

ECONOMIC REVIEW

March
1986



THE DAIRY INDUSTRY



ECONOMIC INDICATORS

Sri Lanka recorded an overall growth rate of 5 percent in 1985 mainly as a result of increased production in the agriculture and manufacturing sectors; while the country's Gross National Product (GNP) increased by 5.3 percent in 1985 compared to a 5.1 percent increase in 1984 and 4.1 percent in 1983, according to the Central Bank's Annual Report for 1985. The report also states that per capita GNP increased by 3.7 percent (in rupee terms) and at current prices was Rs.9,219 (US Dollars 339) in 1985 as against Rs.8,759 in 1984. However the reports table of Basic Economic Indicators reveals that (in US Dollar terms) the per capita GNP came down from US Dollars 344 in 1984 to US Dollars 339 in 1985.

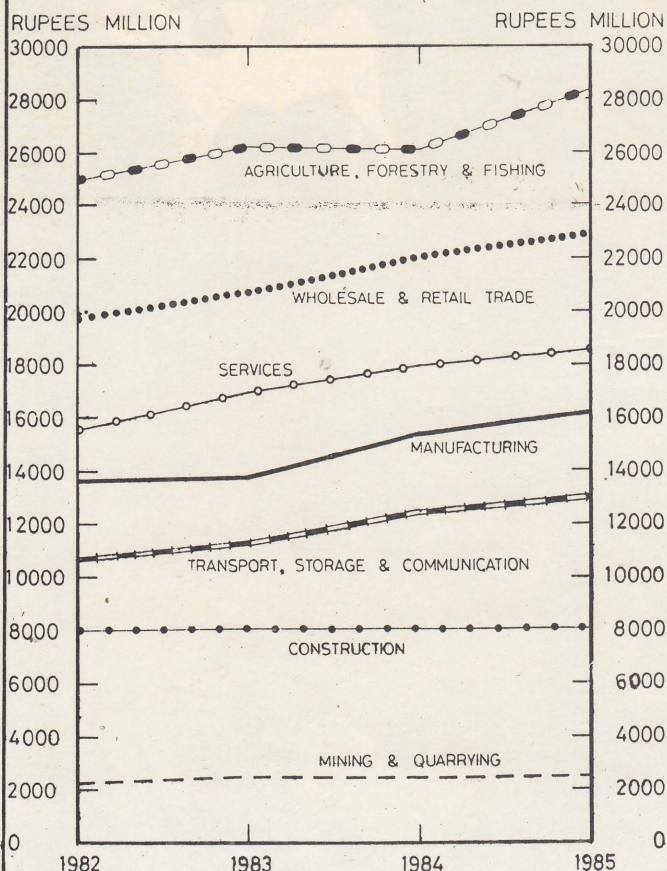
In 1985, real Gross Domestic Product (GDP) increased by 5.0 percent compared with 5.1 percent in 1984. The rate of expansion of Gross Domestic Expenditure (GDE) continued to slow down - it was 10.0 percent in 1985 compared with growth rates of 18.6 percent in 1983 and 16.4 percent in 1984.

Furthermore, in contrast to the two previous years, in 1985 domestic savings decreased by 28.3 percent from Rs.30.6 billion in 1984 to Rs. 21.9 billion in 1985. The ratio of national savings to GDP fell from 22.2 percent in 1984 to 16.1 percent in 1985.

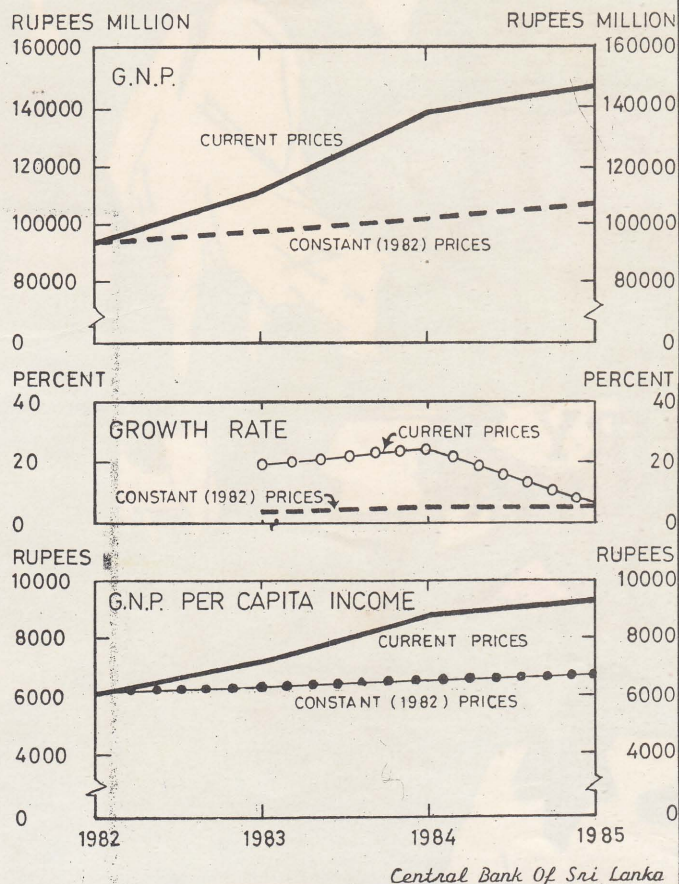
Despite the series of adverse factors affecting the economy in 1985, the report maintains that the economy grew at an impressive rate owing to the continued expansion in the agricultural sector which accounts for about one fourth of the country's GDP. The most pronounced increases in 1985 were recorded in coconut and paddy production, both of which had declined in the previous year.

Among the other unfavourable economic developments the economy had to contend with in 1985 were the decline in commodity prices, particularly of tea and coconut; the continuing drop in tourist traffic and consequent decrease in tourism related services; the increased expenditure on defence activities; a slowing down of foreign investment; and the disruption of economic activities in the northern and eastern parts of the country. The substantial deterioration in Sri Lanka's balance of payments in 1985 is regarded as one of the most serious adverse developments. There was also a reversal in government fiscal operations compared to the previous two years, with budgetary operations in 1985 getting more expansionary. Meanwhile, Sri Lanka recorded an unfavourable trade performance in 1985, with export earnings declining for the first time since 1972.

GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN
AT CONSTANT (1982) FACTOR COST PRICES



GROSS NATIONAL PRODUCT



Central Bank of Sri Lanka

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CONTENTS

COLUMNS

Diary of Events	2	January - February, 1986
Commodities	20	TEA - Prices decline; RUBBER-Market firm
Urban Development	20	Land value fluctuations around the city of Colombo
Agriculture	22	An increase in fertilizer use
Foreign News Review	23	- Bewildering behaviour of commodity prices - Increasing food security for the poor

SPECIAL REPORT

3 THE DAIRY INDUSTRY

	4	Livestock and the economy
	6	Foreign loans and grants for the dairy sector
	9	Milk nutrition
M.U.A.Tennakoon	10	Reasons for short supply of milk
K.A.S.Dayananda	12	Economic viability of small scale dairy farms
	14	Credit facilities for dairy development
	15	Planning dairy development
	18	Dairy: its role in India

FEATURES

Mrs. P.C.H.Ranasinghe	25	Conservation of Environment, Transport and Development
Rohana Ulluwishewa and Jun Sakai	28	Buffaloes as a source of farm power; Possibilities for improvement

NEXT ISSUE

- * Sir Lanka's Inland Fisheries: an assessment of the problem areas, progress and prospects
- * The economy in 1985
- * Structure and potential of non-formal credit in the Galnawa area - a case study
- * Recent investment trends

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COVER

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THE ECONOMIC REVIEW is intended to promote knowledge of and interest in the economy and economic development process by a many sided presentation of views & reportage, facts and debate.

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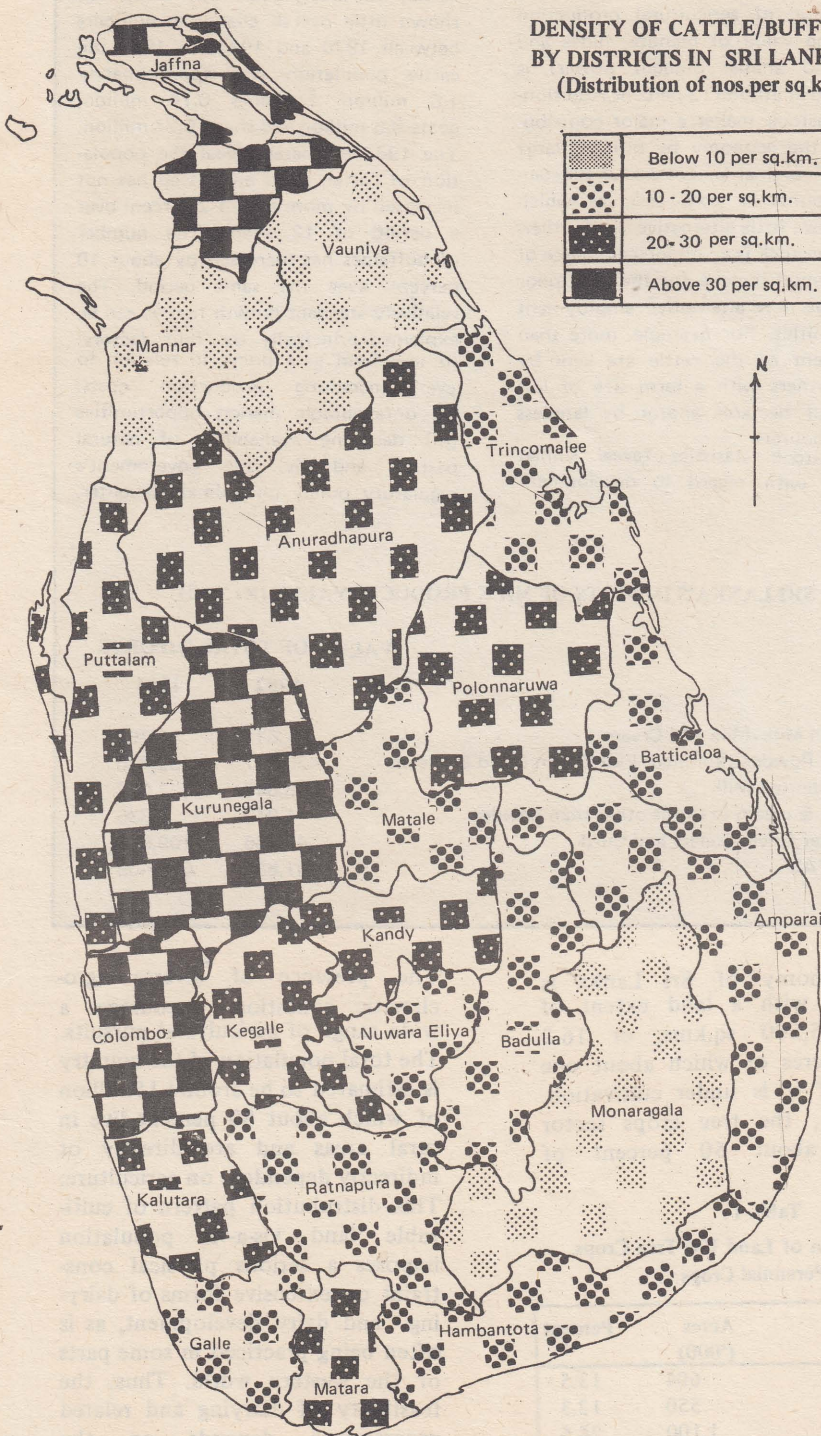
DIARY OF EVENTS

Jan.

1. The Colombo Consumers Cost of Living Index for December 1985 was 575.3 the Department of Census and Statistics announced. In November 1985 it was 567.0 and in December 1984 it was 566.9
 3. The Foreign Investment Advisory Committee was making a strong bid to attract new investment in the manufacturing sector - particularly light industries and agro industrial projects. The FIAC received 77 proposals in 1984 of which 56 were approved, according to a press announcement. The number of units approved had fallen from 77 in 1983 to 56 in 1984 and 44 in the first ten months of 1985. Meanwhile, the GCEC approved 13 projects in 1983, 15 in 1984 and 10 upto October 1985.
 4. Ministers from Algiers, Iran and Libya met in Algiers to discuss the grave deterioration on the world oil market, the official Algerian News Agency APS stated. Discussions centred on how to re-establish OPEC's position in the world oil market and restore crude oil prices to levels compatible with interests of producer countries and their development needs.
 7. Sugar produced by the Pelwatte Sugar Company, which is handling a big development project in the Moneragala District, will be more expensive than imported sugar at current prices according to a press report Pelwatte, which plans to produce 14,000 metric tons in 1986, expects to produce 15,000 metric tons in 1987. Local production will still be short of the country's consumption now running at around 270,000 metric tons per year.
 8. The year 1986 has been declared International Year of Fisheries and the Fisheries Ministry intends making this a significant year for the fishing industry in Sri Lanka and providing maximum assistance to the fishing communities, according to an official announcement.
 11. Inflation last year recorded a decline according to the Consumer Price Index (CPI) which showed a rise of only 2 percentage points between January and December 1985, as against 8 points in 1984 and 20 points in 1983, the Finance Ministry announced. A Ministry statement attributed the slowing of inflation mainly to the low price increase of agricultural commodities. A banking outfit which has helped in raising foreign loans for Sri Lanka, the Banker's Trust Corporation of New York, has reported a net income of \$ 371.2 million last year, up from \$ 306.8 million in the previous year, stated a press report.
 14. The Yemen Arab Republic became the 90th government to ratify the agreement establishing the Common Fund for Commodities. The only requirement still to be met before this Fund becomes effective is that the countries having ratified it represent two thirds of the Fund's directly contributed capital of \$ 470 million. At present, the 90 countries account for 57.87 percent of the Fund's capital, ie. 8.80 percent short of the required percentage. These 90 countries include in particular 69 developing countries, China and all the OECD countries (with the exception of the United States, Portugal, Turkey and Iceland) and represent three quarters of world population and merchandise trade and nearly two thirds of world GDP.
Japan agreed to give Sri Lanka Yen 245 million (approximately Rs 33 mn) in debt relief; the money to be extended in the form of cash grants to relieve the Sri Lanka government of its debts to the Japanese government under loan agreements concluded during the period September 1969 to March 1979.
 15. An International Organization World View International donated Rs 350,000 to the villagers in the Dambulla AGA's Division to improve cattle farming, small industries and other agricultural activities.
 16. The Government of Germany has agreed to provide experts in electricity planning, hydro power planning, water supply and regulation, hydrology, irrigation and to a certain extent the equipment for implementing a Master Plan for Electricity. The total cost of this aid, given on a grant basis, is Rs 61 million (approx DM 5.5). The Government approved a proposal to enter into an agreement for 90 million francs from the Government of France for the 2nd Stage of the Nilwala Ganga project. Of this amount 45 million francs will be provided by the French Treasury and is repayable over 30 years at an interest rate of 3 percent. The balance 45 million francs is from the French banks and is repayable within a period of 10 years at the prevailing export credit interest rate.
 18. Trading on the highly speculative spot market in Britain's Brent crude oil has ground to a halt amidst allegations of fraud and bad faith - putting the once-booming market's survival in doubt, industry sources said in London. The crisis has been triggered by the shock of the previous month's plunge in world oil prices.
 25. The UNDP has agreed in principle to finance a feasibility study for the Kalu Ganga Multi Purpose Project which is intended to provide power, irrigation and flood control over the Ratnapura and Kalutara districts.
 28. Tea prices at the Colombo auctions continued their downward plunge with average prices per kilo reaching Rs 29.04 for the last sale in January as against Rs 60.87 per kg at the same time in 1985 and Rs 75.30 per kg in 1984, according to broker's reports.
 31. Crude oil prices which have fallen almost 50 percent in the past three months could dip to \$ 12 a barrel, according to experts at a symposium in New York. Analysts said the dramatic fall in oil prices over recent months was caused largely by increased output by Saudi Arabia, the key OPEC producer.
An agreement was signed in Colombo with US AID for \$ 25,000 for flood relief measures.
- Feb.
5. A recent Treasury Study indicates that tea revenue to Government in 1986 will be less than half the Rs 2.2 billion earned last year from Sri Lanka's major export product. According to these projections tea will yield revenue slightly exceeding Rs 1.1 billion, down from Rs 2.2 billion in 1985, a senior official said.
 6. Sri Lanka is expected to make a substantial saving on oil imports this year due to a slump in international oil prices reflected in a 125,000 metric ton oil tender closed by the Ceylon Petroleum Corporation. The Corporation's previous purchase for the same quantity in January 1986 was US \$ 27.18 barrel, while this purchase was below US \$ 1b per barrel.
 15. Sri Lanka's exports of tea were down to 198 million kg in 1985 as against 204 million kg in 1984. The approximate average FOB price in 1985 was Rs 60.61 per kg as against Rs 77.14 per kg in 1984. Foreign Exchange earnings from tea also dropped to Rs 12,002 million in 1985, from Rs. 14,000 million in 1984, according to data released by the trade.
 24. Oil prices continued their plunge reaching US \$ 16.25 per barrel on the European Spot Market as compared with US \$ 28.75, 4 months earlier stated a press report.
 27. The Japanese government pledged an outright grant of Rs 390 million to help Sri Lanka set up its own pharmaceutical factory and a headquarters for the National Youth Service Centre.

THE DAIRY INDUSTRY

DENSITY OF CATTLE/BUFFALOES BY DISTRICTS IN SRI LANKA
(Distribution of nos. per sq. km)



The importance of dairying and dairy product development has been stressed in all development proposals of Sri Lanka over the past 50 years. Since 1938 five known Dairy Development Plans have been formulated, and implemented to the extent of availability of funds, the last of these being the Medium Term Plan of 1977-1981. These proposals linked the significance of dairying to a variety of historic factors. Yet they have all agreed that dairying has an important role to play as a major foreign exchange saver for the country on the one hand; and a provider of employment and income, and nutrition generator to the rural sector on the other. Thus, targets have been set to increase the volume of production by raising the average annual yield per cow and increasing the size of the herd milked in order that the country can achieve self sufficiency in dairy products within a reasonably brief period of time. The strategies employed have ranged from the establishment of state owned cattle farms to varying sizes of private investments. The private investments suggested have extended from between small holdings with two cows to multinational involvements in rearing, milching, milk collection and processing plants with massive investments.

The evolution of dairying has its roots in the nomadic era. In Sri Lanka cattle rearing can be traced back to the early history of the island (500 B.C.) when the first settlers from North India raised

This map, based on Agricultural Census data, shows that Kurunegala and Gampaha in the Intermediate Zone have the heaviest concentrations of cattle and buffaloes; although the majority of cattle are reared in the Dry Zone districts such as Puttalam, Anuradhapura and Polonnaruwa.

cattle and buffaloes largely for draught and to some extent for the production of milk and ghee. Dairying in the modern context, encompasses an array of economic activities in which agricultural farming, agro-processing and farm product development, marketing and farm product management are interwoven into a single art. Thus, it is multi-purpose in its operations, multidisciplinary in approach and multi-dimensional in development. The term dairying refers to an amalgam of functions, such as production and marketing of milk and its products, which includes caring and breeding of herds, feeding, milking, milk collection and processing into dairy products. The present state of development in dairying is a function of scientific and technological advancement in which improvements in the disciplines of physiology, genetic science, microbiological and nutritional science and chemistry are involved.

ROLE OF DAIRYING IN SRI LANKA'S ECONOMY

Dairying constitutes a lengthy production process that commences with the growing and preparation of fodder to the sale of milk or milk products to the ultimate consumer. This long process is divided into two sub-phases. The initial phase contains the breeding and feeding of cattle upto the milking stage. Although this phase appears to be rather simplistic it is said to cover about 70 percent of work in the total process of milk production. It is during this phase that the groundwork for milk production is made in which a multiplicity of disciplines are involved and operations performed. The second phase covers the remaining 30 percent of the work, that is, collection, processing, bottling, packing and presenting, marketing and distribution. It is during this phase, that dairy economics happens to have command and an important role to play.

Livestock and the economy

The contribution of livestock to the gross value of agricultural production (including value of manure, hides and skins and animal draught power) is estimated at around 12 percent. Additionally, livestock makes a major contribution to the economy by utilising large areas of marginal land as well as substantial amounts of crop residues which would have little alternative use. Furthermore, livestock is an important source of supplemental income for the rural poor who have few alternative employment opportunities. For example, more than 95 percent of the cattle are kept by small farmers with a farm size of less than four hectares and/or by landless estate labourers. All livestock statistics reveal similar patterns with regard to development

trends over the past twelve years. the population of ruminants animals, ie, cattle, buffaloes, goats and sheep has shown little overall change in numbers between 1970 and 1982. In 1970 the cattle population was approximately 1.6 million, buffaloes 0.74 million, goats 0.6 million and sheep 0.27 million. The 1982 estimates reveal the population of cattle, goats and sheep has not increased by more than 1-2 percent over a period of 12 years. The number of buffaloes has increased by about 10 percent over the same period. The relatively stagnant growth figures can be explained principally by four factors: (i) low farm gate prices in relation to ever increasing production costs; (ii) unfavourable market opportunities (iii) declining availability of natural pasture and (iv) the government's regulatory policy on animal slaughter.

SRI LANKA'S IMPORTS OF MILK PRODUCTS-VALUE (Rs.'000)

	VALUE OF TOTAL IMPORTS	
	1982	1984
Fresh Milk-Milk and Cream	1,614	1,752
Milk Powder-Skimmed, Full Cream Dried & Cream	426,227	535,830
Condensed Milk	8,617	7,027
Milk & cream in forms other than powder	1,913	1,836
Butter, Ghee, Cheese and Curd	43,166	109,961
TOTAL	481,537	656,406

The economy of Sri Lanka is endowed with a land extent of about 65,500 sq.kms. or 16.2 million acres of which about one fourth of it is under cultivation. By 1981, the tree crops sector covered about 50 percent of

Table 1



Distribution of Land Use-Tree Crops and other Perennial Crops

Land Use	Acres (000)	Percent
Tea	604	13.5
Rubber	550	12.3
Coconut	1,100	24.5
Total tree Crops	(2,254)	(50.3)
Paddy	1,650	36.8
Other Crops	(2,232)	(49.7)
Total field crops	4,486	100.0



cultivated area while the share of paddy had been about 37 percent. (See Table 1 and Diagrams).

The presence of diverse agro-climatic conditions encourages a wide range of agricultural pursuits. The total population of the country is estimated to be around 15 million of which about 80 percent live in rural areas and are directly or indirectly dependent on agriculture. This distribution pattern of cultivable land vis-a-vis population imposes a serious physical constraint on extensive forms of dairying and dairy development, as is often being practiced in some parts of the western world. Thus, the feasibility of dairying and related programmes depends on the suitability of the model followed, and selection and use of technology and skills that could be adjusted according to the basic physical constraints. Even now the heavy pressure on land, which has given rise to a series of tenurial and distributional problems, poses questions

LAND DEVELOPMENT POTENTIAL

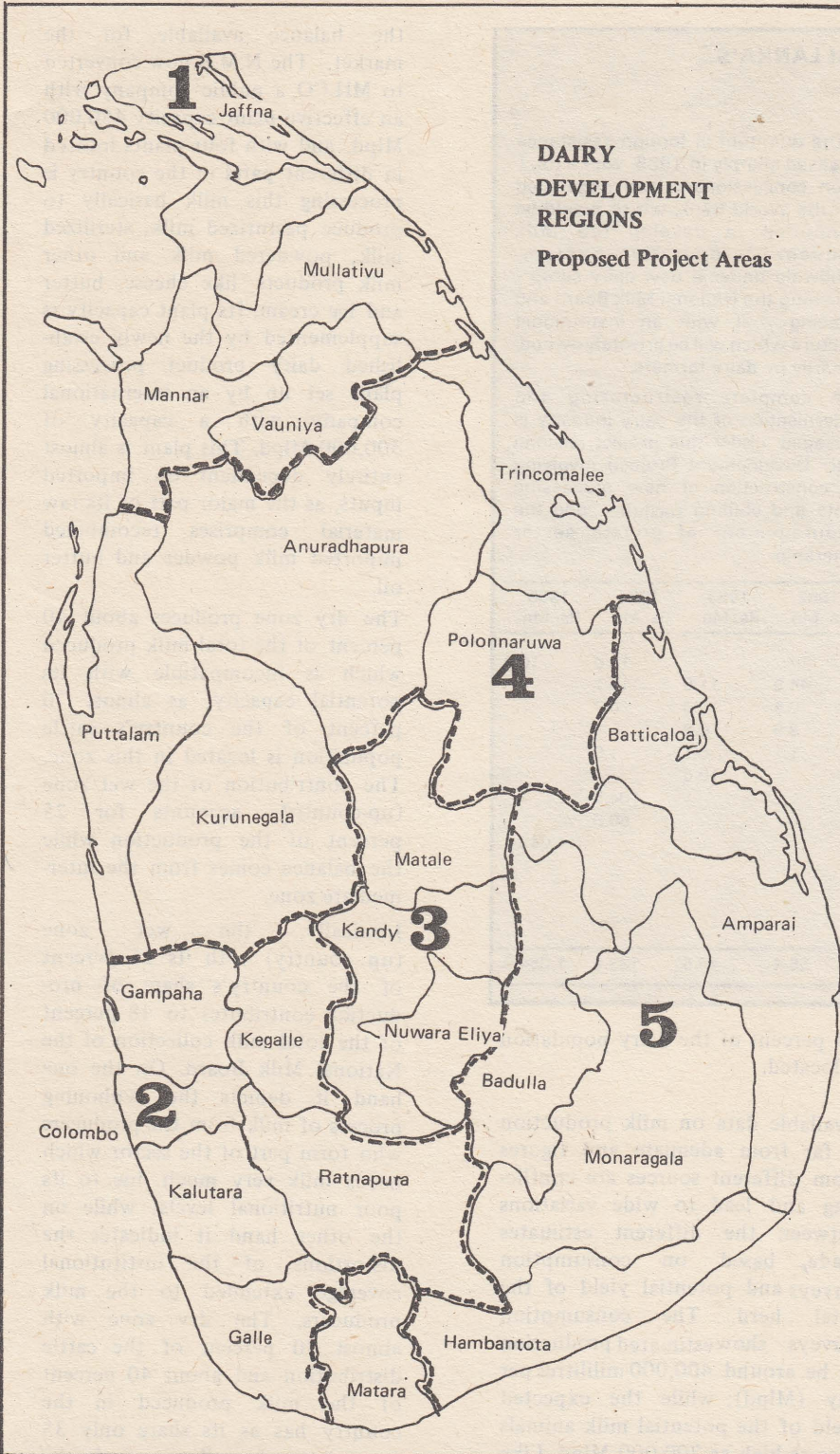
-  Partially or wholly unsuitable land for agriculture
-  Developed Area



-  Developable Area
-  Forest Reserves



DAIRY DEVELOPMENT REGIONS
Proposed Project Areas



The proposed project would cover the entire country and for project purposes Sri Lanka would be divided into five milksheds. They are:

1. **JAFFNA** - Including Jaffna, Mullativu, Mannar and Vauniya.
2. **COLOMBO** - Including Colombo, Kalutara, Kegalle, Ratnapura, Galle and Gampaha.
3. **KANDY** - Including Kandy, Matale, Nuwara Eliya.
4. **POLONNARUWA** - Including Polonnaruwa, Anuradhapura, Puttalam, Kurunegala and Trincomalee.
5. **MONARAGALA** - Including Monaragala, Badulla, Amparai and Hambantota.

FOREIGN LOANS AND GRANTS FOR SRI LANKA'S DAIRY SECTOR

The dairy sector of this country has been a regular recipient of international assistance from many sources and in a variety of forms such as direct technical assistance, grants, food aid commodity aid and concessionary loans for development of the industry.

The table below indicates some of the main sources of external assistance channelled to the dairy sector during the five year period 1980 - 1984, and the aid pledged in 1985. Of this aid, project aid and commodity aid constitute a major portion; while Finland, Switzerland, Netherlands and the IDA have been the main sources of the aid.

The quantum of foreign assistance increased sharply in 1985, with a Rs. 1 billion concessionary loan negotiated with the World Bank, which would be channelled to develop the Milk Producer Co-operative System islandwide under a new dairy setup - abolishing the National Milk Board and replacing it with an institutional structure which will be privately owned, primarily by dairy farmers.

A complete restructuring and modernisation of the dairy industry is envisaged under this project (second IBRD Development Project) involving the construction of new processing plants and chilling facilities and the encouragement of private sector ownership.

Funding Country/ Agency	1980 Rs. Mn.	1981 Rs. Mn.	1982 Rs. Mn.	1983 Rs. Mn.	1984 Rs. Mn.	1985 Rs. Mn.
1. ADB					13.0	10.9
2. Finland			44.9	11.6	10.1	
3. Switzerland		6.8	0.5	15.0	5.7	
4. IDA	14.5	13.5	8.9	0.3		
5. Sweden		0.3	1.1	0.1	1.9	
6. Australia				19.6		
7. Netherlands					104.6	
8. USA					50.0	
9. World Bank (IBRD)						1,043.1
Total	14.5	20.6	55.4	46.5	133.4	1,054.0

on the selection of technology, and the viability of their operation.

The data available on dairy and livestock are scanty and discrete. According to the latest available estimates, the total cattle population is about 1.7 million of which roughly about 17 percent are exotic or crossbreds, which is supplemented by about 0.9 million buffaloes. The contribution of this sector to the G.D.P. is less than 2 percent and comprises about 8 percent of the total agricultural output of the country. Furthermore, the estimated herd of milking animals amounts to about 552,000 of which approximately 75 percent comprises cattle. The pattern of distribution of this herd among various parts of the country shows an obvious concentration in the dry zone of the country, where almost

70 percent of the dairy population is located.

Available data on milk production is far from adequate and figures from different sources are conflicting and lead to wide variations between the different estimates made, based on consumption surveys and potential yield of the total herd. The consumption surveys show estimated production to be around 400,000 millilitres per day (Mlpd); while the expected yield of the potential milk animals runs as high as 700,000 Mlpd. Like most of the developing countries, the bulk of this production is retained to meet household consumption needs, and another portion spills off to local markets through middle men. The National Milk Board which is the formal milk processing agency purchases

the balance available for the market. The N.M.B. now converted to MILCO a public company with an effective plant capacity 450,000 Mlpd, and with four plants located in different parts of the country is processing this milk basically to produce pasturized milk, sterilized milk, powdered milk and other milk products, like cheese, butter and ice cream. Its plant capacity is supplemented by the newly established dairy product processing plant set up by an international company with a capacity of 300,000 Mlpd. This plant is almost entirely dependent on imported inputs, as the major part of its raw material comprises recombined imported milk powder and butter oil.

The dry zone produces about 40 percent of the total milk produced which is incompatible with its potential capacity, as almost 70 percent of the country's cattle population is located in this zone. The contribution of the wet zone (up-country) accounts for 25 percent of the production while the balance comes from the intermediate zone.

Ironically, the wet zone (up country) with its 25 percent of the country's share of production contributes to 48 percent of the total milk collection of the National Milk Board. On the one hand it depicts the syphoning process of milk from the producers who form part of the sector which needs milk very much due to its poor nutritional levels; while on the other hand it indicates the distortions of the institutional coverage extended to the milk producers. The dry zone with almost 70 percent of the cattle distribution and about 40 percent of the milk produced in the country has as its share only 35 percent of collection of the National Milk Board. Another point worth noting is the discrepancy between the NMB prices and those offered in the local markets in the dry zone which perhaps has deprived the dry zone milk producer from enjoying the favourable price structure offered by the NMB.

Table 2

Average Quantities of Milk and Milk Products Consumed per Person
for one Month by Income Group (Rs.)

Item	0- 200	201- 600	601- 1,000	1001- 2,000	2001- 3000	3001- 5,000	5001- 10,000	Over 10,000	Over all Average
Milk (MLT)	172.5	319.35	377.15	662.8	1045.7	1372.9	1566.7	2824.1	675.0
Fresh Milk Cow	124.85	226.15	271.55	517.25	816.9	1072.9	1279.9	2273.6	521.8
Fresh Milk Goat	--	16.9	5.85	10.95	5.1	13.2	7.3	--	8.0
Infant Milk	3.25	29.35	48.2	51.05	58.5	60.9	88.5	93.8	51.2
Other Powdered Milk	28.85	25.85	31.7	64.45	106.2	143.7	129.1	214.3	63.2
Condensed Milk	--	1.3	0.45	0.8	6.2	6.3	5.3	20.1	2.0
Curd/Yoghurt	1.65	9.35	14.05	12.4	25.3	59.0	50.2	200.9	19.7
Infant Cereal Food	--	1.65	1.35	0.95	1.6	2.2	--	2.7	1.4
Other Milk	1.5	7.7	4.0	4.95	25.9	14.7	6.4	18.7	8.6
Milk Products	6.35	1.1	1.75	4.55	15.8	43.9	53.4	167.7	10.1
Butter	6.35	1.1	0.4	2.5	11.0	36.3	39.3	92.9	6.7
Cheese	--	--	--	--	0.4	0.8	2.8	0.6	0.2
Moru	--	--	--	--	0.2	--	--	--	--
Ice Cream	--	--	0.5	0.4	0.9	1.4	5.7	51.7	1.1
Other	--	--	0.85	1.65	3.3	5.4	5.6	22.5	2.1

Source: *Consumer Finances and Socio Economic Survey, 1981/82*

Table 2 above gives the pattern of consumption of milk, by different income groups in the country. It shows that the consumption pattern of milk is highly responsive to the income levels of people. It may also be noted that the consumption pattern of milk products is more strongly receptive to income standards.

In general neither milk nor milk products are over consumed, except by the higher income categories. According to the estimates of the MRI and paediatricians the Sri Lankan per capita milk requirement (all products converted) is estimated to be 5.5 ozs. of standard liquid milk. This distribution should however, be weighted in favour of the different age and social groups. For instance, a baby under one year of age would require on an average about 26.3 ozs. of liquid milk a day.

The demand and consumption of milk exceeds domestic production by about 50 percent; which has to be met by importing the balance requirements from the major milk producing countries. The total import of dairy products is around 12,000 tons annually, providing the liquid milk equivalent of about 400,000 Mlpd. The total value of milk imports which was around Rs. 481 million in 1982 had gone

up to Rs. 656 million in 1984. (See Table 4).

In terms of value, full cream and half cream milk powder constitute 80 percent of the milk imported while the major exporting countries have been the Netherlands, New Zealand and Australia. Other milk products include condensed milk, and a relatively negligible proportion of (in terms of the value of total milk imports), butter, cheese, curd and ghee. The tariff structure on imported milk arranged in ascending order starts from a low duty of 5 percent on infant milk and whole milk to about 100 percent on other dairy products like cheese and butter.

The significance of dairying, together with the relatively stagnant growth rate and constraints confronting this sector were well summed up by an introductory statement of a "Livestock Sector Strategy Report" prepared in August 1984. (See box) Attempts at developing the dairy industry, with assistance from several donor agencies and countries have been intensified in recent years. One such agency is the World Bank's soft-arm affiliate the IDA. An International Development Association (IDA) Mission in 1982/83 evaluated the reactions of the dairy sector

to a variety of policy incentives and adjustments made by the authorities and put up a new set of proposals which were indentified as a major shift in the strategy adopted hitherto. On the basis of these proposals the country was divided into five major distinctive milk production systems namely, the estate system; the mid-country small-holder system; the dry zone system; in order to achieve an incremental milk production target of 106,000 Mlpd by the seventh year of its operation. In the earlier project being implemented with IDA assistance in the 1970s, the Project area was confined to the Mid-country Wet Zone and the Coconut Triangle; but the IDA's reformulated project decided to undertake some aspects of dairy development in each of the agro-climatic zones around a 'milk shed' with a view to giving a fillip to the total national programme in the long term. The programmes targets are expected to be achieved by increasing the number of milk animals, changing the composition of the domestic herd, by increasing the share of cross-bred varieties and increasing the daily average yield per animal. These objectives are to be achieved through setting up of about 1,920 village level milk producing farmer societies.

DISTRIBUTION OF LIVESTOCK BY MAIN CLIMATIC ZONES, 1982

Species	Dry Zone	Intermediate Zone	Wet Zone	Total
Cattle	995	355	338	1,688
Buffaloes	458	239	182	879
Goats	326	80	106	512
Sheep	22	5	1	28
Pigs	16	15	44	75
Poultry	2,079	1,125	3,038	6,242

Source: Sri Lanka Livestock Statistics 1983

Livestock keeping largely hinges on the agro-ecological conditions prevalent in the farmer's socio-cultural and religious environment. This table which depicts the livestock distribution by the main agroclimatic zones shows that the majority of cattle and buffaloes are reared in the Dry Zone.

Table 3 Average Expenditure on Milk and Milk Products per person for one month by income groups (Rs)

Income Group	Milk	Milk Products	On Milk and Milk Products	On All Food Items
0 - 200	2.4 (1.75)	0.20 (.14)	1.46 (1.06)	136.95 (100)
201 - 600	2.58 (1.89)	0.13 (.09)	2.72 (1.99)	136.01 (100)
601 - 1000	3.06 (2.05)	0.05 (0.03)	3.11 (2.08)	149.09 (100)
1001 - 2000	5.75 (3.12)	.16 (0.08)	5.91 (3.21)	183.77 (100)
2001 - 3000	9.60 (4.33)	.88 (0.39)	10.48 (4.73)	221.53 (100)
Over 3000	14.28 (5.45)	2.05 (0.78)	16.33 (6.24)	261.61 (100)

Source: Consumer Finances and Socio Economic Survey, 1981/82

The overall impact of such an ambitious programme if continued unabated, could be favourably felt in the fields of supplementary employment and income generation, redistribution of income, foreign exchange savings, improvements in nutritional status, and changes in total welfare and living standards. Whether these effects can be achieved would depend on many factors and if these aspects are not properly looked into, the present programme also would eventually end up without having made any significant change in the existing position.

Table 3 above indicated that the average expenditure on milk and milk products per person, is only 3.6 percent of their total expenditure on all food items. This had been alarmingly low in the case of lower income groups.

The average consumption figures either by sector or otherwise do not indicate a realistic picture, so that the average per capita consumption of 76 millilitres per day (Mlpd) and the average rural per capita consumption of 480

Mlpd can be used only as a barometer to get an idea about the pattern of milk consumption.

In general, the consumption of milk and milk products in Sri Lanka is said to be well below the levels prevalent in other South Asian countries. Hence the income elasticity for the demand of milk and milk products is estimated to be about 0.6-0.8 at mean consumption level.

Several Dairy Development Plans have been formulated and implemented over the last few decades, one of the more recent being the Medium Term Five Year Plan 1972-1977. This Plan attempted to develop the Dairy Industry in the Mid-Country and the Coconut Triangle, and IDA assistance was provided for this purpose. But, in spite of genuine efforts made by the project's technical Staff this Plan came up against many serious constraints and could not fulfill the targets it had set out to achieve. Finally, the Project was revised for the period 1975-1977. But in spite of the revision, due to future constraints the progress of the Revised Project was also impeded and by 1979 of the total IDA credit

of US Dollars 9 million for the Project only US Dollars 4.6 mn had been expended or committed. An indepth examination of these constraints revealed the familiar pattern of how the country's dairy development Plans have gone awry and why despite the vast potentialities livestock, (and milk production particularly) is not still not at the "developed" stage it should have reached. There have been achievements but progress on this Plan was far from satisfactory.

In this particular instance there was a low level of private sector participation particularly from operators of larger farms (16ha-20ha) due to the uncertainties of land ownership and land tenure. What is important here is that the plans could not foresee the underlying reasons for the low-response of private individuals, or the public sector for that matter, to the changes envisaged in the Plan.

Inconsistency in price trends of producers of milk vis-a-vis cost of animal feeds gave rise to discouraging terms of trade. For instance, while the farm gate price of milk remained unchanged the price of poonac (coconut cake) which was Rs. 400 per ton in 1975 increased to an unprecedented level of Rs. 2,400 per ton, in 1977. This discouraged farmers from expanding their dairy herds and in many instances resulted in closures of dairies; accelerating the dwindling of the productive herd, while further reducing milk production.

Shortages and temporary failures in feed supply has been another obstacle. Notwithstanding the high prices, the total supply of feed available in the country was adequate to meet only one-third of the demand created by the new Plan. For instance, to implement this Five Year Plan (1972-77) the entire animal industry needed 176,000 tons of feed per annum, but in actual practice what was available in the country had only been 63,000 ton pers annum in 1974. Inadequacy of the institutional infra-structure was another problem. The milk collection was

handled solely by the Multi-purpose Co-operative Societies which were not sufficiently geared to absorb changes envisaged in the Plan. Non availability of suitable stocks, and cattle in sufficient numbers to meet the demand when existing operators or new operators showed interest, was another constraint.

High mortality ranging from 25-40 percent among calves in the hill and mid-country zones where temperate breeds were maintained was also a problem. Mortality among calves is largely due to starvation between birth and four months by depriving them of milk, due to farmers extracting maximum milk from the cows to compensate for the high price of cattle feed and shortage of high quality herbage feed.

Inadequate supporting services such as "Artificial Insemination" (AI) services, veterinary assistance and supply of drugs. This led to an emergence of an informal sector capable of providing the same services at a high cost, which was not affordable to average dairy producers.

Insufficiency of high quality herbage feed for the productive cattle arising out of high pressure on land, particularly in the hill and mid-country.

A more detailed discussion of these constraints has been pursued in the latter section of this Special Report. The significance of these constraints is that, over and over again the same constraints or a combination of similar constraints have impeded past endeavours to streamline the dairy industry of this country. That there are "vast potentialities for livestock production in general, and milk production in particular in Sri Lanka, in the different agro climatic zones in the island, provided the available resources are judiciously harnessed" has been a common refrain of experts and specialists both within and outside the country. But if the constraints identified are not properly considered and due priority not afforded to the Livestock Sector it is inevitable that the same old pattern would be followed.

Milk Nutrition

Milk is considered a complete food. In the Mammalian world, milk is the exclusive food of young ones until their digestional system is sufficiently matured to digest other food substitutes. The growth pattern of human babies differs from that of the young ones of other mammalian counterparts, as the period between their birth and

maturity is much longer, during which period milk in different forms and sources provides much of the essential nutritive elements during this period.

Milk is superior to the other food forms as it provides essential minerals and vitamins in a balanced ratio and on easily assimilable form.

Table 1
Composition of a Selected Group of Milk Products

Product	Water	Fat	Protein	Lactose	Ash	Calcium
Fresh milk	87.0	3.9	3.5	4.9	0.7	118
Dry Cream	0.7	65.0	13.4	17.9	3.0	—
Butter	16.0	80.6	0.6	0.4	2.4	20
Butter oil	0.2	99.5	0.3	—	—	121
Skimmed milk	90.5	0.1	3.6	5.1	0.7	121
Yoghurt	89.0	1.7	3.4	5.2	0.7	120
Plain Condensed skimmed milk	66.0	0.4	12.5	18.4	2.5	—
Sweetened condensed milk	26.5	8.1	8.1	11.4	1.6	262
Ice cream	63.2	10.6	4.5	6.6	0.5	146
Dry skimmed milk	3.0	0.8	35.9	52.3	8.0	1308
Dry malted milk	2.6	8.3	14.7	20.0	3.6	288
Cheese	37.0	32.2	25.0	2.1	3.7	750

According to the table above much of the fresh milk and other milk products contain water, followed by different combinations of fats, protein, lactose, ash and calcium. Fat content is assumed to be relatively high in those products like butter (86%) and butter oil (99%), cheese (32%), dry cream milk (65%), while protein content is high in dry cream (13.4%), plain condensed skimmed milk (12.7%), dry skimmed milk (35.9%), cheese (25.9%). Calcium is amply available in dry skimmed milk with most of the vital vitamins and minerals. Table 2 provides us an idea about the vitamin availability of a few of these milk products.

Milk is absolutely vital in the early years of the growth of the brain and nurturing mental power. Milk starvation and under-nutrition in the early stages of life is therefore said to cause mental retardation for life.

Breast feeding no doubt is the best form of food for babies in their early growth stages. However, breast feeding is not feasible throughout the growth stages. Milk and milk products supplement part of this food gap in the second, third and fourth growth stages extending upto physiological adulthood. In addition to this group, lactating mothers, invalids and old age groups form the milk sensitive groups in the population.

Table 2
Vitamin Content of Some Milk Products

Product	A	B ₁	B ₂	B ₆	B ₁₂	Bio	B ₁₂
	Carotene (IU/100g)	Thio-mine (Mg./Kg)	Ribo-flavin (Mg./Kg)	Nico-tinic acid (Mg./Kg)	Pyri-doxine (Mg./Kg)		
Milk	156	0.44	1.75	0.94	0.64	3.46	0.31 .0043
Butter	3108	0.03	0.16	0.5	0.4	2.3	— —
Skim Milk	9	0.4	1.7	0.86	0.45	3.6	0.16 .0038
Ice Cream	523	0.48	2.3	1.1	—	—	— —
Cheddar Cheese	1196	0.30	5.0	0.49	0.75	2.7	0.20 .013

REASONS FOR SHORT SUPPLY OF MILK

M. U. A. Tennakoon

Inferior Genetic Constitution of Animals

A local milch cow with an average carcass weight of about 188 Kgs. provides about 270-450 Kgs. of milk per lactation and a local cow buffalo with an average carcass weight of 300 Kgs. is capable of giving about 500 Kgs. of milk per lactation. The per lactation milk production of a superior bread cow in a temperate climate is over 2,000 Kgs. (Pagot, 1977). In terms of daily production of milk a local cow produces 2-5 pints where as a cow in a temperate climate produces well over 15 pints.

Climatic Constraints

There appears to be a positive correlation between the animal's size and climate (Pagot, 1977). Hot weather affects dairy cattle by making it more difficult for the animals to lose heat from their bodies. At air temperatures below 26.5°C (79°F), heat can be lost readily by natural processes. As air temperatures rise above this limit, heat lost by natural processes becomes inadequate and more heat has to be eliminated by a greater expansion of lungs involving increased respiratory rates. When the temperature of the air reaches or exceeds the body temperature and radiation spill acts, all heat must be lost by evaporation. It is at the higher air temperatures that humidity becomes important because as the water vapour content of the air rises, its capacity to absorb water from the animal's body falls (Johnston et al., 1954). As air temperature rises in the humid tropics, the problems of heat disposal become more urgent and appetite is often reduced in order to reduce the "heat increment" arising from digestion (Whyte, 1967). These problems could be clearly seen in most parts of Sri Lanka where temperatures often remain well over 80°F and humidity remains uniformly high throughout the year.

Poor Animal Health

The list of cattle diseases in the hot humid tropics is a long one. It includes most of the viral bacterial diseases of the temperate countries in addition to diseases that have disappeared there (rinder pest, bovine pleuro-pneumonia etc.), and also specifically tropical or those diseases whose severity is greater in the tropics than in the temperate countries (typhus, somiasis, tick-borne fever, blood and intestinal parasitic diseases etc.)

Adaptation Difficulties of Better Breeds

Harsh climate and diseases being two major constraints in rearing cattle in the tropics, animal breeders still have problems in deciding the best livestock to be adopted to the tropical areas. Some types such as imported Zebu varieties tolerate high temperature and low humidity but they often fall sick when humidity is high (Pagot, 1977). Sahival, Sindhi and Tharpakar are few varieties which have the ability to tolerate high temperature and somewhat high humidity and as such those varieties seem to be ideal for cross breeding with local varieties in the Dry Zone. The European varieties adapt somewhat satisfactorily to cool temperate climates in the tropical highlands (e.g. Ambawela) but at lower altitudes (Mid Country and Coconut Trinagle etc.) their adaptability becomes weak due to increasing heat, humidity and tropical diseases.

Because of these climatic limitations, genetic improvement of animals brought to Sri Lanka from the temperate countries, becomes difficult. Such animals register a late age of first calving in Sri Lanka. Nadarajah (1970) observes that jersey heifers imported from New Zealand experienced first calving at an average age of 35 months in Sri Lanka whereas they would have normally experienced their first calving at 24-30 months

in their country of origin. Similar observations were made by Mahadevan in 1956.

European animals when brought to tropical lands show initial difficulties in re-productive functions, frigidity in males and irregular ovarion cycles in females etc. Even long after the imported animals' settle down in the tropical environments, they show humoral problems, cutaneous or skin disorders and coat shedding (hypertichosis).

Poor Quality of Fodder

When temperature and humidity fluctuate, particularly due to the alternate rainy and drought periods as in the Dry Zone of Sri Lanka, the quality and quantity of natural accessible forage vary considerably. After the rainy season's abundance, there is the dry season's scarcity.

Apart from the quality of forage, the movement required in the hot sun for grazing during the dry season also affects the animal. In the Dry Zone from about the middle to the very end of the rainy season, water holes are numerous and grasses are abundant and of reasonably good quality. Hence, the animals can easily find the quantity of grass needed for its maintenance and growth. However, by the middle of the Dry Season, grasses have nearly disappeared in the Dry Zone in particular. As shown in Fig 1 a dry season could vary from 8 months in Jaffna to 3 months in Polonnaruwa and Batticaloa. (Domoros, 1974). As a result, only a few leaves of browse are acceptable and the animal, in spite of a large daily grazing period, is unable to find sufficient forage for its maintenance. It also loses weight due to the amount of energy needed in its search in the hot sun for palatable grass and water to quench its thirst. Sometimes more than 10 Kms. must be travelled daily¹.

With the beginning of the rainy season following a long spell of drought, there is an abundance of grass and the animals too are expected to gain growth rapidly. But contrary to expectation they

continue to lose weight for sometime after the commencement of the season's rain. The new grasses have a high moisture content and the amount that one animal can eat is still less than its normal requirement.

The crude protein content of many tropical grass varieties is said to be less than 14 per cent. Some varieties have a very low protein content of 4 per cent only. As already noted, the proper use of this limited protein content in natural grasses for the growth, maintenance and production of animals is hindered by the harsh climate and poor animal health. However, several studies point to the fact that there is a remarkably higher protein content in the herbage produced by most of the grasses introduced into the Mid-country and the Hill country¹ of Sri Lanka (Sivalingam, 1964; Fernando, 1969; Appadurai, 1977; Sivasupramaniam and Sithamparanathan, 1974).

In those pastures in the arid and dry regions of Sri Lanka, there is rapid growth of grass during the short seasonal rain, after long periods of dormancy in growth due to moisture shortage. Grass matures quickly and also reaches the stages of flowering and seeding faster. Hence, stocks have to be grazed during most part of the year on standings of very low moisture value. In these grasses the dry matter content is high and it causes digestive problems because of the all round low intake of watery forage.

Scarcity of Fodder

Scarcity of fodder arises out of two factors. First, there is the seasonal scarcity, the magnitude of which varies with the length of drought differing from region to region and from year to year in a region. The dry season's fodder scarcity is highest in the Dry Zone and least in the Wet Zone.

¹ To avoid energy waste in roaming in the hot sun in search of forage and water, in Israel and in Queensland, Australia, night grazing was experimented with and the results were very encouraging (Whyte, 1967).

Second is the limitation of large grasslands itself. Sri Lanka being a thickly populated country has a total extent of 1.07 million acres under permanent meadows and pastures somewhat suitable for year round grazing. However, except for a few large grazing lands such as the 'villus' in the Polonnaruwa district, the other small and highly scattered grass patches in crown lands and private properties inhibit the maintenance of large herds. About 80 per cent of land holdings are under 2 acres in extent (Census, 1973). As the population increases, the land holding sizes would continue to decrease unless economic opportunities in the non-agricultural sector expand sufficiently to relieve population pressure on the cultivable lands. In small land holdings under existing levels of fodder production the permissible herd numbers are very small. Most of the small properties permit the maintenance of only two or three animals. Some of these holdings are so small that no grazing is practised in them by the peasants.

Though the estate land holdings are large, the placing of crops in them is such that either the space available for fodder growth is limited (tea estates) or the existing tree crops form dense shady canopies (rubber) prohibiting the undergrowth of grasses. The workers in these estates, therefore, resort to limited grazing of their animals. Some sort of grass cultivations as under-crop is possible only in the coconut estates.

In the less populated Dry Zone, where the pressure on land is less acute than in the Wet Zone, irrigable lands are cultivated with cereals once or twice a year. Irrigated fodder cultivation still remains a costly business. Even the marginal lands are used for highland paddy or subsidiary food crops posing limitations to grazing lands.

The Dry Zone farmers are not accustomed to the integration of animal husbandry with cereal farming. They will concentrate on cereal cultivation in limited irrigable and marginal lands until such time as they are convinced that an

intensive combination of farming and cattle breeding would permit a higher return than from cereal cultivation alone.

Inadequate Concentrate Feed

A low nutrient value of indigenous grasses (protein content less than 14 per cent) requires supplementation of cattle food with concentrates to provide the minimum of 16 per cent protein required by milch cows (Ten Year Plan, 1959). Coconut cake (poonac) is the familiar concentrate feed in Sri Lanka with about 20 per cent protein in it. The neglect of coconut plantations in the wake of Land Reform, cyclone devastation of about 400,000 coconut plants in the Chilaw area, and severe drought conditions that prevailed during the early 1970s reduced coconut production, while prices escalated (Table 4). In 1977, the black market coconut cake prices varied from Rs. 2,000/- to Rs. 2,400/- per ton. In 1978, a ton of coconut cake which cost Rs. 3,700/- rose to Rs. 4,500/- in some areas in 1980. The recovery of the domestic coconut cake production was so low that a part of the domestic requirements of it was imported in 1979.

The other supplementary feeds include mixtures of different ratios of cereals, wheat bran, rice bran, flour and rice sweepings locally prepared by farmers depending more on the availability of these items rather than on consideration of their nutrient values. The estimated available quantities of these items in 1977 are given in Table 5.

Table 5
ESTIMATED FOOD
CONCENTRATE COMPONENTS
AVAILABLE

Components	Quantity (Tons)
Cereals	10,000
Wheat Bran	25,000
Rice Bran	10,000
Flour & Rice sweepings	2,000
Gingerly meal	5,000

These ingredients are used in varying proportions by these farmers to prepare the animal feed.

But, the appropriate ratios of feed mixture (NLDB, 1974), the minimum daily requirements per head (Ten Year Plan, 1959) and the cost are set out in Table 6.

Thus, in 1977, the minimum requirements of 3 lbs. of food mixture per head of cattle, cost Rs. 4.80 which would have imposed a considerable financial strain on the small scale dairy farmer.

Collapse of the communal grazing system in the Dry Zone

In the past cattle breeding remained an integral part of the agricultural way of life in the Dry Zone. Farmers depended greatly on animals for draught power needed in subsistence agriculture. Hence the villagers had to protect both crop and cattle.

The strategy adopted to safeguard this dual interest was a unique one. Conventionally the cultivators were required to watch their crops more closely than the cattle owners were required to watch their cattle grazing communally in the uncultivated lands in the village. The farmers were required to erect sufficiently strong fences enclosing their cultivated fields to keep off the roaming cattle. This arrangement was necessary because apparently it was the same owners of crops who owned the cattle as well.

This community organisation showed the first symptom of collapse in the late 1940s when the farmers began to think that cattle was no more an absolute necessity to work land. This idea originated as a result of government's propaganda to popularize the use of tractors in working farms¹. The traditional farmers who were rather reluctant to switch over gradually adopted the new technology being popularised by the Government.

It induced most farmers to neglect the training of animals for work in numerous field operations and finally to sell their idle cattle. With the increase of non-cattle owning farmers, there developed a conflict between the cattle owning and non-cattle owning farmers as to whether cultivated field owners should take the entire responsibility of protecting the cultivated fields from the village cattle with proper fencing or the cattle owners should keep their communally grazed

¹. The government opened tractor units in district towns in the Dry Zone to demonstrate time saving in ploughing.

ECONOMIC VIABILITY OF SMALL SCALE DAIRY FARMS

(The experience of a mid-country dairy farmer)

K. A. S. Dayananda

The mid-country has a long tradition in dairying, a legacy left behind by the colonial planters. Today it survives as an important supplementary source of income to the poor segments of the people in the villages and estates.

There are hardly any lands in the mid-country to establish pastures or grazing lands economically. Thus the dairy farmers have to depend on grasses found in ravines, paddy field ridges or roadsides to feed their cattle. The relatively mild weather permits lush growth of grasses such as Guinea A, 'Fox Tails' and legumes such as

Gliricidia for almost nine months of the year. From mid-January to mid-April is the dry season, during which anything from paddy straw to Jak fruits are fed to the cows. Temperate breeds such as Friesians, Ayreshire, Jersey, Shorthorn etc. now exist in this area as a mixed breed called cape cows. This herd is constantly being upgraded by A.I. (artificial insemination) programmes of the Department of Animal Production and Health. These animals easily outyield local breeds by 3-4 fold.

Informal Cattle 'Exchange' Market

The dairy farmers have to maintain dairies in their small holdings or behind their line rooms. The majority

Table 6
PROPORTIONS OF INGREDIENTS IN FEED MIXTURE,
MINIMUM DAILY FEED MIXTURE REQUIREMENTS PER HEAD COST

Ingredient	Proportion		Cost ⁽¹⁾ (Rs.)
	Percentage	Lbs.	
Poonac	50	1.5	1.49
Wheat bran	25	0.75	2.68
Rice bran	20	0.6	0.54
Cereals	5	0.15	0.09

Note: (1) - Calculated at the 1977 price of Rs. 2,400/- per ton.

Source: NLDB (1977) & Ten Year Plan (1959).

cattle under strict vigilance and prevent crop damage.

With the emergence of this conflict, instead of the conventional practice of constructing strong fences to protect crops from the village cattle, the field owners built less-strong fences and compelled the cattle owners to guard their animals from breaking such weak fences into cultivated fields. When a crop damage from village cattle occurred, the administrators with an avowed policy of increasing food production acted in favour of the cultivator. It discouraged cattle keeping in the village and that eventually decreased milk production in the Dry Zone to its present low level.

Increasing Demand for Beef and Decline in Bovine Population

Beef remains the cheapest source of protein for urban dwellers. The price

of beef of a given weight is often less than that of fish. Hence, there was always a higher demand for beef than for fish notably among the poorer majority of urban dwellers. Beef is also in great demand as other sources of animal protein such as chicken and pork are in short supply. As a result, slaughtering of cattle for beef has increased considerably amidst numerous controls placed on transportation and slaughtering of cattle. Very recently the slaughter of cows, heifers and calves was banned. Yet, it is extremely unlikely that illicit slaughtering of such animals has come to a halt. The exact nature of the decline in cattle population cannot be clearly determined, because there is no proper enumeration of the bovine population in Sri Lanka. All data, however, indicate clearly the declining trend.

of them keep a herd of 1-3 cows and about 1 follower.

To start a dairy farm is by no means an easy task. The selection of a good animal needs expert guidance, and also one has to invest a good sum. At the informal cattle markets in the urban centres such as Gampola and Nawalapitiya, there are 'cattle brokers', who function as a kind of 'cattle exchange'. They do provide a useful service to the dairymen in buying and selling cattle. The price of a cow is determined on the open market price of milk, the yield of milk per day, its physical appearance and age of the cow. If the market price of milk is Rs. 3/50 per bottle (current price) and the cow yield 10 bottles, the value of the total quantity of milk produced per day is multiplied by one hundred. So the value of the cow in this case is Rs. 3,500/-. The broker's fee is Rs. 50/-.

Poor Feed Resources

Adequate and nutritious feed is important in maintaining a good dairy herd. A cow needs about three bundles of grasses. If bought grass is given, the cost per bundle is Rs. 4/-. Even then the grasses that could be obtained do not provide all the nutrients a cow needs. Hence whatever the theories pronounced by researchers on rearing cows with grasses alone, these animals in the mid-country have to be provided with a good ration of concentrates, if adequate quantity of milk is to be obtained. The ingredients most popular in these areas are poonac and low quality rice bran on 1:2 basis with minerals which cost around Rs. 5/36 per kilogram at current rate. The current price of poonac is Rs. 128 per cwt and rice bran Rs. 70/50 per kgs. The quantity of poonac in the ration declines when its price goes up. A few farmers give readymade feeds such as dairymax.

Farmer Attitudes to A.I. Services

A few years ago farmers obtained the services of stud bulls of temperate breeds maintained in these areas to service their cows. Now there are only a few such bulls as the farmers sold out most of them with the increased popularity of A.I. services. Currently an A.I. service costs Rs. 25/- whatever the official rates are. If the cow does not conceive, two subsequent insemination are done for which only the 'bus

fare' will have to be paid. The cost of a natural service by a stud bull is higher at Rs. 70/-. Two subsequent services are free if the cow does not conceive.

However, the dairy farmer and the A.I. extension worker are faced with several demoralising situations since of late.

The extension worker naturally expects these farmers to be bit more 'scientific'. Unfortunately most of these farmers lack the knowledge or basics of good dairy management. The most common complaint of the extension workers is that the farmer is late in detecting a cow in heat and of informing the veterinary surgeon's office.

On the other hand farmers complain that the extension workers are not prompt enough and that they provide preferential treatment to well-to-do people. Thus A.I. services do not reach all the dairies in an even manner.

There are instances when even the writer himself was disappointed due to the non arrival or late arrival of the extension worker. The A.I. service has to be carried out within 36 hours after the heat occurs. There were instances when frozen semen was not available. On such occasions the farmer's frustration is understandable when he has to travel 5-6 miles to reach the veterinary surgeon's office quite often by bus leaving aside his other work.

Neglect of the Pregnant Cow

The heifer needs no special feeds for the first calving. However, during subsequent calvings a pregnant cow has to be looked after very carefully to get the best possible yield of an animal. During this period, particularly during the last two months of pregnancy, she has to be fed with an extra ration and concentrates and minerals of about 3 kilograms. The number of farmers who can afford to feed the cow in this manner is minimal as it will cost around Rs. 160/- a month.

The absence of such practices also deprives the cow of prime health at calving, protection from diseases such as milk fever, and a calf with higher weight for vigorous growth. Under such circumstances the cape cow cannot give out its best during lactation, so that through no fault of hers, it is the cow that is condemned when she gives a low yield, not the

poor management. Ultimately she ends up in a slaughter house very early.

Poor State of Calf Rearing

The calf as it grows needs at least about 5 bottles of milk per day for at least 60 days, which is the recommended practise by vets. Five bottles of milk cost around Rs. 17/50 at free market rate or Rs. 10/50 at the co-operative milk collector's price. Will our subsistence farmers allow such an allocation even if an excellent calf is born due to the A.I. service. *What is the point of having a good A.I. service if this calf is not brought up properly giving a right allocation of milk?* Some farmers even have the idea that the cow hide's milk for her calf, and therefore they draw out the maximum possible milk. The ultimate result is the high calf mortality rate, which is said to be about 40 percent in these areas. This is a great loss to the farmer, and to the country.

However, if a female calf survives up to the age of 7-8 months she could be sold for about Rs. 600-700, whereas male calves are sold for slaughter for about Rs. 200-300.

The Milking Cow

Generally milk is taken for consumption only after the fourth day of calving.

The absence of healthy milking habits among most of these dairymen cost them a lot due to mastitis, a diseases of the udder. The high incidence of mastitis could be controlled if farmers could resort to simple preventive practices such as the use of potassium permanganate solution in washing the udder, and dipping the teats after milking in the same solution, which kills disease causing germs. This is an inexpensive practice which will not cost more than Rs. 5/- per month. But this is something unheard of among our small scale dairymen in this area.

The milk production of a lactating cow peaks at the end of the second month. Thereafter if the cow is well fed, the milk production keeps at the same level for another 1-2 months. The lactating cow has to be fed 2-3 kilograms of concentrates depending on the milk yield.

A cow could be milked for about 10 months during which period she may

yield about 2,000 bottles of milk (after leaving about 300 bottles for the calf, if the calf is properly fed) worth around Rs. 5,000/-.

Mode of Milk Sales

The dairymen sell their milk either to the local boutique or to the co-operative society or to both.

In the open market, the current price of a bottle of milk is Rs. 3/50. It is a 'tradition' in some of these areas to mix it with (at least twenty five percent) water. However, the quantity that could be marketed is limited, due to lack of purchasing power of the neighbours.

The milk collection for the Co-operative Producers Association is carried out by a contractor, who is usually a shrewd businessman. This man keeps a tight control over the milk suppliers by giving them advances (loans) for emergencies. He checks every can of milk, with a lactometer, for water and any sub standard milk he instantly rejects. He therefore gets the best milk from producers, but pays them the lowest rate (minus transport charges) irrespective of fat or of SNF contents. The current rate received by producers in these areas is around Rs. 2/80 per ltr. or about Rs. 2/13 per bottle.

Operational Cost of Milk for the First Five Months of Lactation

Cost	(Rs.)	Selling price per bottle (Rs.)
3 bundles of grass	16.00	2.13
Concentrates	5.36	
Labour cost	10.00	
Total	31.36	
Cost per bottle	<u>3.14</u>	<u>3.14</u>
Loss per bottle		- 1.01

Assumptions
1) Milk yield per cow is 10 bottles per day
2) A manday is required for 3 cow unit.

Under the circumstances the dairy farmers should receive at least Rs. 5/00 per bottle at farm gate, at least to break-even. If this happens we would expect a progressing dairy industry. If such concessions could be provided to the local sugar industry, why cannot the dairy farmers be given the same facility.

Cowsheds and Drugs

A farmer has to incur considerable expenses to put up a small cow shed. He has to cement the floor. Then he has to spend Rs. 300 - 400 every other

Credit Facilities for Dairy Development — IDA Loan Scheme

A specific scheme of credit for dairy farmers had not been formulated until the second half of 1970's, although the credit component had been emphasised as an integral part of the dairy development programme in some of the earlier proposals. The first systematic credit scheme for dairy development was initiated with the IDA/Sri Lanka Dairy Development Project in which assistance to the tune of US\$ 3,875,000 provided by the IDA to meet institutional credit requirements of farmers participating in this project.

year to purchase cadjan for the roof. Also, coir ropes for the animals, particularly if they are tethered, are needed every other month. Each of these ropes or 'Theda' cost Rs. 10-11 each.

Medical attention and drugs for the animals are needed quite often. For convenience farmers consult private practitioners of Veterinary medicine, who are mostly retired extension workers of the Department of Animal Husbandry. They provide quite an efficient service for a moderate fee. But purchase of medicines from local drug stores is expensive. A popular

These funds had been allocated among the two state banks, namely the People's Bank and the Bank of Ceylon on an equitable basis, with an on lending margin of 4 per cent to meet the cost of administration. The rate of interest payable by the recipient farmers was 10 per cent.

The eligibility criteria for this scheme was that the recipients should possess at least two acres of suitable land for pasture development, the credibility of the applicant reflected in terms of his past history of banking operations (non defaulting), and the economic viability and the bankability of the proposition at hand. Credit was provided for the purchase of animals, forage developments and improvement to building and plants - the upper limits of the loans were determined by the regional variations of prices of cattle (Rs. 2,500 to Rs. 3,500 per cow) and the number of animals financed.

The performance of the banks in implementation of this scheme, as measured in terms of its coverage, acceptance and the recovery status had not been encouraging. The two leading banks involved had stressed a variety of reasons for this state of affairs, among which were the absence of basic infrastructure, the high cost of production, and the non availability of concentrate feed and milch animals.

The Nuwara Eliya Dairy Development scheme which was launched, independent of the IDA assisted project, had stressed the importance of a livestock marketing system and expanding the extension, training, and health services. Institutional credit inter alia had been identified as a vital element in this integrated programme and the two state banks were expected to share the credit component, equivalent to the value of US \$ 2.282 million.

Six districts, namely, Colombo, Galle, Gampaha, Jaffna, Kalutara and Kegalle were identified to be suitable for this program. The role of the state banks had been to provide the potential dairy farmers (small holders and agricultural labourers) with medium and long

wormer such as 'Nilworm' is now difficult to get in these areas.

Conclusion

It is the opinion of the writer, who has about 15 years of dairying experience, that before starting new dairy ventures in the country it may be prudent to think about the ways and means to tap the full potential of our cape herd by improving of dairy management. This is the most neglected aspect in the mid-country dairy development programme at grassroots level.

term credit for the purchase of cattle/dairy, capital assets, to meet other establishment costs and working capital requirements. The banks were expected to liaise closely with the DAPH, in the activities related to organization of milk producing organizations, collection of loan repayments, carrying out pre and post supervision, and finally recovery of funds disbursed. A regionalized programme was initiated by the State banks to incorporate the estate workers and other Upcountry peasants interested in cattle farming in an organized dairy development scheme. This scheme was phased out over three stages, with the later two stages being abandoned due to operational problems like the non availability of milch cows.

ADB ASSISTANCE

The Department of Animal production and Health (DAPH) within the Ministry of Rural Industrial Development in liaison with the two state banks had designed a credit scheme for on-farm development of small scale livestock farmers, with a view to assisting the small farmers to be actively involved in the upliftment of quality and productivity of cattle, buffaloes, pigs and poultry.

This overall programme, designed with the assistance of the ADB, is aimed at improving the quality and quantity of the cattle stock, nutrition and husbandry, strengthening the livestock marketing system, and expanding the extension, training and health services. Institutional credit has been identified as a vital element in this programme, and the two state banks are expected to share the credit components amounting to US\$ 2.282 million.

Of the 10 districts selected for development in the livestock plan, six had been allocated for dairy related development. These six districts include Colombo, Galle, Gampaha, Jaffna, Kalutara and Kegalle. The participating banks have been asked to provide the potential dairy farmers and the producer associations with medium and long term credit for the purchase of cattle, and other capital assets to meet establish-

PLANNING DAIRY DEVELOPMENT

The question of self sufficiency in dairying and dairy product development had been approached basically as dependent on increasing the number of milch cows available in the country, and raising the productivity of cows milked. In a broader sense these activities may constitute only 70 percent of the production process, which is related to the physical production aspect of dairy development. The remaining 30 percent deals with the effectiveness and efficiency of the basic infrastructure conducive for such a process, and the components highlighted under this includes, product design, processing, packeting, marketing and distribution. A few major attempts have been made during the post-independent era, to consolidate these factors into a favourable mix so that the country could reach self sufficiency in milk. Even before these plans were

ment costs and their working capital requirements. The banks were expected to liaise closely with the DAPH, in the activities related to organization of milk producing associations, selection of loan recipients, post and pre-supervision of credit disbursed, and recoveries.

The credit assistance would be extended either to expand existing enterprises or to start new ones, and the project anticipates coverage of approximately 3,000 farmers. The size of such a dairy unit is expected to be in the range of two cows or buffaloes. The maximum ceiling for these loans would be Rs. 49,500, and the bulk of the loans granted have been around Rs. 15,000/- due to the easy accessibility arising out of relaxed terms and conditions.

The credit extended under this scheme may be utilized either to meet establishment costs (investment capital) such as construction of sheds, purchasing of cross-breed animals or to meet working capital expenses like purchasing of feed or paying of other operational expenses.

The project-oriented nature of this facility has enabled the banks to streamline the eligibility criteria

mooted a few efforts adhoc in nature, had been taken in this direction in which the stress had been to import high-breed animals from major dairy producing countries.

The Economic Development Plan of 1953 - 1959 proposed to pursue the work already being followed by the Division of Animal Husbandry and Veterinary Services in the state owned dairy farms. During this period the emphasis had mainly been (1) Supply of good cross breed cattle for urban dairies. (2) Development of the milking properties of water buffaloes to encourage the use of buffaloe curd in rural areas. (3) Introduce large scale milk sheds in the urban areas to carry-out intensive forms of dairying. (4) Production and distribution of sires likely to produce progeny of specific food survival rate and economic response in particular regions.

to a much simpler form. Some of the more important criteria laid down in the project includes the honesty of the borrowers, reflected in their past credit discipline, presence of acquired skills of dairying, and availability of minimum resource level in which land, and other forms of equity contribution which are not less than 15 percent of the total cost of the project. Furthermore, membership of a registered dairy producers association would be essential.

The Central Bank's re-finance facility has enabled the two participating banks to extend this facility at a substantially lower lending rate of 12.5 percent per annum. The total assistance package covers such auxiliary elements as extension, education, marketing, veterinary services, and setting up of producer associations, all of which need to be integrated and provided in a proportionate mix for a successful implementation of this scheme. Therefore the overall performance of this scheme will be determined to a greater extent by the relative importance assigned to these integrated components, and the level of their individual as well as collective contributions in making the expectations of this scheme a reality.

The Ten Year Plan 1959 - 1968

The Ten Year Plan identified animal husbandry to be an area with immense potential in agricultural development. The increasing strain on the exchange budget that was equivalent to around Rs 60 million in 1958, was projected to reach Rs 100 million and this alarmed the planners and those concerned about economic performance. A strain of this magnitude had been interpreted to be quite unreasonable against the very conducive agro-climatic conditions of the country for breeding and caring of cattle. Thus the Ten Year Plan set an ambitious livestock development target with a strong bias on dairy development.

“Special emphasis is placed on animal husbandry and the country's needs of milk and meat products. This is a field of production which has not flourished in the past, but for which the potential for development is great. The target of the plan is to raise the value of the country's output of milk, meat, and other dairy products from Rs 87 million in 1957 to Rs. 211 million by 1968, an increase of 14.3 percent.” (Ten Year Plan, 1957).

In terms of the volume of milk produced, the local production that stood at 153 million pints in 1958 was expected to reach the level of 495 million pints by 1968, which is more than a two-fold increase. For this to be achieved, a substantial change in the quality and quantity of the country's dairy stock of 338,000 cows had to be introduced. The Plan emphasized that to make a change in the present net yield of 1.2 pints per cow per day the cattle population should be improved, the standards of pasture and the concentrate feed should be raised, and the management techniques and technology used in dairy farming should be substantially upgraded so as to reach a reasonable yield of 3.2 pints per cow per day.

Thus the Ten Year Plan quite logically postulated that self sufficiency in milk depends on achie-

ving firstly, an improvement of the average yield of 3.2 pints per day. As an incentive to increase local milk production, the pricing and marketing system was proposed to be streamlined, for which the Milk Board was set up. The Milk Board initially concentrated on the supply of fresh milk, which ventured into various forms of processed products only in the recent years. **Agricultural Development Proposals 1970-1975**

This Plan set an important landmark in the dairy development of the country, by offering a series of concrete proposals to develop the national livestock strength, in order to increase milk production. The Plan identified the regional variations in agro-climatic conditions, and the plan of action suggested had attempted to incorporate these variations. Thus, the hill country, with its temperate climatic conditions had been suggested to use imported exotic breeds like Jersey, Derby and Ayreshire from Europe. The environmental and other resource base of this zone was found to be ideal for intensive dairy farming. Even before the completion of the ten year plan another interim programme was introduced between 1962 - 1964, which was called the Short Term Implementation Programme. The highlights of this programme, had again been the emphasis made on -

- (i) raising the average yield of local cows
- (ii) increasing the number of cows milked from the existing stock.

The potential for raising the average yield was found to be immense as the present yield had been drastically low. However, the remedial action possible appears to have been rather long term as changes have to be introduced into animal genetics and institutional infrastructure influencing such improvements. The second proposal dealt with a rather quick yielding area of activity, and the methodology applied was to improve the marketing facilities to induce the peasants to milk and market their produce. The rationale behind this proposal had been that the farmers

are not encouraged to increase the yield as in domestic farming. It also identified the professionalism available in the dry zone both for cattle breeding and rearing. The establishment of the Condensed Milk Plant under the auspices of the National Milk Board, the introduction of improved varieties of grass suitable for local conditions, and the demarcation of certain areas of the coconut triangle for intensive dairy development had been a few other important outcomes of this proposal.

The Five Year Plan 1966-1970

The Five Year Plan identified the strategic role of dairy as an option being qualified both under the import substitution and agricultural diversification programme. The main emphasis of this plan was to (i) improve the quality and extent of pasture, in which a two-fold increase of the existing land extent of 30,000 acres had been targeted; (ii) to import improved breeds of cattle for cross-breeding so as to expand the milk herd; (iii) the expansion of the network of milk collecting centres already established under the NMB; (iv) the recognition of credit component and the importance of extension services to develop a domesticated dairy development scheme.

Accordingly it was targeted to reach self-sufficiency in full cream milk powder, butter fat and skimmed milk.

However the performance of the project had not been far away from its original expectation and thus it had to be re-formulated to give “a new dimension to it”. At this reformulation stage, the emphasis was shifted from providing credit to commercial dairy farms to the formation of Dairy Producers Associations, based upon the Anand Pattern of dairy corporation. (See box)

The government, based on the suggestions of the mission, increased the price of milk by 38 per cent which was accompanied by a heavy subsidy offered for dairy producers for growing fodder and purchasing - of quality cows.

The IDA Sector Mission of 1982 and the Present set up

The second stage of the IDA mission evaluated the response of the dairy sector to the basket of incentives offered by the government and based on their findings, the sector mission outlined the need for the following changes, in March 1983, on policy:

- 1) To streamline the network by setting up collecting centres equipped with milk testing.
- 2) To improve the transportation system by increasing road fleet, and speed up the transportation process between collecting centres and factories.
- 3) To establish the importance of bank credit as the main financing source, namely for purchase milk cows, improve pasture and set up small farm milk units.
- 4) To provide technical assistance for on farm development in the wet zone.

The project study recognized the difference in regional potentialities for dairy development and wanted priority to be given to the hill country, mid country and coconut triangle as the major zones.

The mission suggested that the entire country should be divided into five milk sheds, namely:

- a) Jaffna -
Includes the administrative districts of Jaffna, Mullativu, Mannar and Vavuniya.
- b) Colombo -
Includes the administrative districts of Colombo, Kalutara, Kegalle, Ratnapura, Galle and Gampaha.
- c) Kandy -
Includes Kandy, Matale and Nuwara Eliya.
- d) Polonnaruwa -
Includes Polonnaruwa, Anuradapura, Puttalam, Kurunegala and Trincomalee.
- e) Moneragaia -
Includes Monaragala, Badulla,

Ampara, Habantota and Batticaloa.

The mission also identified that to ensure that both rural producers and urban consumers gain from a programme of dairy development, major institutional and organizational changes which result in increased milk production and promote processing and marketing should be introduced.

A major diversification from the existing institutional framework proposed was the liquidation of the public sector's direct involvement in dairy development activities. The aim of this change had been to maximize efficiency at the level of collection, processing and marketing of milk for which the study recommended that the Government of Sri Lanka should divest itself of the management of investments in milk processing and marketing, which are essentially commercial activities purported to be better handled by the private sector. It was presumed that a private company unlike a public enterprise would have full autonomy in pricing and management and would pay sufficient wages to attract high calibre staff.

The study also visualised that the existing co-operative system is incapable of providing the producers with the benefits of higher prices, and therefore under the new set up the producers should be granted greater control over the affairs of the dairy producing associations for which they were encouraged to enter into partnership with entrepreneurs in building the dairy industry. In view of this environment, the new project is proposed to be established with an organisational infrastructure patterned after the Indian Amul model. However, the new entities would be registered under the Companies Act and not under the Co-operatives Act.

The project is planned for implementation over a period of seven years.

The objectives of the project are as follows:

- 1) To create an apex organization to provide financial and technical

support for the long-term development of the dairy sector;

- 2) To increase rural employment and incomes through expanding milk production (by providing autonomous organization for the efficient collection, chilling, processing, and marketing of milk and by allowing producers to share in the management and profits of each of these activities in the dairy industry).
- 3) To increase the supplies of domestically produced and hygienically processed liquid milk to urban areas;
- 4) To provide technical assistance and training to support the development of the sector;
- 5) To strengthen and support the monitoring and evaluation of projects in the livestock sector.

The entire project is divided into 6 different components.

They are —

1) Organization and Management

The organizational and management structure of the project contains a four tier structure, in which a non profit guarantee company called Dairy Development Foundation (DDF) is set up at the apex level. The Milk Industries Lanka (MILCO) Limited owned by producers and the private sector forms the next level of organization, which is followed by Milkshed Producer's Companies (MPCs). At the lowest level would be the Village Milk Producers Companies (VMPCs) owned by producers and it is proposed to set up 1920 such companies at the grassroots level.

2) Processing Plants and Chilling Centres

To modernize and expand the capacity of milk chilling, processing and marketing, it is intended to rehabilitate the existing plant in Colombo and set up three additional plants in

Colombo, Kilinochchi, and Ampara and finally to establish about 11 medium sized plants at other regional centres like Haputale, Haliela, Nawalapitiya, Chenkaladi, Ruwanwella, Vavuniya, Chilaw, Horana, Tissamaharama, Kolagalle and Norwood. At the end of this scheme the total plant capacity would reach 490,000 NLPD with expansion capabilities to reach the 630,000 NLPD level.

3) Technical Inputs and Extension Services

The dairy farms will be provided with artificial insemination (AI) Services, an Emergency Veterinary service, first aid, and advisory services on fodder and pasture production and dairy management. The flow of the advisory, technical, and extension services, would form different magnitudes proportionate to the role and responsibilities of the different organizational structures discussed above, under the Organization and Management Component.

4) Training

The project had emphasised the importance of training of people and expects to launch different types of programmes for different groups of people involved in the project. The proposed training would be provided at local centres as well as at Anand in India.

5) Technical Assistance

The fact that the bulk of the technical assistance can be found in Sri Lanka itself is recognized by the study team. Yet, provision is made to have about 408 man-months of technical assistance at the base cost of US\$ 3.2 million and this constitutes almost 85 percent of the provision made for technical assistance.

6) Monitoring and Evaluation

The project contemplates having monitoring and evaluation sepa-

Dairy Its role in India

The recent achievements in the sphere of dairy and dairy product development in India depicts the extent to which the economic, social and cultural setting in India matches with the requirements of a dairy culture.

Economically much of India is still rural, with almost 76.3 per cent of its population being rural. The socio-economic realities of this vast rural sector are such that 50.70 per cent of the persons fall below the officially set poverty line, as measured in terms of per capita calory availability of 2400 units per day. Similarly the problems of unemployment and paucity of economically productive land to absorb rural peasants, among which a majority

rately in which physical and financial progress would be monitored by the Dairy Development Foundation itself while the evaluation aspect would be taken care of by the Ministry of Rural Industries Development.

The total cost of the project is estimated at Rs. 2,093 million of which 47 percent will constitute the foreign exchange component. The price contingencies of the total cost, (inflation) over the 7 year period is estimated to constitute 30% of the total cost of which the reliability is questionable given the bitter experiences of many major projects implemented during the last seven year period.

About 66 percent of the total cost is expected to be financed through foreign assistance coming in the form of commodity aid and other donor assistance. Another 28 percent would be financed through a soft loan from an IBRD, credit while the balance which comes to about 6 percent will be provided by the local banks.

The study also highlights the importance of an effective tariff structure to enhance stability and protection of the industry in the early years of the programme's operation. The purpose of such tariff, which is advocated to be below the level of 25 percent, is proposed to be superior in delivery goods.

are small farmers, marginal farmers, and agricultural labourers, leads to dairying being most feasible alternative to contain their economic conditions at least in the short run.

Culturally the caring for and breeding cattle runs back to the early ages of Indian history, in which, the cow was given a sacred place in Indian society. To quote from Mahabaratha "with their milk and with Haris manufactured there from they uphold all creatures in the universe" depicts the status of the cow in Indian society. The Hindu Vedas written before 1200 B.C., mentioned the use of butter as food. The mention of milk and milk products implies the presence of dairying in the very early ages of Indian history.

This historical and cultural setting made domestication and keeping of milk producing herd animals an indispensable part of rural life. The same animals were used for work, and production of milk. The milk was consumed at the point of production both as milk or as domestically made dairy products.

Dairying therefore fits ideally to the priorities spelled out in the recent plans and strategies for rural development in India. For instance, the sixth five year plan set out the following priorities for rural development.

1. Increasing production, and productivity in agriculture and allied sectors.
2. Resources and income development of vulnerable sections of the rural population through development of primary, secondary, and tertiary sectors.
3. Provision of additional employment opportunities to the rural poor, for gainful employment, during the lean agricultural season through a rational programme.
4. Provision of essential minimum needs.
5. Skill formation and skill upgrading programmes to promote self and wage employment amongst the rural poor.
6. Facilitate adequate availability of credit to support the programme taken up for the rural poor.

Although those six priorities show a lot of overlapping, the central theme is that the rural development programmes should ensure the best utilisation of the available local resource endowments. Dairying has a unique feature of fitting into the bulk of those six priorities, as dairying can ensure self employment, nutrition, income upgrading, draught power, organic fertilizer, etc.

It is also true that dairying has a strong edge over the other alternatives, due to its inherent advantage of easy adaptability to the state delivery programmes covering credit, marketing, input distribution, and extension. Thus, the state institutions, show a strong inclination to select dairying indiscriminately, in their development plans. For instance, dairying is one of the most cognitive areas selected by the bankers to finance in the Intergrated Rural Development Programme (IRDP) assisted projects.

A model blindly followed by many Indian states under the dairy development programme, is the Amul, or Anand Pattern, which was conceived initially in Gujarat state. The programme for replication of this model is named as "operation flood" under which a number of milk producing districts, and consuming centres scattered throughout India were proposed to be linked into a single milk producing and marketing grid.

The Anand pattern is conceived as a Village Milk Producers Co-operative in which milk producers at village level are voluntarily organized. These village level co-operatives have been made members of the district level co-operative milk producers union.

The village level Co-operative Societies are said to be open to all the milk producers within the village. At a general meeting of members, a managing committee is elected from the membership, who are responsible for the day to day operations of the society, i.e. milk collection, quality control, sale of cattle feed, price determination and the provision of auxiliary services like artificial insemination and veterinary facilities. The village level milk producers societies are linked to district unions where cattle feed plants, semen collection, veterinary services etc. are centred. The district unions have an independent board of management, elected from the affiliated unions. The dairy owned by a union has a milk drying plant, to convert the seasonal surpluses, into milk powder, and other conserved products, which helps to stabilize the price of milk during the flush seasons.

The paucity of natural feed, i.e. adequate natural pastures, made dairying in most of the states heavily dependent on preserved grass, and other artificial cattle feed concentration. Thus the price of cattle feed concentrates decides the producer margins and the economic and social profitability of dairying. The provision of cattle feed concentrates wherever possible at reasonable costs helps the poor farmers to retain a higher margin. Therefore, the role of the district union as an intermediary in providing a better farm gate price on the one hand and

containing the prices of inputs like cattle feed concentrates are seen as strong points of the Anand pattern dairy model.

The replication of Anand pattern, named 'operation flood' has the twin objectives of ensuring a remunerable price to milk producers throughout the year, and providing a regular supply of milk to urban consumers at a reasonable price. This replication is designed in such a way that the conventional milk producing areas are properly linked with the major consuming centres of the country through a national 'milk grid.' The producing areas although designated as Western, Northern, Eastern and Southern, are centered around the states of Gujarat and Maharashtra in the West, Uttar Pradesh and Rajasthan in the North, West Bengal in the East, Andhra Pradesh, Tamil Nadu and Karnataka in the South. The major milk markets are the urban centres of Delhi, Bombay and Calcutta.

The poor genetic constitution of the majority of farm animals, the acute shortage of feed and fodder, the limitations imposed by the environmental conditions in certain parts of the country, inferiority of animal health cover, and marketing system in other parts are some of the major constraints that hampered Indian dairying reaching the projected targets. But this does not under value the achievements. It only attempts to evaluate the achievements in a broader perspective.

Although, Indian dairying has been successful in conquering the multinationals, the self-sufficiency achieved does not mean that milk production has achieved the overall milk requirements of the country. According to an earlier estimate the availability of milk during the Fourth Plan period was only around 108 grams per head per day while the nutrition expert group for the ICMR recommended 300 grams of milk for pre-school children, 250 grams for school children, and 200 grams for adult man and woman, and an additional 150 grams, 350 grams for expectant mothers. In the light of these estimates the present level of production will have to go a long way before real self-sufficiency is reached.

Another criticism about the Anand pattern of dairying is that it helped draw all the milk away from the villages resulting in nutritional deprivation of the rural population. Generally the rural people convert liquid milk into ghee for realizing its cash value and consume butter-milk by-products for meeting marginal nutritional requirements. Therefore even traditionally milk flowed from the rural producing areas to the urban demand centres. After the co-operatives were formed a comparatively better price was paid than by the

traditional trade, and the milk flow was intensified. In a way, this led to short term slaughter tapping on the one hand and drying of a traditional source of nutrition; perhaps the only cognitive source; for the rural producers. Studies on this unequal drain indicates different findings. Some studies have asserted that the new mechanism has compelled the rural milk producers to settle at a lower welfare equilibrium by resorting to nutritionally poor cereals and other substitutes. There is however another view point suggesting that 'operation flood' had enhanced the money income, purchasing power and the amount of milk retained at home for domestic consumption.

The average values of milk sold or retained presented by most studies depicts a distorted picture. Neither do they reveal a realistic distribution of milk retained by the poor segments of the producers vis-a-vis the rich, nor do they depict the heavy over consumption of milk and other dairy products by the urban rich vis-a-vis the urban poor. There is however, a valid argument that the consequences of 'operation flood' had put the price of milk beyond the reach of urban poor. Special provision was made to provide subsidised milk to the poorest of the poor, in the urban centres; although the extent of coverage of such a scheme is still questionable.

Similarly questions are range regarding the extent to which the Amul and Anand pattern is subsidised through grants, loans and hidden subsidies in the form of protection etc., which would otherwise have been diverted to increase the general welfare of the consumers. It should be noted that Amul had received financial assistance to the tune of 64 per cent of its total capital cost.

Another criticism levelled against the 'operation flood' scheme has been the adverse effects created by it due to its strong dependence on food aid. It is sometimes alleged that the due to this food aid milk production in India had become highly dependent on imported milk. This has often been linked with the wider gaps seen between the achievements and targets of operation flood. The places in which most achievement had been shown are those non-priority areas like the number of societies established, number of plants set up, staff recruited or, the sophisticated machines installed which have indirect links with the real production matrix.

In spite of all these real and supposed drawbacks, dairying and dairy products development in India had completed a long journey during which the production level, pricing, marketing and technology have produced a model different from most of the other milk producing countries.

COMMODITIES

TEA-Prices Decline

Tea prices continued to fall through the first three months of 1986 and at the March 30 auction in Colombo average prices were less than half of those of 1984. The lowest gross sales average for the year was Rs. 29.04 per kg recorded on Jan 28 and brokers feared that prices could dip still further. Low grown have been mainly responsible for keeping averages from falling below Rs.30 per kg.

GROSS SALES AVERAGE(Rs/kg)

At Colombo Auctions on March 30

Elevation	1986	1985	1984
(Grown)			
High	31.14	43.63	71.51
Medium	26.57	39.83	62.05
Low	31.35	47.82	62.89
TOTAL	30.08	44.10	65.45

RUBBER - Market Firm

The rubber market in Colombo enjoyed high prices in March as well and prices of latex Crepes in 1986 were Rs.4-5 above those of 1985. Sheet rubber prices also showed increases of -/50 to Rs. 1/- per kg. Most big shippers were cautious and watchful, partly influenced by prevailing high prices, but prospects of increased production in the coming weeks had triggered easier offers in the latter part of March.

AVERAGE PRICES BY MARCH 15

At Colombo Auctions(Rs/kg)

SHEET RSS	1986	1985
No.1	16/18	15/69
No.2	15/85	15/16
No.3	15/42	14/56
No.4	11/97	14/15
L.CREPE		
No. 1X	21/54	16/45
No.1	21/44	16/15
No.2	21/13	15/62
No.3	18/40	14/60

URBAN DEVELOPMENT

Land Value Fluctuations around the City of Colombo

The prices of land in and around the Colombo City have witnessed a steep increase after 1977. This period has also witnessed a five-fold increase in money supply with the introduction of a free market economic policy, a floating of the rupee against other currencies, various incentives offered for savings through state patronage, proliferation of employment opportunities in the Middle East, the increasing development of the gem and the services sectors and general expansion of business activity. All these factors appear to have either directly or indirectly contributed to the rise in land and property values. An essential service and facility for the growing economic activity and pressure on space during the last few years has been an active property market and construction sector. The result was the appearance of an active invisible land and property market in the city of Colombo and the suburbs. After 1977 the land and property sales market in the city and suburbs has been operated largely by real-estate agents. There is also evidence of the establishment of mushroom type real-estate agencies around the city which have ventured into construction of dwelling houses for their customers on an easy payment basis. As seen in the price fluctuation pattern of land and property it can be concluded that there seems to have been two phases over which these changes have occurred: firstly from 1978—1981; and the other period after 1981. It may be noted that there was a rapid increase in land prices according to price trends in the 1978—1981 period. The following table gives a sampling of land prices on the outskirts of the city over the eight year period 1978—1985 (Table 1)

According to the data given in this table the lowest price recorded (Rs. 600 per perch) was in Battaramulla and the highest price recorded (Rs. 4,500 per perch) was in Nawala, in the year 1978. In 1979 the lowest minimum price (Rs. 1,000 per perch) was recorded in Battaramulla, Kiribathgoda and Kotte, while the highest price (Rs. 8,000 per

perch) was recorded in Nawala and Dehiwala. The increase in these two years was gradual but from 1980 there appears to be a rapidly increasing tendency in land and property values. In 1980 minimum prices still remained (around Rs. 1,500 per perch) in Kiribathgoda and an extraordinarily high maximum price (around Rs. 20,000 per perch) has been recorded in Nugegoda.

In the year 1981 there seems to be a tendency towards an increase in land and property values when compared with the previous years. From 1981 onwards this trend continues with the lowest minimum price (Rs. 2,000) recorded in Kiribathgoda and the highest maximum price of land (Rs. 25,000) being recorded in Nugegoda. In the other areas mentioned in Table 1 there has been a generally increasing trend in prices although there have not been any significant increases or decreases over the period up to then.

Table 2 shows the tendencies in the increase of land prices experienced during the period 1978 to 1985 outside Colombo City.

The information in Table 2 reveals some important indicators regarding the increase in land values. In the year 1979 the highest increase in the minimum price of land was recorded in Ratmalana, which amounted to 150 percent compared to the previous year. The highest increase in the maximum price of land was recorded in Dehiwala amounting to 100 percent.

In other areas there was a general tendency towards increase in values. The most significant year was 1980 in regard to the increase of land prices when compared to the previous year (1979) and the following year (1981). A 33.3 percent increase was recorded for the minimum price, and a 185.7 percent increase was recorded in maximum prices; both in the Nugegoda area. The other exceptional feature was the increase of prices in the Kotte area, where in that year (1980) the increase

TABLE 1
FLUCTUATIONS OF LAND PRICES FROM 1978-1985
(PER PERCH IN RUPEES)

Name of Zone	1978		1979		1980		1981		1982		1983		1984		1985	
	Mini	Maxi	Mini	Maxi	Mini	Maxi	Mini	Maxi	Mini	Maxi	Mini	Maxi	Mini	Maxi	Mini	Maxi
Nugegoda	2,500	4,000	3,000	7,000	4,000	20,000	5,000	25,000	7,000	25,000	6,500	30,000	7,000	30,000	7,000	30,000
Nawala	2,000	4,500	3,500	8,000	3,500	12,000	4,000	13,500	8,000	20,000	8,000	15,000	8,500	15,000	8,500	14,500
Ratmalana	1,000	3,500	2,500	6,500	3,500	9,500	4,500	12,000	4,000	12,000	4,500	14,000	6,000	15,000	6,000	15,000
Dehiwala	2,500	4,000	3,000	8,000	3,500	12,500	3,500	15,000	6,000	15,000	6,000	15,000	7,500	15,000	6,000	15,500
Battaramulla	600	2,500	1,000	3,600	2,000	6,000	2,500	7,000	2,500	7,000	3,000	7,000	3,500	7,000	4,000	7,000
Maharagama	1,000	2,800	2,000	4,000	2,500	1,000	3,000	12,000	3,000	12,500	3,000	14,000	5,000	15,000	5,000	15,000
Kiribathgoda	700	2,000	1,000	2,500	1,500	6,000	2,000	10,000	2,000	12,000	2,000	12,000	3,000	12,000	4,000	12,000
Kotte	800	2,000	1,000	2,000	2,000	10,000	5,000	12,500	4,000	14,000	5,000	14,000	6,000	14,000	6,000	14,000

Source:

- (i) Land Value Changes 1977 - 1981, with special reference to Kotte area - M. Jinadasa A People's Bank, Research Department Publication (1981)
- (ii) Information obtained from Real Estates Agents in and around the city of Colombo.

TABLE 2
PERCENTAGE PRICE FLUCTUATION OF LAND VALUES
(1978 - 1985)

Name of Zone	1979		1980		1981		1982		1983		1984		1985	
	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year	Percentage of increase over previous year
	Increase of mini.	Increase of maxi.	Increase of mini.	Increase of maxi.	Increase of mini.	Increase of maxi.	Increase of mini.	Increase of maxi.	Increase of mini.	Increase of maxi.	Increase of mini.	Increase of maxi.	Increase of mini.	Increase of maxi.
Nugegoda	20.0	75.0	33.3	185.7	25.0	25.0	40.0	---	- 7.1	20.0	7.6	---	---	---
Nawala	75.0	17.8	---	50.0	42.9	12.5	100.0	48.1	- 25.0	6.2	---	---	---	3.3
Ratmalana	150.0	86.7	20.0	42.1	5.0	26.3	- 11.11	---	12.5	16.6	33.3	7.1	---	---
Dehiwala	20.0	100.0	16.7	56.3	---	20.0	71.4	---	---	---	25.0	---	- 20.0	3.3
Battaramulla	66.6	44.0	100.0	66.7	25.0	16.7	---	---	20.0	---	16.6	---	14.2	---
Maharagama	100.0	42.9	75.0	150.0	20.0	20.0	---	4.1	---	12.0	66.6	10.7	---	---
Kiribathgoda	42.9	25.0	50.0	140.0	33.3	66.6	---	20.0	---	---	50.0	---	33.3	---
Kotte	25.0	---	100.0	400.0	150.0	25.0	- 20.0	12.0	25.0	---	20.0	---	---	---

* Fluctuation of land prices percentage computed according to the absolute figures given in Table 1.

in minimum price recorded was 100 percent and the increase in maximum price recorded was 400 percent, when compared to the previous year. An increase of 400 percent was the highest recorded value over the entire eight year period of 1978-1985. The tremendous increase in values (experienced in the Kotte area) was mainly due to the implementation of the Sri Jayawardenapura-Kotte Development Project.

The steady increase in land prices from the year 1981 and onwards seems to be a regular tendency in the pattern of prices, according to data in Table 2. From 1982 and after, however there was a slowing down in fluctuations of prices, according to this table, with the increase or decrease in land prices being rather slight. But in the year 1984 there is again a significant trend with an increase observed in minimum prices of

land values in all areas observed. This implies there was a possible scarcity of land for dwelling houses in the city and greater pressure on land in the suburbs, as the land values depend to a large extent on the location factor.

(There were five exceptions, however, from 1982: where decreases were recorded against the minimum prices of the previous year in 1982 at Ratmalana, 1983 at Nugegoda and 1985 at Dehiwala; and against maximum prices in 1983 and 1985 at Nawala.)

Observing the data in these two tables together it could be concluded that by 1982 land value changes in the suburbs of the city were more or less constant, though overall prices kept moving upwards in keeping with the general inflationary trends in the economy.

Prior to 1980 the construction sector had grown at an unprecedented pace

and according to the Central Bank this sector's real growth rate had been 28 percent in 1978, 20 percent in 1979 and 11 percent in 1980. But this momentum could not be sustained and by 1981 the growth rate fell to a negative 3 percent, and in 1982 and 1983 it recorded a further negative real growth rate. Again, in 1984 real output in the construction sector declined marginally. In seeking the reasons for this slowing down in pace of construction activity from 1981 onwards we find two main reasons, namely, the escalation in costs of building materials (arising from a slow supply response to demand), and the high costs of buildable land. The overall impression that emerges from this survey, however, is that land and property values fluctuate together with movements in other factors in the economy.

M.J.

AGRICULTURE

An Increase in Fertilizer Use

The use of fertilizer during the first nine months of 1985 has recorded an increase when compared to the same period of the previous year. In the 1985 period there was an increase of 7.6 percent or 23,100 metric tons; from 303,400 metric tons in 1984 to 326,537 metric tons, according to the statistics compiled by the National Fertilizer Secretariat. This is the highest recorded amount of fertilizer consumption during the first nine months of any year. Though the percentage increase in use of fertilizer during the first nine months of 1985 is lower than that of the first nine months of 1984, this increase in quantity used is more encouraging since it contributed to the continuing trend in the increase in fertilizer use over a five year period after the considerable decline in fertilizer use to 366,300 metric tons in 1981.

All the crops, other than minor export crops and tobacco, had recorded an increase in use of fertilizer during the 9 months of 1985 compared to the same period of the previous year. In terms of quantity of fertilizer the highest level of increase was recorded in the paddy sector, followed by the tea sector.

Favourable Prices and Weather

The increase in use of fertilizer during the first nine months of 1985 could be mainly attributed to the stability of fertilizer prices where no changes were made after the fertilizer price revision in May 1983. Another important factor contributing to the increase in fertilizer consumption in 1985 was the considerably favourable

weather conditions which prevailed during the period as in the case of the previous year.

However, unlike in the previous year, during the first nine months of 1985 price changes in crop production had not contributed towards the increase of fertilizer consumption since there were declines or only marginal increases in the prices of most of the crops produced during the first nine months of 1984. The disturbed situation in the Northern and Eastern provinces affected the fertilizer distribution system to a great extent and thereby the consumption of fertilizer in these provinces. If the crop prices increased or remained as good as those of the previous year and the ethnic problems did not disturb the demand and supply situation of fertilizer in the Northern and Eastern provinces, overall fertilizer consumption in the island during the first nine months of 1985 would have increased still further.

Paddy

The use of fertilizer in the paddy sector during the first nine months of 1985 has shown an increase of 9.9 percent or 10,282 metric tons; from 104,400 metric tons to 114,700 metric tons in relation to the same period of 1984. It is more interesting that there was a satisfactory increase in the use of fertilizer in the paddy sector despite stagnation of paddy prices and decreases of the area brought under paddy cultivation over the period under review. The guaranteed price of paddy which was revised to Rs. 62.50 in March 1983 was not changed till the end of the period under review. Even in

the open market paddy prices did not change considerably during the period in relation to the same period of the previous year. (See table 2). The area brought under paddy cultivation during the paddy cultivation year 1985 decreased by about 9 percent; from 990,000 hectares in 1984 to 942,000 hectares in the following cultivation year. However, the total amount of fertilizer used in the paddy sector has increased due to the considerable increase in the average volume of fertilizer used per acre during the cultivation year 1985.

Table 2
Paddy Prices Rs Per Bushel (Open Market Prices)

	1984	1985
1st Quarter	79.03	83.08
2nd Quarter	75.86	75.12
July	77.59	77.99
August	76.87	77.15

Source: Central Bank of Ceylon

Tea & Rubber

The consumption of fertilizer in the tea sector during the first nine months of 1985 had increased 6.5 percent or 6,600 metric tons, from 101,400 metric tons to 108,000 metric tons in relation to the same period of the previous year. The tea sector has obtained this satisfactory performance in spite of the substantial decline in tea prices (See Table 3).

Table 3
Tea Prices Rs Per Kg (Colombo Auctions)

	1984	1985
1st Quarter	62.79	54.11
2nd Quarter	68.56	36.86
July	53.65	34.09
August	56.70	34.87

Source: Central Bank of Ceylon

In the rubber sector fertilizer consumption has increased comparatively by 8.2 percent or 1,600 metric tons from 19,300 to 20,900 metric tons during the first nine months of 1985. The increase in the use of fertilizer in rubber cultivation could be attributed to the satisfactory price levels that existed for this crop in addition to the stability in fertilizer prices and the fairly good weather conditions that prevailed during the period under consideration. During this period there has been only a marginal increase in the rubber crop prices compared to the same period of the previous year (See table 4).

A major part of the tea and rubber plantations in Sri Lanka come under the estate sector. One reason for the better performance of the use of fertilizer in the tea and rubber sectors was the better

Table 1
Use of Fertilizer Among Major Crops
During the First Nine Months of 1984 and 1985

Crop	First nine months of	First nine months of	Change	
	1984 in M.T.	1985 in M.T.	in M.T.	in %
Paddy	104,372	114,654	+10,282	+ 9.85
Tea	101,433	108,008	+ 6,575	+ 6.48
Rubber	119,272	20,854	+ 1,582	+ 8.21
Coconut	27,698	28,144	+ 446	+ 1.61
Subsidiary Food				
Crops	11,662	12,598	+ 936	+ 8.03
Minor Export Crops	1,818	1,610	- 208	-11.44
Tobacco	2,612	1,924	- 688	-26.34
Others	34,533	38,747	+ 4,214	+12.20
Total	303,400	326,537	+23,137	+ 7.63

Source: National Fertilizer Secretariat

Table 4
Rubber RSS No. 1 Prices Rs. per Kg (Colombo Market Price)

	1984	1985
1st Quarter	15.77	15.49
2nd Quarter	14.16	16.29
July	12.60	16.42
August	13.71	16.32

Source: Central Bank of Ceylon

levels of plantation management, including better fertilizer application, in estate plantations compared to the small holding plantations in Sri Lanka.

Coconut

The use of fertilizer in the coconut sector has increased marginally during the first nine months of 1985; by 1.6 percent or 400 metric tons from 27,700 metric tons in 1984 to 28,100 metric tons. Coconut prices declined dramatically over the period under review. (See table 5). If coconut prices had not decreased in this way the increase in fertilizer consumption in the coconut sector could have been much higher. During the year 1984, when there was a substantial increase in coconut prices, the highest increase in fertilizer consumption amounting to 38 percent or 14,300 metric tons was recorded in the coconut sector.

Table 5
Coconut (Desiccated) Prices Rs Per Kg (Colombo Market Price)

	1984	1985
1st Quarter	27.65	17.29
2nd Quarter	26.72	15.53
July	27.58	9.59
August	26.44	7.46

Source: Central Bank of Ceylon

Subsidiary Food Crops

Fertilizer consumption in subsidiary food crops which mainly consist of onions, chillies, maize, soya bean, cowpea and greengram had increased by 8 percent or 900 metric tons from 11,700 metric tons to 12,600 metric tons over the period under review. When the acreage under paddy cultivation increases there is a tendency for a decrease in acreage under subsidiary food crops. This trend may be observed in the cultivation year of 1985, which could also be the reason for the decline in fertilizer consumption in subsidiary food crops. In 1984 when the acreage under paddy cultivation increased, consumption of fertilizer in subsidiary food crops had decreased by 9.5 percent.

Minor Export Crops

The use of fertilizer in minor export crops which include cinnamon, cardamom, pepper and cloves had declined by 11.4 percent or 200 metric tons. The use of fertilizer in tobacco cultivation had also decreased by 26.3 percent. This decline in fertilizer

FOREIGN NEWS REVIEW

BEWILDERING BEHAVIOUR OF COMMODITY PRICES

A recent session of UNCTAD's Committee on Commodities agreed that world commodity markets find themselves in a crisis unprecedented in terms of its duration and depth. Growing disillusionment with International Commodity Agreements (ICAs) has been expressed in some circles, especially in the light of the current crisis in the operation of the International Tin Agreement; and despite several attempts negotiators have so far failed to clinch agreement in renegotiating the current ICAs (relating to cocoa and natural rubber) which are due to expire. International discussions on a number of the 11 commodities under the Integrated Programme for Commodities (IPC) not covered by ICAs have been in abeyance; and furthermore sharp differences of views have characterised discussions on commodity processing, marketing and distribution at the special session of the Committee on Commodities held earlier in 1985.

UNCTAD's Acting Secretary General, Alister McIntyre, referred at the recent sessions to the dramatic collapse of primary commodity prices which has seriously weakened the economies of the majority of developing countries. By the third quarter of 1985, commodity prices in dollar terms had been some 34 percent below the 1980 average, while the commodity terms of trade had worsened by some 16 percent over this period. Although price

consumption in tobacco cultivation needs to be taken seriously when the 46 percent decline in fertilizer consumption in tobacco cultivation in the previous year (1984) is also considered. The level of fertilizer consumption in other crops, mainly in vegetables, potatoes, fruits and home garden crops has increased by 12.2 percent or 4,200 metric tons.

In order to increase crop productivity it is necessary to adopt a package of measures; among which application of fertilizer to the recommended levels is a very significant one. Since in Sri Lanka yet the levels of fertilizer application in all crops is below the recommended levels there is a considerable scope to increase productivity in all crops by increasing fertilizer application while at the same time also adopting other necessary measures such as better water management, soil conservation, and weed and pest control. H. L.

movements had not been as sharp when expressed in non-dollar currencies, the recent strengthening of other major currencies against the dollar had brought no significant improvement in most dollar commodity prices.

"The behaviour of commodity prices is to say the least bewildering" commented McIntyre. There was some evidence that the abnormally high real rates of interest which had prevailed in the industrialized countries since 1980 had greatly increased the cost of holding commodity stocks, resulting in a large reduction in inventories which had accentuated the contraction in demand resulting from the lower level of economic activity. In addition, the squeeze on international liquidity since 1981 had adversely affected the demand for a number of commodities as stores of value because of the tendency to move investment into more liquid assets. The constraints on the availability of foreign exchange had also induced many developing countries to export more, in volume terms, in order to minimise their loss of foreign exchange earnings. The volume expansion itself is said to have been a contributory factor to the continuing depressed level of prices for many commodities.

On the whole, it was fairly evident that changes of a far-reaching character were occurring in patterns of demand and supply for a number of primary commodities, whether agricultural products or minerals and metals. These changes were bound to affect profoundly the development situation and prospects of very many developing countries. "One thinks particularly of the least developed, low-income and very small countries that are heavily dependent on a few commodities for their foreign exchange earnings and livelihood", McIntyre added. "Their future may be very grim unless they begin now to examine their concrete prospects, and what are the practical options open to them to put in hand effective policies and actions for achieving a successful transition." The task facing the international community was to provide support measures both appropriate to the circumstances of the individual commodity and to the particular developing countries concerned. "If governments are ready once again to tackle commodity issues and are determined to achieve results,

they will all need to show flexibility in considering together how best to deal with the present situation. In doing so, it would be advisable to take full account of the lessons of experience", McIntyre stressed.

Commenting on the debt-servicing problem of developing countries, McIntyre stated that if the commodities situation was not addressed as a matter of top priority, it was bound to affect the capacity of several indebted developing countries to service their debts. Action on commodities should form an integral part of strategies to promote adjustment through growth. The International community now had a timely opportunity to pull together, in a coherent manner, a number of complementary initiatives in areas such as trade liberalization, co-operation in development measures, finance for structural adjustment, and export earnings stabilization. These could together improve significantly the present situation of many commodities. Such opportunities were well within the reach of governments, if they were ready to make the effort.

Another major topic before the Committee on Commodities concerned the need for increased participation of developing countries in the processing, marketing and distribution of commodities of export interest to them, including their transportation. On the one hand the Group of 77 (developing countries) wished to move ahead and to draw up measures that would constitute provisions under each element of the frameworks that had been mentioned in the UNCTAD Conference resolution 124 (V) such as improvement in market transparency and increased technical and financial support for the development of national marketing and distribution systems of developing countries. The Group of 77 wanted to begin consideration of institutional arrangement for accomplishing this task.

Group B, (the developed market economies) on the other hand, believed that the first step in establishing the frameworks was to agree on the criteria that should apply to them. Among those that it proposed were: that the frameworks should consist of mutually acceptable guidelines or principles which would be applicable to all

governments and which would not be legally binding; that maximum use should be made of existing institutions and that the proposed frameworks should not infringe on responsibilities of these institutions, and that the local processing of commodities should be economically justified in the light of dynamic comparative advantage and in the context of on going trade liberalization with a view to establishing economically viable enterprises which would contribute to sound economic development.

INCREASING FOOD SECURITY FOR THE POOR

The world has plenty of food but some 700 million people in developing countries do not eat sufficiently well to lead an active working life. Nearly half of these people are acutely undernourished; they barely subsist on a minimum survival diet, a new World Bank policy study has revealed. The study titled "*Poverty and Hunger: Issues and Options for Food Security in Developing Countries*," has also made suggestions about what can be done to alleviate this problem.

The basic cause of hunger of "food insecurity", which affects almost a third of the population in the Third World (excluding China) is poverty or lack of purchasing power, according to the Report. Hunger persists even in countries that have reached self-sufficiency in food. Food insecurity cannot be eliminated without alleviating the poverty of countries and people. This is the central conclusion of the Report.

Economic growth will ultimately provide poor people with enough income to acquire enough food and such growth should be a primary goal of economic policy. But growth will increase their purchasing power only slowly and may not reach everyone.

In the long run, linking poverty alleviation with economic growth is the best way to reduce malnutrition and chronic food insecurity, the Report states. But in the short run, specific and cost effective programmes designed for

the poor and malnourished are also needed.

The Report identifies two forms of food insecurity: transitory and chronic. Transitory food insecurity, a temporary decline in a family's access to food, results from unstable food prices, food production, or incomes. Its worst form is seen in famines. Chronic food insecurity affects households that are continually unable to buy enough food or produce enough of their own.

The choice of intervention needs to be based on "a balanced concern for budgetary and economic costs, administrative and political feasibility, and their expected benefits," states the Report. In sub-Saharan Africa, for example, where food producers themselves, together with some urban poor and rural landless, suffer from food insecurity, policies should focus on raising producer prices to stimulate production, and raising incomes, with subsidy programmes for the urban poor and employment programmes for the landless.

Foreign assistance, the Report says, should continue to emphasize investments that benefit the poorest people. This includes projects that increase the supply and lower the price of food. It should also improve the capacity to handle sharp and sporadic increases in food imports, as well as the management of small, strategically located emergency food stocks. Other programs that deserve foreign support are those aimed at improving the nutrition of vulnerable population groups through income transfers, nutrition education, better drinking water, and preventive health and family planning services. The Report also maintains that it is helpful to support efforts to diversify crops, improve transport facilities, and provide public employment.

Food aid is often used directly to augment the earnings of the poor and their nutrition. The Report cites the efforts of the World Food Programme and voluntary agencies which co-finance development to the poor for work performed. Better integration of these kinds of projects in a country's overall development program is expected to improve the long-term benefits of such aid.

FEATURES

CONSERVATION OF ENVIRONMENT, TRANSPORT AND DEVELOPMENT

Mrs. P. C. H. Ranasinghe

In this paper Dr. P. C. H. Ranasinghe, a Ph.D. (Cantab) and M.C.I.T. (Eng), who is a senior lecturer of the Department of Geography at the University of Colombo, maintains that decisions to invest on transport should be taken not in isolation but along with consideration of other sectors of the economy, and should be coordinated with urban development; and considered as a factor which encourages development, improves mobility and enhances the environment.

It is not irrational to think of transport, properly applied, as an instrument for the pursuit of National Policy objectives, particularly where great distances are a limiting factor to balanced national growth. If a country is to remain cohesive, goods and people must be moved over the distances that separate them. It could be expected that the cost of distance would be a burdensome factor on the shoulders of the nation in the future when implementing a National Policy for development of resources, industries or regions.

It is understood that the functioning of an economy needs the use of transport and that, as economies develop, specialized production increases and relatively more-transport is required. Yet transport improvements alone cannot produce economic growth, though in a suitable environment it can be the missing factor. Hence, decisions to invest on transport should be taken not in isolation but along with consideration of other sectors of the economy. Therefore, there are a few aspects to which attention (needs to be paid) when taking decisions regarding transport planning. These would include the following:

- i. Transport plans should be analysed with direct relation to the general economic development plan. In particular, alternative uses of investment funds should be considered to determine the relative attractiveness of transport investments.

- ii. All modes of transport should be considered together as one interacting system, and all phases of each transport mode's operation should be taken into consideration in evaluating new projects.
- iii. The effects of transport plans on other sectors of the economy, whether there is direct cost or benefit to those sectors, should be evaluated.
- iv. Within the context of the broader economic development plan, there should be a basis for evaluating different transport pricing policies.
- v. An effort should be made to investigate the effects of transport on the other major independent variables such as population growth, foreign trade or even weather.
- vi. Transport improvements should be co-ordinated with urban development. Transport should be considered as a factor which encourages development, improves mobility and enhances environment.

FACTORS TO BE CONSIDERED IN A CONSERVATION STRATEGY WITH REGARD TO TRANSPORT

Space

There is an interaction between transport and land utilization. Space on land is a scarce resource in developed as well as in developing countries. In Sri Lanka, land is becoming a scarce resource especially in the urban areas. The expansion and development of transport systems need space — track space (roads, canals, railways, pipe-lines) and terminal space (airports, railway stations, bus stops and depots, harbours and container yards, etc.). Most of these find their space especially in the urban areas, at the expense of other amenities such as parks and open spaces, housing and business premises.

Increase in population and increase in urbanization demand a progressive widening of the roads and also transport terminals in urban areas. At the same time, the increase in population demands extra food. In rural areas, useful agricultural land may be occupied by tracks. There are no recorded instances where roads previously in use have been scrapped and the land returned to agriculture. Thus, we see a conflict in demand for land. One may, therefore, look at the alternative methods of transport which might avoid or at least delay this conflict.

It is understandable that the space needed for right of way is indeed a scarce resource. Hence, it is more sensible from the point of view of conservation to make the best use of the space already allotted for movement. Thus, presently laid railways, canals and road networks should be used to the maximum, unless their conversion or abandonment lead to conservation in other resources.

For instance, railway is economical in space and energy, and also economical in mechanical wear and tear. Canals are exceptionally economical in energy and wear.

The table below shows the relative efficiency on space of different modes of transport. Thus, it illustrates that public transport is more efficient than private transport and railway is yet more efficient on space than passenger bus.

All over the world, those who are interested in conservation and development are expressing increasing concern for rationing urban space and giving priority to those who use it sparingly and cleanly. For example, cities like Singapore and New York are restricting the use of motor cars. Thus, modern town planners and traffic engineers, whether in developed or developing countries no longer contemplate to widen the roads and

TABLE 1

Persons per foot—width per hour	Speed—mph	Persons—ph
Urban railway	30	1,700
30 passenger bus on urban street	7	550
Car with driver on urban street	10	55

Source: Urban Transport Sector Policy Paper, World Bank.

increase the volume of traffic flows. Instead, the planner is now seeking to control and limit the traffic flow and also to give priority to public transport which uses road space so much more economically.

The future conservation strategy should be to discourage as much as possible the use of private vehicles and to have a very efficient public transport system in order to conserve the valuable space. Whether such public transport is owned and operated by private or public sector enterprise is irrelevant to this issue.

Materials Usage in Construction and Maintenance

Here, the advantage lies with canals since the cost of water, including pumping it to higher levels and also maintenance of canal banks are not so costly. Railways on the other hand, are costly at the original construction, but given constant and careful upkeep are cheap in material. The cost of highways would vary, depending significantly on the quantity of earthfilling involved and the distance to which granite has to be transported. Thereafter, the maintenance of a highway depends largely on axle-loads and weather conditions. Although the space has been allotted and the cost of construction has been already incurred, the improvements, expansion and the maintenance of any mode of transport should be related to its resource consumption in longterm operation and maintenance.

Extension or expansion or upliftment of any existing modes or tracks of transport should not be carried out without a detailed study into all the facts and figures and the social and economic costs and benefits.

Widening and upliftment of urban and also inter-city highways in Sri Lanka could be restrained if, public (mass) transport is encouraged over private transport. The existing highway network should be operated so as to facilitate, in the first place, the movement of public transport so that public space can be used more economically and the need to invest scarce public resources could be minimized.

Energy

In Sri Lanka, there is no comprehensive study done on the economics of

energy consumption on different modes of transport. However the Sri Lanka Transport Sector Study, Friedrich - Ebert - Stiftung, 1982, gives the following figures:

TABLE II

Mode	Passenger Miles per gallon
Bus	284 - 433
Train	216 - 352
Car	46 - 50

Urban space and laid tracks are a scarce resource almost in any part of the world. Petroleum based energy is also a scarce resource except in oil producing countries. On a world perspective oil is expected to be running out within 50 to 60 years. It is generally accepted that the quantity of oil required to move a ton of goods by road will move four times that tonnage by rail or by water. Where passenger transport is concerned the ratio in Sri Lanka is approximately that a private car rider consumes 10 times as much as a bus or train rider.

The chief petroleum user in Sri Lanka, is the transport sector. The factor to be considered is how far the currently practiced forms of transport are economical.

It is appropriate to consider the alternative forms of transport as well as alternative sources of energy due to the following reasons: namely, scarcity of fuel, increase in price of fuel, growing dependence on petroleum imports, balance of payment deficits, foreign exchange shortages, urban congestion, noise and air pollution, increase in the accident rates, and the limited availability of funds to widen and also uplift the conditions of the present road network.

An energy policy should be formulated to lower the overall transport-energy intensiveness.

Table 3 illustrates in-bound and out-bound vehicles and estimated passengers to and from the city of Colombo on a normal week day between 6 a.m. and 7 p.m. (Assumption: here, on number of passengers carried is SLCTB 75; Private passenger bus 32; and Car 2.)

The above table clearly demonstrates that out of the total vehicular traffic only 16% comprises SLCTB buses while they carry an estimated passenger volume of 60%. Private passenger buses though greater in number than SLCTB carry only 36% of the estimated passengers. The highest volume of vehicles is formed by motor cars in the city which comprise 55 - 62% and they carry a very limited number of passengers, 4 - 6% only.

Therefore, from the conservation point of view, it is advisable to control and limit the private motor car and also controls should be applied on private buses with smaller capacities, especially in urban areas, particularly in the city of Colombo. More cars and more smaller capacity passenger vehicles mean less fuel economy, more road congestion, and greater consumption of time and energy on the road, more traffic hold-ups, more noise and increased air pollution, especially by petrol consuming vehicles, higher incidence of accidents and greater wear and tear of road surfaces, and also wear and tear of vehicles themselves.

To eliminate the wasteful use of energy as far as passenger transport is concerned, it is advised that private sector diesel buses with bigger capacities and SLCTB buses should run according to a set time-table so as to prevent overlapping and wasteful competition. Encouragement should be given to public sector transport services as much as possible. The use of private cars should be discouraged by direct as well as by indirect methods.

TABLE III

In-bound	Vehicles	%	Passengers	%
SLCTB	12,904	19	967,800	60
Private buses	17,980	26	575,360	36
Cars	37,931	55	75,862	4
Total	68,815	100	1,619,022	100

Out-bound	Vehicles	%	Passengers	%
SLCTB	10,883	16	816,225	59
Private buses	15,208	22	486,656	35
Cars	42,078	62	84,156	6
Total	68,169	100	1,387,037	100

Compiled by P. C. H. Ranasinghe, from a traffic count in March, April and May, 1983.

However, one area where the private sector can contribute in a meaningful way as far as transport is concerned, is the village sector. While bigger capacity diesel vehicles should be used in the urban sector, smaller capacity diesel vehicles should be used on village roads. Special considerations and concessions should be given to bus owners who run on village routes.

At present, 28% of the country's income is spent on oil imports (Economic Review, March 1983). Therefore, from the point of view of resource conservation, it is proposed that CGR, SLCTB and Private transporter should be integrated and have a unified and co-ordinated system of transport.

The aim in urban transport should be a restricted use of the private car, a reduction in air and noise pollution, better facilities for journeys between home and work, reduction of the traffic congestion and minimizing of investments on road building and expansion.

In rural transport our aim should be to ensure a fair level of public and private passenger transport services to facilitate the transport of people and as well as goods for those who cannot use a car or have their own form of transport.

If we can provide better public transport services to induce people to give up the use of private vehicles, then it will cause some reduction in oil consumption and in road investment.

As far as energy conservation is concerned, use of electricity may conserve fossil fuels which in turn will conserve the environment. Thermally generated electricity may conserve fossil fuels to a certain extent as against the direct use of oil. If hydro or nuclear energy can be used, there will not be a draw on oil or coal at all. Hydro-electricity also will have added advantage of little noise, less air pollution and no soot. However, energy conservation needs correct choices both in the mode of transport and also in the form of energy.

The estate sector should make use of the railway. Even on diesel-oil, freight trains are said to be 3 or 4 times more fuel efficient than road vehicles. If we made use of electricity to run the

train, it would be more favourable from the point of view of the conservation. By electrification, energy saving would be much greater, as most of the electricity in Sri Lanka can be generated through hydro sources. Even with fossil fuel thermal electricity could be generated with a better fuel efficiency at a central thermal station than on board a diesel locomotive. For passenger services too, electrification can have added advantages, especially with regard to acceleration out of station stops. A faster journey for the passengers and a better mileage output from the rolling stock and crews can be achieved by having a quicker run round. From the investment point of view electric equipment in train service is usually said to have twice the life span of equivalent diesel stock.

The recent revival of the canal system stretching from Puttalam to Kalu Ganga is a welcome sign since the canals can be used cheaply for freight transport. Canals have their inbuilt advantages such as energy conservation, labour intensity, and environmental compatibility. Moreover, they can be used as waterbodies to drain the rain water in the city. Canals should be used as much as possible to transport heavy, bulky, non-perishable goods. The canal system should be extended as far as possible.

Environment

Exhaust gases from vehicles with gasoline engines are said to contain 150-200 different compounds. Only a few have been identified as harmful. From vehicles, with gasoline engines, gases such as carbon monoxide, hydrocarbons, oxides of nitrogen and compounds which contain lead have aroused attention of most environmentalists and conservationists. Lead is regularly added to automobile gasoline in order to extract more power from the internal combustion engine, while maintaining its smooth, regular operation. After burning, about 75% of the lead is introduced into the atmosphere. However, this technique means that considerable quantities of lead are emitted to the air due to the extensive and rapid increase of road traffic. Irrrefutable confirmation that lead in urban atmosphere originates from gasoline combustion is now provided by the findings of isotope analysis. It has not yet been possible to prove that lead has done harm to the Sri Lankan

population, but there could be a risk of harmful effects after a long period of time or resulting from combination with the effect of other substances.

Exhaust gases from gasoline vehicles contain large amounts of carbon monoxide and are thus much more toxic than exhaust gases from vehicles with diesel engines. On the other hand, diesel gases cause more immediate discomfort as they contain more soot as well as substances which smell bad and irritate the mucous membrane. Incorrect setting of the fuel pump is the main cause of soot formation, which can be eliminated completely. It can be believed that the problem of vehicle exhaust gases will become more severe if the trend is not arrested in time. Since the number of vehicles increase yearly, we can expect that the proportion of air pollutants especially in urban areas will increase even more steeply.

Noise is a social problem which has attracted more and more attention in recent years. Absence of noise constitutes an important part of a good environment. The majority of people experience noise as irritation, a factor which disturbs harmony and enjoyment. However, noise can also develop into a health hazard and a medical problem affecting the community. Noise can disturb personal communication. In more serious cases noise can cause direct physiological damage in the form of occupational diseases, either psychic or psychosomatic of the internal organs and blood vessels.

One of the major sources of noise in the communities of today is motor traffic, in spite of all the work that has been devoted to make more silent engines. Some vehicles' engines are practically silent and the general trend is towards quieter engines. However, traffic noise is already severe and creates increasing annoyance especially in urban areas. Tyre tread and squeal, gear grinding and body rattles also contribute to the traffic noise level. This does not depend only on the noise level of the individual vehicles but it is also due to the technically unsuitable way in which they are being used, especially in the city.

Traffic is also responsible for the increasing percentage of urban area

which is paved and, therefore, non-absorbent. This, together with housing density, with more area roofed, leads to reduction in foliage and rainfall run-off problems.

Care for the Environment

The theoretical base for a policy for the care of the environment must consist of an awareness of the ecological systems in which mankind participates. Furthermore, such a policy must endeavour to bring the activities of mankind into harmony with other biological processes.

An essential pre-requisite for an environment policy is legislation. This would regulate the behaviour of individuals and groups. This legislation should be backed up by specialized administrative machinery. This machinery should be responsible for seeing that the laws are put into effect; and the laws are continuously revised and adapted to cope with new problems.

Some Guidelines for Deciding on a Transport Policy

- i. Activities should be located as much as possible to minimize physical movement, and direct physical movement should be limited to the most suitable mode of transport.
- ii. Serious thought and efforts should be made towards developing other forms of transport, specially those driven by electricity. There is great potential in Sri Lanka for hydro-power and this resource should be harnessed to a great extent to achieve fuel economy in transport and industry.
- iii. Wherever possible and feasible canals and railways to be used in preference to roads, especially for goods traffic.
- iv. In urban areas where possible private vehicles should be reduced to a minimum and public transport should be encouraged.
- v. In rural areas, a system of minibus should be encouraged where people as well as goods can be transported at the same time.
- vi. The allocation of funds for highway development should be more for rural roads. Preference should be given to improving the foundation and the surfaces of the existing roads rather than to widening of roads.

BUFFALOES AS A SOURCE OF FARM POWER: POSSIBILITIES FOR IMPROVEMENT

Rohana Ulluwishewa and Jun Sakai

Professor Jun Sakai of the Department of Agriculture Engineering, University of Kyushu in Japan, who was an agriculture and machinery consultant to the Appropriate Technology Research and Development Centre at Ekala; and Dr Ulluwishewa of the Department of Geography of Sri Jayawardenapura University who has carried out specialised research in this field, make a strong case in this paper for utilizing of buffaloes for farm power.

In many developing countries a large part of the farm population depends on the draught animals as a source of power for production and distribution of food. The significance of draught animals as a source of power for tillage operations increases as the market price of non-renewable energy sources rise. Their significance cannot be overlooked even in the near future because the alternative energy sources such as bio-gas, solar, wind and hydropower which are often recommended for non-oil producing

- vii. Specific attention should be paid to decrease emission of hydrocarbons, carbon monoxide and nitrogen oxides from motor traffic. There could be a slight drop in fuel economy as an increasing amount of crude oil is required to supply the same quantity of unleaded gasoline, but saving from possible environment damage should be worth considering.
- viii. Studies should be undertaken more closely on the effects of building up of new highways and roads, on the drainage, on microclimates and on the general ecology of the adjacent countryside.
- ix. Extension of access roads to wilderness areas should be restricted.
- x. Since highways are extensive users of land surface it is worth considering the upgrading of already existing roads to form a major system of national road network to serve the maximum number of settlements in the island. Other utility lines such as water, sewerage, telephone, etc., could follow the same national road network.

developing countries are less applicable to the tillage operation. Therefore, as population increases and the land available per family decreases, draught animals will assume even greater importance. The draught animals represent an additional source of income for the farmer through their use for hire and haulage. Apart from this, draught animals provide a sort of insurance against unexpected crop failures since they are disposable property on which maintenance costs are very low. However, the work output of draught animals may be limited because of poor nutrition, disease or a poorly designed harness and equipment. Furthermore, the animal population is often smaller than desirable because of problems involving economics, genetics and reproduction.

In Sri Lanka too, just as in many other developing countries, draught animals, mainly buffaloes, play a significant role as a source of power, providing low-cost power for small farmers. It is evident that the cost of buffalo tillage is less than that of tractor tillage almost everywhere in the country. Apart from its cost advantages, many farmers claim superiority of the quality of land tilled by buffaloes in relation to that undertaken by the tractor (Ulluwishewa and Tsuchiya, 1983).

However, the major criticism against buffalo draught power is its comparatively low work output which disqualifies it from being a part of modern agriculture. However, if its work output could be improved, it would be a suitable and viable source of power for small farmers. Although the work output of animals is dependent upon many factors, there is greater potential to promote the animal's work output through the improvement of:—

- (1) the feeding system
- (2) animal training, yoking and harnessing and
- (3) attached implements.

Therefore, in this paper, attention is focussed on these three aspects, with a view to exploring the possibilities of improving the work output of buffaloes.

Feeding System

Generally, draught power which could be generated by any kind of working animal is determined by its body weight and size. It is approximately ten percent of the body weight.

Since the body weight of a domesticated animal is largely determined by the quality of feeding, the improvement of the feeding system is vital. The traditional buffalo feeding system in Sri Lanka has been the free-grazing method under which animals are allowed to stray in search of wild plants. Although the cost of feeding is almost zero, animals are not properly fed under this method. The volume of green leaves and water available for animals vary seasonally. This is especially true in the dry zone which experiences a prolonged dry season.

During the dry season, apart from the food and water shortage, there is a danger of sickness and epidemics.

Consequently, at the beginning of the rainy season when animals are needed to draw the plough they are not able to generate sufficient power owing to their poor physical condition.

The alternative method: stall-feeding system, under which animals are kept in sheds and fed by cut-grasses and concentrates is effective in keeping animals in a better condition throughout the year, enabling them to generate higher draught power. This method provides an opportunity to have animals in good condition at the beginning of the cropping season. Maintaining the liveweight of animals throughout the year is better than allowing them to lose weight and then regain it just prior to the peak work period (Smith A.J. 1980). This system permits them to maintain their body weight and to preserve energy which would otherwise be spent by them on travelling long distances during grazing to find water. The supply of concentrates and cut-grasses especially, provides, TDN (Total Digestible Nutrient) in standard levels; which is



The water buffalo has come to be regarded as the tractor of Asia, as exemplified in this pair of buffaloes at work near Malang, East Java, in Indonesia. Rising energy costs over the past decade have brought about a reevaluation of the role of the buffalo as a draught animal and significant source of power.

not possible when grazing on natural pastures long, except during the early part of the wet season. Better care given to each animal and keeping them away from epidemics also contributes towards enhancing their physical condition. All these factors result in increased work output.

On account of the situation there is a strong case for Sri Lankan buffalo-keepers to shift from the traditional free-grazing system to the stall-feeding system. Such a shift would considerably contribute towards improving the animals work output. Apart from this, the stall-feeding system will prevent the animals from causing damage to crops, which has now become a serious problem. It would also save the expenses that animal owners are compelled to pay as compensation for crop damage caused by their animals. The large volume of dung and urine which could be collected from animal-sheds would also provide very scarce fertilizer.

However, this system would add an extra work load to farmers. Daily supply of cut-grasses or concentrates and water, and cleaning animal-sheds would take up much of the farmer's time, and the farmers are unfamiliar with this type of work. If the animals are used only for draught power for farm operations the extra time and cost (for purchasing concentrates, housing, etc) spent for animals would not

generate any extra income. In such a situation, although the animals are used only once or twice a year the extra burden they cast upon farmers would remain throughout the year. Therefore, the stall-feeding method is highly unlikely to be acceptable to farmers unless buffalo management is developed on a commercial basis in that it could generate an extra income. If the stall-feeding system is to be practised it needs to be developed to provide milk and meat to the market, which would provide an extra income. It has been found that buffaloes could generate a high income, even as much as cattle, if they are properly managed. The idea that the buffalo is incompatible with cattle has been found to be false. "The truth is that with good livestock management, the two animals are a natural complement to one another" (Cockrill, W. Ross, 1981). Another myth is that buffalo meat is tough and that it cannot be marketed on a large commercial scale. "When the bufflao is reared primarily as a beef animal, its meat is tender and tasty. Buffalo veal is particularly good" (Johnston, P. 1981). Evidence is available to prove that buffaloes could provide low cost meat under a better management system. "Meat from buffaloes that are reared and fed for early slaughter is of excellent quality. Because the buffalo is superb converter, meat can be produced at a lower cost than in the case of cattle and without the need of expensive fodders and concentrates" (Cockril, W. Ross 1980). Apart from meat, the buffalo milk has also been

found to be similar to cow's milk. It is very rich in both butterfat and in non-fat solids, but is otherwise closely similar in chemical composition, physical properties and acceptability to cow's milk. Furthermore, its quality could be improved more by feeding it high level concentrates. It seems that there is no other strong scientific barrier in developing buffalo keeping under the stall feeding system, although there may be cultural barriers which must be eliminated for the sake of the development of this sector.

The prevailing free-grazing system is no longer suitable to the new irrigated settlement schemes which are expanding at a high rate in the dry zone. Lands for grazing are not allocated there and it is prohibited to drive animals to irrigation channels for water. It is extremely difficult to keep the animals from causing crop damage in un-fenced farms. The trespassing animals have already become a serious problem in many settlement schemes. Therefore, if buffalo keeping is to be developed, a shift from the prevailing free-grazing system to the stall-feeding system is inevitable.

was found to be comparatively high under this system. Therefore, as it has been pointed out, more income generating measures have to be adopted in association with the improvement of buffalo management.

Needless to say, any shift from such a long standing tradition needs to be made over a long period, as a drastic change may not be readily acceptable to farmers. Therefore, further research is needed to find a suitable strategy.

Training, Yoking and Harnessing

Training, yoking and harnessing largely determine the capability of work animals. The accuracy and quality of work performed by draught animals is greatly influenced by ease and effectiveness of control which depends on an effective guidance system, good training and regular practise. Therefore, animal training is very important in any attempt to improve their work output. Concerning buffaloes in Sri Lanka, training has not yet been given sufficient attention. Some field surveys pointed out that lack of trained buffaloes considerably prevented farmers from using buffaloes for tillage

is to be revived, animal training is inevitable. Experience in some of the West African countries suggests that proper animal training programmes could considerably contribute to raise their work capacity. For example, in Sierra Leone, animal training centres and village-level animal training programmes play an important role in popularising animal draught power among small farmers (Starkey, P.H. 1982). Sri Lanka also needs such a strategy to improve buffaloes as draught animals.

Most of the yokes that are used in developing countries have not changed in design for many centuries. Consequently, there would seem to be considerable scope for their improvement. The most ancient types of yokes are primarily designed for a sure and easy control of the animal rather than for the best utilization of their power; whereas in the modern harness attention is particularly given to power efficiency, and proper control of the animal is done by careful training. In the former case the harness was used mainly to control animals and transmission of power was a secondary matter. The use of poorly designed harnesses and yokes causes inefficient transfer of power from the animal to the implement. Improper hitching requires the animal to exert a greater tractive effort than is actually needed to overcome implement draught. It has been pointed out that "the majority of yokes used for controlling cattle and buffaloes in Africa and South and East Asia do not allow for optimum working efficiency" (Goe M.R. 1983). This is the situation in Sri Lanka too. However, in many other Asian and African countries, research and experiments are being conducted in order to improve the traditional methods of yoking and harnessing, and some countries have already obtained encouraging results. In Bangladesh Agricultural University, a study was undertaken to design and develop a suitable neck harness for local cattle with the idea of improving the efficiency with which power is transmitted from the animal to the implement. From the first introduction of ox-cultivation in Kenya early this century, the harnessing system has hardly been changed. Neck yokes, long wooden poles with sticks through it, to fix and separate the animals, are



The work output of buffaloes has remained comparatively low and one reason is that the traditional plough and yokes used on these animals have not changed in design for many centuries. In Sri Lanka particularly, as seen here, the double yoke harness has its disadvantages. Sri Lankan farmers have always been using buffaloes in pairs for various field operations regardless of the amount of power actually required.

There is evidence to prove the feasibility of the stall-feeding system in irrigated settlement schemes. For instance, among the farmers in the Kaudulla irrigated settlement scheme, buffalo management is successfully done under the stall-feeding system (Ryan M. F. Abeyratne and J. Farrington 1981). However, the cost per animal

operations (Ulluwishewa R. and K. Tsuchiya 1984).

Buffaloes have been neglected over the last three decades, since the invasion of tractors in the 1950s. So the currently available animals are not trained; and furthermore young farmers do not possess experience in training buffaloes. Therefore, if buffalo power

common. These yokes are not adapted to the shape of the neck and are not covered with any lining. Steering and guiding is done orally and with the help of sticks. Often the animals do not walk in straight lines which results in poor field conditions for operations like ploughing. In the mid seventies an improved steering system ("Indian method") consisting of a nose rope and reins, was introduced, and the wooden sticks were replaced by a big U-bolt. At present, research projects are being conducted to develop more efficient collar type harnesses. Many research projects like this are in progress in Botswana, Zambia and Zimbabwe too. (CTUM 1985). The double neck yoke in South America has remained unchanged since the Spanish Colonial era and few if any attempts have been made to replace it by better designs. In Bolivia where animal power is the principal source of power for the peasant farmer, some research projects have recently been undertaken to develop a yoke that will enable the power of the animal to be better used.

It has been found that when the traditional yoke was used, a pair of oxen could not pull a metal plough for a whole day since they got tired rapidly. These studies have revealed that the maximum force developed by oxen was 26.7% greater when the oxen were harnessed with a Bavarian yoke rather than when they were harnessed with a traditional one. From this study they realized the significance of constructing a yoke which combined the advantage of the traditional yoke, which is similar to the traditional one but more efficient in controlling animals and making use of the animal's power. This was made of wood in a manner similar to the traditional yoke, but simpler, lighter and cheaper. In Japan, in the 1940's and 50s, many research projects were undertaken in order to improve the traditional methods of harnessing and yoking. Niiseki (1957) studied three types of harnessing methods (shoulder, breast and body) and found that breast and body types had merits over the shoulder type. In Costa Rica, Mexico and Peru too research projects aiming at better yoking and harnessing are in progress (CTYM 1985). Some research centres in Europe have also shown the possibility of obtaining better work output by improving the

methods of harnessing and yoking. A research project conducted at CTYM has found that wearing a collar, which results in spreading the load more evenly round the animals shoulders, improved the net efficiency of both Brahman cattle and water buffalo. It has been pointed out that the use of an improved harness employing a breast strap or an adjustable padded yoke allows for increased tractive effort and better animal control and comfort. Recent experiments have revealed that when an uncomfortable yoke was used, a 380 kg. steer was willing only to pull a load of 30 kg. but when the yoke was padded with foam rubber it willingly pulled a 50 Kg. load (Smith A.J. 1981). On account of all these encouraging results it can be assumed that the traditional methods of yoking and harnessing in Sri Lanka, which have remained unchanged over the past centuries, may have been a reason for the low work output of buffaloes. Therefore, if these traditional methods are improved, buffalo work output could considerably be promoted.

Furthermore, the double yoke harness which is used in Sri Lanka with animal pairs has some disadvantages. Historically the double yoke harness which had been used in Northern India was brought to Sri Lanka by early settlers who migrated from Northern India, to the Dry zone of Sri Lanka. Since then double animal ploughing has been practised. Centuries ago, the double yoke harness was changed to the single yoke in China and in Central Europe. The Chinese took it to Korea, Japan, the Philippines, Thailand, Vietnam, Indonesia and other countries of South-East Asia (Hopkin, J.T. 1969), but it did not reach Sri Lanka. Therefore, Sri Lankan farmers have always been using animals in pairs for various field operations regardless of the amount of power actually required which is mainly determined by the technological characteristics of the implement, soil type, soil moisture content, etc. Under certain conditions there may be some field operations which require less draught power than that generated by a pair of buffaloes. But, in the absence of a single yoke harness, farmers are forced to use animal pairs, which results in power wastage. Furthermore, the present practise of using a double yoke

harness has some more disadvantages. When several animals are hitched as a team it incurs a loss of energetic efficiency. In principle, the total draught power increases as more animals are hitched together but on the other hand the draught power per animal decreases.

Apart from this, animals of two different sizes do not fit into the same yoke. Therefore, those who possess only one animal have to make an effort to hire or borrow a second animal of the same size. This extra effort is a real loss in the case of operations which could be more easily and effectively done by a single animal. In view of the cost that the farmers have to bear for hiring draught animals it is advisable to introduce an efficient single yoke harness. Instead of using two animals, only one animal would be required if the single yoke harness is popularized in Sri Lanka. Consequently, as the number of animals that are employed to carry out the field work is cut down to half, the cost of operation will be eventually reduced. In fact, a new method of single animal ploughing has already been demonstrated (Weerakody, W. A. S. 1985). However, it is necessary to conduct intensive training of the animals for a single source of power.

Implementations

Since the technological characteristics of animal drawn implements affect the work output of draught animals, improvement of the animal drawn implements also has potential to raise the buffalo work output. Therefore, research projects have to be conducted in order to identify the technological defects of the implements presently being used and to improve them so that higher work output from draught animals could be gained. During the animal powered farming era in the developed countries, many research projects, aiming at the improvement of the quality of animal drawn implements, were conducted but in the developing countries where animal draught power is still dominant, such research projects are yet few. The primitive animal drawn implements being used in many developing countries tend to reduce the work output of draught animals. However, research projects in some developing countries have shown encouraging results.

Paddy farmers in Sri Lanka too, just as in many other developing countries,

still use primitive animal drawn implements which have not changed over many centuries. The Sri Lankan indigenous plough which is pulled by a pair of animals has a long rigid plough beam extending up to the animal yoke line. It is characterised by the short plough sole and limited throat clearance. It is non-adjustable and therefore the ploughman cannot adjust the plough to change the ploughing depth and the inversion direction of furrow slices. These limitations constrain the work output of draught animals and the quality of work performance. Therefore, if animal draught power is to be promoted, it is necessary to improve the indigenous animal drawn implements which are in use at present. Such an improvement will undoubtedly increase buffalo work output.

At this point, it is worthwhile to mention how the Japanese agriculturists improved their plough. Initially the Japanese also used two types of non-adjustable ploughs called non-sole and long-sole, which had been adopted from Northern China and Korea respectively. Each type had its own advantages and disadvantages. The non-sole plough had the advantage of less friction between the sole and furrow bottom, but holding the plough in proper position was difficult. The long-sole plough was easy to hold in proper position, but the friction at the bottom was fairly great. Due to the individual efforts of certain ardent inventors in the 19th century, the advantages of these ploughs were mixed in the short sole plough, which had reasonable length of sole, so that the friction was less than that of the long sole plough; and handling of the plough was less than that of the long sole plough and handling of the plough was easy. Thus, the fundamental construction of the modern plough was completed, around 1900. (Sakai, J. 1984). At the same time, the material and geometry of mould board curvature were improved so that the plough could be drawn by lesser draught power. The power required to draw the plough was further reduced by adding an extra smaller front body. This smaller front body cuts off about half of the furrow-slice and throws it into the path of the main body which cuts the lower half of the furrow-slice and turns both soil layers together to the side. Thus, the double plough

supplements the turning action of the single plough mechanism, and gives better pulverisation of soil, which makes harrowing easier. This Japanese plough was further improved by adding some adjustable mechanisms which enables the ploughman to control ploughing depth, width and inverting direction of furrow-slices. In this way the Japanese plough became an excellent animal drawn plough (Ulluwishewa R. K. Tsuchiya and J. Sakai 1985).

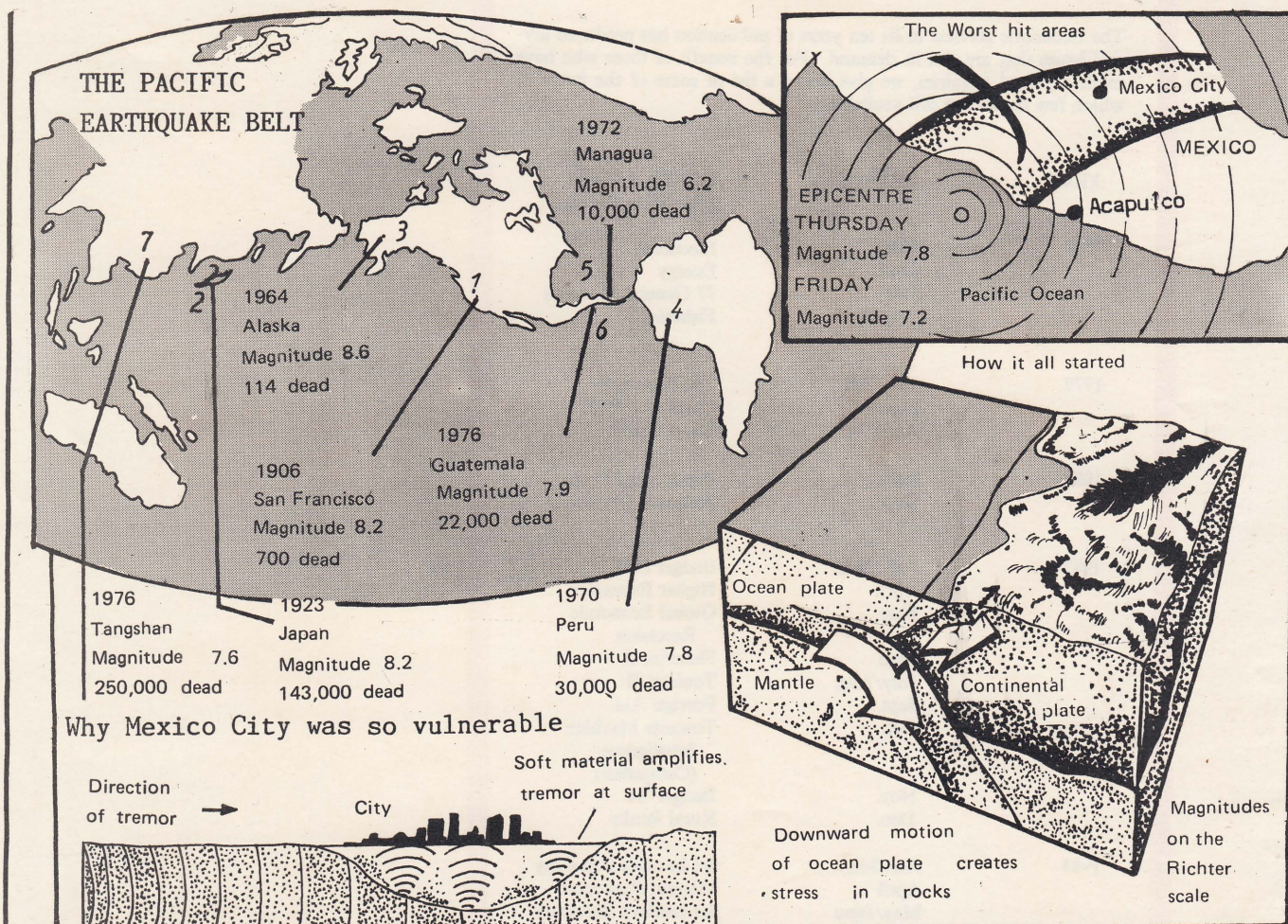
In Thailand too the improvement of the local animal drawn ploughs has shown encouraging results. Six years ago the Thai-IRRI Co-operative Farm Machinery Project undertook an experiment that aimed to reduce the draught of the buffalo plough. It has been found that a mouldboard with a larger radius of curvature required less specific draught and further reduction could be obtained when the plough point and mouldboard assembly was rotated 20°—25° clockwise about a horizontal axis, providing a more gradual approach to the soil. The lower draught requirement apparently resulted in higher work output (Rojanasaroj, C., Fischer R.C. and C. Chakkaphak 1981).

The Sri Lankan traditional plough which remained unchanged over

centuries has to be improved. Such an effort is needed to enhance the work output of draught animals. Recently a new single animal drawn plough (Weerakkody plough) has been invented and efforts are being made to introduce it to farmers. This "plough" has a better feature than the indigenous plough. It is constructed in such a way that it has a longer plough sole (to make the plough stable during ploughing) and a wider throat clearance (to minimize build-up of mud and trashes in front of the mouldboard). It is also light weight like the indigenous plough" (Weerakkody, W. A. S. 1985). However, a sustaining effort is needed to improve the traditional implements and to train draught animals.

In this way the draught power which is generated by the available buffalo population could be increased by improving the current traditional feeding system methods of harnessing, yoking and animal training, and the technological characteristics of the traditional animal drawn implements. Such improvements would cause higher buffalo work output and lower cost of tillage which provide incentives for wider use of buffaloes for village operation.

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FEARS OF ANOTHER QUAKE ON THE PACIFIC EARTHQUAKE BELT

While San Francisco prepared to commemorate the 80th anniversary that all but destroyed it on April 18, 1906, public safety officials were reminding Californians that they still lived on shaky grounds, since the earth below them had been wobbling and trembling in a spate of small earthquakes. For more than a decade, geologists have been warning that enormous stresses are accumulating on the San Andreas fault, a rift in the earth's crust that slashes across California from a point north of San Francisco to the Mexican border. Eventually, they say, this stored energy will be released in an instant, like a coiled spring, in a potentially catastrophic earthquake. This is because for more than a thousand years, according to their studies, such a quake has occurred at intervals, averaging 145 years, along a section of the San Andreas fault 35 miles Northeast of Los Angeles.

The last major earthquake occurred in Mexico last year. The illustration above shows why Mexico city was so vulnerable. This devastation in Mexico City, 250 miles away from the epicentre, resulted in an unfortunate combination of circumstances. It was mainly low frequency waves that reached Mexico City. These waves happen to correspond to the natural vibration of high rise buildings, and therefore the buildings were particularly affected. Mexico City, set in a bowl of mountains, is built on silts and peats that accumulated in what were shallow lakes and wetlands—there would have been less damage if the city had been built on solid rock.

The Pacific coast of the Americas is one of the most earthquake-prone regions of the world as we could see. It marks the boundary between two of the six great plates that make up the earth's crust. When these plates, floating raft-like on the less rigid material below, slide past or ride over one another, strain builds up in the rocks. Eventually, the accumulated energy is released in an earthquake.

The Economic Review in its ten years of publication has produced several issues that are still in demand. For the benefit of those who have made repeated inquiries, we give below a list of some of the issues of which few copies are still available.

YEAR	MONTH	COVER STORY (The Main Feature)	
1978	May	Elections	
	June	Energy	
	July	77 General Elections	
	August	Fisheries	
1979	Jan./Feb.	The Economy	
	March	Children (IYC)	
	April/May	Rural Credit	
1982	Sept.	Presidential Polls	
	Dec.	National Elections	
1983	Feb./Mar.	Budget 1983	
	April	Higher Education	
	May	Global Economic Recession	
	June	Fisheries II	
	July/Aug.	Tourism II	
	Sept.	Foreign Aid	
	Oct.	Towards Machine Intelligence (Computers)	
	Nov.	Budget '84	
	Dec.	Rural Banks	
	1984	Jan./Mar.	Sri Lanka's Economy
		April	Mineral Resources
May/June		Sri Lanka's Economy	
July/August		Export Development	
Sept./Oct.		Paddy Farming	
Nov./Dec.		Water Supply & Sanitations	

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