. ) | | | | | |
| Flavored milk | | 4,563 | 9,125 | 13,685 | 13,685 |
| (Thousand 0.2 liter pcs. ) | | | | | |
| Butter | | 128 | 256 | 384 | 384 |
| (000.200 gram packs) | | | | | |
| 2. Ex-factory prices(per pack in Rs.) | | | | | |
| a. Plain milk (500 grams) | | 10.31 | 10.31 | 10.31 | 10.31 |
| b. Flavored milk (200 grams) | | 6.11 | 6.11 | 6.11 | 6.11 |
| c. Butter (200 grams) | | 32.76 | 32.76 | 32.76 | 32.76 |
| 3. Input Costs | | | | | |
| a. Row milk (Rs/liter) | | 12.5 | 12.5 | 12.5 | 12.5 |
| b. Packages (per pack in Rupees) | | | | | |
| Plain milk | | 0.54 | 0.54 | 0.54 | 0.54 |
| Flavored milk | | 0.45 | 0.45 | 0.45 | 0.45 |
| Butter | | 1.96 | 1.96 | 1.96 | 1.96 |
| Milk collection cost (Rs/liter) | | 2.0 | 2.0 | 2.0 | 2.0 |
| 4. Flavourings and other materials | | | | | |
| (per 200 gram ) | | | | | |
| a. Sugar | | 0.36 | 0.36 | 0.36 | 0.36 |
| b. Essence, flavorings | | 0.10 | 0.10 | 0.10 | 0.10 |

[1] Milk fat extracted is generally 8 grams/per liter of raw milk processed into plain milk, and 15 gram per liter of raw milk processed into flavored milk.
[2] Butter contains 82% milk fat.

**Table 4.5 Investment Requirements of the Pasteurizing Plant[1]**

(Unit: Rs. 1,000)

| | | Year | | | |
|---|---|---|---|---|---|
| | | 1 | 2... | 10... | ..20[2] |
| 1. | Project preparation and supervision | 2,958 | | | |
| 2. | Land and buildings | | | | |
| | Land(10 ha) | 500 | | | 500 |
| | Main building (1,200 m sq.) | 4,000 | | | 800 |
| | Cool room | 1,500 | | | 200 |
| | Laboratory (with equipment) | 1,000 | | | |
| 3. | Utilities | | | | |
| | Electricity | 1,000 | | | |
| | Standby Generator | 2,000 | | | |
| | Water supply | 500 | | | |
| 4. | Equipment | | | | |
| | Processing | 30,600 | | 22,950[3] | 6,210 |
| | Homogenizer | 2,000 | | | 400 |
| | Separator | 2,000 | | | |
| | Crates | 800 | | | |
| 5. | Treatment Plant | 2,000 | | | |
| 6. | Vehicles and Office Equipment Tankers(3) | 6,000 | | | 1,500 |
| | Car | 1,500 | | | 250 |
| | Office equipment | 1,000 | | | 500 |
| | | 59,358 | | 22,950 | 10,360 |

[1] The processing plant has a capacity to process 15 tons of raw milk per day.
[2] The salvage value of liquidation.
[3] Renewal of processing equipment.

## Table 4.6 Project Income and Expenditures

(Unit: Rs. 1,000)

| | | Year | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4.. | ..20 |
| A | Expenditures | | | | | |
| | 1. Fixed Investments | 59,758 | - | - | - | - |
| | 2. Stocks and receivable | 12,500 | 12,500 | - | - | |
| | 3. Operating costs | 1010 | 41,888 | 76,401 | 105,719 | 105,719 |
| | - of which milk | | (22,812) | (45,625) | (68,437) | (57,487) |
| | Sub-Total | 60,768 | 54,388 | 89,901 | 105,719 | 94,769 |
| B | Income | - | | | | |
| | 1. Plain milk | | 18,815 | 37,631 | 56,447 | 56,447 |
| | 2. Flavored milk | | 27,886 | 55,772 | 83,658 | 87,658 |
| | 3. Butter | | 4,193 | 8,387 | 12,580 | 12,580 |
| | Sub-total | | 50,894 | 101,790 | 152,685 | 152,685 |
| C | Net cash flow | -60,768 | -8,753 | 5,312 | 25,546 | 25,5646 |

**Table 4.7 Annual Operating Costs of the Pasteurizing Plant**

**(Unit: Rs.1,000)**

| | 1 | 2 | 3 | 4... | ...20 |
|---|---|---|---|---|---|
| 1. Raw milk intake | | 22,812 | 45,625 | 68,437 | 57,487 |
| 2. Collection costs | | 3,650 | 7,300 | 10,950 | 10,950 |
| 3. Packaging materials | | 85.2 | 6,570 | 9,850 | 9,855 |
| Flavored milk | | 2,053.1 | 4,106 | 6,159 | 6,159 |
| Plain milk | | 985.1 | 1,970 | 2,955 | 2,955 |
| Butter | | 247.0 | 494 | 741 | 741 |
| 4. Flavorings | | 3,650 | 7,300 | 10,950 | 10,950 |
| 5. Wages and Salaries | | | | | |
| Wages | 400 | 3,000 | 4,000 | 4,000 | 4,000 |
| Staff welfare | 150 | 500 | 500 | 750 | 750 |
| 6. Electricity and Fuel | | | | | |
| Electricity | | 750 | 750 | 900 | 900 |
| Fuel | | 225 | 225 | 250 | 250 |
| 7. Office expenses | | | | | |
| Consumable | | 400 | 400 | 500 | 500 |
| Office expenses | 50 | 360 | 274 | 274 | 500 |
| Vehicles | | 300 | 360 | 480 | 480 |
| Marketing/Advertising | 110 | 183 | 274 | 300 | 500 |
| General Administration | 300 | 300 | 300 | 500 | 500 |
| 8. Maintenance | | | | | |
| Buildings | | 143 | 143 | 143 | 143 |
| Plant | | 2,280 | 2,280 | 2,280 | 2,280 |
| Vehicle | | 50 | 100 | 150 | 150 |
| Total | 1,010 | 41,888 | 76,401 | 105,719 | 94,769 |

**Table 4.8 Cost Structure of Pasteurized Milk**

(Unit: Rs.1,000)

| | |
|---|---|
| Milk producer price | 13.00 |
| Milk collection. operation and cooling | 1.50 |
| Factory procurement price | 14.5 |
| Procurement overhead | 0.2 |
| Cost : ex-factory | 14.7 |
| Packing materials | 1.6 |
| Processing and packing labour | 0.3 |
| Plant variable overheads | 0.2 |
| Total processing cost | 2.8 |
| Administration | 0.4 |
| Selling and distribution | 1.0 |
| Advertising and promotion | 0.5 |
| Losses(% of ex-factory price) | 0.53 |
| Defense levy(4.5% of retail price) | 1.14 |
| Processor margin | 2.1 |
| retail margin | 2.0 |
| Retail price per liter | 25.43 |

The figure are as of June 1996.
Source : MILO.

## Table 4.9 Income and Expenditure Flows

(Unit: Rs.1,000)

A: Total Investment

| Year | Income | Expenditure | Net cost |
|---|---|---|---|
| 1 | - | 60,768 | 60,768 |
| 2 | 50,894 | 54,388 | -3,494 |
| 3 | 101,790 | 88,901 | 12,889 |
| 4 | 152,685 | 105,719 | 46,966 |
| 5 | 152,685 | 105,719 | 46,966 |
| 6 | 152,685 | 105,719 | 46,966 |
| 7 | 152,682 | 105,719 | 45,966 |
| 8 | 152,685 | 105,719 | 46,963 |
| 9 | 152,682 | 105,719 | 46,963 |
| 10 | 152,682 | 105,719 | 46,963 |
| 11 | 152,682 | 105,719 | 46,963 |
| 12 | 152,682 | 105,719 | 46,963 |
| 13 | 152,682 | 105,719 | 46,963 |
| 14 | 152,682 | 105,719 | 46,963 |
| 15 | 152,682 | 105,719 | 46,963 |
| 16 | 152,682 | 105,719 | 46,963 |
| 17 | 152,682 | 105,719 | 46,963 |
| 18 | 152,682 | 105,719 | 46,963 |
| 19 | 152,682 | 105,719 | 46,963 |
| 20 | 170,000 | 105,719 | 46,963 |

B: Equity

| Year | Income | Expenditure | Net cost |
|---|---|---|---|
| 1 | 35,600 | 358 | 35,242 |
| 2 | 58,394 | 55,753 | 2,641 |
| 3 | 101,788 | 98,953 | 5,835 |
| 4 | 152,682 | 95,782 | 56,900 |
| 5 | 152,682 | 112,430 | 40,252 |
| 6 | 152,682 | 112,259 | 40,423 |
| 7 | 152,682 | 133,508 | 19,174 |
| 8 | 152,682 | 133,338 | 19,915 |
| 9 | 152,682 | 133,167 | 19,688 |
| 10 | 152,682 | 132,994 | 12,682 |
| 11 | 152,682 | 127,139 | 25,682 |
| 12 | 152,682 | 127,139 | 25,682 |
| 13 | 152,682 | 127,139 | 25,682 |
| 14 | 152,682 | 127,139 | 25,682 |
| 15 | 152,682 | 127,139 | 25,682 |
| 16 | 152,682 | 127,139 | 25,682 |
| 17 | 152,682 | 127,139 | 25,682 |
| 18 | 152,682 | 127,139 | 25,682 |
| 19 | 152,682 | 127,139 | 25,682 |
| 20 | 170,000 | 127,139 | 42,861 |

## Table 4.10 Projected Financing Schedule

(Unit: Rs. 1,000)

| Year | Bank loan received | Interest[1] | Repayment of principal | Outstanding Loan[2] |
|---|---|---|---|---|
| 1 | 35,600 | 196.8 | - | 36,668 |
| 2 | 7,500 | 1,365 | - | 45,493 |
| 3 | - | 1,365 | 5,687 [3] | 39,806 |
| 4 | - | 1,194 | 5,687 | 34,119 |
| 5 | - | 1,024 | 5,687 | 28,432 |
| 6 | - | 853 | 5,687 | 22,745 |
| 7 | - | 682 | 5,687 | 17,058 |
| 8 | - | 512 | 5,687 | 11,371 |
| 9 | - | 341 | 5,687 | 5,684 |
| 10 | - | 171 | 5,684 | - |

[1] A real interest rate (above inflation) of 3% per annum.
[2] Interest capitalized during the first two years.
[3] Repayments made at the end of calendar year.

# 5. POULTRY MEAT PROCESSING

## 5.1 Introduction

This report is one of two in-depth studies undertaken while preparing a Master Plan for Southern Area. The area referred to as Southern Area in this report is the same as that for which a task force was created by the President. It includes all of Southern province and five adjoining AGA divisions of Uva province.

This report is meant to provide further information on some sectors that are identified to be promising by the Master Plan. Details are provided at a pre-feasibility level. The feasibility studies should be undertaken by interested private investors.

The feasibility study will include information specific to the site where the project will be located. It is strongly recommended that the potential investors should also carefully check the input and product prices used in this report. Investment costs are not very significant in determining project viability, though they are a key determinant of investors' ability to finance the project.

Experience in the product line would be an asset for the potential entrepreneur. This is not assumed in this report. Investors with no previous experience are also encouraged to further investigate the potential of poultry meat production in Southern Area.

## 5.2 Poultry Industry in Sri Lanka

### 5.2.1 Production and consumption

The amount of poultry meat produced in commercial enterprises is very small in Sri Lanka. Within that small market, industrialized formal enterprises have a small share. The very small modern sector, on the other hand, appears to be extremely efficient technically. If true, this would suggest that the conditions in Sri Lanka are very favorable for poultry meat production and the Country can become a very competitive producer for the international markets.

One major indicator of the underdeveloped status of poultry industry is the relative prices. In countries with developed poultry industries, the price of poultry meat is one-third of the price of red meat. In Sri Lanka, the price of poultry meat is higher than that of beef and mutton. There is a similar situation in the case of eggs.

Most people in Sri Lanka can not consume beef for religious reasons. This should lead to relatively high levels of poultry meat consumption. Yet, the consumption levels are very low compared with other countries in the region and the world. This is shown below.

| | Per capita annual consumption (kg) | Consumption growth rate (1988-94) (%) |
|---|---|---|
| World | 8.6 | 5.0 |
| Asia | 4.0 | 8.4 |
| China | 4.3 | 13.4 |
| Thailand | 9.2 | 5.3 |
| Indonesia | 3.0 | 4.6 |
| Sri Lanka | 2.1 | 12.1 |

Although the base is tiny, consumption has increased rapidly during the last 10 years. This has occurred primarily by substituting poultry meat for fish while the overall levels of intake from all sources has remained static at around 15 kg per capita per annum. This overall level and the amount of poultry meat consumed is insignificant compared with other countries.

In USA, per capita broiler consumption is over 30 kg per annum and follows an increasing trend. In most members of European Union, poultry meat consumption is over 40 kg. despite the high levels of red meat consumption.

The industry sources estimate that per capita poultry meat consumption in Sri Lanka will reach 5 kg per annum by the year 2000 if the current trends continue. A more conservative projection is provided by the Animal Production and Health Department. The Department projects per capita consumption of 3 kg in the year 2000. The implied annual growth rate is 16% in the first case and 12% in the second.

The past growth in poultry industry appears to have been constrained by policy induced factors. In developed poultry industries, the commercial producers rapidly expand output and reduce prices if the relative prices favored poultry meat to the extent observed in Sri Lanka. The time lag in poultry meat production is also very short so that the adjustment is almost instantaneous. In Sri Lanka, the industry has not expanded the output and has remained stagnant at a level where production should still provide excess profits.

### 5.2.2. Organization of industry

In all cases where poultry meat industry is well developed, commercial production is highly integrated. For poultry meat, this integration generally involves parent stock, commercial broiler houses, concentrate feed, and a processing unit. Of these, broiler growing units are generally owned or leased by individual farmers while the rest is owned and operated by a single company (generally referred to as the integrator). The production components involved and some of the major variants for commercial production are illustrated in Figure 5.1.

There are four systems of integration. In the extreme case, all units are owned and managed by one company (nucleus farm). Another case represents a high level of integration: all units except commercial poultry growing are integrated in one central unit (the integrator). Chicks would be grown into broilers by contract farmers whom the integrator supplies with all inputs. Looser forms of integration are possible. The integrator provides only some of the inputs and others are purchased from independent producers of feed or chicks. The last form is independent producers having different sources for different inputs and undertaking their own marketing. Both the sources of inputs and marketing outlets are frequently changed under this system.

The scale of all of these components is related, though variations are possible; the parent stock unit may produce commercial chicks for sale to outsiders in addition to the requirements of the integrated unit. Similarly, feed may be sold to independent producers while satisfying the requirements of the integrated unit. Thus the capacity of the feed mill can be much larger than the requirements of the integrated unit.

Each component of an integrated broiler operation has a different scale. Yet, the capacity of all components has to be balanced; there should be sufficient production of day old chicks to meet needs of commercial growers; the processing plant should have the capacity to process the broilers. The efficient scale of a poultry unit is generally set by that of the component with the largest size requirements. This tends to be the parent stock in broiler production. This unit will produce day old chicks which will be sold to commercial growers. The broilers are purchased at the end of growing cycle. The integrator will also provide feed to the growers. The central unit is likely to provide also extension services, though all medicaments and vaccines will be commercially purchased.

Broilers purchased by the integrator are processed and marketed by the central processing unit. This unit may or may not own the distribution system depending on the marketing arrangements. In countries where the retail system is well developed, the integrators will use the existing system. In absence of such, they may build up their own distribution network.

In the model presented in Figure 5.1, it is assumed that the integrator produces day old chicks (DOC), feed, and undertakes processing. It is not essential to undertake each component from the start of the project. A potential integrator may enter the business by building a processing plant. He can supply all other inputs to associated commercial growers by buying the feed and DOC from other firms. At the same time, he can purchase part of broilers from independent producers. As the business develops, the firm will add new components to his output.

Absolute integration may thus not be necessary if some of the inputs are provided at reasonable prices in the market. It seems possible that the firm could make supply contracts with existing parent stock operators in Sri Lanka for supply of DOC. The parent stock component can be postponed to later years. The same may be done for feed. The details of an entry strategy and timing of various investment components should clarified at the feasibility stage.

### 5.2.3. Industry structure

(1) Number of producers

The most competitive sector of poultry meat production is the hatcheries which produce day-old-chicks (DOC). There were 46 hatcheries producing DOC in 1995. Three produced layers only.

The rest produced either broilers only or had a combined output of both layer and broiler chicks. There were thus 43 potential competitors for a producer of broiler type DOC.

Most producers were of small scale. Four large companies (Three Acre Farms, Bairaha Farms, Christombu and National Livestock Development Board) produced 80% of the total DOC. Production capacity is reported to be around two times the actual production- companies using only half of the installed capacity. This excess capacity is due to rapid growth in new investment while growth in demand has remained modest by comparison.

Paradoxically, the least efficient sector in poultry industry in Sri Lanka also appears to be DOC production. Chick prices in Sri Lanka are a higher proportion of production costs than any major producing country in the world (Table 5.1). This large number of industry producers and low level of technical efficiency are inconsistent. Competition in the sector should improve efficiency and drive down the price of DOC. This issue needs to be explored further. There may be large potential gains for a parent stock operator with a heavy emphasis on DOC production. Such a producer would capture a large share of the national market for DOC and push prices down by exploiting economies of scale.

There are around 20 feed mills producing finished poultry feed. Ceylon Grain Elevators (Prima) and Gold Coin are the main suppliers with around 80% of the market. There has been a third entrant into the market in 1996. This is a joint venture between Bairaha and Cargill and produces the Nutrina brand.

Development of industry at the processing end has remained underdeveloped. Only half of the poultry meat output is processed in modern plants. Bairaha farms is the market leader with 15% of the output. It is followed by Ceylon Agro industries with 10 to 15% of the output. There are three other smaller processing plants (Maxie House, Crystal Springs, and Pussala Farm). None of these is located in Southern Area. These numbers indicate that less than half of the output of commercial poultry producers is marketed through a modern/ hygienic processing and distribution system. The rest is handled in traditional manner where the birds are processed on the farm for retail in the immediate vicinity or are sold live to the consumers.

The processing and marketing costs of the traditional systems are very low and modern enterprises can not compete with these on costs alone. Hygiene in poultry meat, however, is a

critical issue. Most consumers would shift to reliable brands as incomes increase. Over time, the market served by traditional processors shrinks and the demand shifts to the output of modern processors.

(2) Marketing systems

The major feed and DOC producers have buy-back arrangements with the commercial broiler growers. The payment is on the basis of live weight. In Sri Lanka, processors supply their own retail outlets, institutional outlets and restaurants, and a network of independent retailers/wholesalers.

There is also a network of smaller operators who supply shops, small hotels and butcher stalls with dressed meat. These birds are generally purchased from independent producers, home processed and delivered to market outlets. Hygiene and storage temperatures are not satisfactory. Live birds and hot dressed birds are also sold at the village level.

(3) Major structural problems

The poultry industry in Sri Lanka suffers from two major weaknesses. Compared with other countries, the cost of feed and DOC are high in Sri Lanka. In most indicators of technical efficiency, in contrast, Sri Lanka has a well developed sector (Table 5.1). In some key indicators such as the number of days needed to produce a marketable product, average live weight at that time, and feed conversion efficiency, Sri Lanka outperforms the major poultry producers in the world. This indicates that the Country has the comparative advantage to become a major exporter if the producers are given access to inputs at the world prices.

The high cost of chicks is probably due to both lack of competition and the high feed costs. Feed costs seem to be unreasonably high in Sri Lanka: almost double the prices in USA and comparable to those of European Union which has one of the highest grain prices in the world (Table 5.1). Both industry structure and inefficient handling/trade in imported feed ingredients cause the high prices.

One possible support for feed industry in Southern Area is to promote maize and soybean production in the region. Cooperation with major international seed producers would be a

requirement. The government support can be concentrated in extension services to the farmers while financing may be extended through the processors. Early indications are that Southern Area has comparative advantage in producing these feed ingredients and this should be clarified prior to undertaking major production programs in the region.

Introduction of these crops at a large scale into the region will be in conflict with the present government policy of promoting rice self sufficiency. Further allocation of available land for rice production may not leave room for expanding other crops at a significant scale.

## 5.3 Size of the Regional Market

Information on total consumption and the share of industrial producers in Southern Area is not available. Nationally known brands are not produced or processed in the region. The high income market for these is supplied by shipments from the poultry belt around Colombo. The tradesmen interviewed in Southern Area estimate the amount of these shipments to be less than 100 tons per month. An additional quantity of up to 50 tons/month may be supplied by the small independent producers in the region.

The estimates of the regional market size and the likely market size for an enterprise to be established varies greatly depending on the assumptions one makes. In all cases, however, the market size is larger than the 800 tons that will be produced by the relatively small operation studied in this report.

The estimates of inflows of commercially processed meat in the region indicate a potential market size of 1,500 tons per annum. This is the market served by a high cost industry, incurring high transport costs and operating without a complete cold chain. The formal market would clearly be much larger if the industry were to increase its technical efficiency, provide a hygienic product and promote poultry consumption.

The likely market size, therefore, will be drastically different from the present one if supply bottlenecks are eliminated Even at the present scale of regional consumption, the proposed project will have no marketing problems if it supplied half of this regional market.

The potential size of the market is much larger under alternative assumptions. The first is based on the likely regional demand, average per capita consumption in the Country, and projected regional population. These results are presented in Table 5.2.

Income and population growth estimates in the table are the targets set by the Master Plan for Southern Area. The calculations are made separately for two levels of demand changes in response to income growth. In the first case the change in demand will be proportionate to the increase in income. This is a reasonable expectation for a luxury food item in a low income country. In these countries, the demand elasticity of income for food as an overall group is around 0.4. The elasticity for protein sources is generally double the average of the food group. An elasticity of 0.5 is taken to estimate the likely lowest market demand. The results of this estimate are also presented in Table 5.2.

The size of potential regional market can be defined in very different ways. Depending on the definition and the entrepreneur's commitment to promote consumption, target production would vary from 3.3 to 14.4 thousand tons in the year 2000 under the alternative assumptions. All of these indicate that the size of a likely poultry meat investment should be much larger than the minimum efficient size studied in this report, which produces less than 1,000 tons of meat per annum. There will be more than one such project in the region even if the scales are much larger than the one studied in this report.

The actual location of the project in Southern Area will also affect the size of the market. The likely share of the new producer in the regional market will change depending on prices, distribution system and the market segment targeted. Some of these are discussed below.

The present population of Southern Area is 2.66 million people; for a location in Galle, the market would be larger. It would include all of Southern Area, Moneragala and parts of Uva province.

A project located in Hambantota would serve the eastern part of the market while areas closer to Colombo will be supplied by the existing industries. The present market served by dealers located in Hambantota is in fact very small compared with the potential regional market: sales of 120 tons of poultry meat per annum compared with an estimated total regional consumption of around 1,500 tons per annum in 1995.

The regional market is expected to grow rapidly in the future under all conceivable scenarios. The levels of consumption implied under all scenarios are very modest. One may, therefore, target a very large expansion with appropriate government support. The industry would become a very significant source of income and employment in the region with such a policy stance and support from the Government. Two key components of the public support for the industry would be improvements in feed availability (either by facilitating imports or promoting domestic production of feed ingredients), and financial support both to the integrators and the participating farmers.

## 5.4 The Proposed Project

### 5.4.1. Project scale

An integrated poultry meat investment has four distinct components that should be treated as separate profit centers. These are 1) parent stock to produce day-old chicks, 2) broiler houses where the chicks are raised to marketable weight of 1.6 kg (live weight) in a period of around 40 days, 3) a feed plant to provide feed for parent stock as well as commercial broilers, and 4) a processing plant where broilers are slaughtered and packed for marketing. The last will include sufficient cold storage to match fluctuations in production and sale flows.

Technical efficiency suggests that the scale of these four activities should be similar. Variations however are possible depending on how the industry is organized. One could sell only day old chicks to farmers who would buy their feed from other suppliers. In this case it will not be necessary to build a feed mill.

Alternatively, one could build a very large feed mill and sell part of the output to outsiders after satisfying the demand of the integrated operation. Similarly, the processing plant can be built at a very large scale and broilers could be purchased from independent commercial farms if these exist in the project hinterland.

Of the four components of the integrated poultry meat production operation, the largest scale requirement generally derives from the parent stock operations. The breeding chicken (parent stock) should provide a steady number of eggs that are hatched to produce day old chicks which

then are converted to poultry meat after an interval of 40 days. There is a time lag from the importation of day old parent stock birds to egg production (around 24 weeks) and from egg to chick production. The whole operation therefore needs to be carefully planned. It generally requires purchase of five to 10 batches of parent stock birds per annum with separate rearing and laying facilities.

Sri Lanka imports most of its parent stock needs. There is one small grand parent stock unit but its size is small. The industry's long term viability depends on the continuation of the present policy of providing access to the best poultry breeds in the world.

Once the capacity of the parent stock operation is established, the other units will be specified up to that capacity by investing in the required number of other units. There is thus one component of the operation with the largest minimum efficient scale and as many units of the other components as would be needed to achieve balance between capacities of all components.

The minimum size of parent stock operation actually observed in Sri Lanka is six thousand birds imported in three batches. Based on producer production specifications, each broiler parent stock bird should produce 140 DOC. In Sri Lanka, however, heat stress on the heavy parent stock is severe and actual production is around 110 DOC per bird housed. At the chosen parent stock scale, the broiler production will be 627,000 commercial chicks and 802 tons of poultry meat per annum (Table 5.3).

The analysis of the likely market size in the South indicate that the parent stock operation can be established at a larger scale than the minimum efficient size. This should be considered at the feasibility stage. The actual size chosen at that stage is likely to be much larger than the unit studied in this report.

The output of the project studied in this report is very modest compared with the total production in Sri Lanka: estimated at 37,000 tons in 1995. The larger size may also be helpful in interesting potential foreign investors whose overheads would probably preclude them from taking equity in a small project.

An alternative is to build the small capacity studied here during the first years. The capacity, however, will be doubled every year until the scale economies are exhausted. It is unlikely that

these will be faced before the level of production reaches 10,000 tons, roughly a quarter of the total present production in Sri Lanka.

The processing plant for the output of 800 tons will have a daily capacity of 2,508 birds on the basis of 250 working days in a year. This is a very small capacity and can be handled by a few workers with little equipment. Establishment of a rendering facility for the by-products and processing of whole birds into choice cuts would require a capacity of at least 10, 000 birds/day. One possibility is to build the large capacity and provide services for independent producers or procure broilers from them for marketing by the integrated operation. Given the shortage of modern marketing facilities for the existing independent producers, this larger processing capacity will be profitable on its own.

The required feed is 2,454 tons. This is based on live weight of 1.6 kg per bird and feed conversion ratio of 2.0 for broilers. The parent stock feed requirement is separately estimated and added to that of broilers (Table 5.3). The implied daily feed production is 9.8 tons. Again, this scale is too small for efficient feed production. The standard feed plants produce a minimum of 10 tons per hour.

The feed probably needs to be palleted in Sri Lanka. Birds are likely to be reared in open houses and loss will be a major problem if feed is not palleted. The palleting machinery is expensive and would require a larger scale than indicated in this study.

The number of commercial farms growing the broilers and, therefore, the number of beneficiary participating farmers will depend on the size of broiler units. A worker normally would handle at least 10,000 birds/cycle. In Sri Lanka, the size of a broiler house is generally in the range of two thousand. This is accepted as a notional unit. Each cycle will take 40 days to reach maturity and a cleaning period will be needed in-between batches. Five cycles per annum is an easily attainable target. Each broiler house will thus raise 10,000 birds/year. With 627,000 birds produced by the parent stock operation in a year, 63 farmers will participate to raise chicken. The number will be less if the average broiler house size is increased.

### 5.4.2. Project inputs

Availability of concentrate feed is a constraint to development of all livestock activities in Sri Lanka. This is particularly severe in the case of poultry which relies exclusively on concentrate feed. Key feed ingredients are maize and soybean paste. Both are imported. Access to port facilities will be critical for the feed unit. The costs will vary by a wide margin depending on whether ingredients are imported in bags or in bulk.

Domestic production of poultry feed requires the availability of grain ingredients as well as specialized inputs. Although Sri Lanka exports 240,000 tons of wheat bran a year, diverting this to the local industry is of limited usefulness. Poultry feed requires grain of high starch and low fiber content. Bran can not be used in significant proportions in poultry feed, because it has a very high fiber content.

Maize is an ideal ingredient for poultry feed. It has to be imported without a major expansion in domestic production. Maize substitutes are not easily available. Similarly, there is a need for high protein ingredients for poultry feed. Soybean cake is generally considered indispensable for this. Cottonseed imports contemplated from India will not benefit the poultry sector as this is suitable for ruminant feeding only and can not be used in poultry feed.

Specialized feed ingredients of poultry feed include fish meal and oils. Fish meal is not produced in Sri Lanka and its production is not proposed in the near future. The limited amounts of fish available should be used for direct human consumption. Only by-products of canning factories and fish for which there is no demand for direct human consumption should be processed into fish meal to be used as an animal feed ingredient. The fish meal requirements of poultry industry in Sri Lanka will be met by imports in the near future.

### 5.4.3. Prices

All prices used in this report are those of mid-1995. At the time, the exchange rate was Rs. 56 to US$1. Price adjustments are not made for inflation in the future, because all calculations are made in constant 1995 prices. It is assumed that the change in costs of inputs will be the same as the price of final products.

This assumption needs to be verified while preparing the final feasibility study. The relative prices of the poultry meat are expected to decline parallel to technical improvements. Under competitive market conditions, this would lead to a fall in product prices and will benefit the consumers. The potential fall in poultry meat prices can be quite substantial and will warrant the use of a different set of relative prices.

The use of constant base year prices require adjustments in the treatment of interest on loans; the interest component corresponding to inflation is not be included as a cost. The real interest rate is a cost and is included among project costs. This is assumed to be 3% per annum throughout the project period.

This study has collected actual costs for most items. These include feed and feed ingredients, parent stock birds, equipment and construction costs. Costs of utilities, land and veterinary medicines are difficult to estimate, though some information was available on these. The overall consistency and reliability of these latter cost components is checked by taking the known ratios on cost components given in Table 5.1. The total costs given in Table 5.1 include the residual items on which information is not collected directly but are estimated in this manner. These incidental items are around 10% of costs actually calculated.

Comparisons with other countries show that Sri Lanka has cost disadvantages deriving from high parent stock bird and feed prices. The difference between prices in Sri Lanka and other countries is very large (Table 5.1). This large difference in the cost of DOC can not be attributed to heat stress and other technical factors and needs to be further explored.

Similarly feed prices are too high. The feed costs in Sri Lanka were higher than in any other country in 1996. While the prices of these two inputs are high, their quality seems to be comparable to all other countries. This is evident in the very favorable parameters for average days at slaughter and weight at that time.

One likely cause of high DOC and feed costs is the small size of these units in Sri Lanka. Another possibility is the trade restrictions and handling costs at the border which push up the prices of imported inputs. Both chick and feed production is heavily import dependent. In the case of feed, improved technical efficiency may require access to a port silo.