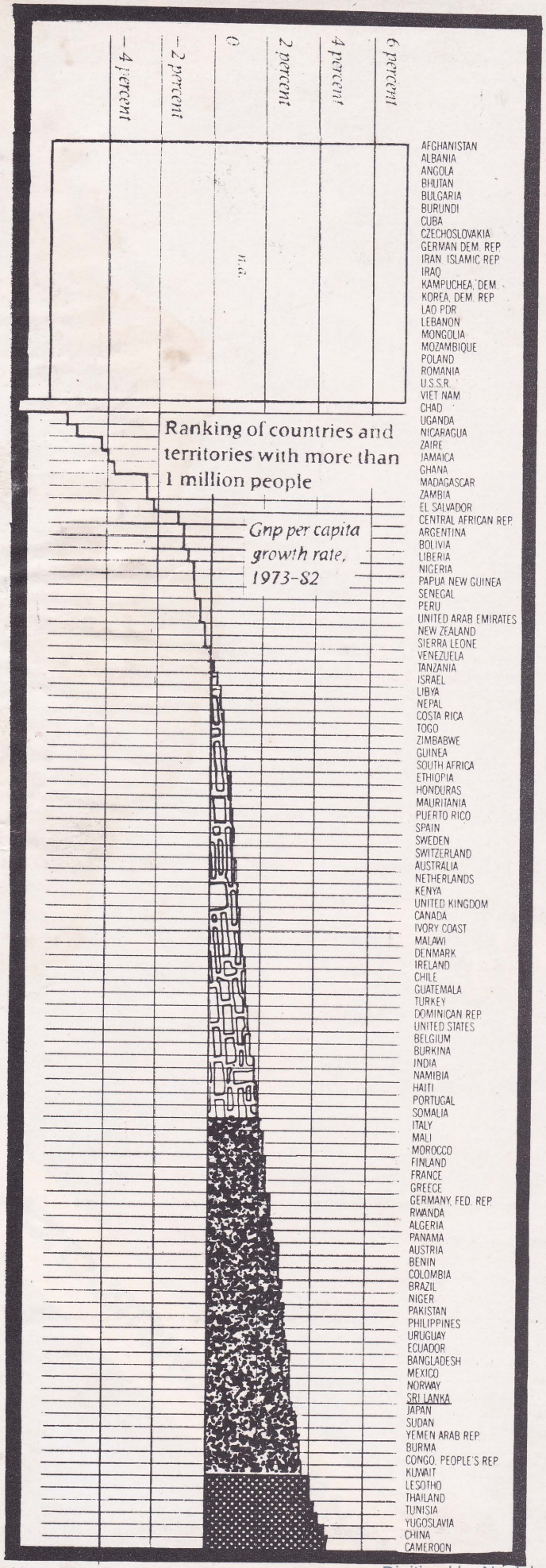
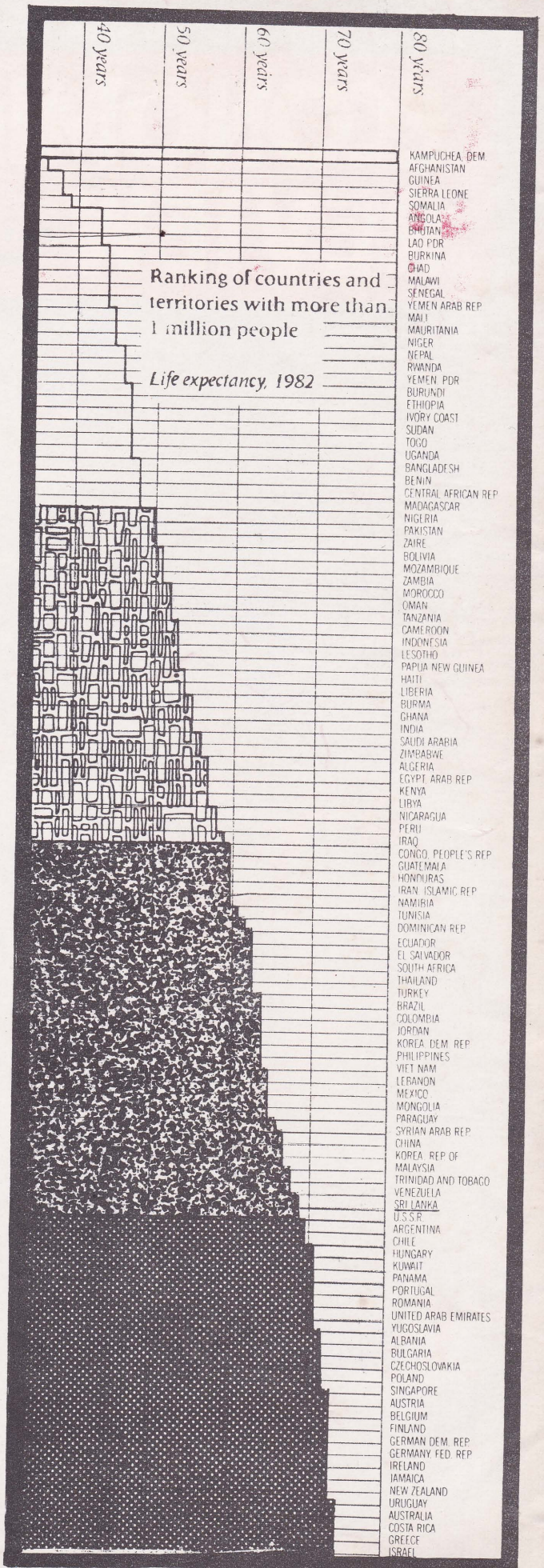
ECONOMIC REVIEW

JULY/AUG 1985

MAHAWELI CONSTRUCTION



14 countries with GNP per capita growth rates of over 4.6% have been left out (See p.32)



15 countries with a life expectancy of over 74 years have been left out (See p.32)

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Subscriber's Note

Owing to the importance of the subject of our Special Report for the first time the Review comes out a a Double issue. Subscribers please note that his Special 64 page issue on the Mahaweli will be regarded, for subscription purposes, as two separate issues.

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NEXT ISSUE

- The Tea Industry — its importance in Sri Lanka's economy, a historical perspective, the current state of the trade and industry and future trends.
- World debt issues — the Latin American crisis, Sri Lanka's plea for capital requirements of the Third World.
- Exchange rate changes and devaluation of the Sri Lankan rupee.

COVER

- Courtesy — Mahaweli Development Authority

MAHAWELI DIARY

1958 – 61
Studies carried out in some parts of the Mahaweli Project area by the United State Operation Mission (USOM)

1961 – 62
Investigations of separate parts of the Mahaweli Project area done by the Canadian Hunting Survey Corporation (CHSC)

1963
Government requested the UN Special Fund to explore possibilities for complete utilisation of water resources of the Mahaweli Ganga for purpose of irrigation and hydro-power. The UNDP appointed the FAO to carry out a survey in two stages. the first to prepare a comprehensive study of the river basins included in the project area and a Master Plan, and the second to provide the feasibility studies for the selected first phase of the project development.

1964
Proposals for Victoria Project studied by Hunting Technical Services of Canada.

1964 – 68
The UNDP/FAO studies carried out with Sri Lankan counterparts covering the land and water resources of the Mahaweli Ganga.

1969
A final report of the UNDP/FAO study was issued by the FAO, together with a Master Plan to be implemented over a period of 30 years, supported by specific reports on 17 subjects.

1970
The first project in the Master Plan was undertaken by the World Bank and the Sri Lankan Government.

1970
The Mahaweli Development Board (MDB) was established under Act No. 14 of 1970.

1973 – 76
A Kotmale project feasibility study was carried out by Water and Power Development Consultancy Services, India Ltd. (WAPCOS)

1975
Stage II of the Project I commences.

1976
Polgolla Bowatenna Complex and Victoria Minipe diversion Project I of Phase II completed.

1977
Decision to accelerate implementation of the Mahaweli Development Programme.

1977
Victoria geological survey started by the Department of Irrigation and a special geological investigation of the project area carried out by Soil Mechanics Ltd. UK.

1978
Economic viability, impact and evaluation studies on Randenigala Project undertaken.

1978
Maduru Oya site investigation commenced.

1979
Works contracts on Kotmale Project awarded to AB Skanska Cementgjuterite of Sweden.

1979
Mahaweli Authority was established under Act No. 23 of 1979.

1979
Ministry of Mahaweli joint venture comprising M/s Salzgitter Consultancy Gmbh of Germany, Agrar & Hrdrotech Nik Gmbh of Germany and Electrowatt Engineering Service of Switzerland with CECB, MDB, CEB, Irrigation Department and Survey Department studies on Randenigala were undertaken and feasibility study completed.

1979 Dec. 18
Underground works contract on Kotmale dam signed with AB Skandka.

1980 March 23
Construction of Victoria Dam was formally inaugurated.

1980 March 3
Contract for construction of Victoria Dam and tunnel was awarded to Balfour Beatty Nuttall of UK.

1980 April 7
Main Civil Works contract on Maduru Oya dam awarded to FAFJ of Canada comprising a joint venture of 4 Canadian firms.

1980 Sep. 3
The contract for hydro mechanical works on the Maduru Oya project was awarded to Hydraulic Engineering Corporation of China.

1980 Oct. 20
Contract for power station buildings was awarded to Constain International Ltd. of UK.

1981 June 26
Contract signed for power station plant on Kotmale Project with Skanska.

1981 Oct. 15
Substation plant contract on Kotmale Project signed with ASEA AB of Sweden.

1982 Jan. 16
The river was diverted through temporary opening in the Victoria Dam.

1982 Oct. 12
Impounding of the reservoir on the Maduru Oya project commenced.

1982 Nov. 17
Handing over the spillway at Victoria Dam to the gate contractor.

1983 Feb. 14
A ceremonial placing of the final corefill on the Maduru Oya Dam to top off work on the dam.

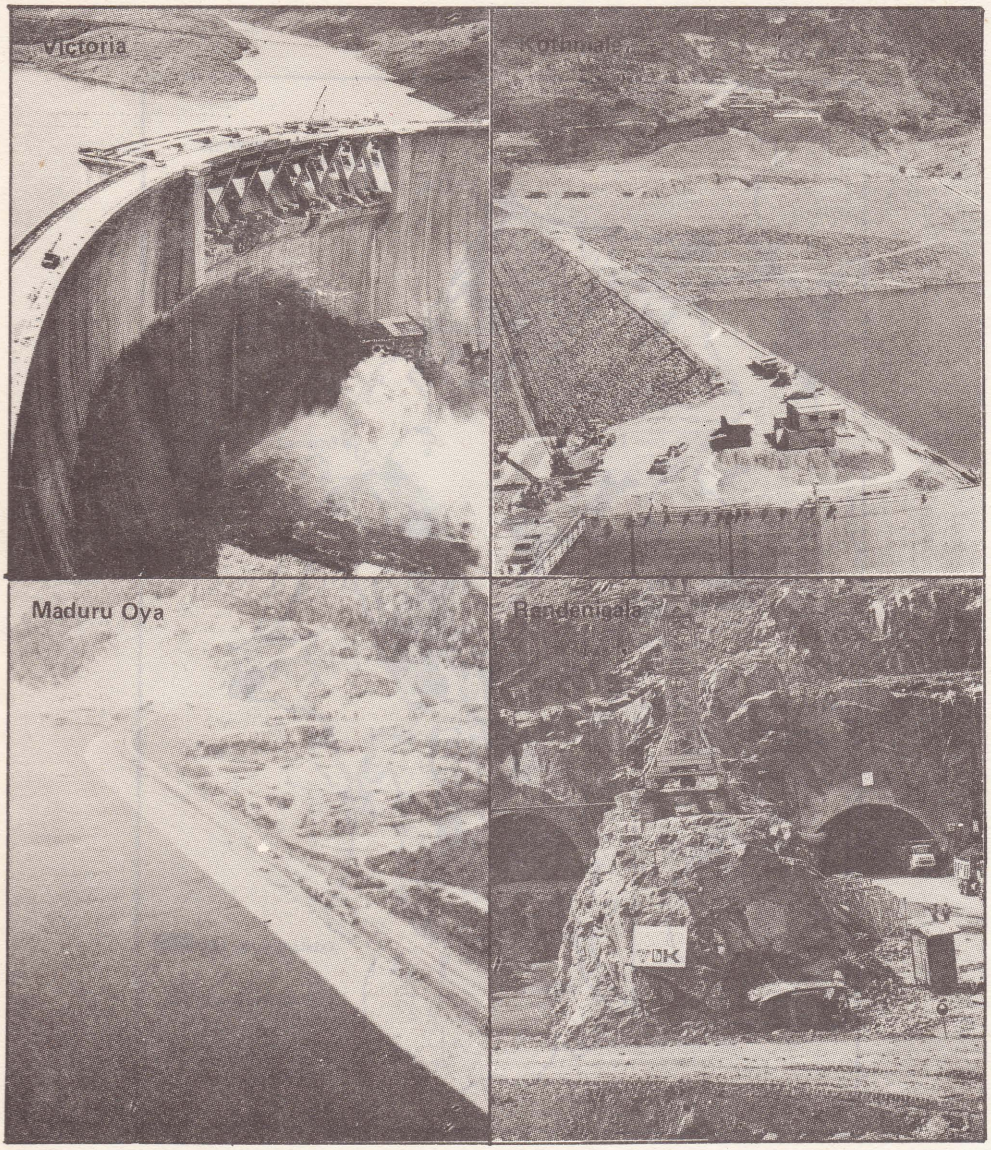
1984 March 3
The contractor completed construction work on the Maduru Oya Rock fill dam on schedule and a ceremonial topping up took place to mark the occasion.

1984 March 30
Ceremonial diversion of the Mahaweli Ganga for construction of the Randenigala dam.

1984 April 7
The impounding of the Victoria Dam initiated the filling of the reservoir.

1984 Nov. 17
Kotmale was completed and ceremonially impounded by Sri Lanka's President.

1984 April 12
Formal inauguration of Victoria Dam and Hydro electric scheme by the British Prime Minister and Sri Lanka's President.



MAHAWELI CONSTRUCTION

The official commissioning of the Kotmale Project on August 24 this year marked the completion of a major part of the construction work on the Mahaweli Ganga Multi Purpose Project. The accelerated Mahaweli Programme, begun in 1978, was due for completion within a period of six years, yet several factors such as faulty rock formations, engineering difficulties on both the dams and tunnels, funding and administrative delays, and the fact that a project of this magnitude had never been attempted in Sri Lanka before held up work on more than one occassion, particularly in the early stages. Plans on some projects had to be altered and the original six year deadline may stretch over a further 3 years, though a major part of the construction has now been completed.

The accelerated Mahaweli Programme as constituted at present is made up of 3 main components: the headworks projects, at Victoria, Kotmale, Maduru Oya and Randenigala; the downstream engineering and irrigation works; and settlement and agricultural production. Construction activity is confined mainly to the first two components and it was felt at the outset that if the Accelerated Programme should falter it would do so first at the levels of construction.

The original programme, in the Master Plan formulated by an UNDP/ FAO team covering a 30 year period, was considerably amended when the Accelerated Programme was drawn up. For instance, the six year Accelerated Programme was intended to irrigate 340,000 acres as against the original plans for 900,000 acres under the 30 year programme.

The original cost estimates in the early 1970's on the larger 30 year project was around Rs. 7 billion, though later in 1970 the programme of irrigation, hydro power, agricultural and infra structural facilities of all projects was estimated to cost as much as Rs. 15 billion. In 1978, however, the somewhat more modest accelerated programme comprising six major reservoirs, five power stations and downstream development of systems A, B, C and D were estimated to cost Rs. 11 billion; although by the end of 1984 a sum of over Rs. 25 billion had already been spent on only some of these projects and a further Rs. 16.5 billion was due to be spent over the next five years. (See Table 1). The total cost of the four major headworks, namely Victoria, Maduru Oya, Kotmale and Randenigala was estimated at Rs. 23.7 billion at the end of 1984, and by that date Rs. 17.5 billion had been expended on these four projects. The other downstream engineering and irrigation works and settlement and agricultural activity alone was expected to cost as much as Rs. 12.5 billion.

The Mahaweli Development Programme thus has continued to be not merely the country's biggest investment item in recent years, consituting around 35 percent of the government's budget; it has also roused more attention than any other project attempted in this country. This project is easily the most ambitious scheme ever to be undertaken on the island and has been the keystone of the government's development programme since 1977.

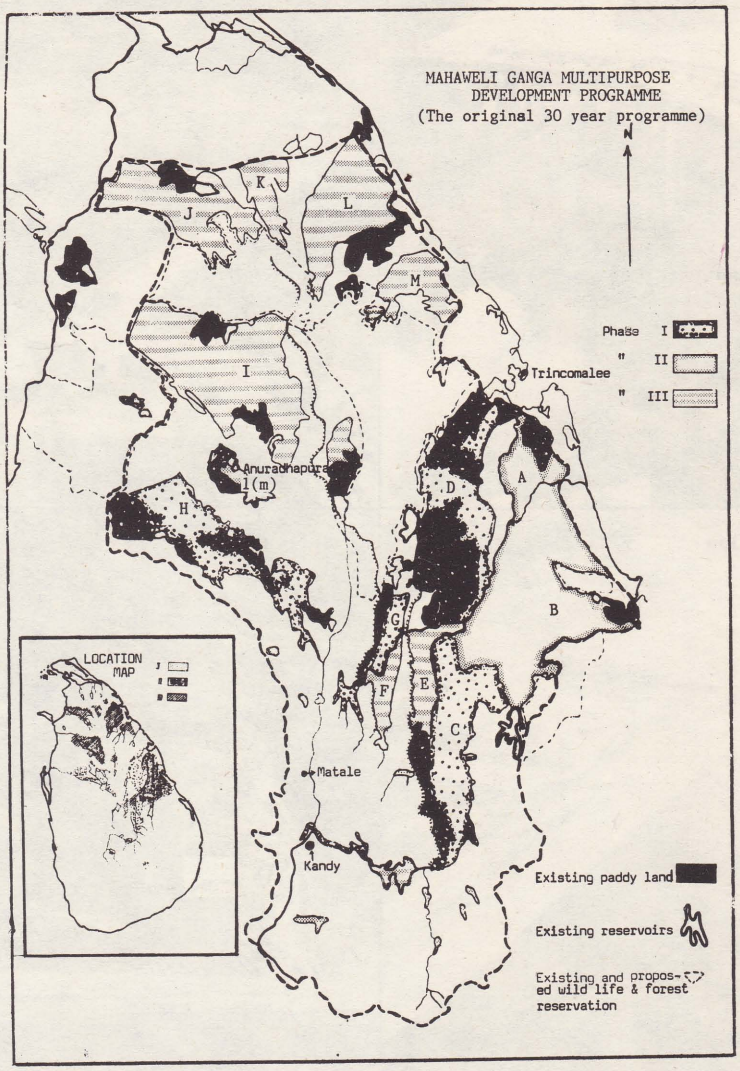
Accelerated Programme

After 1977 the pressure was heavy for speeding up implementation of this project. A step-wise implementation of the Mahaweli Development Programme would have lasted 25 years from 1975. The new government, in July 1977, decided to speed up implementation of a truncated programme and complete the project within its term of office of 6 years. A decision was taken for 'acceleration' or immediate implementation of certain key projects of the Programme based on the recommendations in the Mahaweli Master Plan that had been formulated in 1968 by the United Nations Development Programme (UNDP) and the United Nations Food and Agriculture Organisation (FAO) with the assistance of Sri Lanka's Departments of Irrigation, Survey, Agriculture and the then Department of Government Electrical Undertakings. What was meant by 'acceleration' was to undertake simultaneously a number of projects which under normal conditions would have been done sequentially.

After the decision was taken by the Government to accelerate the Mahaweli Development Programme, the responsibility for its implementation was vested in the newly established Ministry of Mahaweli Development. As an umbrella organisation for planning and implementing the Programme, the Mahaweli Authority of Sri Lanka (MASL) was established by Parliamentary Act No. 23 of 1979. The MASL, the Mahaweli Development Board (MDB), the River Valleys Development Board (RVDB) and the Central Engineering Consultancy Bureau (CECB) were placed under the aegis of the Ministry of Mahaweli Development.

The Master Plan

The Mahaweli Ganga basin covers a total area of about 4,000 sq. miles of the country's 25,000 sq. miles and has been estimated to discharge nearly 6.4 million acre-feet of water into the sea.

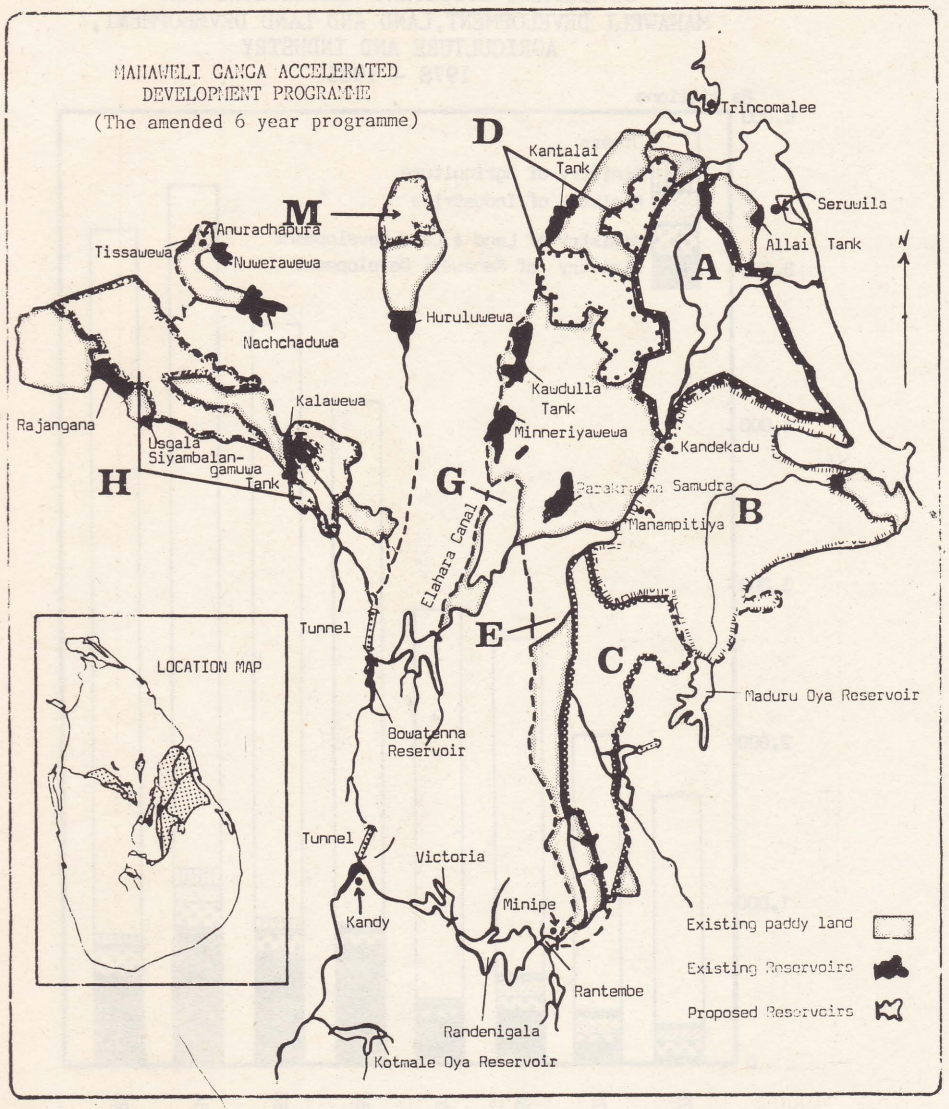


This volume of water represents approximately one fifth of the total discharge of all the Island's rivers into the sea. In order to plan the utilisation of the water resources of the Mahaweli in an effective manner, an UNDP - FAO team together with Sri Lankan engineers and scientists carried out investigations during a four year period between 1964 to 1968, and formulated the 'Master Plan' which proposed to utilise 4.3 million ac. ft. of the flow of the Mahweli Gange in an area of 900,000 acres in the dry zone of the country, while 0.9 million ac. ft of water available in these areas were also to be utilised.

It was originally intended not merely to irrigate 900,000 acres of land but also develop 15 multi-purpose projects, 4 trans-basin diversion canals and several power stations with a total capacity of 500 megawatts, and settle over half a million people who would earn their livelihood in the area — all at a cost of Rs. 27 billion (in 1977 prices).

The original Mahaweli Master Plan had envisaged the development of 365,000 ha.* (901,500 ac.)** of new land under irrigation of which 100,000 ha. (247,000 ac.) consisted of already developed land but which had been recommended for improved irrigation facilities. It planned for the construction of a series of reservoirs on the Mahaweli Ganga, its tributary the Amban Ganga, the Maduru Oya, Yan Oya, Malwatu Oya and proposed the development of irrigation projects in thirteen "systems".

*Ha = Hectares **ac = acres,



Accelerated Mahaweli Programme — Cost Estimates (Rs. Million)*

Project	Mid 1978(1) economic prices	Cumulative(2) Expenditure upto end 1984	Estimated(3) Expenditure 1985 — 89	Total (2) + (3)	Total cost Mahaweli(4) Development Ministry Estimates
1. Victoria	3,086	6,523	659	7,182	7,890
2. Kotmale	3,328	6,649	1,003	7,652	8,755
3. Randinigala	1,827	1,893	2,314	4,207	4,450
4. Maduru Oya	800	2,532	—	2,532	2,631
5. Minipe Transbasin Canal		1,165	20	1,185	1,543
6. Irrigation System 'B'		2,442	6,995	9,397	10,487
7. Irrigation System 'C'		1,838	2,588	4,426	5,529
8. Irrigation System 'G'		63	109	172	
9. Stage I and II		1,595	34	1,629	
10. Others		311	887	1,198	
Total		25,001	14,569	39,580	41,285
11. Operation & Maintenance			1,945	1,945	

(1) Implementation Strategy Study, NEDECO Engineering Consultants 1978.
(2) Central Bank of Ceylon, Annual Report 1984 p. 42.
(3) Public Investment 1985 — 89, National Planning Division, Ministry of Finance & Planning May, 1985 p. 179.
(4) Mahaweli Prospects and Programme, Ministry of Mahaweli Development Dec. 1984, pp 6 - 9.

*The escalation in costs over these 7 years could be accounted for partly by the inflationary trends over this period and partly as a result of additional expenses on the project, mainly due to unforeseen circumstances. An indication of the extent to which the increased expenditure was affected by inflation is given below.

As measured by the Colombo Consumer Price Index, the inflation rates for each year from 1978 to 1984 were as follows:

1978 — 12% 1981 — 18%
1979 — 11% 1982 — 11%
1980 — 26% 1983 — 14%
1981 — 18% 1984 — 17%

On this basis the total increases as a result of inflation from 1978 to 1984 was 109 percent.

The first phase consisted of the construction of the Polgolla - Bowatenne Complex, the Victoria-Minipe diversion and the Moragaha-ande Reservoir to benefit 135,000 ha. (333,400 ac.) of land under irrigation and installation of 200 MW*** capacity for power generation.

The second phase was for the development of 95,000 ha. (234,600 ac) using the storage of water which would be made available in Victoria and Moragahakande reservoirs, and installation of approximately 15 MW of capacity for power generation.

The third phase was for the construction of other reservoirs such as the Kotmale, Randenigala and those on the Uma Oya, Loggal Oya and certain tributaries of the Amban Ganga to irrigate parts of the North Central and Northern Provinces and installation of approximately 380 MW capacity for power generation.

Need to Accelerate

At the end of 1977 when the Government decided to telescope the implementation programme proposed in the Master Plan into a tight time frame of six years it included only the major projects of the Master Plan in its Accelerated Programme. The Government was prompted by many motivating considerations to accelerate the implementation of the Mahaweli Programme within the shortest possible time. The imperatives of keeping the nation fed, the annual drain on the foreign exchange resources of the country arising from the necessity to import staple food, the need to contain the rising prices of food, and the problem of acute unemployment were among the main considerations.

The increasing costs of fossil fuels and the increasing demand for electricity in the rapidly expanding

***mw = megawatts

commercial and industrial sectors and in Urban re-development areas,and the high demand for rural electrification too prompted the Government to accelerate the Mahaweli Programme, as the generation of hydro-power formed one of its essential components. In fact, hydro-power came to receive greater emphasis than irrigation after the oil price hikes of the early 1970's and this priority for power is evident in the accelerated programme.

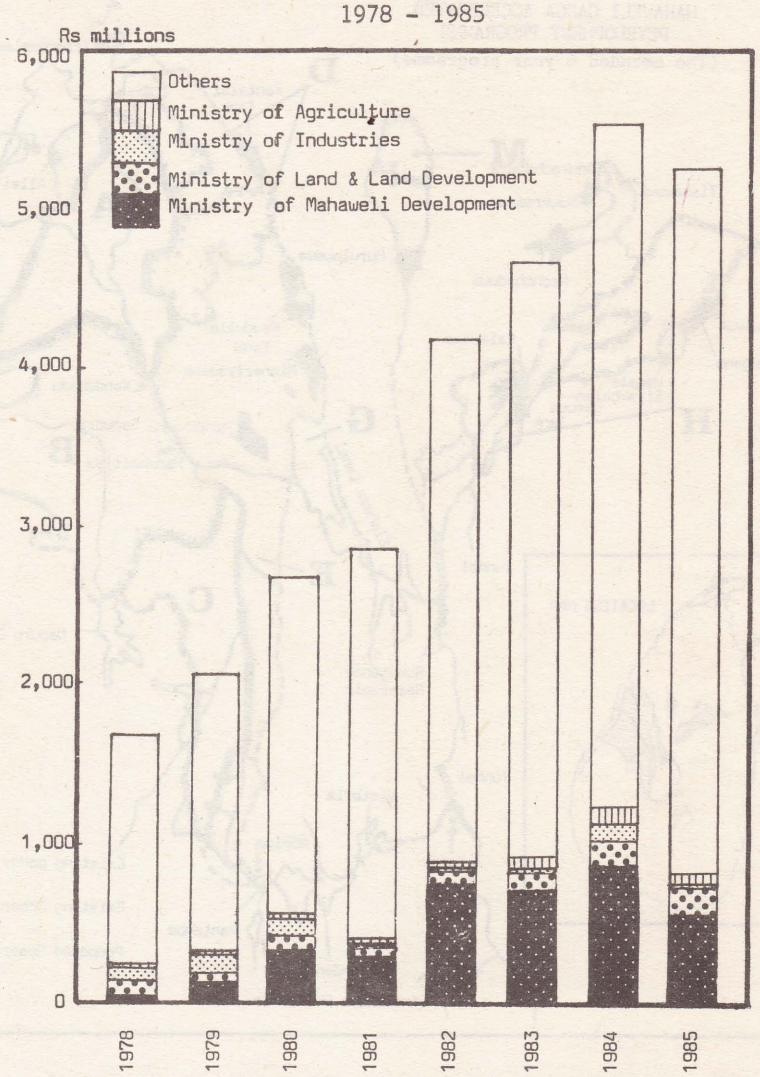
The installed capacity in Sri Lanka even in 1982 was 455 MW and the average consumption for the country was 123 MW hours per head, which was considered one of the lowest averages in Asia. Also at the time, only about 10 percent of the rural population was provided with this facility. This situation highlighted the need for the expansion of the rural electrifiation programme.

Furthermore, the slow implementation of the Mahaweli Programme, over the originally estimated period of thirty years, it was also felt would have made the cost of construction unbearable for the country in the face of spiralling inflation, which was pushing up construction costs.

Multi-Purposes of Project

The Accelerated Mahaweli Programme envisaged the construction of a series of reservoirs with hydro-electricity plant, to develop a large extent of land in the downstream areas with irrigation facilities, for establishment of new settlements and agricultural development. This new programme envisaged the irrigation, agricultural and infrastructure development of about 320,000 acres (compared to the original 900,000 acres) and increasing the hydro-electric generating capacity of the Island by 400 megawatts by the construction of six major reservoirs and five power stations. It was hoped to complete these major works within six years from 1978 at an estimated coast of Rs. 11 billion, the major part

GOVERNMENT BUDGETARY ALLOCATIONS FOR MAHAWELI DEVELOPMENT,LAND AND LAND DEVELOPMENT, AGRICULTURE AND INDUSTRY 1978 - 1985



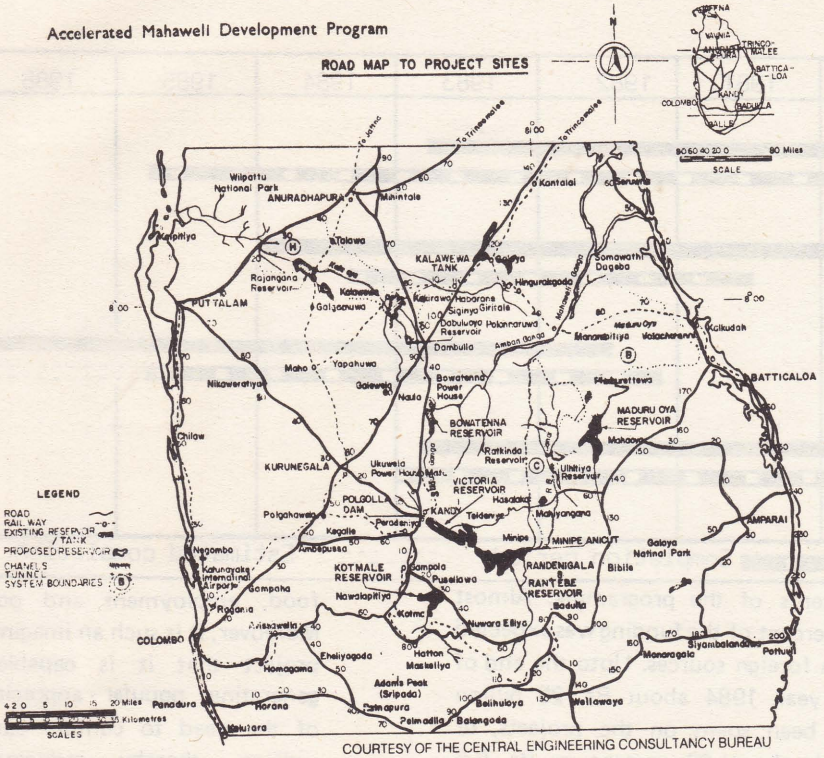
Source:Estimates of Revenue and Expenditure of the Sri Lanka Government 1982 Volume I - Annual Report Central Bank

of this investment being for equipment and materials.

The accelerated plan originally included the construction of the Kotmale, Victoria, Maduru Oya, Randenigala and Moragahakanda Projects simultaneously in a single concerted construction phase. A later review of this implementation strategy by the Netherlands-Consultancy firm pointed to a situation that with proper water management, the construction of Kotmale, Victoria and Maduru Oya reservoirs alone would be sufficient to irrigate the land area and generate hydro-power to the extent that was expected under the Accelerated Programme. However, the Government decided to take up the construction of four reservoirs, including the Randenigala reservoir, along with the three recommended by the NEDCO studies. Randenigala was justified solely on the basis of the country's energy requirements anticipated around 1986.

Basic Features

The Accelerated Mahaweli Programe was therefore brought down to three main components: (a) the four main headworks projects of Victoria, Kotmale, Maduru Oya and Randenigala; (b) the downstream engineering works dealing with



COURTESY OF THE CENTRAL ENGINEERING CONSULTANCY BUREAU

diversion works; and (c) the irrigation and the development of downstream areas, which included the systems 'B' and 'C' and later 'A' and 'D', the balance lands in system 'H' and some lands in system 'G' comprising the old Elahera colonization scheme.

The major projects of the original Accelerated Programme listed for priority attention were:

(i) Maduru Oya Dam, Irrigation and Power Tunnel, Power Station and Link tunnel:
(ii) New Minipe Anicut, Right Bank Transbasin Canal and Ulhitiya Reservoir;
(iii) Kandakadu Anicut;
(iv) Victoria Dam, Power Tunnel and Power Station;
(v) Randenigala Dam and Power Station;
(vi) Kotmale Dam, Power Tunnel and Power Station;
(vii) Moragahakanda Dam and Power Station; and
(viii) Irrigation facilities and settlement in areas A, B, C and D.

The basic features of the projects falling within this Accelerated Programme covered the following aspects of irrigation and hydro-power.

Irrigation and Drainage Systems

The Accelerated Programme was expected to supply water to an extensive region along the course of the river, mainly to the Mahaweli plain stretching from Mahiyangana to Trincomalee. This region is described in the Mahaweli Development Plan as the Systems, A, B, C and D (see amps) Initially systems B and C were to receive water.

The big irrigation engineering works comprising five major dams and related works expected to supply Mahaweli water to 320,000 acres of new land and 90,000 acres of existing paddy land coming within this region. An approximate breakdown of the extent of new land in the Accelerated Mahaweli Programme is as follows:

System A	– 36,000 ha.	(89,000 ac)
System B	– 48,000 ha	(118,000 ac)
System C	– 24,000 ha.	(59,000 ac)
System D	– 19,000 ha.	(47,000 ac)
System G	– 2,800 ha	(7,000 ac)
	126,000 ha	(312,000 ac)

Additionally, the on-going work of System H was also brought under the Accelerated Programme.

Generation of Hydro-Power

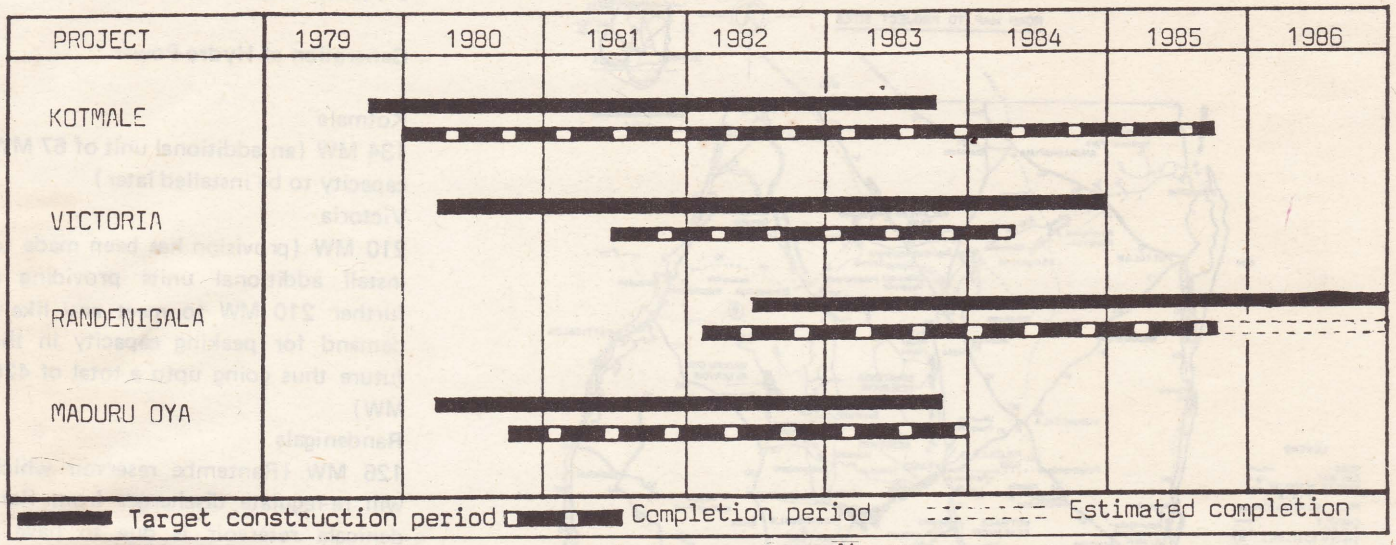
Kotmale
134 MW (an additional unit of 67 MW capacity to be installed later)
Victoria
210 MW (provision has been made to install additional units providing a further 210 MW to meet any likely demand for peaking capacity in the future thus going upto a total of 420 MW)
Randenigala
126 MW (Rantembe reservoir which will re-regulate discharges from Randenigala reservoir is due to have a total installed power capacity of 49 MW)

The Accelerated Programme by itself is a project of immense magnitude when considered in the light of the demand it makes on the country's resources; but there was also now the added factors of the tight time target set for implementaton and the necessity for many other action programmes before work actually commenced on these projects.

The decision to accelerate the Mahaweli Programme required speedy action to get the feasibility of the key projects, recommended in the Master Plan in general terms, studied and appraised in detail before acceptance for implementation and for foreign funding. In this, the services of a number of foreign agencies were obtained and studies carried out with advice from the Central Engineering Consultancy Bureau were financed by a number of donor countries. Based on those feasibility studies, a development programme and implementation strategies were prepared.

Apart from the Master Plan and the early feasibility report which was prepared by Messrs SOGREAH of Grenoble, France, in respect of System H and the feasibility reports on Polgolla; and Bowatenna Complexes

MAHAWELI HEADWORKS CONSTRUCTION PROGRAMME-TARGETS AND ACHIEVEMENT



and the Kotmale Power Project prepared before 1977, such detailed feasibility studies had not been done in respect of any other Project under the Mahaweli Development Programme.

Foreign and Local Funding

The implementation of the Programme also called for harnessing adequate resources, particularly the raising of foreign funds for the construction of the Projects and the implementation of the various downstream development programmes. In this, the country was fortunate in obtaining commitments of funds from USA, Canada, UK, the Federal Republic of Germany, Sweden, the Netherlands, Belgium, Kuwait, Saudi Arabia, Japan and from international funding agencies like the World Bank.

The international community showed a quick response and steady co-operation when it came to mobilising the financial and technical resources for the implementation of these projects. One factor responsible for this ready response was that within two years of the announcement of the Accelerated Mahaweli Programme the government had arranged for or completed detailed feasibility studies on all aspects of the Programme and linked donors with the main elements of the programme. Almost 70 percent of the funding was expected from foreign sources. Upto the end of the year 1984 about Rs. 25 billion had been spent on the projects, of which about 26 percent or Rs. 6.6 billion was spent during 1984 and only around 30 percent of this was from local funds. In the resource allocation for national development, the Accelerated Mahaweli Programme continued to receive the highest priority. The government's views on this priority were summed up in the following statement by the Minister of Finance in an address to prospective foreign investors visiting Sri Lanka in September 1980:

> "The Mahaweli will not only provide the much needed cheap power and save on expensive oil imports, but also provide the insurance to the farmer against unpredictable rains, in achieving higher agricultural output. We cannot develop agriculturally unless we get effective control over water. Contrary to popular belief, it is not a long-term project in a convetional sense. It is a conglomeration of short-term projects of dams, reservoirs, water channels, and farmer settlement — each of which can produce results within 3 to 4 years — results in the form of land, food, employment and power. Moreover, it is such an imaginative project that it is capable of generating popular appreciation of the need to contain current welfare, thereby inducing a transfer of resources from consumption to investment. It is the vision of the future that we wish to build. Thus, our whole economic strategy could flounder, without Mahaweli."

The Minister of Lands, Land Development and Mahaweli Development viewed the magnitude of the project bieng attempted in the following manner, in 1978:

> "The enormity of the tasks under the Accelerated Programme can be visualised from the fact that the development envisaged therein far excced the combined irrigation and power benefits derived from all the multi-purpose hydro power and new irrigation projects undertaken in this country since independence.
>
> Clearly, the Accelerated Programme is a massive task. Never before has such a multi-faceted and vast undertaking been attempted in our country simultaneously, over such a

THE ANCIENT MADURU OYA DAM

A major re-design of the proposed new irrigation outlet structures of the Maduru Oya project became necessary when the presence of an ancient "horowwa" (sluice) was discovered directly on the original alignment of the Right Bank Outlet Works. Preservation of this archaelogically important structure has necessiated driving a 180 metre (590 ft) long tunnel.

When the Maduru Oya was designed by the Engineering Studies Organization of the MDB, according to the usual practice the engineers used the topographical survey maps for the first location of the proposed headworks. Detailed engineering surveys are done around the site of the proposed headworks thereafter, and detailed designs are based on the engineering surveys. When construction work is started bulldozers are used to clear the jungle at the site after which the structures to be constructed are set out during which further work with survey instruments are involved.

At Maduru Oya the bulldozers were put to work at the site of the proposed new dam with no one aware that an ancient dam had existed at this very site. Any surveyors who had worked in the area had apparently mistaken the remains of the massive earth dam at the site for a natural hill formation, covered as it was with dense jungle. After the breached ancient bund was discovered in this dramatic fashion engineers wondered whether there were further surprises in store because a headworks with such a massive embankment had to have other appurtenant structure, namely, one or more sluices, and a sipllway. In due course a massive sluice was unearthed. It's construction in brick work of extremely good and consistent quality, bonded with resin made it one of the most remarkable discoveries in the treasure house of rare archaelogical finds in the country in recent times. Some samples were sent for carbon dating in USA and it was found that these bricks are about 1,600 years old. The identification of this ancient structure has not yet been firmly established. The references presently available for such an identification include the following:

R. L. Brohier had investigaged the inter relationship of canals and reservoirs in the river basins to the west of the main Mahaweli Ganga namely the Kala Oya, Malwatu Oya, Aruvi Aru, Moderagam Aru etc. His paper presented at a Royal Asiatic Society meeting in 1937 chaired by the then Governor of Ceylon, remains the definitive work on the subject to this date.

However, in regard to the eastern side of the Mahaweli Ganga which includes the main river, its chief tributary the Amban Ganga, its principal distributory the Verugal Aru and the adjacent Maduru Oya there is less evidence for proper identification of the ancient projects.

However, the evidence today suggests that the Kandakady Ela is man made and the Verugal Aru is a natural river. The off-take the Verugal from the main Mahaweli Ganga is only about 30 feet above sea level and the Verugal Aru meanders in the manner of an ancient river. The Kandakadu Ela on the other hand takes off from the Mahaweli Ganga at a higher elevation from a point further upstream of the Verugal Aru at a location just about the Verugal Anicut which diverts water into the Inlet Channel to the ancient tank. The Allai tank is important because the Seruwila Dagoba stands on its eastern side and is known to have been built by Kakavanna Tissa around 170 B. C.

The Mahavamsa described construction work done by Kakavanna Tissa's great grandson Kutakanna Tissa who reigned at Anuradhapura from 44 B. C. as follows "In the region between the rivers (he made) a great canal called Vannaka and the great Ambadugga Tank".

There is also an inscription found at Minvila which reads "the canal of Putakhanna Abhaya son of Macudila of the family of Devanampiyatissa". Paranavitane has identified this Putakhanna Abhaya with Kutakhanna Tissa.

Finally the Molahitiyavelegala inscriptions state "Hail! King Abhaya eldest son of King Kutakhanna and grandson of the great King Devanampiyatissa, deidicated with the golden pitcher the canal of Ganataka in the Ataragaga, to the priests residing in the Pilipavata Monastary", Paranavitane says "As regards the place names mentioned in the record, Ataragga is equivalent to the Pali Antaraganga and means 'the land between two rivers'. The Mahavamsa tells us that Kutakkanna Tissa the father of the donor in the present record, founded in this region a monastary named Pelagam Vihare, and a canal named Vannakka. The Pilipavata of one inscription is most probably identical with this Pelagama. As it is natural to expect that the record was set up near the monastary which was intended to be benefited by it, we may venture to suggest that the ruins at Molapitiyavelegala marks the site of the Pilipavata or Pelagama monastary, and that the tract of country named Ataragaga has to be sought for in that narrow strip of land between the Mahaweli Ganga and the Maduru Oya, and not between the former and the Ambanganga as suggested by Professor Geiger. Unfortunately, the name of the canal is partly obliterated, but it is not Vannaka, that which, as seen above, was founded by Kutakhanna Tissa".

The accurate carbon dating of the bricks from the newly discovered ancient Maduru Oya Headworks seems to indicate that his structure dates back to about the first cnetury B. C. It would appear that Paranavitane's identification of Attaragaga as the land between the Mahaweli Ganga and the Maduru Oya is correct and that the ancient Maduru Oya Headworks had been built by King Kuttakhanna Tissa or Puttakhanna Abhaya.

widely scattered area and scheduled for completion in such a tight time-frame".

At this stage five major dams; Victoria, Maduru Oya, Kotmale, Randenigala and Moragahakande were to be built, though the fifth project proposal came to be shelved. The first of the headworks projects to be completed was Maduru Oya, followed by Victoria and Kotmale.

MADURU OYA PROJECT

The Master Plan proposed by the UNDP/FAO Team in 1965 – 68 concluded that the water resources of the Mahaweli Ganga would be more than sufficient to develop the available land in the Mahaweli Basin and therefore they suggested a trans-basin diversion of the Mahaweli waters to the adjacent basins. It was found that since the Maduru-Oya basin was on the eastern side of the Mahaweli basin it could receive additional water from the Mahaweli Ganga through a diversion at the Minipe anicut via the Right Bank Trans-basin Canal and the Randenigala Maduru Oya Tunnel. The original proposal envisaged the irrigation of 46,750 hectares of new land and 3,750 hectares of developed paddy lands in System B lying within the Maduru Oya Basin. The reservoir

Continued on page 10

was to be formed by impounding the water of the Maduru Oya augmented by the Mahaweli water, conveyed from the Minipe anicut into this reservoir. The site selected for the dam is of much historical interest as it was found that on this very site an earthen dam had been constructed several centuries ago. (See Box)

A rockfilled dam was selected as the most economical type of dam suitable for this site, after considering other alternatives such as a concrete gravity dam and an earth filled dam. This was the first rockfilled dam to be constructed in Sri Lanka. The main features of the dam are listed in the adjoining box.

Finances

The headworks of the Maduru Oya project were financed by a soft loan from the Government of Canada. The amount of the loan was Canadian $76 million, and free of interest commitment or service charges. The loan is due to be paid in 80 semi-annual instalments commencing on March 31, 1990, and ending on September 30th 2029. This loan was for the foreign component of the project; while the local costs of the project were met by the Government of Sri Lanka.

Consultancy Services

Initial site investigation and preparation of plans, designs and tender documents were done by the Central Engineering Consultancy Bureau (CECB). Further Canadian aid was provided by the Canadian International Development Agency (CIDA) the organisation of the Canadian government responsible for monitoring the project and disbursement of the funds. CIDA made provisions for a grant and the engineering consultants, Crippen International Limited, who were responsible for development of the construction drawings and for supervision of works on site, in collaboration with the CECB.

THE MADURU OYA DAM — MAIN FEATURES

Dam

The dam is situated 40 km South of Manampitiya and has a maximum height of 41 metres with a crest elevation 101 metres above M. S. L. and length along the crest 1,090 metres. The upstream face has a slope of 1.8 horizontal to 1.0 vertical, while the downstream has slope of 1.5 horizontal to 1.0 vertical.

The storage of Maduru Oya Reservoir is 596 x 10. cu. m (483,730 ac. ft) of which the dead storage is about 15 percent.

Spillway

A 150 metre wide chute free-flow spillway, excavated in rock with a free overflow concrete section about ½ m. high is provided on the Left Bank of the dam, capable of discharging 1,610 cumecs (56,480 cusecs) with a flood lift of 1.9 m.

Sluices

The Right Bank Sluice (4.0 m dia.) has a capacity of 32. 5 cumecs (1,150 cusecs) and the Left Bank sluice (4.5 m dia) a capacity of 56.2 cumecs (1,985 cusecs). Provision was made for one Kaplan turbine unit of about 2.5 MW capacity under the Right Bank sluice and 2 Kaplan units of 2.5 MW each under the Left Bank sluice-under a rated head of 13 metres, and the turbines to be installed under each of these sluices.

Increasing the Storage

It was proposed to raise the dam by 2 metres and increase the storage of Maduru Oya Reservoir by 20 percent (ie. to 710 x 10 cu. m) to be done on the same contract with only about 1½ percent additional quantities. The spillway to be raised by 2 metres by the provision of gates, to get additional head.

There are two saddle dams, one on the left Bank 520 m and 20 m to be of earth fill and rock fill. The saddle dam on the Right Bank of earth 60 m long and 12 m high.

Link Tunnel

The catchment area of Maduru Oya Reservoir is only 453 sq. km. (175 sq. ml.) yielding about 260,000 ac. ft. annually from its own catchment. It is therefore to be augmented by 680,000 ac. ft. per year from Victoria Reservoir through the Minipe Right Bank Canal and Link Tunnel from Ratkinda Reservoir.

The link tunnel is 5.6 km. long (3.5 miles) with a diameter of 4.7 m (14.7 ft.) in the unlined secitons, 4.2 m in the concrete lined sections and 4.4 m in shotcreted sections with a capacity of 34 m^3/sec. The inlet channel leading to the tunnel from Ratkinda is 920 m long 6 m. wide and the outlet channel is 140 m. (4600 ft.) long.

The main parameters of the reservoir dam appurtenant structures and the link tunnel are as follows:

Reservoir	
Catchment Area	453.0 sq. km. (175 sq. miles)
Full supply level	96.0 m (314.98 ft.)
Gross storage upto FSL	596.6×10^6 cu. m (483,470 acre. ft)
Dead storage	111.5×10^6 cu. m (90,350 acre ft.)
Live storage capacity	485.0×10^6 cu. m (393,000 acre ft.)
Dam	
Maximum height above foundation	43.0 m (141.08 ft.)
Crest Elevation	103.0 m MSL (337.93 ft.)
Length along crest	1,008 m (3,306 ft.)
Spillway	
Length of Spillway	150.0 m (492 ft)
Discharge capacity	1600 cumecs (56,460 cusecs)
Outlet Works	
Capacity of Right Irrigation Outlet	28.0 cumecs (988 cusecs)
Irrigation conduit diameter	4.0 m (13.12 ft.)
LB Irrigation Conduit diameter	3.5 m (11.48 ft.)
Link Tunnel	
Length of Link Tunnel	5,728 m (3.58 miles)
Diameter of Link Tunnel	4.5 m (14.7 ft.)
Capacity	34 cumecs (1200 cusecs)

Contract Awards

The Maduru Oya contract for the main civil works was awarded on April 7, 1980 to a Canadian Contractor FAFJ, a Joint VEnture comprising the following Canadian Firms: The Foundation Company of Canada Ltd; (Sponsor); Atlas-Gest International Ltd; Fitzpatrick Construction Ltd; and Janin Construction Ltd.

The contract for Hydro-Mechanical works, Contract No. 3A was awarded to the Hydraulic Engineering Corporation of China in September, 1981 for the supply and installation of Hydro-Mechanical Equipment. The values of contract awarded are shown in the table at right.

Finally the total costs of the Maduru Oya headworks amounted to Canadian $ 100 m. (Foreign) and Local costs Rs. 923 m. making a total of Rs. 2,631m. Canada also provided a sum of Canadian $ 26 m. towards the local costs by means of food aid during 1981/82.

In 1979 the total cost of provision of irrigation facilities, including infrastructure requirements such as roads, community centres, storage facilities etc. was estimated to amount to Rs. 2,400 million. On this basis, the total cost of headworks was expected to be about Rs. 1,150 million with about 40 percent being the cost of the dam only. Nearly two thirds of this cost was required in foreign exchange.

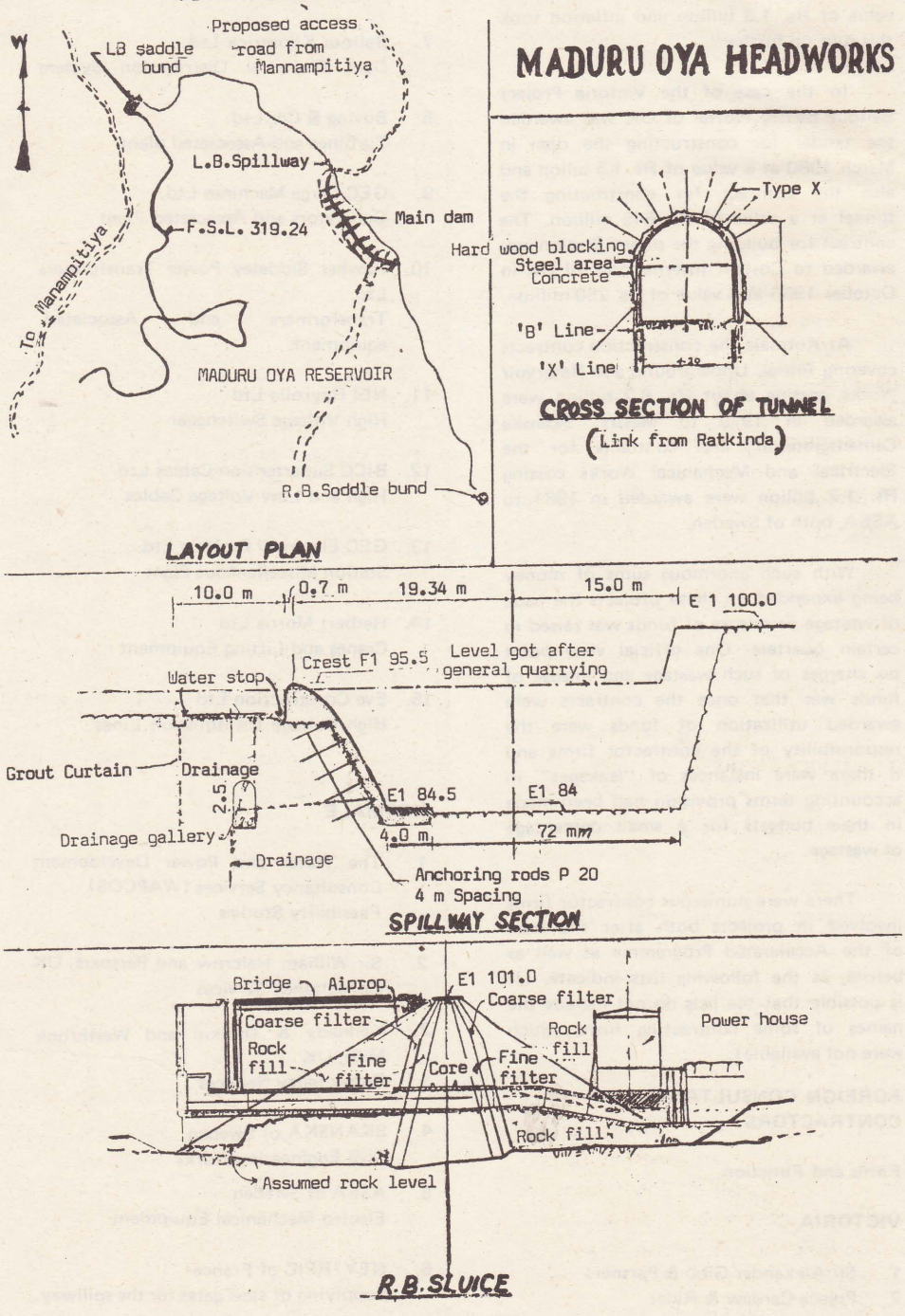
Meanwhile, according to the "Mahaweli Programme – Review of Progress 1980" the construction programme for the project was scheduled to cover a period of 3 years commencing immediately after the preliminaries were completed in 1979. Construction operations on the dam were to be concentrated in the years 1980 - 81 ending with the final closure works in 1982. According to this schedule the installation of electro-mechanical equipment was to be carried out during the last two years of construction and the testing of the equipment to be completed by January 1983. But there arose delays and a lag in the scheduled programme.

The contract was awarded only

Continued on page 13

	Local Rs.	Foreign Rs.	Total Rs.
Contract No. 2	235,031,981	849,369,671	1,084,401,652
Contract No. 4	53,834,927	200,141,600	253,976,527
Contract No. 3A	2,164,500	10,791,429	21,955,929
	291,031,408	1,069,302,700	1,360,334,108

(Conversion Rate Used: 1C$ = 13.25; 1 US$ = Rs. 21.00)



FOREIGN CONTRACTORS

Nearly 70 percent of the funding on the headworks was coming in through foreign sources and in terms of the conditions of the foreign assistance received on the Mahaweli Project the contractors were generally from the country which provided the funds. The level of funding and inflow of funds had never occured before on so large a scale on any other project in Sri Lanka's history. In the case of Maduru Oya Project, for instance, the consortium of four Canadian firms was awarded contracts in April 1980 to the value of Rs. 1.3 billion and inflation took this sum up further.

In the case of the Victoria Project Balfour Beatty Nuttal of UK was awarded the tender for constructing the dam in March 1980 at a value of Rs. 1.5 billon and also the contract for constructing the tunnel at a value of Rs. 645 million. The contract for building the power Station was awarded to Costain International of UK in October 1980 at a value of Rs. 250 million.

At Kotmale the construction contracts covering Initial, Underground and Reservoir Works costing about Rs. 6.2 billion were awarded in 1979 to Messrs. Skanska Cementgjuteriet; and contracts for the Electrical and Mechanical Works costing Rs. 1.2 billion were awarded in 1981 to ASEA, both of Sweden.

With such enormous sums of money being expended on these projects the issue of wastage or misuse of funds was raised in certain quarters One official view point on charges of such wastage and misuse of funds was that once the contracts were awarded utilization of funds were the responsibility of the contractor firms and if there were instances of "leakages", in accounting terms provision had been made in their budgets for a small percentage of wastage.

There were numerous contractor firms involved in projects both after the start of the Accelerated Programme as well as before, as the following lists indicate. (It is possible that the lists do not include the names of some contracting firms, which were not available).

FOREIGN CONSULTANTS AND CONTRACTORS

Firms and Function

VICTORIA

1. Sir Alexander Gibb & Partners
2. Preece Cardew & Rider
3. Hydraulics Research Station
4. Balfour Beatty Nuttal Joint (Comprising Balfour Beatty Construction Ltd. & Edmund Nuttal Ltd.)

Consulting Engineers in association with Specialised advice from Main civil contractors for Dam and Tunnel

5. Costain International Ltd.
   Power Station
6. Whessoe Boving Joint Venture (Comprising Whessoe Heavy Engineering Ltd., Boving & Co. Ltd.)
   Hydraulic Equipment
7. Balfour Kilpatrick Ltd.
   Dam Electrical Distribution System
8. Boving & Co. Ltd.
   Turbines and Associated plant
9. GEC Large Machines Ltd.
   Generators and Associated Plant
10. Hawker Siddeley Power Transformers Ltd.
    Transformers and Associated equipment.
11. NEI Reyrolle Ltd
    High Voltage Switchgear
12. BICC Supertension Cables Ltd
    High and Low Voltage Cables
13. GEC Electrical Projects Ltd
    Station Miscellaneous Plant
14. Herbert Morris Ltd
    Cranes and Lifting Equipment
15. Eve Construction Ltd
    High Voltage Transmission Lines

KOTMALE

1. The Water and Power Development Consultancy Services (WAPCOS)
   Feasibility Studies
2. Sir William Halcrow and Partners, UK
   Consultancy Services
3. Kennedy & Donkin and Westbrook Mills, UK
   Consultancy Services
4. SKANSKA of Sweden
   Civil Engineering Works
5. ASEA of Sweden
   Electro Mechanical Equipment
6. NEY/RPIC of France
   Supplying of steel gates for the spillway.

RANDENIGALA

1. Joint-venture Randenigala M/s. Salzgitter Agrarund Electrowatt
   Feasibility Studies
2. Kreditanstalt fur Wideraufban – 'KFW'
   Dam Construction
3. Joint Venture of M/s Dyckerheff and Widman, Bilfinger and Berger and Alfred Kunz, of West Germany Joint Venture
   Randenigala Civil Contractors
4. Marchinenfabrik Augsburg-Nueraberg A.G. (M.A.N.) of west Germany
   Randenigala Hydromechanical Contractors
5. Brown Boveri and CIE Aktiengesellschaft (BBC) of West Germany
   Randenigala Electrical Equipment Contractors

MADURU-OYA

1. Crippen International Ltd
   Canadian Consultants
2. The Foundation Company of Canada Ltd., Atlas-Gest, International Ltd., Fitzpatrick Construction Ltd & Janin Construction Ltd. Joint Venture
   Dam Construction
3. ACRES
   Consultants' (Maduru Oya Dam and System B)
4. SOGREAH
   French Consultants (Maduru Oya Dam design)
5. Hydraulic Engineering Corporation of China (HECC)
   Manufacture of all hydro-mechanical works for Maduru Oya project.

DOWNSTREAM DEVELOPMENT

1. Snowy Mountains Engineering Corporation, Australia
   Construction and upgrading of 134 kilometres of raodway in Systems B & C.
2. Tippets-Abbett-McCarthy-Stration (TAMS) of USA
   Environmental assessment study and plan of action in System B & C.
3. Vianini Italy
   Contractor The R. B. Transbasin Channel, Minipe.
4. Hazama Gumi Toda & C. ITOH of Japan (Joint Venture)

Contractor — R. B. Transbasin, Channel No. 2 Ratkinda.

5. Nippon Koel Jec & Chue Koihatsu, Corporation Japan
Consultants (Moragaha Kanda Feasibility Report)

6. NEDECO — The Netherlands
Consultants — (Implementation Strategy of the Accelerated Mahaweli Programme)

7. SOIL Mechanics Ltd. of UK
Consultants (Special Geological Survey)

8. Zachry - Diltingham USA. (Construction of Left Bank Main Canal)

9. Louis Berger International Inc. USA.

in April 1980 for the construction of the three dams, namely, the main dam, one on the left Bank and one on the Right Bank. A revised implementation schedule required completion of the link tunnel by April 1983 to allow transfer of Mahaweli water to the reservoir. The impounding of the reservoir commenced on October 12, 1982 with closure of the dry-season diversion conduit; and the main dam and spillway were completed in 1983. A review by the Consultants Crippen International Ltd., indicated that the contractor attributed delays in the schedule to the late award of the contract which caused a loss of construction time during the non-monsoon season.

Expatriate personnel working in a project site

Crippen pointed out that even specific contracts such as the award of the Electrical Mechanical Contract fell behind schedule which would have had the effect of delaying power house construction. Due to such delays initially, virtually no permanent work could be undertaken at this stage and the contractor felt that as a result the full 1980 construction season was lost.

Initial Problems

In a project of this magnitude, where uneven resources had to be mobilised on so large a scale within a limited time span, delays spawned. The consultants on the Maduru Oya Project drew attention to several factors that according to them caused delays in the early stages, and it was some of these same factors that affected the other projects as well, in the initial stages. Apart from the late award of contracts, delays in establishing schedules, bonding requirements and mobilization of advance payments; there were also problems such as non-availability of local equipment, delays in arrival of construction equipment from offshore, lack of adequate spare parts, unpredictable ocean freight shipments, and lack of experienced operators despite the salary incentives offered. In the case of the Maduru Oya Project there were instances where due to lack of services or delays in providing these services, expatriate personnel had to be deployed on construction work other than site construction. But despite such initial problems the contractor succeeded in completing the project on schedule as a result of an intensive effort together with the support of a dedicated staff and good weather conditions. Though the project started late, with the relatively dry 1980/81 monsoon the contractor was able to deploy his forces very efficiently during early 1981 on cofferdam construction and recover a substantial portion of time lost in 1980.

Another problem faced by this project and some of the other headworks projects was that of delays in raising the required financial resources which was aggravated by general inflationary trends and an escalation in costs.

Thus, in 1981 although aid commitments had increased substantially in support of Sri Lanka's development strategy high inflation and a large and steady deterioration in the terms of trade had made them inadequate. The result was that large financing gaps emerged on many development projects, which in turn caused strong budgetary pressures and a heavy current account deficit in the balance of payments. Sri Lanka had even to resort to non-concessional finance on a significant scale to help to cover these budgetary and balance of payment gaps. On the Mahaweli Programme, however, the initial underestimate of costs and subsequent unexpectedly high price escalation resulted in a heavy increase in total costs. This resulted in large financing gaps on the headworks. In order to finance the increased local costs, without resorting to inflationary finance, the government had no alternative but to cut down on other public investments. The policy of not introducing new projects initiated around this time continued into mid 1980's.

The consultants reporting on the Maduru Oya project drew attention to the escalation of costs in this specific instance. The rapid rate of increase in cost escalation for the Sri Lanka rupee part of the project was of major concern during the first 18 months of the project. Between 1981/82 costs had gone up an estimated 122 percent and this made budget projections difficult. However, by the end of 1983 the rate of escalation of costs slowed down

somewhat; by then Sri Lanka's rupee portion of the project cost had increased by 155 percent and the Canadian $ portion by 25 percent relative to tendered prices. The end result was that total escalation payments to complete the work were Rs. 364 million and Canadian $ 10.5 million. When these figures were applied to the non escalated costs the total, including escalation, were Rs. 650.9 million and Canadian $ 92.9 million in a project where the total cost was Rs. 2,482 million or Canadian $ 127.3 million.

Implementation Schedule

The planned schedule for the Maduru Oya project, developed in 1979 called for the dam to be complete so as to detain the waters of the 1982 monsoon in the reservoir. Following award of the main civil contract in mid 1980 the Canadian Contractor employed a work force of about 100 expatriates and 2,500 Sri Lankans, working two shifts six days per week, and with approximately $ 25 million worth of heavy equipment to achieve this target.

The hydro-mechanical contract was awarded in October 1981. Working to a tight erection schedule, the HECC erection team, comprising 45 Chinese nationals achieved closure of the intake gates in October only 12 months after award of this contract. This critical activity allowed impounding of the reservoir to commence as scheduled.

All work was completed by July 1983.

Infra-Structure

The Maduru Oya Reservoir site is situated in a jungle far away from habitations. The nearest town is Polonnaruwa, which is about 64.4 km (40 miles) away. The remoteness of the site proved a challenge both to the Mahaweli Authority and the contractors, particularly in providing the required infra-structure to undertake the construction of this project.

The infra-structure required the provision of the following:

* Over 35 miles of access roads, most of it paved, at an approximate cost of Rs. 30 million.
* A complete town site for about 200 Canadians, including families, and some 250 Sri Lankan staff on the banks of Pimburettawa tank. Attractive staff bungalows and accommodation, a large recreation centre and school and medical facilities were set up at this townsite. Nearby was the labour camp accommodating the 2,500 workers on the project.
* The required electric power supply for construction and domestic purposes was provided by the Ceylon Electricity Board (CEB) from power lines extended from Mahiyangana and Polonnaruwa. Full standby emergency diesel generator power supply was also provided.
* The Ceylon Petroleum Corporation (CPC) constructed a special refuelling station at Welikanda to cater to the needs of this project. This depot has a storage capacity of 250,000 litres (50,000 gallons) dieseline and 22,500 litres (5,000 gallons) of petrol.
* A water supply scheme for the construction staff and workers was also constructed; the purified water for this purpose being supplied from the Pimburettewa tank.

Downstream Irrigation Development

Water from the Maduru Oya reservoir will irrigate areas in System B through its Left Bank (LB) and Right (RB). Work on the Left Bank Main Canal and its branch and distributory canals commenced after work was completed on the main dam and reservoir. The construction of the main and branch canals was divided into 2 phases: under the first phase, about 60 km. (37.3 miles) of the main and branch canals were due to be constructed. The second phase comprises about 80 km (49.7 miles) of the main and branch canals.

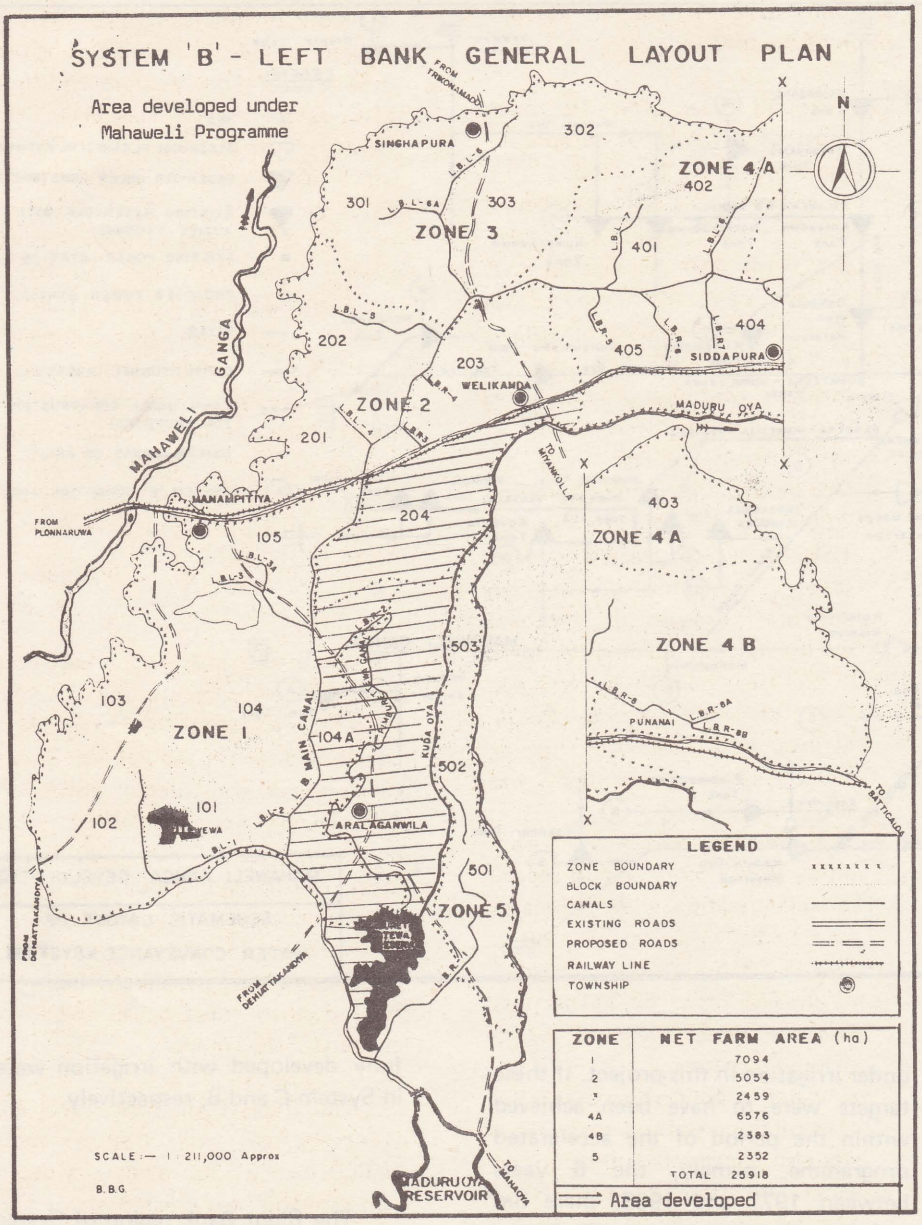
Work on this canal was given on contract to Messrs. Zachry-Dillingham, an American Joint-Venture and those portions of the Left Bank Main Canal serving blocks 501 and 502 in Zone 5, which total 1,500 ha. (3,600 acres) were completed by 1984. Construction of the main and branch canals serving blocks 101, 102 and 103 in Zone 1, totalling about 3,000 ha. (8,400 acres) were also completed. Distributory and field canals were also built to provide irrigation facilities in Blocks 501 and 502 of Zone 5, and a further 3,500 ha. (8,400 acres) in Z Zone I blocks 101, 102 and 103 were programmed for completion for Maha 1984.

All these canals in the Left Bank area will be concrete lined. Under phase 1(a), about 25 km of Main canals and about 35 km of Branch canals were constructed, this work commencing in July 1982 while under Phase 1(b) about 30 km of Main canals and about 50 km of Branch canals were being constructed. All work on this contract is expected to be completed by March 1986. The total cost of these canals would be nearly US$ 100 million.

The Right Bank Main canal and Branch canals will irrigate about 14,000 ha. (35,000 acres). A detention reservoir was created at the confluence of Nagolla, De & Kaduinne Elas at what is called the NDK Dam and the RB main canal to it from the Maduru Oya RB Sluice, 2.3 km in length was constructed. Work on the rest of the RB main canal and Branches were due to be given out on contract and work due to start in 1985.

The Main Conveyance System which has been completed to feed the Mahaweli waters into these new areas in Systems B & C comprises:

(a) The new Minipe Anicut and the Minipe RB Transbasin canal, about 31 km in length.



(b) Twin service reservoirs at Ulhitiya-Ratkinda with a combined spill-way.

(c) 10.90 km Ulhitiya Left Bank Main Canal feeding Zone 2 of System C.

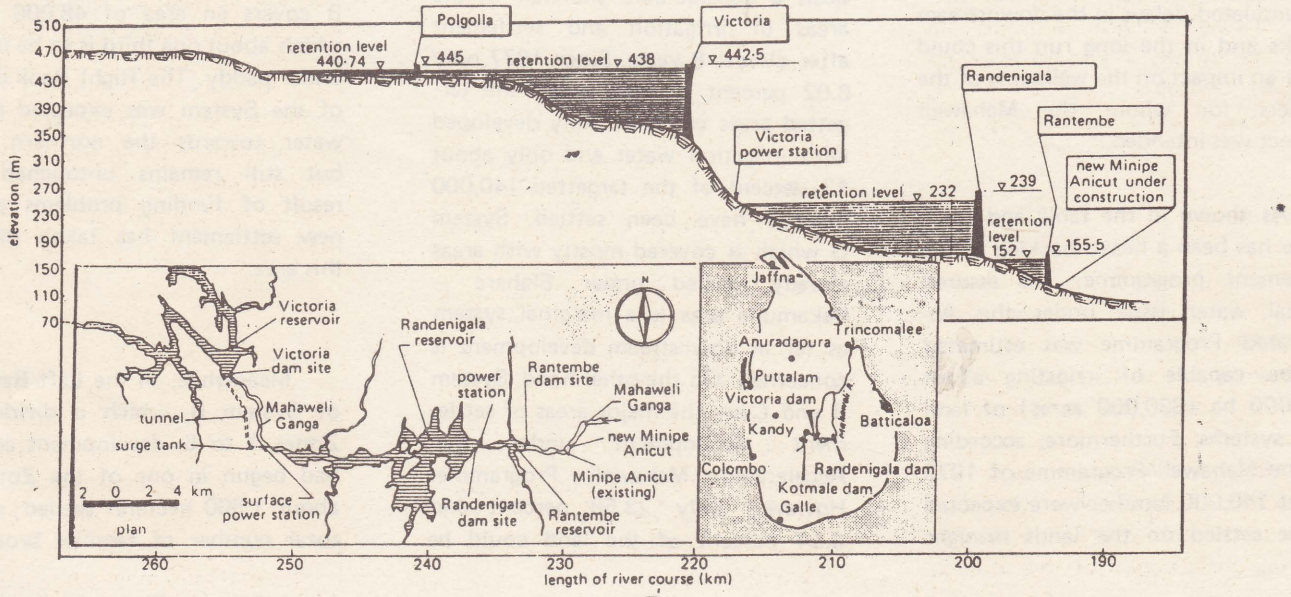
(d) 17.35 km Ratnkinda Right Bank main canal No. 2 feeding Zones 3 to 6 of System C, (under construction).

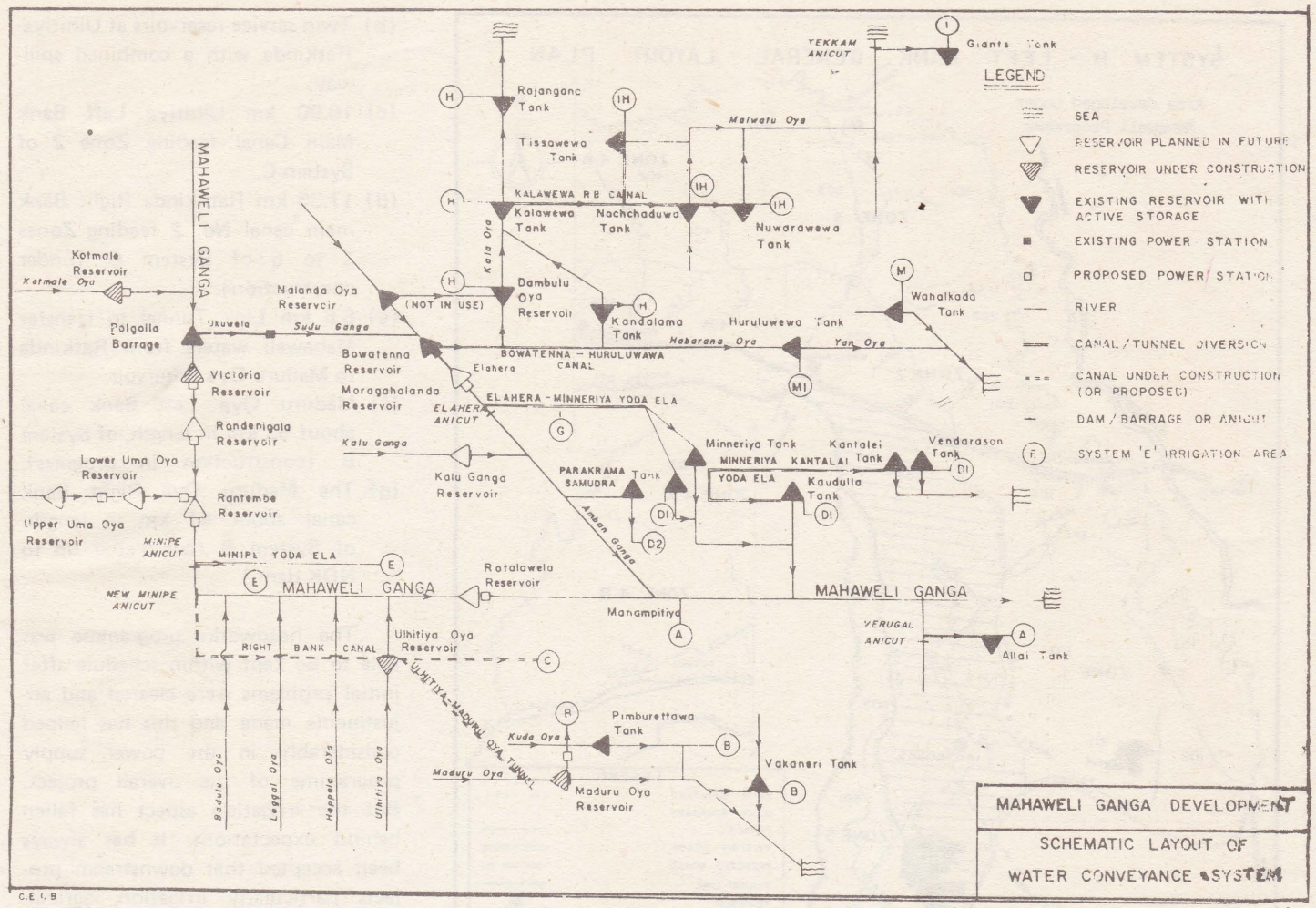
(e) 5.6 km Link Tunnel to transfer Mahaweli waters from Ratkinda to Maduru Oya Reservoir.

(f) Maduru Oya Left Bank canal about 53 km in length, of System B (construction in progress).

(g) The Maduru Oya Right Bank canal about 41 km in length, of System B (completed up to NDK dam.)

The headworks programme was able to be kept within schedule after initial problems were cleared and adjustments made and this has helped considerably in the power supply programme of the overall project. But the irrigation aspect has fallen behind expectations. It has always been accepted that downstream projects particularly irrigation, agriculture, and settlements are as important as the headworks since the major objectives of the Accelerated Programme such as the increase of food production, saving of foreign exchange





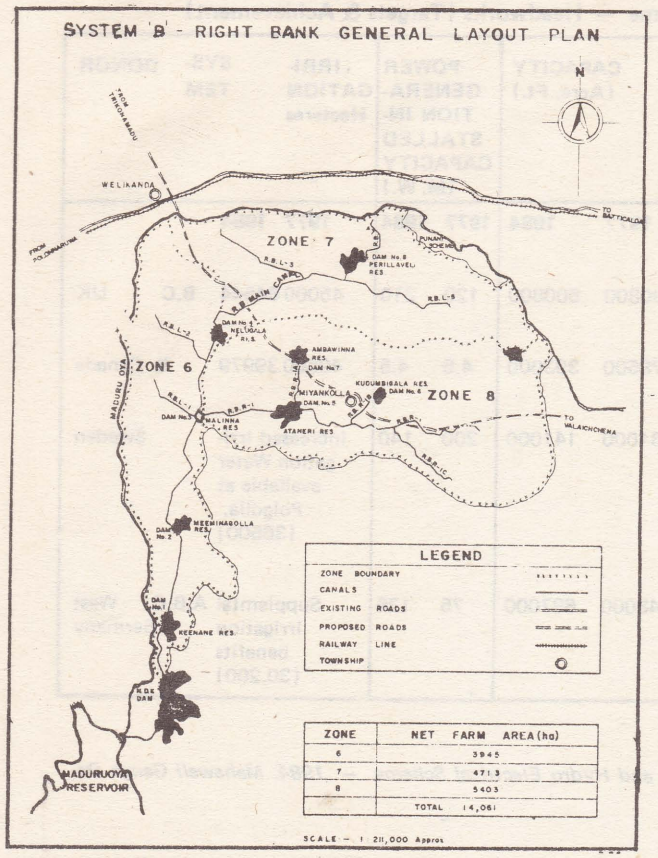
expenditure, and employment generation could not be achieved without the full development of the downstream projects. The late start and delays in construction at different stages of the project have resulted in accumulated delays in the downstream works and in the long run this could have an impact on the wellbeing of the settlers for whom the Mahaweli Project was intended.

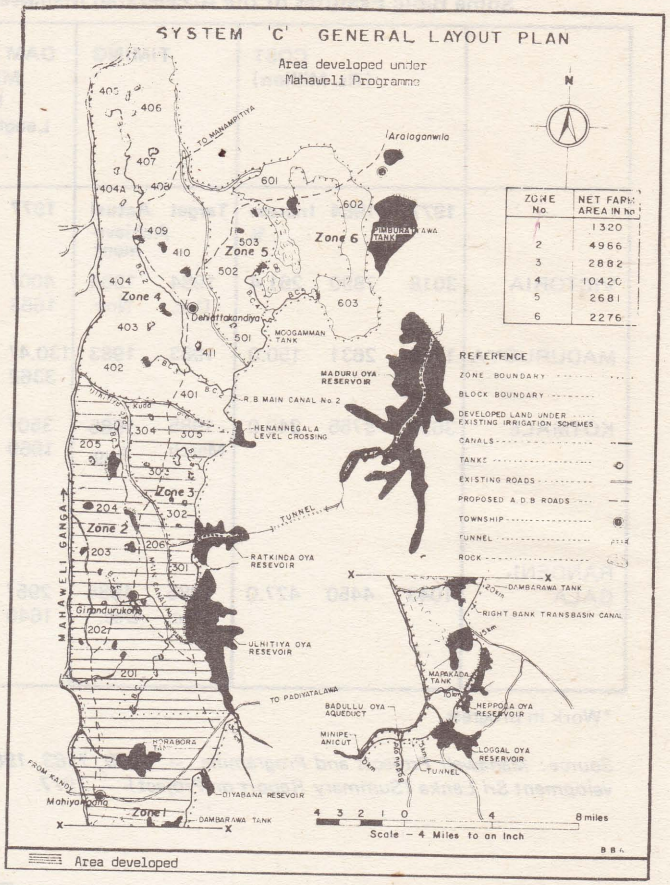
As shown in the table and maps there has been a heavy backlog in the settlement programme. The assured annual water issue under the Accelerated Programme was estimated to be capable of irrigating about 131,000 ha (330,000 acres) of land in 5 systems. Furthermore, according to the Mahaweli Programme of 1979 about 140,000 families were expected to be settled on the lands brought under irrigation in this project. If these targets were to have been achieved within the period of the accelerated programme, namely, the 6 years between 1977 and 1983, there has been a considerable shortfall in the areas of irrigation and settlement after almost 8 years. Since 1977 only 6.02 percent of land under the targetted areas could be fully developed with irrigation water and only about 13 percent of the targetted 140,000 families have been settled. System G which is covered mostly with areas already settled under Elahera – Bakamuna area is a marginal system as far as downstream development is concerned. On the other hand, System B and C are the major areas of settlement development under the Accelerated Mahaweli Programme. However, only 23.58 percent and 3.54 percent of the land could be fully developed with irrigation water in System C and B, respectively.

The Right Bank region of System B covers an area of 48,000 ha. of which about one third is to be brought under paddy. The Right Bank channel of the System was expected to take water towards the northern region but still remains untouched as a result of funding problems and no new settlement has taken place in this area.

Meanwhile, in the Left Bank area of System B, which is divided into Zones 1 to 5, development activities had begun in one of the Zones and about 1,500 hectares settled; and the total number of families brought in

BRINGING MAHAWELI WATERS TO SYSTEM "B" AND "C"



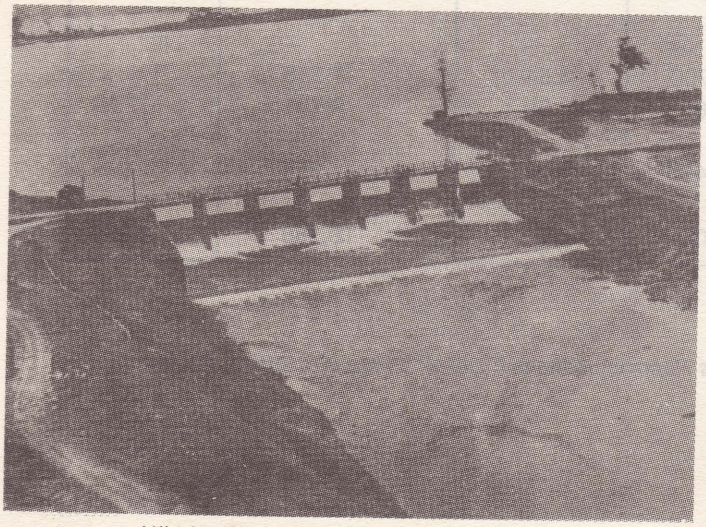


was 7,515. As seen in the map it is only part of Zone 1 in System B that has been developed while Zones 2, 3, 4, 5 and part of 1 are awaiting development.

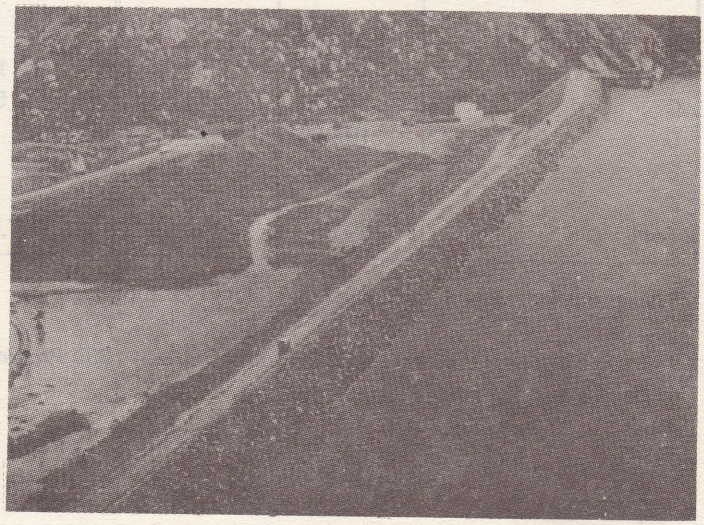
System C comprises about 66,000 hectares and here Zones 1, 2 and 3 have been developed, while Zones 4, 5 and 6 are awaiting development. With increasing incidence of terrorist activities in these areas there could be a serious threat from this quarter to further progress on downstream development and settlement within the Mahaweli Project.

By early August work at several sites in System 'B' and 'C' had come to a standstill, with construction of farmer houses and minor canals halted in the Welikanda, Sinhapura, Sevanapitiya and Katuwanwila areas. Despite the threats construction work on the canal intended to carry water from Maduru Oya to Poonani was continuing with difficulty.

(A further discussion of Downstream Development in these areas irrigated by the Mahaweli waters is contained on pages 34 — 37).



Ulhitiya Oya spilling over following recent rain's



Maduru Oya and Reservoir

TABLE 2

Some Basic Features of the Accelerated Mahaweli Programme — Headworks (Targets & Achievement)

	COST (Rs. Million)			TIMING		DAM PARAMETERS Height/ Length (Ft.)		CAPACITY (Acre. Ft.)		POWER GENERATION INSTALLED CAPACITY (M. W.)		IRRIGATION Hectares		SYSTEM	DONOR
	1977	1984	Increse %	Target	Actual Achievement	1977	1984	1977	1984	1977	1984	1977	1984		
VICTORIA	3018	7890	261.4	1984 Dec.	1984 Nov.	400/ 1663	400/ 1663	590800	500800	120	210	45000	64544	B,C	UK
MADURUOYA	1758	2631	150.0	1983	1983	130.4/ 3362	130/ 3307	378500	393000	4.5	4.5	49500	39979	B	Canada
KOTMALE	3650	8755	240.0	1985 March	1985 Aug.	350/ 1969	262.4/ 1969	331000	141000	200	140	Increased Irrigation Water available at Polgolla. (36500)			Sweden
RANDENIGALA	1043	4450	427.0	1985 Dec.	1985 Dec.*	295/ 1640	308/ 1590	648000	697000	75	126	Supplemtal Irrigation benefits (30,200)		A,B,C	West Germany

*Work in progress.

Source: Mahaweli Projects and Programme — 1979, 1983, 1984. Victoria and Hydro Electrical Scheme — 1984. Mahaweli Ganga Development Sri Lanka (Summary Report on Project) — 1977.

Table 3

Accelerated Mahaweli Programme — Targets and Achievements of Downstream Development and Settlement (Hectares)

	Target of Accelerated Programme between 1977 — 1983			Achievements as at 31. 05. 1985.		
(1) Systems	(2) Irrigatable Land	(3) Number of families to be settled	(4) Total Area developed with irrigation	(5) 4 as a % of 2	(6) Total number of families settled	(7) 6 as a % of 3
A	36,000		—	—	—	
B	48,000		1,700	3.54	7,515	
C	24,000	140,000	5,658	23.58	9,781	12.96
D	19,000		—	—	—	
E	2,800		450	16.07	854	
Total	129,800	140,000*	7,808*	6.02	18,150	12.96

*Area fully developed upto level of irrigated farming.

Source: Mahaweli Projects and Programme 1979 — 1984 Progress Reports, Mahaweli Development Authority, Department of Census and Statistics Studies.

VICTORIA PROJECT

Victoria Multipurpose Project was the second of the four large multi-purpose projects to be completed, when its dam and hydro electric scheme were formally inaugurated in April this year. This project is one of the key elements in the Mahaweli Master Plan. Following a study in 1962 of the resources of the Mahaweli Ganga basin by the Hunting Survey Corporation of Canada, a Master Plan for the development of the basin's hydro electric and irrigation resources was completed by the FAO and UNDP in 1968. This Plan identified the Victoria Falls site as a prime location for a dam and a storage reservoir. A feasibility study commissioned in May 1978 and completed early in 1979 formulated a project to harness the Mahaweli's resources for both power and irrigation. This project included :

* the Victoria Dam (122 metre or 400 ft high concrete arch and measuring 507 metres (or 1,663 ft along the crest)

* a power tunnel (5.7 kilometre long : 6.2 metre diametre)

* a power station (three 70 MW machines—initially with provision for 3 further 70 MW machines)

* the diversion works at Minipe, a transbasin canal, additional storage reservoirs and development of irrigated agriculture in the area known as System C.

The study also considered closely the effect of other existing and planned storage and diversion schemes on the Mahaweli Ganga. Several specialised foreign consultants, assisted by Sri Lanka's Central Engineering Consultancy Bureau, established the feasibility of the Victoria Project and demonstrated :

* The economic advantages of exploiting the maximum feasible height of the dam permitted by existing upstream river control works.

* The optimum power station tail-water level to correspond to that of the next projected reservoir downstream at Randenigala.

* The requirement to design the Victoria Project as a staged development so that the installed capacity could be doubled in the future when the power station operates at a period of peak power demand.

* The need to build an extensive transmission system at the higher voltage level of 220 KV to transmit power from the various Mahaweli Developments to the load centres.

Of the various alternative types of dam considered, it was decided that a concrete arch dam would be the most economic solution if the geological conditions were suitable.

Exploratory work, under the direction of the Irrigation Department, provided evidence of the rock and geological conditions in the gorge. This was supplemented by a concentrated programme of drilling, testing and geophysical investigations for which a British specialist contractor was appointed. Using equipment flown to Sri Lanka the contractor, Soil Mechanics Ltd., carried out the major part of these supplementary invetigations covering the tunnel line and the power station site as well as the site of the dam in the last quarter of 1978. By the beginning of 1979, it was possible to confirm the feasibility of an arch dam for the site. The dam location selected was between the Hulu ganga confluence and the Victoria rapids across the Mahaweli. The catchment area at this dam site is 1,869 sq.km. (730 sq.miles).

By the middle of 1980 the main Civil Engineering and Mechanical Plant contracts had been awarded and work was started on the dam. By early 1981, however, initial work was falling behind schedule with "soft rock" problems halting work. (sea box)

Construction of the 122 metre high arch was divided into 36 blocks and there were reports that under the first of these unsuitable material had been found. These reports stated that the sites overlying geneiss contained a limestone intrusion, and at the interface of these a thin laminated layer of weather black rock had been discovered. This material varied in nature but was found to be fundamentally a hornblende schist containing, among other minerals, biotite. Apparently, layers were flaking off when softer samples of the rock were squeezed by hand.

"The material is not suitable to found a dam on" Dr Paul Back, a partner of the dam's consulting engineer Sri Alexander Gibb & Partners told a correspondent of the British journal " New Civil Engineer", early in 1981. "It is being removed and replaced with dental concrete" he said. At this stage contractors required several weeks for additional excavations and started concreting only by March 1981, thus putting back work by 6 to 8 weeks although this delay was covered up as work progressed.

The river diversion through the temporary opening in the dam was affected on target in January 1982; and the handing over of the spillway blocks to enable the contractors erecting the automatic radial gates toproceed with this work was achieved on schedule in November 1982.

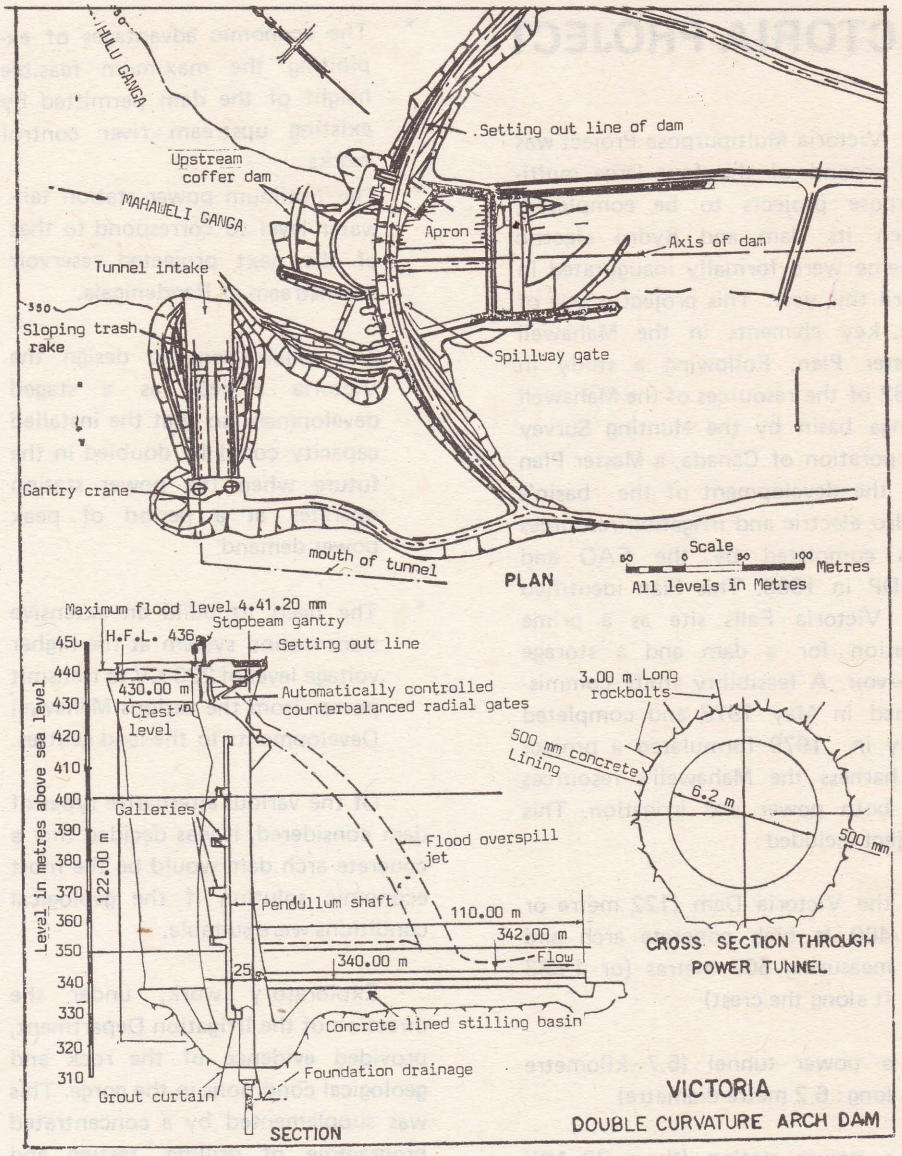
A feature of the automatic radial gates is that they do not have to depend on the power supply to be opened; they open when predetermined water levels are reached and electric power is required only to close the gates. Eight radial gates, 12.5 metres (41 ft), wide and 6.5 metres (21 ft) were provided. The gates over-spill with an effective width of

100 metres (328 ft) is capable of passing a discharge of 8,200 cu. metres per second (289,542 cusecs) under a head of 11 metres (36 ft). Two low level sluices have been provided in order to make provision for drawing down the reservoir at initial filling or at any subsequent time and also to pass silt which may accumulate immediately above the dam. Other features are a circular tunnel 6 metres diameter (19.7 ft) and concrete lined throughout, and a 21 metre (69 ft) diametre concrete lined chamber for dealing with surges in the tunnel.

Work on the tunnel, power station, hydraulic equipment contracts and on the electrical and mechanical plant contracts proceeded concurrently with the work on the dam. The rate of concrete placing reached record levels during 1983 using modern methods of mixing and placing concrete, such as travellers on high lines above the dam called "BLONDINS". More than 50 percent of the total volume of dam concrete was placed in that year and this enabled the impounding of the dam on target in early April, 1984.

The initial setbacks to the construction programme were due to delays in mobilising the necessary funds and setting up the construction facilites for the dam. Next, in the foundation excavation work unfavourable geological conditions resulted in additional delays. Measures were therefore taken to accelerate the construction programme by providing incentives in order that the contractors could bring in extra resources.

The excavation of the tunnel was interrupted due to poor geological conditions in a portion of the tunnel roof which collapsed. (see box) The re-alignment of the tunnel trace in this reach was necessary and also a relocation of the surge chamber to avoid the bad patch. The final "hole through" was achieved on November 17, 1982. Concrete lining of the tunnel was slow during the first half



of 1983 but it gathered momentum thereafter. The grouting work on the tunnel was ready for filling by July 12, 1984.

The main contractor Balfour Beatty Nuttall faced more than one set-back on their work at Victoria and there were fears in 1981 whether they could pull through successfully. The journal "New Civil Engineer" in an issue of December 1981, drew attention to the plant nightmare that racked Victoria tunnel. This journal reported that the joint venture BBN was battling to recover from a series of difficulties "which had both jeopardised timely completion of the huge Victoria dam project in central Sri Lanka and called the contractor's abilities into question. From the start, BBN knew that the programme for the double curvature arch dam—financed largely by a £ 100 million grant from Britain's Overseas Development Agency—was extremely tight. A host of early problems, mainly with mobilisation of plant and labour, led to a state early in 1981 when many people doubted whether recovery was possible."

"Management changes and a colossal effort stemmed the rot, and the contractor met its first target date—river diversion by mid January 1982. This was achieved despite dis-

Victoria Tunnel Fault

Rock on the southern outfall drive had proved remarkably good. Trouble had been expected where the line crossed a limestone bed, but none occurred.

Then last summer, with about 600 m of the drive completed on a steady 1 in 20 uphill slope through quartz gneiss, a probe hole driven ahead of the face detected water under this high pressure. Grout was pumped in, but after advancing a further few metres yet more grout had to be injected. In all 233 tons of grout were used to form a shell round the tunnel.

Tunnelling was resumed, but after firing the second round on August 1, 1981, the tunnel boss saw water to flow from the face. He immediately withdrew his men and equipment, just in time to avert a catastrophe as tonnes of rock and water broke down onto the area where they had been working, the water cascading through the tunnel and out of the portal.

Returning to the face, 24 m of tunnel were found to be full of broken material washed out of an unforseen fault. When the flow eventually subsided after four or five days, some 100,000m^3 of water were reckoned to have flooded out.

Removal of the debris began, while shotcrete, mesh and extra rock bolts were applied to the roof: but as fast as material was removed, more poured in from the collapsed roof ahead. To form a safe base from which to advance, seven steel arch ribs were erected at 1m spacing and concreted, while falls continued.

From cored holes drilled ahead, the fault was found to be 5 m wide with broken rock either side and several secondary faults, crossing the tunnel line at 45 degrees and laying back over the tunnel at 70 degrees dip. As more material was cleared, a "chimney" could be seen on the left shoulder some 10m ahead of the last rib. Its height was subsequently estimated at around 50m though understandably no one was going to take a close look.

Fragments of rock "as big as a desk" continued to tumble down. Twice, further major falls filled the face, with muck back throughout the ribbed length.

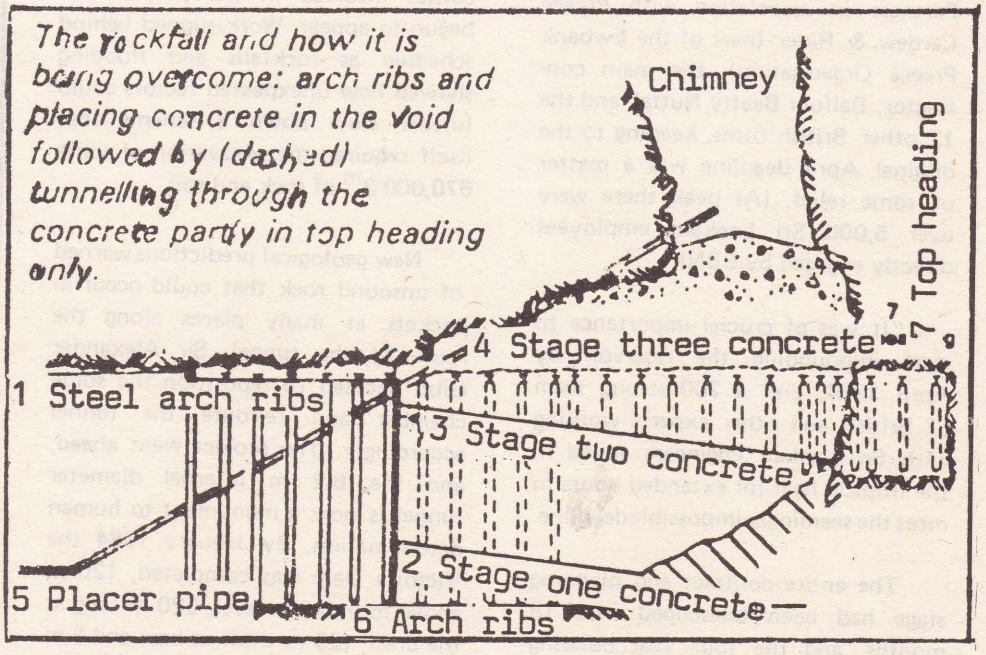
Careful mucking out with a Hymac backacter working from the protection of the ribs removed around 3500 m^3 and allowed a bulkhead to be erected against the front of the ribs. The tunnel was then concreted to the shoulders. The crown and part of the cavity above were then filled by blowing concrete through a placer pipe inserted through a 25mm hole drilled from behind the ribs.

With full protection at last installed, BBN started to tunnel through the concrete. The first 5m were advanced by very careful blasting-three or four times per metre—and installing five more arch ribs. The contractor then opened a 3m by 3m top heading to investigate the ground ahead, mucking out with a small Eimco 622 tracked overloader originally brought in for work on the dam. The crown member of the heading's protective steelwork will eventually be incorporated into the full size ribs as the tunnel is opened out, so avoiding any unnecessary ground disturbance.

When NCE visited the site earlier this month the heading had penetrated the fault beyond the concrete. The face was timbered up, with removal of only one board at a time to allow mining by hand of the soft "gung" behind. Meanwhile, a series of probe holes were providing drainage to prevent any further water-pressure build-up. By the end of the week, 13 ribs had been completed and the heading was entering better ground.

However, problems are far from over. Probes indicate a 60m length of bad faulting and BBN estimates that, even with no further setbacks, it will be mid March next year before the bad section is cleared. And no one knows what further faults may be encountered on the remaining sections.

Source: New Civil Engineer, 17/24 December 1981.



covery of unexpected limestone cavities under the dam foundation and downstream apron, and a flood which inundated the foundation works in September 1981.

Next, the 5.8 km long power tunnel was causing concern. Delayed mobilisation and poor driving rates had already put progress well behind programme when a major rockfall brought the outfall drive to a complete halt. The tunnels could only be completed on time with a vast injection of cash."

These problems were finally overcome and on April 7, 1984 Sri Lanka's President closed the Victoria dam in a formal impounding ceremony which began the accumulation of water that built up to a 43.8 km reservoir storing 688m. One of the foreign engineers associated with the project commenting on this situation stated "the first flow of water through the 5.8 km tunnel engineered by Balfour Beatty Nuttal, to Sri Lanka's largest power station, built by Costain International, was the practical demonstration most needed to still local doubts about the scheme's feasibility. For the consulting engineers, Sir Alexander Gibb & Partners in association with Preece Cardew & Rider (part of the Ewbank Preece Organisation), the main contractor, Balfour Beatty Nuttal, and the 12 other British firms, keeping to the original April deadline was a matter of some relief. (At peak there were over 5,000 Sri Lankans employees directly engaged by BBN).

"It was of crucial importance to start impounding the reservoir by April 1984, and a 200 strong team of British and other experts working with Sri Lankan engineers toiled in the tropical heat for extended hours to meet the seemingly impossible deadline.

The entire contract and planning stage had been telescoped into 18 months, and the four year building time was short for a project of such scale.

Changing emphasis in Mahaweli Programme

The Manager of the Victoria project and Deputy General Manager Central Engineering Consultancy Bureau, Mr. H. B. Jayasekera commenting on the change of emphasis in the project and economic banefits stated that the original programme was drawn up by the UNDP in the 1960's and the UNDP/FAO Master Plan of 1968 included several projects with the emphasis on irrigation and agriculture.

From the outset the project had the advantage of the latest methods: The use of advanced computerised technology showed that the double curvature arch design was the cheapest of all alternatives, and geophysical tests confirmed the site's suitability. Models at Wallingford, near Oxford, Britain's leading hydrology centre, established the feasibility of the plan to divert the Mahaweli.

Balfour Beatty Nuttall found new ways of saving on contract time. Yet by early in 1982, with work well under way, the full scale of the difficulties involved in the project had begun to appear. Work slipped behind schedule as rockfalls and flooding showed how unexpected factors could further slow down a scheme that itself required the excavation of some 670,000 3^m of rock and soil.

New geological predictions warned of unsound rock that could occur in pockets at many places along the route of the tunnel. Sir Alexander Gibb decided ro reposition the surge chamber and re-route the tunnel accordingly. The project went ahead, and the 6.2 m internal diameter tunnel is now a monument to human determination. By January 1984 the Victoria Dam was completed, 120 m above foundation level, 520 m long at the crest, (25 m thick at base and 6 m at the crest), containing 610,000 3^m of concrete. The creation of this huge artefact in only five years from

The oil crisis of the early 1970's and the dramatic rise in oil prices changed the whole situation. Oil prices increased almost ten fold and emphasis naturally had to be shifted from irrigation to hydropower. In the original programme power was a small component compared to irrigation, but after the oil price hike power was given priority. The decision at this stage was an economic one to tap maximum energy in the shortest possible time. This was one reason why water couldn't have been taken to the NCP. The decision was that there should be minimum of diversion and therefore only the minimum requirements at Kalawewa and Elahera were met.

The original programme was phased over a 30 year period. The NEDECO consultants were called in around 1977 and they identified as priority the 4 headworks and systems A,B, & C. All the required power, agriculture and irrigation potential was to be tapped from these projects. Thereafter the original concept of maximum diversion was changed to minimum diversion. The result was that the earlier programme of 70—80 reservoirs to irrigate 900,000 acres was considerably reduced.

Moragahakanda was being looked into by the Japanese, with a view to financing the project but it was never taken up after NEDECO submitted their report.

At Victoria the emphasis was changed to provide 210 MW and provision made to provide a further 210 MW to meet peak power demands of the future. The total cost of supplying energy was estimated at Rs. 8,000 mn of which the cost of Victoria was Rs. 3,000 m; Kotmale Rs. 3,000 mn; and Maduru Oya Rs. 2,000 mn.

In the case of Victoria, as in the other headworks, the decision to shift the emphasis to power was based on strict economic criteria. It has been estimated that the power benefits alone would help to recover the cost of construction; while the other benefits such as agriculture, fisheries and irrigation became national assets."

its planning stage has made the world take notice."

There were considerable setbacks during the mobilisation and initial construction period. The Engineer's evaluation of these delays totalled to an extension of the contract completion period by 4 months in Dam and Tunnel contracts. However, swift action was taken to correct this situation and a substantial additional bonus was built into the contract for completion of the construction within the original contract period.

The principal benefits from the Victoria project were hydropower production and providing a regulated source of water for irrigation. (see box)

Earlier all available flows in the Mahaweli Ganga were diverted at Polgolla, with a maximum capacity of 57 cubic metres per second (2,000 cusecs) for generation of hydro-power at Ukuwela. When the Victoria reservoir was completed the diversions at Polgolla were limited to the minimum requirements for irrigation only, thereby reducing the total hydro-power production at Ukuwela. This loss is compensated by extra energy generation from the higher heads available at Victoria and Randenigala. Studies reveal that about 600 GWH (600 million units) of firm energy can be generated while about 200 GWH of secondary energy can be added to the grid. Meanwhile, the regulated releases from Victoria (even without Randenigala reservoir) are capable of meeting the irrigation requirements for lands in Systems B and C where about 70,000 hectares (175,00 acres) of new lands can be developed.

At the price of oil prevailing in 1979, and basing the benefits from hydro-power production in comparison with energy produced by oil, the internal rate of return had been computed to be over 12 percent. Though the inflationary trends pushed up the investment cost of the Victoria project, the increase in price of oil was at a higher rate, and this made the project more attractive.

Under the estimate of the Master Plan of 1968 the cost of Victoria Multi-Purpose Project was estimated at Rs. 740 million of which Rs. 155 million was allocated to irrigation and the balance to power. The foreign component of the cost was Rs. 350 million and the local component Rs. 390 million. The kind flow of foreign funds (£ 145 million) for the accelerated Mahaweli Program is given below:

- First release United Kingdom £ 4.75 million (for the feasibility studies, consultation and the supervision of cosntruction).
- Outright Grant £ 100 million to meet of the costs of civil engineering headworks.
- Additional grant £ 13 million for further expenditure on civil engineering headworks.
- Additional grant £ 7.25 million for further expediture on civil engineering.
- Commercial credit £ 20 million for electro mechanical equipment.

The total cost of Victoria Headworks is £ 145 million (foreign) and Rs. 2,511 million (local), making a total cost of Rs. 7,890 million. Balfour Beatty Nuttal were awarded the contracts for construction of both the dam and tunnel at a cost of Rs. 1,468 million for the dam and Rs. 645 million for the tunnel; while the Power House building contract, at a cost of Rs. 251 million, was awarded to Constain International Ltd.

The international journal "World Water" in its issue of May 1984 also made reference to this situation as follows: "Britian has given $ 160M in aid towards dam construction costs – a figure which includes a top-up grant given last year to help meet

In 1981 costs on the Victoria Project were estimated at Rs. 7,456 million on the following basis:

	Rs. M.n
Dam	2,338
Tunnel	939
Power Station	259
Hydraulic Equipment	613
Physical Contingencies	512
Bonus on Civil Contract	60
Electro-mechanical Contracts	871
Cables	63
Transmission Lines	102
Consultancy	432
Digane Township	104
Work by other Agencies	328
Overall Contingencies and Parity Changes	835
	7,456

inflation costs. In total UK contractors have walked away with contracts worth about $ 250M on this tied-aid project with BBN taking the lion's share with a $ 180M dam contract".

There is no doubt that the value of expenditure increased considerably since 1978, just as much as the value of the revenue or returns on this investment were also expected to have moved up proportionately. An estimate published in the British journal 'New Scientist', earlier this year (see para) states that inflation pushed up on the Victoria Project from an estimated £ 700 million in 1977 to £ 2,000 million in 1983 (an almost 3 fold increase), while foreign grants have stayed more or less at the same level. This journal argues, however, that the cost to Sri Lanka has increased from an earlier estimate of £ 300 million to £ 1,600 million today. It also maintains that three countries, Britian Sweden and West Germany, are the most substantial foreign investors, and "the financial help provided by these countries will eventually return through payments to contractors and consultants. Britian, for example, has given £ 160 million in aid, and British companies have signed contracts to the value of £ 250 million." (See Box)

ADAM'S TEARS TURNED TO ELECTRICITY

Fabian Acker (Editor, International Water Power and Dam Construction)

When Adam was expelled from Eden, he went to Sri Lanka (so the story goes) and, sitting on a mountain now called Adam's peak, he cried bitter tears which were so large they became the island's rivers. Today some of those tears are backing up behind the Victoria dam, which started filling in April last year. It is part of one of the most ambitious water developments in Asia, the Accelerated Mahaweli Development Programme. The Programme is now on schedule, and will be completed within the seven years planned for it. But it has gone ahead against the advice of the United Nation Development Programme and the Food and Agriculture Organisation both of which recommended 30 years, and in the face of bitter objections from the opposition of the Sri Lanka Freedom Party. The project has become a political as well as an engineering challenge and the government's stand under the leadership of President Junius Jayewardene, will soon be tested.

The programme's first turbine will start turning in July, and virgin or underwatered lands are already being farmed. So far, the benefits cannot yet match costs. When the scheme was started in 1970, the government obtained foreign aid of about $ 400 million, with the US, Sweden, Canada, West Germany, Saudi Arabia and Britain among others providing loans or grants. In 1977 Jayewardene's government, formed by the Conservative United National Party, was elected. It put forward plans for greatly accelerating the scheme with only moderate training. But while inflation brought up the costs from an estimated $ 700 million in 1977 to $ 2000 million in 1983, foreign grants stayed more or less at the same level. The cost to Sri Lanka, therefore, has increased from an earlier estimate of $300 million to $ 1600 million today.

With a considerable amount of foreign expertise, Sri Lanka began to exploit the potential of the Mahaweli River at an increasing rate. The complex of dams, hydropower stations and irrigation networks now being built should nearly double the country's installed capacity from 562 megawatts to 1070 megawatts. The river rises in the hills in the centre of Sri Lanka and discharges after a run of 330 kilometres near the port of Trincomalee; its major tributary, the Kotmale Oya, is also part of the development. New irrigation canals will bring 127,000 hectares of virgin land under cultivation.

Three countries, Britain, Sweden and West Germany, are the most substantial foreign investors. The British have just finished construction of the 128-metre high Victoria dam, and in July will install the first of three 70 megawatt turbines. Swedish contractors are working on the Kotmale dam (87 metres high) and the Germans are building the 91 metre Randenigala dam. The financial help provided by these countries will eventually return through payments to contractors and consultants. Britain, for example, has given $ 160 million in aid, and British companies have signed contracts to the value of $ 250 million.

The development of the river and its tributaries is based on an elaborate system of channels, holding reservoirs, dams and hydropower stations. Nevertheless, a part from the electrical component and the large areas involved, it is probably no more complex than systems constructed during the third century AD and continuously refined over many centuries, In one case, after engineers had chosen the best site for a dam with the benefit of reliable instruments and extensive rainfall data, it was found on investigation that one was built there 1500 years ago. It had gradually fallen into disuse and been forgotten.

The intention is to use the drop or head of the Mahaweli to generate hydroelectric power at a number of sites along its length. With its main tributary, the Kotmale Oya, there is a head of 2130 metres, which can be exploited before it reaches the sea. As water is released through the turbines or spillways of one dam, it is directed to the reservoir of another one further downstream, and so on, so that the river's water may pass through six or seven reservoirs before reaching the sea.

In some cases the water is intended only for irrigation, in others, for both irrigation and power. Having one system for both needs is cheaper than building one system for each. But it can lead to problems in a developing country such as Sri Lanka where industrial needs for energy may conflict with agricultural requirements for irrigation water. The first big dam on the river (that is, the one furtherest from the sea) is the 87 metre-high Kotmale, which is being funded in part by the Swedish International Development Agency. It is being built of rock and stone quarried locally, and, at the end of 1984, material was being placed at the rate of 100,000 cubic metres a week, which is equivalent to 1500 lorry loads every day. This rate of working, which is unusually intense, is necessary to meet the revised deadlines of the Accelerated Programme. In the original plan, the dam would have been 25 metres higher, thus increasing the reservoir's capacity by 150 percent; however, the extra height can be added at a later date if necessary.

The reservoir will help to smooth fluctuations between dry and wet seasons the water will flow to a powerhouse along a tunnel seven kilometres long, and from there into an existing reservoir, the Polgolla on the Mahaweli. This arrangement illustrates the complex balance between power and irrigation. The Polgolla feeds two other power stations one which shares an irrigation reservoir. This means that the rate at which energy is generate at the first power station, Kotmale, will affect the flow of irrigation water into another reservoir downstream. When irrigation needs are high, water will have to be released from the main reservoir, even electricity is not required. Then, when electricity is needed and the year is dry, there may not be enough water in the main reservoir to generate it.

Geology, as usual, has also provided its crop of problems. No exploratory tests can give complete assusrance of the rock's quality where tunnels have to be built, or where the dam's foundations should go. The true nature of the rock may not be discovered until well after construction has started. For example, the 7-kilometre tunnel from the Victoria dam, which will carry water to its power station, has to bend three times to keep within good rock. During constuction a fall of weak rock set the programme back by many months which was only made up by round-the-clock working. The position of the Kotmale dam had to be moved by about 200 metres after potential faults were discovered at the planned site.

With the commisioning of the first turbine at Victoria, the British have at least put most of their problems behind them. But Sri Lanka itself still has many to resolve. There is the question of finance and how seriously the economy may be skewed to pay for the project. There is the question of ecology, which even the best-engineered schemes must affect. There is the question of the thousands of families who must be resettled and brought back into productive life.

All of these questions must be answered satisfactorily if Sri Lanka is to reap the benefits of the Mahaweli programme. The biggest question, is, can the country (still under tension from the Tamil problem) sustain itself through the austerities of today in the hope of better times tomorrow?

Source: New Scientist 14 Feb. 1985

KOTMALE — Environment and Earth Structures

Commenting on the possibilities of the danger to the ecology by building the Kotmale dam at its existing site and also on the instability of the geological structure in the area. L. Alexis wrote as follows in an issue of "The Ecologist" in June 1984.

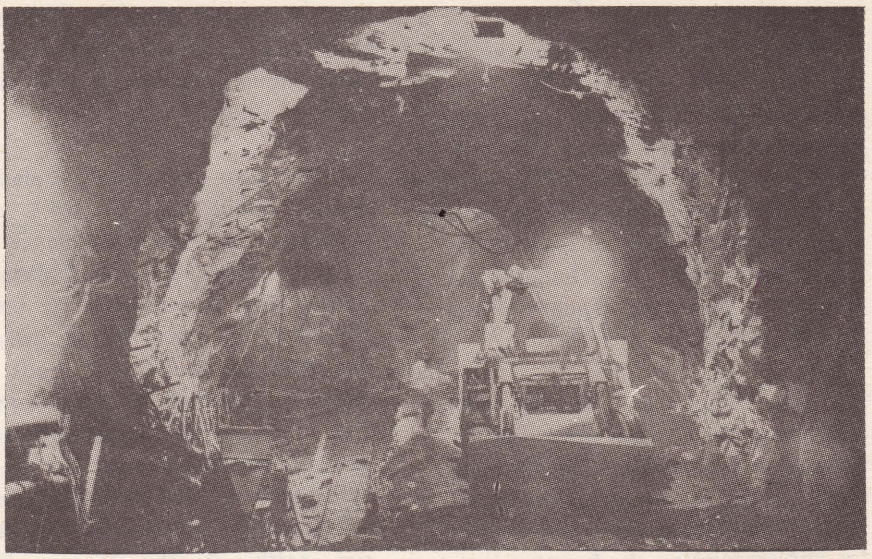
This dam is being constructed by the Swedish construction agency SKANSKA, which was awarded the contract without any competitive bidding.[1] Kotmale dam was going to be completed in 1984. However, after discovering limestone caverns beneath the origianl site, the entire project was moved 200 metres downstream. Now the expected completion date is February 1985.[2]

How a major hydroelectric dam could have been sited in such an unsuitable place is still uncertain. Pat Sadler, the chief resident engineer of the scheme, has said, "There's been a lot of geological studies done on this project in the past, but no one appeared to have co-ordinated the results of them and drawn the appropriate conculsion."[3] As another engineer put it, "The original site was not an obvious choice."[4]

A 1954 report — commissioned in 1947 after heavy rains washed away 200 villages and caused serious landslides in the Kotmale Valley — states:

"In the Kotmale Valley we have a rather unusual combination of geological, structural and topographical features which give rise to a strong tendency towards slope failures. Over these features man has no control . But superimposed on these are a different set of conditions for which man is responsible and which have increased the potentialities for slope falilures inherent in the area. These are in the main: (1) Removal of forest cover on the upper slopes of catchments, and from talus debris at the foot of scarp faces; (2) Inefficient drainage of steep slopes under plantation; (3) Ponding of water for paddy cultivation on terraces above unstable slopes."[5]

A 1979 report on the geology of the Kotmale area also warned against earth slides. The report states, "An investigation of the stability of the sides of the reservoir is necessary, in particular to the dam on the left bank. Slides of overburden and weathered rock are most likely to occur from the rim of the reservoir, and rock slides are a possibility. Slides are most likely to occur after heavy rains, and also after a sudden drawdown.[6]



Travelling through the Dumbara rocks for construction on the Kotmale project

A 1981 report details similar problems at the newly chosen site;

"The panel identified a variety of adverse geological features such as unstable soil and rock masses in the reservoir area, solutioned and cavernous limestone in the reservoir and below the dam site and deep and irregular weathering of rock or faults. The potential problems considered were reservoir landslides, leakage of water either into adjacent valleys or beneath the dam, sliding stability of the dam under varying conditions and the potential for piping around the foundation."[7]

In June of 1982, a major earthslip occured after heavy rains, threatening the entire project.8 After several tense days when the earthslips was monitored round-the -clock, some measures (including rock bolting and excavation) were taken to reduce the danger of the slide. Should an earthslip occur after the reservoir is filled — an ever present possibility — the consequences would be severe.

Construction 'mishaps' such as those described above have played havoc with the costs of the project. According to a 1981 World Bank Report on Sri Lanka, "Of all the projects in the Mahaweli Programme the cost of the Kotmale project has risen the most since 1979". The report attributes this "to the delay in implementation caused by the shifting of the dam site and continuing design changes."[9]

A survey undertaken in 1979 to determine the effect of the dam on those areas which would be submerged, revelaed that 1,410 acres of paddy would be flooded along with 3,744 acres of highlands; that 13,000 people would have to be moved; and that Rs. 29 million would have to be paid out in cash compensation for damage to private property other than land.[10]

The NEDECO Report estimated that the economic losses due to inundation would be 20 million rupees. However, the inundation of archaelogical and of natural reserves has not been valued separately.[11]

(Source: The Ecologist, Vol. 14, No. 5 - 6, 1984).

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2. "Consulting Engineer" November p. 28.
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4. Ibid, p. 29.
5. R. Maclagan Gorrie, Report on Kotmale Landslips and adjoining River Catchments, Ceylon: Government Press Sept. 1954, p. 12.
6. Ministry of Mahaweli Development, "Mahaweli Projects and Programme" 1979, p. 6.
7. Ministry of Mahaweli Development, Mahaweli Porjects and Programme, Colombo: Information Service Ministry of Land Development, 1981, p. 25.
8. "Sun Newspaper" 21 June 1982.
9. "Island" Newspaper, 4 March 1982.
10. Ministry of Mahaweli Development, "Mahaweli Projects and Programme", 1979, p. 7.
11. NEDECO, Annex P vol. 5, p. 13.

KOTMALE PROJECT

The third of the Headworks in the Mahaweli Development Programme was commissioned at the end of August this year. The previous Headworks namely, the Victoria Project, was commissioned only two months earlier, while the next of the four Headworks, the Randenigala Project, is due for commissioning by mid 1986.

Both Victoria and Kotmale projects have had their own special features and challenges. The Kotmale Project is the uppermost of the major Headworks Projects being undertaken for implementation. Its function is to develop the hydro electric potential of a major tributary of the Mahaweli Ganga, namely the Kotmale Oya. It will also increase the amount of irrigation water available at Polgolla through regulation of flows in the Kotmale Oya. Preliminary studies were carried out on the Kotmale Project by United States Operation Mission for the U.S.A.I.D., followed by the UNDP/FAO – Irrigation Department joint "Survey" of the Land & Water Resources of the Mahaweli Ganga. Futher studies were carried out between 1973 and 1976 and in 1978 a team of British consultants together with the Central Engineering Consultancy Bureau prepared the final designs and provided Consultancy Services for the execution of the project.

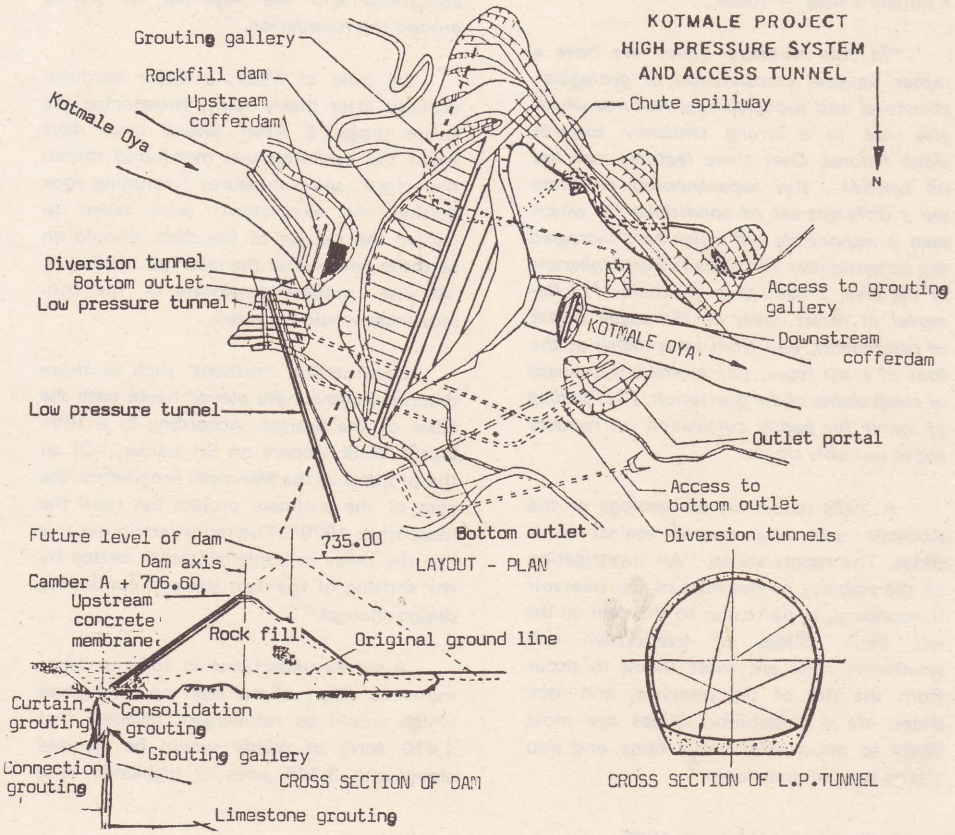
The First stage of the Kotmale dam was to impound the waters of the Kotmale Oya and form a reservoir of a 174 million cu. meters (141,000 acre-feet) capacity. The water stored in the reservoir is to be used for generation of electricity in an underground power plant after which the water will be led into the Mahaweli Ganga. A system of tunnels about 6.6 km (4.1 mls) in length convey the water from the reservoir to the underground and power house and machine chamber. In the machine chamber there are at present two 70 megawatt Vertical Francis turbines coupled to generators to provide electricity. A third similar machine is due to be added in 1986.

The dam site is at Kadadora located about 6.6 km (4.1 mls) upstream of the confluence of Kotmale Oya with the Mahaweli Ganga. The power house is underground and situated in the belly of the Atabage Mountain, about 6.4 km (4 mls) downstream of the Kotmale Oya – Mahaweli Ganga confluence. The project headworks lie on the right bank of the Mahaweli Ganga and is partly in the Kandy district and partly in the Nuwara Eliya district.

This is the first big dam on the river (ie. the one furthest up the river) and it may be observed that the intention of constructing of a dam at this point is to use the drop or head of the Mahaweli to generate hydro electric power at a number of sites along its length. The total extent together with the main tributary, the Kotmale Oya, that can be exploited before it reaches the sea is a head of 2,130 metres. The water released through the turbines or spillways of one dam will be directed to another one downstream and similarly passed through six or seven reservoirs before reaching the sea. In some cases the water would be extended for irrigation while in others it is for both irrigation and power and there are possibilities of a conflict in these interests and priorities between agriculture and industry. "New Scientist" raising this issue stated that having one system for both needs is cheaper than building one system for each. But it can lead to problems in a developing country such as Sri Lanka where industrial needs for energy may conflict with agricultural requirements for irrigation water. (See Box)

Geology

The Kotmale area has had a history of earthslips, landslides and other geological disturbances. Owing to this it was necessary to exercise



great care in the design of the various features of the project. (See Box). Soon after construction work was awarded and during the early stages of the dam construction, when excavations of the riverbed were in progress, the presence of a limestone layer underneath the bed rock below the dam and extending up to the reservoir, was discovered. These and other adverse features led to thorough investigation of all the geological features in order to see whether there are practical problems like landslides above the reservoir leakage of water through the dam foundation into adjoining valleys, earth tremors, etc. which could seriously affect the stability of the project. In mid 1982 a major earthslip was recorded at Kotmale and was the cause of serious concern and action for prevention of further slips (See Box).

A special panel of internationally renowned experts was appointed by the Ministry of Mahaweli Development, to examine all the geological data availabe, carry our further investigations and advise on the adequacy of the design proposed by the Consultants. The panel identified a variety of adverse geological features, such as unstable soils and rock masses in the reservoir area, solutioned and cavernous limestone in the reservoir bed and below the dam site, deep and irregular weathering of rock associated with strong lineaments representing faults. The panel considered that the problems could be handled within reasonable costs by adjusting the design in progress at that time, with some additions and modifications. Most of the recommendations have been incorporated into the design and the panels suggestions, regarding further investigations and monitoring of various aspects have been carried out or are being continued. These unforseen features resulted in a change of the dam's site and size and the delays increased the cost of the dam appreciably.

Project Features

The original proposal was to have the dam at a crest elevation of 735m (2411 ft.). However on the recommendation of a Panel of Experts the dam had to be shifted about 300m (980 feet) downstream in order to locate it on better foundations. Due to this change from the original site it had become necessary to build the dam to a lower crest elevation of 706.5m (2317 feet) in order to limit the expenditure to be kept within the available resources. According to one engineering viewpoint, however, this scheme increases the risk of flooding and damage by lowering the level of the cofferdam.

Organisation of Construction

In accordance with the agreement between the Governments of Sri Lanka and Sweden, made in 1978, the civil engineering of the project was organized through a series of negotiated contracts with the Swedish construction firm Skanska Cement guteriet.

Earthslips at Kotmale

The recent occurence of a major earthslip at the Kotmale power project worksite has brought this unique multi-purpose reservoir under the Mahaweli Accelerated Programme back into focus of public attention.

The landslide which occured over the slope of the newly erected tunnel intakes at Kadadora above the proposed crest level of 706 metres of the dam was the first major occurence of this nature at the Kotmale power project worksite since the commencement of the project in 1979.

We were assured by the CECB chief Dr. A. N. S. Kulasinghe that the landslide had been checked and practically arrested. From a slippage of about 20 millimetres a day the rate of slippage was now around 1 to 2 milimetres a day. 'You can't stop these things immediately or you could create other problems', he said. However, the remedial measures that were being implemented would check even this fractional movement completely.

The rains had caused the earth to slip by about 600 feet and large cracks on the earth were still visible. The earth that had fallen had slid dangerously close to the mouth of the tunnel. The first signs of mass movement we were told, had been observed on June 1, 1982 when cracks appeared beside the dam deviation road above the slope which had been excavated.

These cracks had been kept under observation and immediate instructions had been given to diversify all water entering the unstable slope from adjacent water courses. A rock filling bund erected at the toe of the slip and additional drainage measures at the upper-most elevation point, along with careful monitoring at three levels of the slope had helped to arrest the movement considerably.

Near the dam itself enormous construction machines were helping to drip six-metre long steel rock dowels to the two slabs of rock where movement is still being detected. Around 200 of these dowels will anchor the rocks firmly to the ground and prevent further slipping, we were told. However, the possibility of a major mass movement still exists and all parties on the site are well aware of this and are taking precautionary measures.

On the opposite side as well (area 5) where the Mahakanduru Oya has now been diverted a slip had begun and remedial measures were being taken. Here too we could see rock filling operations in progress and efforts to remove unstable overburden from the top.

Source: The Sunday Observer, July 25, 1982.

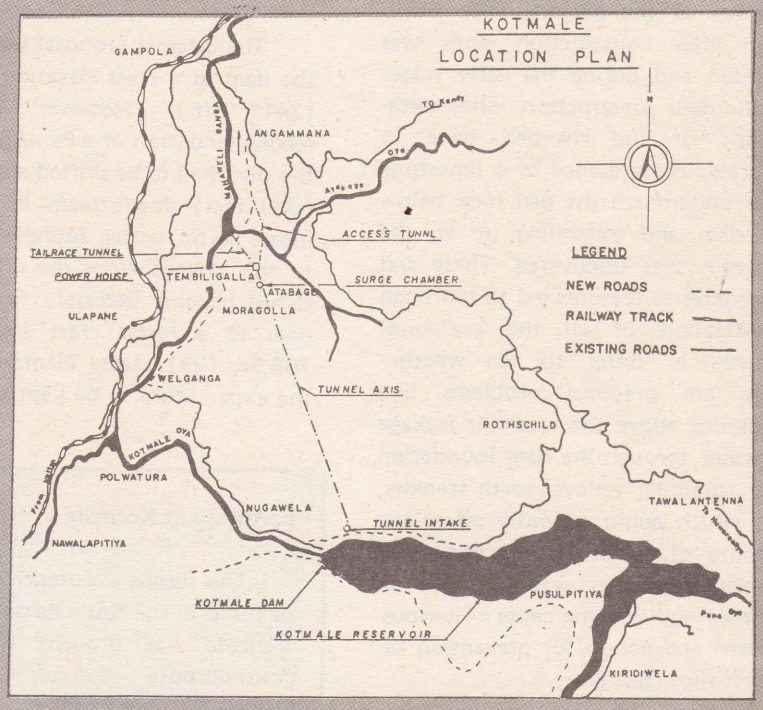
Main Features of Kotmale Project

The Dam

The dam has been constructed out of rockfill obtained from two quarries at the site on either banks above the reservoir levels. The rock had been laid on the cleaned river bed in layers and compacted by heavy machinery, including vibrating rollers. The dam has been made impervious by the construction of a reinforced concrete membrane on the upstream face of the dam. This membrane is of a 300 mm thickness (1. ft.) at the crest and increasing to 474 mm (1.6 ft) at the bed level plinth. The rock underneath the dam has been made impervious by a grout curtain of cement grout injected from the surface. In addition to sealing off the limestone bed under the dam foundation, a grouting tunnel had been constructed beneath the dam and grout had been injected across the limestone layer. In order to commence work on the dam the river had to be diverted. An upstream cofferdam which would not be overtopped by floods up to 1 in 15 year frequency was built and the river water was diverted to flow through two 9.2 m (30 ft.) diameter concrete – lined tunnels excavated in rock on the right bank. These tunnels were capable of discharging a 1 in 100 year flood of 1,700 cumecs (60,000 cusecs). One of the tunnels has now been permanently plugged with concrete (after the constructing of the dam) whilst the other serves as the intake tunnel to the Bottom Outlet. The Bottom Outlet is an emergency outlet to release water from the reservoir and thereby lower its level or as an irrigation by-pass without developing power. Water can be led through the second diversion tunnel which is the bottom outlet into a control chamber provided with valves to discharge upto 90 cumecs (3,200 cusecs) from the reservoir.

Provision for flood discharge is over a gate-controlled chute spillway at the left abutment of the dam. The spillway control structure has 3 radial gates 14m (46 feet) wide by 15 m (49 feet) effective height, that are programmed by computer to open and release flood waters. It has been constructed to discharge a 1 in 1000 year maximum flood of 5500 cumecs (196,000 cusecs) with only 2 of the 3 gates opened. A flip bucket at the lower end of the concrete lined chute will throw the discharge clear of the river banks into the centre of the river bed, to prevent scouring of river banks.

The intake to the tunnel carrying water to the power station is located on the right bank immediately upstream of the dam. At its entrance is a screen which could be raised above the water level for cleaning. About 165 m (540 feet) downstream of the intake is found a bulkhead gate located in a vertical shaft. By lowering this gate the tunnel can be dewatered for inspection of the tunnel.



Tunnel System

The first part of the tunnel system carrying the flow from the reservoir is a 6.4 m (21 feet) equivalent diameter concrete lined horse-shoe shaped low pressure tunnel. This is 6.6 km (4.1 miles) in length upto the upstream surge shaft, which protects the turbines from undue pressure shocks due to flow vairations in the tunnels. The surge shaft is a 15 m (49 feet) diameter concrete – lined vertical shaft constructed directly over the tunnel and connected to it by an orifice. The surge shaft has a gate by means of which the lower portion of the tunnel leading up to the power station can be dewatered. In this area are found the two downstream tunnel construction adits, one of which has been plugged with a steel bulkhead gate which can be opened when the tunnel is empty for inspection. From the upstream surge shaft water is conveyed to the turbines in the power station by a 400 m (1300 feet) near horizontal concrete lined tunnel and a 120 m (390 feet) long circular 5.5 m (18 feet) diameter concrete lined high pressure shaft steeply inclined. The bottom half of the high pressure shaft is steel lined. Near the power station the water is diverted into three pipes of 2.1 m (6.9 feet) diameter that supply the turbines.

Power Station

The power station which houses the electricity generating equipment is an underground cavern 67 m (220 feet) long by 20 m (66 feet) wide by 38 m (125 feet) high. This is the first underground power plant in Sri Lanka. The roof of the cavern is the shape of an arch and the rock is secured in place by rockbolts and shotcrete. The near vertical sides are unlined but rock-bolted for safety. This excavated chamber houses 2 of the 67 Mega Watt generating units driven by vertical Francis Turbines. In 1986 a third similar unit is due to be installed. The chamber houses a part from the generators and turbines a 160 ton overhead travelling crane, 3 turbine inlet valves, drainage and dewatering systems, control boards, an office for maintenance staff and ancilliary equipment for the safe operation of all the machinery installed inside.

Machine Chamber

The main electrical cables from the generators and auxilliary cables are carried upto the switchyard which lies on the surface above the power station cavern through a cable cum ventilation shaft. This is a vertical shaft excavated in rock located towards one end of the machine chamber. It is 8.1 m (26.5 feet) in diameter and 200 m (656 feet) in height. The ventilation of the machine chamber is provided by air forced down ducts provided in this cable shaft. There is a hoist in this shaft for inspection and maintenance of the cables and to provide an emergency exit from the power station.

The first contract signed in August 1979 was the Initial Works Contract for the construction of Engineers' and Contractors' camps, access roads, diversion tunnels, quarry investigations, access tunnel to the underground power station etc. Most of this work was completed by the end of 1982. The next contract signed in December 1979 was for the construction of Underground Works such as the tunnel, the underground power station, the surge shafts, tail race tunnel and ancilliary works. All these works were completed by the end of 1984 except for the lifting arrangement for upstream Surge Shaft gate. The third contract signed in April 1982 was the reservoir works contract in which the main items of work were the cofferdam, concrete faced rockfill dam, spillway, and the bottom outlet.

The contractor was able to complete construction work on the rockfill dam ahead of schedule, and the "topping up" was ceremoniously completed on March 31, 1984. The construction of the upstream membrane commenced in May 1984 and was completed in October 1984. There were delays at the beginning on spillway construction but all work on the contract were completed and the spillway gates kept in the open position at the end of December 1984.

The electro-mechanical features of this project, such as the power plant turbines, generators and ancillary equipment; switchyard equipment such as transformers and switchgear; tunnel and spillway gates; bottom outlet valves and gates were obtained under 9 contracts through another Swedish Contractor ASEA. Most of the equipment are of Swedish manufacture, though ASEA obtained some steel gates from the French manufacturer NEYPRIC and a few items from Switzerland.

The spillway gates measuring 14 m (46 feet) wide by 15 m (49 feet) high are the largest ever to be erected in Sri Lanka. By the end of 1984 most of the electro-mechanical equipment was erected. At the reservoir areas three spillway gates have been erected and are capable of operation. The valves and gates in the Bottom Outlet control chamber and the tunnel intake gate have been erected and are operational. At the Power Station the first generator was due for commissioning in February 1985 and the second from April 1985. The transmission of power from Victoria through the Kotmale switchyard was achieved in September 1984.

New Proposals

Towards the end of 1983 the civil contractor SKANSKA submitted a proposal for the accelerated completion of the reservoir works so that impounding of water could commence in November 1984, four months ahead of the target date. The Government accepted this proposal after which the contractor stepped up progress to achieve this target. The main advantage of the proposal was that early completion of the dam enabled the impounding of the 1984/1985 monsoonal flows for power generation in March 1985. Otherwise by the latter date the flow in the river would have been insufficient. The Mahaweli Authority agreed to pay a bonus of Rs. 10 million per week as an incentive to the contract or for earlier completion, upto a maximum of Rs. 160 million.

The Government decided in 1984 to instal the third generator also at the Kotmale Power Station. The electro-mechanical contractor ASEA submitted a proposal which was accepted by the Government and a firm order was placed for the manufacture and installation of the third machine.

Programme for 1985

Most of the work on the Kotmale project was completed in 1984. The work carried over to 1985 on the civil construction side were the completion of wave-wall and roadway on top of the dam, surfacing of the access roads in the vicinity of the dam and power-station, additional grouting, backfilling to the concrete spillway chute wall and other minor works. The electro-mechanical contractor ASEA had completed erection and testing of generators 1 and 2. At the dam ASEA was completing erection of the 3rd spillway gate and the electrical circuitry so that the spillway gates could be raised or lowered by computer or by push button manual controls.

Employees

The contractors, Skanska and ASEA employed over 200 Swedish

Normal access to the power station is gained from a separate access tunnel 490 m (1650 feet) long which has its entrance portal close to the bridge across the Atabage Oya on the newly constructed access road. There is yet another tunnel from the machine chamber. This is the tailrace tunnel and it conveys water after passing through the turbines to the Mahaweli Ganga. It is 6.4 m (21 feet) in diameter and 635 m (2080 feet) in length. This tunnel is designed to flow full and has a downstream surge chamber to limit pressure shocks due to sudden variations in flow. At the downstream of each turbine draft tube gates are provided to isolate the machines from the tailrace for maintenance purposes.

Switchyard

The power generated by the machines in the underground chamber is transmitted to the national grid through a 220 KV Substation at a switchyard located on the surface above the machine chamber. This switchyard accommodates transformers and switchgear for the generators and the transmission lines to Colombo through Biyagama. The power lines from Victoria are also being routed through this sub-station. The control building housing the power station, control room and offices for the project and the ventilation building housing the ventilation equipment are all located in this switchyard.

SRI LANKA'S KOTMALE HYDRO PROJECT

E. M. Gosschalk *(Sir William Halcow Partners)* Eng. Consultants and A. D. Longman *(Kennedy and Donkin, Westbrook Mills Eng. consultants)*

Geology

The dam and reservoir site are under lain by metamorphic rocks of pre-Cambrian age and comprise gneisses and charnockites with salient limestone beds and minor quartzites. Structurally they form an anti-clinorium plunging to the northwest, whereas the river runs from east to west in the area of the dam site. The dam site itself lies on the southwestern limb of an anticline resulting in the dip of the beds being approximately downstream with a dip angle of about 15°. Major structural features of the area are strong lineaments, either master joints of faults, some of which extend for many kilometres.

Site investigations have been carried out at Kotmale since 1961 with more intensive work in 1979 and 1980. As a result, certain adverse geological characteristics of the dam and reservoir site have been identified as follows:

* unstable soil and rock masses forming the banks of the reservoir and at the project site;
* a thick bed of crystalline limestone underlying the dam site and outcropping in the reservoir, which is a potential cause of leakage from the reservoir;
* the possibility of reservoir-induced seismicity particularly in view of the strong near-vertical master joints and faults in the reservoir areas; and
* the presence of tectonically foliation shears beneath the dam foundations and in the project area generally.

Special investigations were put in hand to examine these adverse geological characteristics. The design of the various project features has been developed to deal with them.

The final proposals, including moving the site of the dam some 200 m downstream were adopted after review of the geological findings and the engineering proposals by an international Panel of experts convened by the Ministry of Mahaweli Development in May 1980.

Dam and Reservoir

The dam is 87 m high above river bed level, and has crest length of 600 m. The crest level of the dam is at an elevation of 706.5 m and it impounds a gross storage volume of 174 x 106 m3 at the top water level of 703 m. The live storage above the minimum operating level at elevation of 664.5 m is 152 x 106 m3. As the height of the dam is somewhat less than the economic height for the site as a result of financial restrictions, provision has been made in the design to raise it at a later date to about 28.5 m.

The dam hhas been constructed of rockfill obtained by quarrying rock at sites above the reservoir level on the left and right banks immediately upstream of the dam site, and is made impervious by a reinforced concrete membrane on its upstream face. It is the first dam of its type in Sri Lanka.

The rock beneath the dam has been made impervious by a grout curtain of cement grout injected from the surface. Silicate grout was also used in the central section where cement grouting did not achieve a satisfactory seal. In addition, to ensure that no leakage occurs through the limestone bed beneath the dam foundations, a grouting tunnel has been driven beneath the river bed and a grout curtain constructed across the limestone bed.

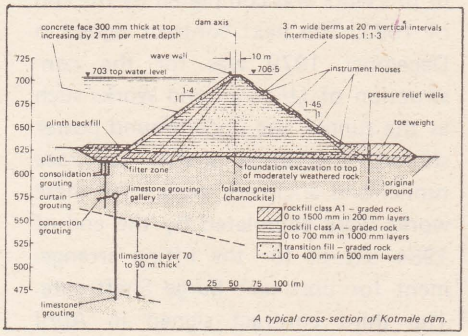
River Diversion

Two 92 m equivalent diameter D-shaped concrete lined tunnels under the dam's right abutment carried the flow of the Kotmale Oya round the dam site during constuction. An upstream cofferdam diverted all floods upto a 1-in-15 year frequency through these tunnels and the upstream part of the main dam was constructed at an early date to divert floods upto a 1-in-100 year frequency before major construction work on the dam fill began.

The Mahakandure Oya, a small left-bank tributary entering the Kotmale Oya immediately upstream of the dam site, was diverted during construction by a 20 m tunnel under the dam's left abutment.

Impounding commenced by the lowering of 70t slip gate to close the intake to the second diversion tunnel. At this time the first diversion tunnel, the Mahakandure Oya diversion and the upstream adit to the low pressure tunnel had to be closed by constructing concrete plugs. Construction of the plug in the second diversion tunnel then bagan. Until the reservoir rose to spillway crest level, the only remaining control was the bottom outlet.

Source: Water Power & Dam Construction March 1985.



A typical cross-section of Kotmale dam.

nationals during the peak construction period. The contractors staff were housed in a well laid out camp comprising 70 houses, a school for young children, club-house with swimming pool, tennis courts and other recreational facilities. The engineers camp which housed the staff of the consultants was built a short distance away and accommodated 18 foreign engineers, 24 Sri Lankan engineers, 20 technical officers and several other grades of staff. The labourers were housed in two camps in the vicinity of the work sites. During the construction period the total employment created was about 4500 men.

Cost Estimates

The estimated cost of construction in the early 1970's was Rs. 1,035 million of which the local component was Rs. 470 million and the balance Rs. 565 the foreign component. The allocation for power was Rs. 665 million and for irrigation Rs. 370 million. This estimate was consider-

We duly acknowledge as the main source for much of the basic data on the Mahaweli Projects the publications of the Ministry of Lands and Land Development and Mahaweli Development, particularly "Mahaweli Projects and Programmes 1980 to 1985".

RANDENIGALA PROJECT

The Randenigala Project is the last of the Major Multipurpose Projects undertaken in the Accelerated Mahaweli Programme. It consists of two dams at Randenigala and Rantembe. Randenigala is due to provide the largest reservoir under the Mahaweli Programme, and is located 6 km (3.5 miles) upstream of Minipe anicut from where the new main Right Bank and the old left Bank canals take oof for irrigation development down-stream. This project is expected to generate about 20 percent of the country's present annual electrical energy requirement and will act as the most important base reservoir for the water management of System C and B and later System A and transbasin areas.

The Project chiefly consists of the construction of a 94 m (308 ft.) high, 458 m (1,590 ft.) rock-fill dam across Mahaweli , creating a reservoir of 860 million cu.m. (697,000 ac. ft.) By July 1985 70 metres of the dam had been completed and there was a further 24 metres to go. The power house on the Left bank immediately down stream of the dam will have an installed capacity of 126 MW. A steel lined 6.2 m (20 ft.) diameter, 270 m (886 ft.) long tunnel through the dam will convey water to the Power House to run the turbines located just below the dam. The gated chute spillway is 48 m (761 ft.) long and is capable of discharging the probable maximum flood of 8085 cumecs (285,500 cusecs).

The irrigation outlet will be through a 9.6 m (31.5 ft.) diameter 375 m (1,230 ft.) long concrete lined tunnel, which along with another similar tunnel is presently used to divert the river during construction of the dam.

Randenigala Civil Contractors (RCC), a joint venture of the three construction firms Dycherhoff & Widermann, Bilfinger & Berger, and Alfred Kunz of the Federal Republic of Germany was awarded the Civil Works contract which is the main component of the project. The Civil Contractor mobilised at site in early September 1982. The site installation works such as access roads, temporary bridges, houses, offices, electricity and water supply were completed in 1983.

By the end of June 1984, rock and soil excavation for Diversion Outlets, Approach Channels, Intake Structures as well as the drilling of the two diversion tunnels and concrete lining of Tunnel No. 1 were completed. Excavation work for Power Intake and Waterways and the Power House and most of the First stage concreting were also done.

Construction work for Power Intake and Waterways, Spillway and Dam Embankment continued upto the end of 1985. All civil works are due to be completed by 1986.

The hydro-mechanical, mechanical and electrical works are being coordinated according to the progress of the civil works and commissioning of the Project is scheduled for mid 1986.

Reservoir Impounding

Randenigala reservoir will have a surface area of 23.5 sq. km. (5,807 acres) but will inundate only 2.8 sq. km. (692 acres) of cultivated land. The population within the reservoir area is only about 2,000 and of them nearly 300 have been re-settled in System C.

-ably revised and by June 1979 the total cost of the headworks was estimated to cost Rs. 6,000 million. Construction costs continued to escalate and by 1982 the new estimate prepared was as follows:

Costs of Headworks – Kotmale

		Estimated Contract Price June 1979	Absolute Contract Price including price variation
		(Rupees Million)	
1. Work done by government agencies (for surveys, rehabilitation, communications, establishment and consultants)		500	800
2. Civil, Works –			
Initial Works	681		
Underground Works	1,214		
Reservoir	2,187	4,082	6,122
3. Hydraulic equipment –			
Tunnel steel linings	46		
Tunnel gates, etc.	56		
Spillway gates	90		
Bottom outlet	75	267	438
4. Generating Plant –			
Power Station	292		
Sub-station	152	444	739
5. Physical contingencies		321	481
TOTAL		5,614	8,580

PROJECT BENEFITS

Irrigation

The Randenigala reservoir will regulate the water release of the Victoria reservoir and will provide supplemental irrigation benefits to Systems A, B and C, with the subsequent development of new Systems in the overall Mahaweli Programme.

Power

The Randenigala power station will generate 428 GWH of firm energy and 100 GWH of secondary energy.

Employment

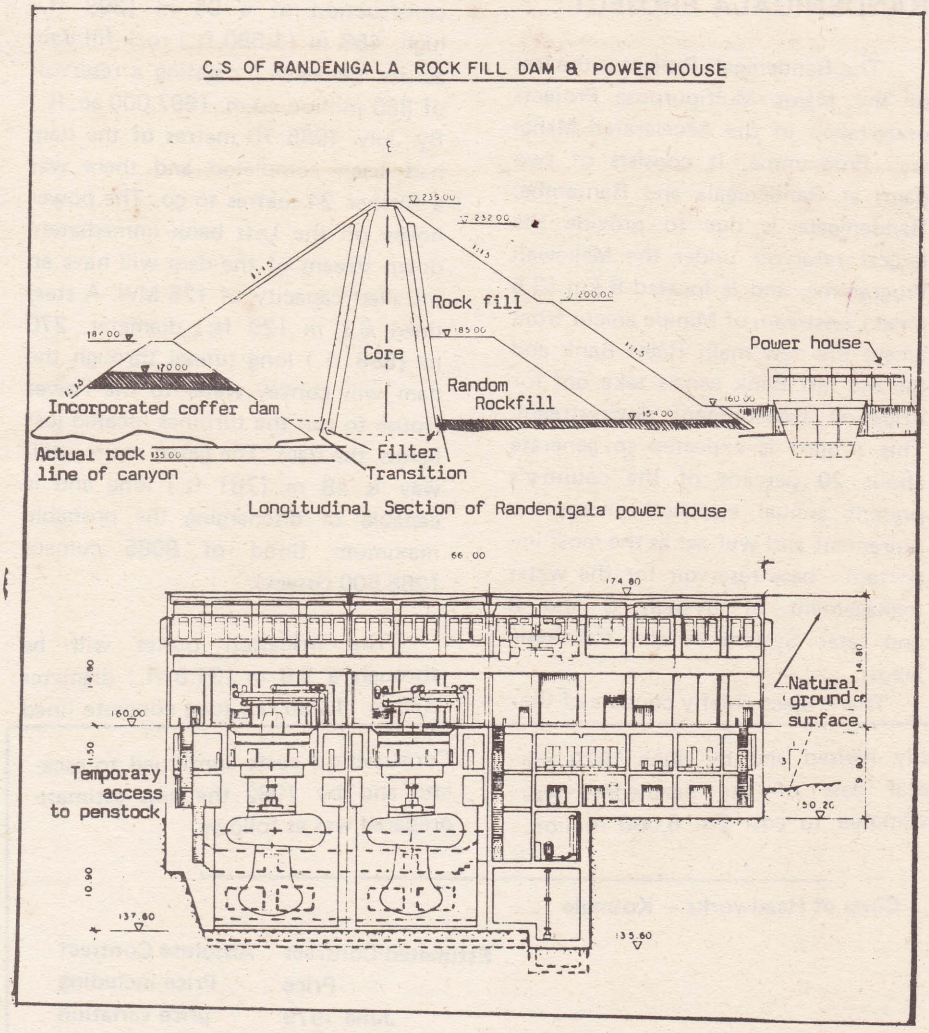
Over 2,000 Sri Lankans are being provided employment during the construction phase. The project began with 125 expatriates and the number is reported to be pruned down for replacement by local engineers.

Cost Estimates

The originally estimated cost of the Randenigala Dam and hydro-electric unit was Rs. 700 million, including a foreign component of Rs. 350 million; the allocation for irrigation being Rs. 415 million and for power Rs. 285 million.

Feasibility studies for Randenigala and Rantembe projects were carried out by "Joint – Venture Randenigala" Consultants, comprising Messrs. Salzgitter Agrarund Electrowatt assisted by CECB, with a Technical Assistance grant of D.M. 8.5 million provided by the Federal Republic of Germany, (through Kreditanstalt fur Wideraufban – "KFW"). This was followed by a long term soft loan of DM 400 million from "KFW" for the construction of the Civil Engineering Components.

There are views expressed among local engineers that the nature of the contracts for the headworks generally limited opportunities for them to benefit from these schemes. As one engineer stated: "the finest opportunity to train and develop the engineering skills were offered by the implementation of the AMP to this country, but that opportunity was missed.



Australia's Snowy Mountains Project did exactly that – they made the best use of opportunity offered. We only helped the big consultants from abroad. We could have provided 100's of engineers and other technical skills by getting closer involved in the project." For a further elaboration of this viewpoint see comments of Prof. Thurairajah on page 34.

The total cost of this complex amounts to DM 400 million (foreign) plus Rs. 822 million (local) making a total of Rs. 4,450 million. Hydro-power will be developed with an installed capacity of 122 MW to generate 525 Megawatt hours of energy (average) annually. The Main contractors for the construction of Randenigala Headworks are the Joint Venture of Messrs. Dykerhoff Widermann, Belfinger & Berger and Alfred Kunz.

Rantembe

Rantembe Dam will be taken up later about 3 km. downstream of Randenigala, below the confluence of the Uma Oya with the Mahaweli Ganga. It will be a concrete gravity dam 41.5 m high with a crest length of 420 m (total volume of concrete being 215,000 cubic metres).

The spillway will have 4 Taintor Gates 16.21 m x 16.0 m. with chutes 16 m. wide and 50 m. long capable of a maximum discharge of 10,235 m^3/sec.

There will be 2 bottom (Irrigation) outlets provided with Taintor gates each capable of a maximum discharge of 200 m^3/sec.

Steel Penstocks of dia. 4.2 m. with a rated discharge of 90 m^3/sec lead to the power station equipped with 2 Francis Turbines with an installed capacity of 24.5 MW each working under a gross head of 33.5 m. This will produce 158 GWH of firm energy annually (average 251 GWH).

The Federal Republic of Germany has provided financial assistance for this project of DM 400 million on easy terms. This was considered enough for the Headworks of Randeinigala and Rantembe Projects, but due to price escalation this was sufficient only for Randenigala at present costs.

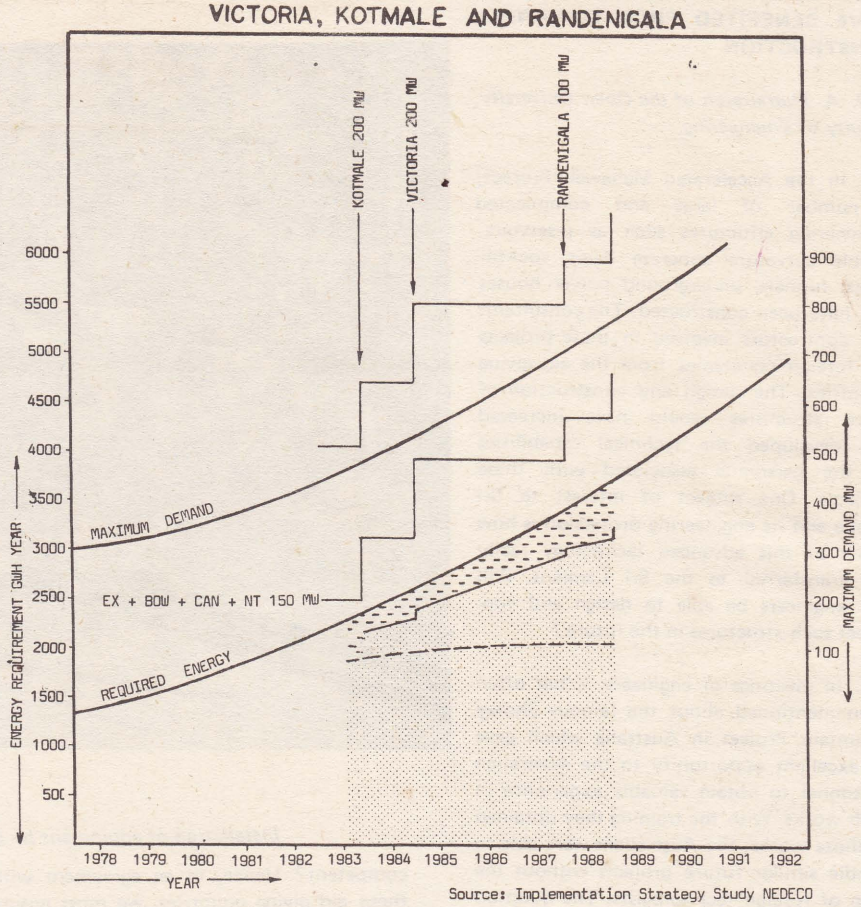
The Minister of Finance declared recently that the Federal Republic of Germany has already agreed in principle to give a concessional aid in a sum of DM 120 million for the Rantembe Project. This amounts to approximtely Rupees 1050 million at ½ percent interest over 50 years. I am confident that the balance money also for the Rantembe Project can be obtained very soon. Rantember is a corollary to Randenigala "I am confident that we will be able to commence this Rantembe Project this year", he said.

Upper Kotmale Hydro Power

An agreement covering a feasibility study of the Upper-Kotmale hydro-power scheme was signed between the Japanese government and Sri Lanka's Power and Energy Ministry on August 10, 1985.

The proposed project includes the construction of one reservoir and two hyro-power generation stations with a total generation capacity of 230 MW. The study will take about 2 years and the final report is scheduled to be submitted to both governments in August 1987.

SYSTEMS CAPABILITY WITH
VICTORIA, KOTMALE AND RANDENIGALA



Source: Implementation Strategy Study NEDECO

EX = Existing system including 50 MW thermal
BOW = Bowatenna
CAN = Canyon
NT = New thermal
—— = Systems capability
= Thermal generation
= Hydro generation
---- = Hydro generation without Kotmale, Victoria and Randenigala

Operation and Maintenance of Headworks

The Mahaweli Authority of Sri Lanka and its project heads, the Ceylon Electricity Board, the Mahaweli Economic Agency, the Mahaweli Engineering and Construction Agency, the Irrigation Department and the Mahaweli Water Management Secretarial will all be responsible for specific functions of operation and maintenance on the reservoirs, tunnels, hydro power plants, dams, channels, drainage systems and other irrigation works and structures that have been constructed at such heavy cost. There is no doubt that great care would need to be exercised over these structures once the construction is over. Among the functions requiring emphasis are:

* Routine maintenance checks of embankment slopes and crests of earth embankments for evidence of the development of unfavourable conditions.

* Detailed inspections of concrete structures by operating personnel at yearly intervals, or more frequently. A more thorough inspection by a board of engineers for important structures.

* Concrete-lined canals to be dewatered periodically and inspected for cracks and ruptures.

* Radial gate offtakes sluices, lifting stems and gear also need constant attention and a high degree of maintenance.

HOW LOCAL ENGINEERS COULD HAVE BENEFITED FROM MAHAWELI CONSTRUCTION

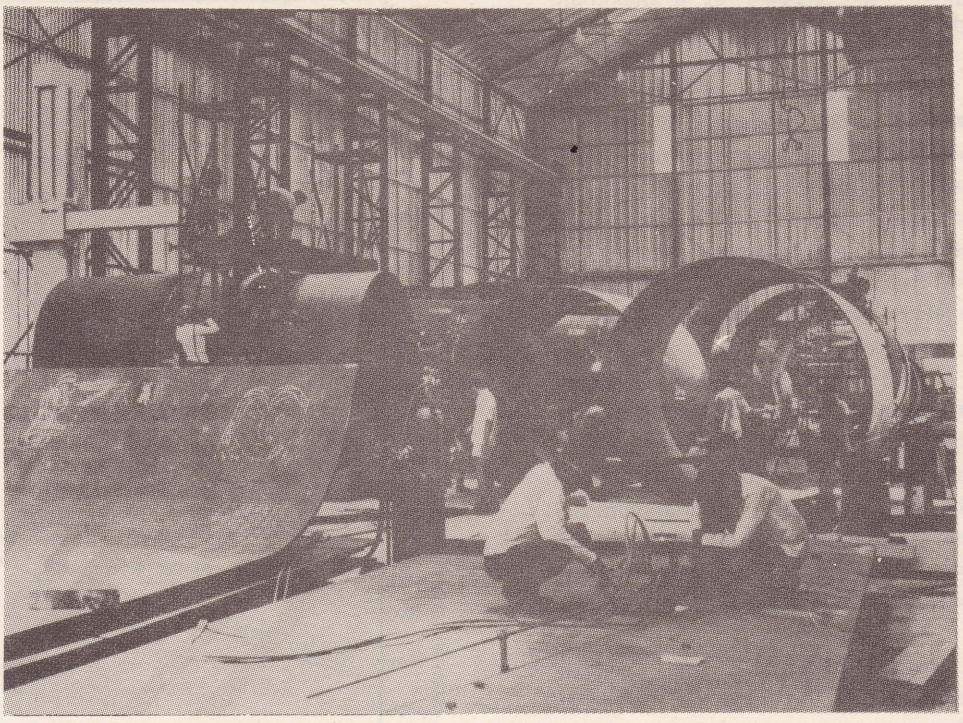
Prof. A. Thurairajah of the Open University, Faculty of Engineering

In the Accelerated Mahaweli Project, a number of large and complicated engineering structures such as reservoirs, double curvature concrete dams, rockfill dams, tunnels, underground power houses etc. have been constructed. The consultants and contractors involved in these projects are foreign companies from the aid giving countries. The design and construction of these structures would have increased and developed the technical capabilities of the personnel associated with these projects. One subject of interest to Sri Lanka and its engineering profession is how much of this advanced technology really got transferred to the Sri Lankans. Will our engineers be able to design and construct such structures in the future?

In meetings of engineers, it has often been mentioned about the famous Snowy Mountain Project in Australia which gave an excellent opportunity to the Australian personnel to obtain valuable experience in such works. With the training they obtained in those works, the Australians were able to handle similar future projects without the help of foreign technologists. The question now is whether this has happened in Sri Lanka; or would we need foreign consultants and contractors if we have to undertake similar jobs in the future?

Technical capabilites of our personnel will develop if we undertake jobs of this nature by ourselves wherever possible and bring foreign consultants to advise us in fields where we are not competent. This is how even foreign companies operate. For example, the contractor for the double curvature concrete arch dam at Victoria, Balfour Beatty Nuttal, had not constructed such a dam before. However, they hired a Swiss company to advise them on this project. Now they can quote the Victoria experience to get jobs of this nature.

It is a fact that aid giving countries are anxious to give the consultancy and contract work to companies associated with their country. Therefore, even in cases where we have the technical capability, they tell us that they cannot entrust the work to a Sri Lankan agency since it has not done such work earlier. Often this is true. But if we allow this, when are we going to be able to tell the aid-giving country that we have done similar jobs earlier and are therefore competent? Hence, in an agreement with these aid giving countries, we must ensure that the Sri Lankans participate to the maximum possible, thus increasing the technical capability of our personnel.



Installation of equipment by Local Engineers at Victoria Power House

An earlier case comes to my mind in this connection. For the construction of a large factory, it was proposed to the aid-giving agency by Sri Lanka that all site investigation works and recommendation of suitable foundations will be undertaken by a group consisting of the State Departments and University. But the aid-giving agency visited our organisations and finally said that they could not accept this group doing the work since they had not done similar work for another large factory before. After much negotiations, the aid-giving agency finally agreed to a compromise solution where the investigation, testing and preparation of the report was carried out jointly in Sri Lanka by the group and a foreign firm. This arrangement increased the experience of the Sri Lanka personnel, so that at least for any further job of this nature, they will be able to satisfy the aid-giving agency about their experience. In fact, when further work had to be carried out at the site, where the site had to be preloaded and settlements monitored, the entire work was handed to Sri Lankan personnel.

In the case of the Accelerated Mahaweli Scheme, we do not believe that a transfer of technology took place which increased the technological capabilities of our personnel. We doubt whether our technical people gained the valuable experience from these projects so that they could now undertake similar projects locally or in other countries. One feels that what took place was the transfer of engineering structures rather than the transfer of technology. It is a pity that Sri Lankan technical personnel have missed this unique opportunity of gaining such valuable experience. On the other hand had we obtained experience in all these works, we would now be able to form a consortium and bid for civil engineering works of this nature in other Third World countries with success. It is also sad to note that the Faculties of Engineering had not been associated with these great engineering works. The staff of the Engineering Faculties would have gained very valuable experience had they been involved in these projects and this experience would have been very useful in the training of future engineers. At least in the future we must provide the means by which the teachers of engineering can be associated with important projects of this nature.

DOWNSTREAM DEVELOPMENT IN THE ACCELERATED MAHAWELI DEVELOPMENT PROGRAMME

Jaap Jan Speelman
G. M. Van Der Top

Jan Speelman and Van Der Top are two researchers from the Department of Irrigation and Civil Engineering, Agriculture University Wageningen in the Netherlands who conducted research in the Mahaweli area. They were in System H1 and System C of the Mahaweli Project in 1979 and 1984 respectively to study the downstream development programme. The observations and issues highlighted below are based on their research experiences during their seven months field work in the System C last year.

Introduction

Besides the construction of a series of reservoirs with hydro electricity plants as envisaged in the Accelerated Mahaweli Programme, the complementary part of the works consist of the development of large extents of land in the downstream areas with irrigation facilities, establishment of new settlements and the agricultural development of these areas. For this Downstream Development the headworks provide the necessary waterstorage and riverflow regulation to safeguard watersupply to the subsystem's main reservoir all through the seasons.

Downstream Development focuses on the settlement of evacuees from the headworks construction-sites, settlement of selectees from wet-zone landless applicants and the resettlement of former inhabitants of the area now brought into command of the diverted Mahaweli waters.

Downstream development would include the following activities:

* construction of the necessary roads, canals, buildings and other structures as well as smaller reservoirs serving the storage and distribution of irrigation water in the development areas.
* Organisation of operation and maintenance of the irrigation and other infrastructure.
* Management of all other activities related to the agricultural and irrigation practices of the settlers.
* Provision of social infrastructure and services to the settlers (health facilities, schools, commercial areas, banks, post-offices, etc)

The combination of the above mentioned fields of attention and the fact that they are simultaneously taking place over widespread areas cause this part of the Mahaweli Programme to be very complicated. Though the headworks may seem to require most technical skill and knowledge, the downstream development of a large scheme like Mahaweli not only proves to require very high capital expenditure but also a multi-disciplinary input of expertise to achieve the goals set at the start of the project.

The fields of attention featuring this downstream development, and the complexity and relative importance of this part of the works are discussed briefly below and the major problem areas pointed out.

Description of successive activities

With the decision to bring the areas of System H, C, G and B under irrigation and to initiate agricultural production through settler-farmers a long process of planning and implementation starts. The basis for all activities is the information gathered through feasibility studies and Project Implementation Reports. The results include guidlines for layout-design and construction, information about soil types their locations, topographical maps of the area, sociological and other surveys on the pre-porject situtation.

After selective jungle clearing and rough land levelling the construction of tanks, canal network, roads and buildings is started. These activities are coordinated by the Mahaweli Engineering and Construction Agency (MECA) and predominantly executed by local contactors. Sometimes foreign contractors execute the construction work (e.g. part of System 'C' is constructed by a Japanese contractor and Canadians constructed the dam of the Maduru Oya Reservoir). In Zone 2, System 'C' part of the canal excavation work was done by worker-settlers; prior to the settlement of their families the farmers could in this way earn an extra income in their future home-land.

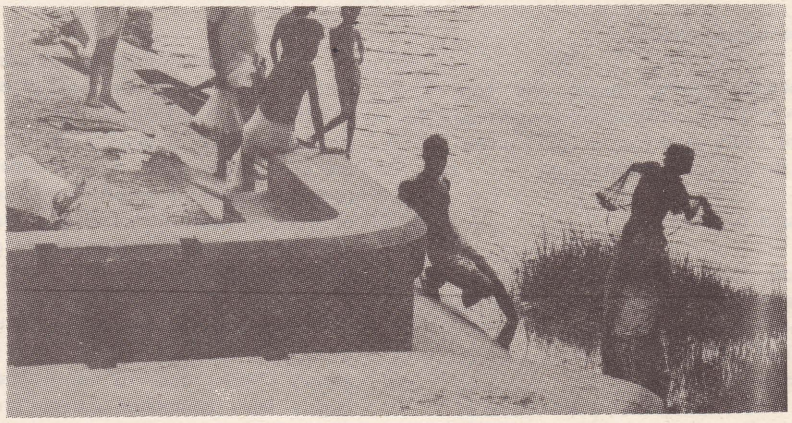
When the construction phase has ended the management of the area is handed over to the Mahaweli Economic Agency (MEA). Both MECA and MEA operate under the Mahaweli Authority of Sri Lanka (MASL).

Settler families then move into the area and build a temporary dwelling on their 0.5 acre homestead. They are given a small subsidy for this purpose, as well as for the construction of a well and a latrine. On their 2.5 acre paddy-land plot only bund marking and rough levelling has been done prior to their arrival so that the actual bund formation and fine levelling of the basins has to be finished by the farmers before th first issue of irrigation water. The settler families are given World Food Program assistance until their first crop is harvested. For this first crop the plots are ploughed by the MEA and free seed paddy (high yielding varieties) and fertilizer is provided to them.

In the meantime agricultural services are organised by the MEA, as well as other facilities such as schools, health facilites, post-office, credit facilities, stores and the roads remaining to be constructed. During and after the first irrigated crop-production it becomes clear which farmers have difficulties in getting sufficient quantities of water, where drainage problems occur, at which places canal reconstruction is needed and which organisational problems need to be tackled.

Extension for staff and farmers is planned to improve agricultural practices and water-use efficiencies in the area, and also on subjects related to community development, hygiene education, income generating activities and financial mangement.

The commercial banks providing the settlers with cultivation loans keep a close watch on the recoveries of their loans and



An anicut in the downstream areas for regulation of water flows for irrigation

do not provide new loans to defaulters. If a farmer sells his harvest to the Paddy Marketing Board the worth of the paddy is lowered according to the outstanding loan at the bank and the remainder is paid to him.

Maintenance of the systems (desilting, structure and canal repairs) is executed in the inter-seasonal periods. Minor repairs are given on contract by the MEA, major repairs are handled by MECA on request from the MEA. Protection of forest reserves, reforestration and soil management in order to prevent soil erosion and degradation are also co-ordinated by the MEA.

With the lapse of time the systems should become stable and high producing areas in which the MEA runs the maintenance and operation of the system with the profits made through agricultural production and related industries.

Through observations made in the Mahaweli Project some features of Downstream Development were identified which could constrain the development to its present stage as well as affect economic prospects in the longer term. The following section focusses on these features, which though not arranged according to their relative importance, are set out chronologically as related to the successive stages of development.

Constraints on Mahaweli Downstream Development

The interaction of physical and social factors in settler development and irrigation management make it extremely difficult to trace causes or assign blame. It is not the intention of this section to harm or accuse persons by mentioning these problems. An open discussion of development constraints is needed if one wishes to counteracttack them and is therefore of crucial importance for the successful completion of the programme.

Pre-construction period

Problems arising during the construction and post-construction period may find their cause in activities (not) undertaken in the pre-constuction period.

Among such problems are:

* Illegal, large scale timber extraction before and during jungle clearing which results in unnecessary deforestation of areas outside the future settlement area, causing:
  - heavy erosion of upper parts of the area,
  - degeneration of denudated soils by physical and chemical weathering
  - future fuel wood shortages
* The production and use of inaccurate soil – and topographical maps of the area resulting in construction errors and unexpected soil-related problems.

Basic information with huge implications for future construction and irrigation design should be subject to strict quality control. Misplaced irrigation-structures causing insufficinet water-inflows in canals, out of command areas in the area planned to be under irrigation and blocked canals because of non or uphill sloping canal bads are examples of mistakes made because of inaccurate pre-construction information gathering.

Construction period

A high quality of construction is a sine-qua-non for a smooth operaton and maintenance of the system in the post-construction period.

With the boom in constuction work due to the acceleration of the Mahaweli Project it became more difficult to be critical about the seleciton of contractors to execute all the works to be done. This was also reflected in generally poor quality control during construction.

A factor aggravating this situation is the role that non objective criteria could play in the assignment of contracts. Such non objective influences eliminates the perquisite of a contractor's good reputation based on former succesfully executed contracts and gives the contractor a free hand in deliberate quality reduction which renders them the profits of off-hand sale e.g. cement. In case a more remunerating contract is accepted simultaneously with one already in execution, labour and means are often extracted from the latter to serve the former, which may cause serious delay in e.g. maintenance and repairworks in which the time factor plays a major role.

With construction works progressing at a high p ace in widespread areas of the project it becomes difficult to maintain a very close supervision of what is happe nning at the cons.truction sites. A weak supervision could propogate the use of inferior materials or improper quantities of valuable materials and therefore has adverse effects on the quality of construction.

The fact that the system is handed over, from the first (MECA) to a second agency (MEA) once its construction has largely been completed creates problems especially for the latter organization. A division of tasks is good in itself by should not result in lessened attention for the long term problems that might result from failing construction quality control.

A large scale income providing programe like the Worker-Settler-Programme is difficult to bring into practice successfully because of the effect it would have on the interests of local contractors who will therefore try to interfere and destroy the programme. Another factor obstructing a programme like this is the status-awareness of farmers, which hinders them working as labourers.

Post-construction period

The problems related to the technical infrastructure in this period can be grouped into two categories:

* Lack of maintenance of canals roads and buildings. Desilting of canals, repair works, reconstruction of wrongly placed and dimensioned or damaged constructions should be initiated by MECA and MEA in the inter-seasonal periods without delay. Delay causes malfunctioning and further degeneration of the system and suffering of individual farmers.
* Difficulties in the operation of the system. The layout of the canal network is based on serving the largest possible command area with water and therefore requires a minute control of the waterlevels in canals, tanks and levelcrossings in order to release enough water to each part of the system.

  Difficulties in getting water in tail end canals and other parts of the canal network are determined by:
  - construction errors
  - soil problems and insufficient lining
  - lack of maintenance
  - improper operation of the regulation and measuring devices.

A proper assessment of the amounts of water flowing in all canals can only be made through an intensive measuring programme carried out during each season. Without flow measurement no equitable and guaranteed water supply to each individual farmer can be guaranteed, and a justifiable water-tax can hardly be imposed on the water users. Water availability is the key-word in irrigated agriculture but a profound analysis of the causes of unequal and insufficient availablity of water is not possible in this article. However, some of the factors will be highlighted here. Upto the level of the Production Unit or Turnout in which 12 to 20 farmers have their allotment, along a collectively used field channel, the allo-

cation and distribution of irrigation water water falls under responsibility of the project management staff. Below this level distribution among the individual farms is left to the farmers through the person of a farmleader chosen by them for this purpose. Practice shows that as soon as the water-supply to the turnout becomes insufficient an equal distribution among farmers is in danger. Unfortunately situations of in-adequate watersupply often occur especially during Yala-season (dry season) when severe water scarcity prescribes efficient use. These inadequacies are mainly caused by internal difficulties in the system's operation.

Although flow measurements are executed in the canal system these appear to be insufficient and inaccurate due to a limited amount of measruement structures of which many have been improperly installed. A proper assessment of flowrate in the canals is not obtained and therefore an equitable and guaranteed watersupply cannot be safeguarded and no justifiable water-tax can be imposed on the water users.

Present procedures rank rather low on formality, information and control and in addition they are severely enhanced by a slowly deterirorating infrastructure due to construction errors, lack of maintenance and disruption by discontented farmers.

The turnout problems start when so called tail-enders (cultivating a small number of allotments on the field-channel end) are deprived of sufficient water through top-end farmers adverse behaviour — scrambling for water, breaking structures, neglecting maintenance etc. — which can be explained by the way in which the upstream canal system is managed and the consequent uncertainity of supply.

Representative farmers, (being un-remunerated, have little incentives to do, any work and even less to attempt to confront) do not always take action against top-enders who take excessive water or persons failing to clean their section of the field-channel. They have no legal power to enforce decisions.

The preceding comments were mainly directed at problems relating to an improper infrastructure. These problems must not be underestimated, neither should their direct influence on the opportunities the settlers get to make a living in the first difficult years be overlooked. Unequal, insufficient or even lack of watersupplies to the irrigated areas have direct and severe implications on the well-being of the settlers and their families. The following comments deal with the above mentioned 'post-cultivation period' although they have no direct relation to the construction as such.

Settlers position

A superficial look at the situation of the settlers in the Mahaweli Project gives an impression of bright prospects becoming reality within a short period after settle-ment. A 2.5 acre lowland plot, a homestead where additional food and cashcrops can be cultivated, a well to provide safe drinking water, a latrine for good personal hygiene and a subsidy for the construction of a temporary dwelling. All preconditions for a rapid development of the farmers towards surplus production, capital formation and a better standard of living seem to be avail-able, including staff and services to guide them in all the necessary aspects of pro-duction and day-to-day life. However, a closer look at the situation reveals the hardships these families are facing. A ham-pered socio-economical improvement of their quality of life is directly reflected to the lowered and delayed benefits of the project as a whole.

It is doubtful if the provision of a Rs. 1,500 subsidy for the construction of a dewlling is the best approach towards good housing of the settlers. A large percen-tage of the settlers are living in huts that could collapse. Profits obtained from paddy cultivation do not seem to be sufficient in most cases to construct a brick house or even repair the temporary hut. The obser-vations that some farmers are already in-habiting brick walled houses or possessing four-wheel tractors is rather misleading since the starting position of the settlers coming from the reservoir and dam areas (Victoria, and Kotmale) was far better than the one their colleagues were confronted with, since high sums of money have been paid to these evacuees for lost properties.

An observation of only several ex-tremely well producing and prosperous farmers could be rather misleading since it will not reflect the average standard of living in the area rather it indicates the different starting positions of the three major categories of settlers and it illustrates that the original egalitarian set up of the Programme (each farmer 2.5 + 0.5 acres, same subsidies and assistance) does not work out in practice.

The evacuees, namely those with a more or less substantial compensation for their lost property are best off. This com-pensation serves as a useful and effective buffer with which these settlers can cope with the 'transitional' problems of settle-ment which are mainly of financial charac-ter. Moreover, this compensation may even suffice to serve as investment capital, which is a prerequisite for a 'take off' towards real agricultural capitalism.

The selected settlers namely those originating from various parts of the Island, are worse off. These settlers lack the capital backing and have to cope with what is made available to them in the settlement areas. Being formerly landless many of these settlers lack the experience of managing a farm on their own, which puts them at the mercy of what the extension services have to offer.

The resettlers, namely those who lived in these area, face their own specific problems of the necessity to adapt them-selves to a newly superimposed irrigation system and community development. It is a heterogenous group of farmers ranging from experienced former colonisation-scheme-participants to tribal people deprived of their traditional chena-cultivation methods, and of course the latter need more attention and guidance than the former.

In spite of these differences in back-ground financial capacity, etc. all parti-cipants in the downstream development are considered as equal and are treated as such. In this perspective scattered symptoms of prosperity in the form of brick-houses and four-wheel tractors may not be indica-tive of the average standard of living. (It merely indicates that some people make good profits in this system where there are also non-settlers. (e.g. private traders, shop keeprs etc.)

Health of the settlers is of basic importance towards their ability to increase production and recover the investment made for them. Efforts to improve settler-health needs to be intersectoral and not solely handled by the Health Department. Health is related to all activities undertaken by the settler, including his irrigation and agricultural practices as well as his personal habits. Construction of a latrine is a good initiative but proves to be useless if its proper use is not guided by hygiene education.

Health problems in the process of settlement can be divided roughly into two stages:

In the initial stage of construction work and the arrival of new settlers, most health problems can be tackled by im-proving sanitary and hygienic conditions of the domestic environment and by distri-buting the necessary drugs. Bowel infections and respiratory diseases prove to cause the major health problems at this stage, since malnutrition is more or less effectively controlled by the provision of World Food rations (although these W. F. rations are often sold off-hand by settlers to generate some cash).

More structural and chronic problems arising from malnutrition (and the absence of proper Family Planning) are linked with the next stage of stabilization. The adverse effects of liberalised trade and the open economy on traditional households which are subjected to the incresing purchase of consumer items and commodities is reflected in the pattern of the settlers expenditure which sometimes show unlogic priorities. With the birth of a new child the mother tends to neglect her toddler since the new born required all her care and attention. Medical personnel and health volunteers find it difficult to convince these mothers of the usefulness of the concept of child-spacing In such circumstances there is a possibility that settlers could head for a future in which the long term effects on health of a huge scale irrigation scheme will begin to surface. The exact impact of these effects are still unknown, but they probably could be caused either indirectly by processes of social differentiation or directly e.g. by the tremendous increase in potential vector-breeding habitats which is liable to increase the prevalence of vetor borne diseases like Malaria. Obvisoulsly it will be insufficient to try to tackle these long term problems solely by medical treatment.

Questions could also be posed on the viability of 2.5 acre farms producing paddy (or other wetland crops), certainly regarding the statistical evidence of a crop faliure occuring every 4 seasons and the inexperience of many farmers with capital intensive cultivivaton of high yielding varieties. Even assuming high yields the surplus production can hardly provide more than the income needed for day-to-day expenses of a family.

To create an independent class of middle peasants who are able to generate enough income from their agricultural production to overcome a crop failure, improve their standard of living and to invest profits in improvement or extension of local agro-based activities, a 2.5 acre plot is too small. This view is supported by some leading economists and agronomists and the issue has also been discussed among leading Mahaweli officials.

Because of the farmers' vulnerable position caused by factors such as the minimal means of production placed at their disposal, insufficient watersupply, delayed input provisions, sickness, unadapted credit facilities and farmer's reluctance to sell paddy at guaranteed prices to the Paddy Marketing Board these factors can all have far-reaching consequences on their financial position and there is a fair chance that they could enter a "vicious circle" of indebtedness gradually but invariably leading to either renting and mortgaging their land or becoming sharecroppers.

The process of sharecropping may not seem that serious but it should be mentioned that sharecropping includes the sharing of risks between two economically unequal partners. With each crop failure or other serious set-back the tenant's economic existence could become more and more precarious. His needs for cash to buy the essentials may drive him into constant debt.

Despite their illegality the above mentioned practices of changing landownership appear to be widespread. It is always not known who is in fact cultivating land under a field-channel. Dealing with such a situation it becomes impossible to call those farmers to account, who neglect their part in maintenance work.

The quality and quantity of extension activities by the staff to improve, update and increase the farmer's knowledge on farm – water management, agricultural practices, financial management and hygiene education is of major importance for increasing production in the development areas. As a side effect intensive extension programmes promote contacts and mutual understanding between staff and farmers.

Agricultural credit

In the triangle of Commercial Bank, Paddy Marketing Board and private traders the latter appears to gain over the other two with respect to both credit-supply and paddy purchase; in spite of the fact that the private traders financial conditions of high interest and low paddy prices seems to be less attractive to the settlers. Some of the factors related to this phenomenon are given below:

Commercial Banks:

* The cultivation loans provided by the banks do not include a consumptive component. The character of rice cultivation, with the benefits coming at once and only twice a year, necessitiates a detailed financial planning over the seasons. Many farmers fail in this planning, which forces them to buy consumptive goods on credit.
* C. B.'s do not provide loans to defaulters, not even during the first difficult transitional years after settlement. They only grant loans to persons who are backed by two guarantors, who have not defaulted themselves. The number of viable guarantors in the project area decreased rapidly in the first few years after settlement.
* Settlers are forced to insure their crop (for Rs. 300/=) before a cultivation loan can be granted to them.

Paddy Marketing Board:

* P. M. B. does not pay in cash. A cheque has to be cashed at the same bank at which the settler receives his loans. The settler's unrecovered debts are first subtracted from the value of the cheque and the balance is cashed.
* Farmers are afraid of tax-raising and therefore are reluctant to reveal their actual yield which will be registered if sold to the P. M. B.
* Sometimes farmers are forced to sell their paddy to private traders as fulfilment of their obligations to them after obtaining loans or purchasing goods on credit.

As soon as alternative loan-providing persons or organisations enter the Mahaweli areas a capital extraction from the project starts. Merchant capital, accumulated in the cities and business centres of the country is provided to indebted farmers by outside entrepreneurs. When they are paid back their loans plus interest either in money or in paddy the profits are invested in the business centre for the purchase of goods, in the worst case of imported goods. A quite fitting comparision with this process is the soaking of a (merchant capital) sponge in a fluid (local means or production) and squeezing it outside the bowl containing the fluid. This capital extraction process has severe consequences for local capital formation and related possibilites to invest profits in the farm to adapt more capital intensive agricultural practices or in the improvement of the settler's standard of living. Possibilities for local agro-based industries to develop and provide labour to the second generation are diminished.

The process is a drawback on the national-economic benefits of the project as the newly acquired means of production in the project are utilized for consumptive purchases of mainly imported goods. Thus these benefits miss their stimulating effect on agricultural and industrial development of the country.

Management constraints

The field staff has to work under difficult circumstances in remote areas of the dry and intermediate zones. Only basic services can be provided and often the families of staff members are unwilling to reside in the project area. This situation has negative effects on motivation and job satisfaction of officers. Intensive communication with Colombo headquarters, regular visits of headquarter staff, job evaluation and supervision are important tools to cope with mismanagement.

Still as compared with the settlers the officers are living in much better circumstances. Their quarters are of good quality; jeeps and motor bicylces are available, their standard of living in all aspects are seen to be higher than that of any settler family. This difference could strengthen the mutual misunderstanding, create hard feelings among the settlers and possibly obstruct communication between the two groups.

A precondition for a good understanding of the problems arising at field level is therefore missing.

The basis for all policies initiated by the project staff should be the need to adapt the proposed measures to the needs and possibilities of the settlers. They determine the priorities to be chosen and the activities to be carried out by the project staff.

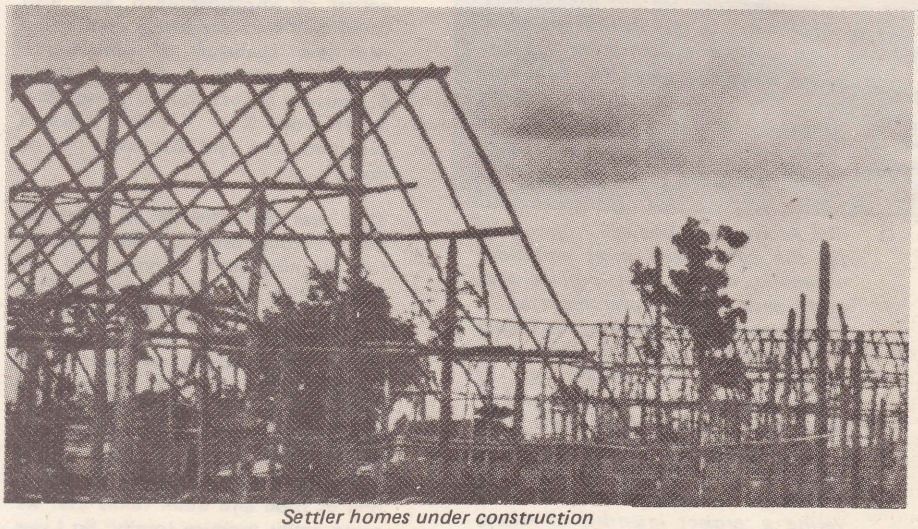
The acceleration of the project has aggravated the constraints caused by the management. A large number of staff are needed and the available group of senior, experienced and educated persons in the country is hardly sufficient to meet the present demand. The 'Brain-drain' to countries abroad offering better salaries aggravates the problem.

The giving out of contracts for maintenance and reconstruction works should not become a major activity for officers having the authority to do this as a part of their normal duties.

The Mahaweli Programme gives the impression of being mainly directed towards construction rather than actual settler development. The greater part of foreign aid is pumped into the hardware of the downstream works; and although plans for social infrastructure in all its aspects exist the real software of financial and agricultural extension and guidance seems to be mainly in the planning stage.

The enormous amount of foreign aid causes a situation in which there could be a tendency for money not to be considered scarce means. If this lack of sense of economy emerges it might easily evolve into a state of inalertness , which in its turn could bring about a lack of involvement in the effort to maintain an effective programme management. This process can have its effects down to the lowest levels of management and be enhanced by the inherent failure of policy – makers to produce positive impulses to lower management level either by compliments or criticism.

Road construction with Local Labour in System "C"



Settler homes under construction

Often the individual officer finds her/himself placed in a difficult position, due to:

- a low income inspite of a heavy burden of responsibilities
- the day-to-day life in a so called "difficult area", which they will not consider as a home as long as their family still lives in the urban areas.
- the frustration of sometimes working under a person who may hold the wrong position.

These factors could affect the well-being of the project staff and also the well-being of the settlers, since it enhances the temptation for officer to misuse or neglect their responsibilities.

Conclusions

The objective of this article was to show the complexity of problems arising in the Downstream Development of the Accelerated Mahaweli Programme. Each of the drawbacks observed can be effectively counterattacked once the underlying causes have been studied in depth. Within, the limits of the vast size of the area developing, existing political limitations on measures that can be taken, and the large number of staff and settlers involved in the development process, possibilities can be found to improve the observed situations and trends.

A precondition for improvement is the approval and encouragement for studies to be carried out that try to identify development constraints in further detail and maybe even more important, the frank discussion of these results at all staff levels. The increased awareness of processes going on in the project areas may then lead to adopt measures that can successfully tackle the problems observed.

The succesful implementation of the Mahaweli Development Project will depend to a large extent on an open eye and mind of persons managing the Downstream Development this is one of the most challenging tasks to be executed in the Project.

N. G. P. PANDITHARATNA IN AN INTERVIEW WITH THE "REVIEW"

Mr. N.G.P. Panditharatne headed a leading firm of Chartered Accountants for several years before he took on full time duties in 1978 to coordinate all activity connected with the Mahaweli project. He was appointed Chairman and Director General of the Mahaweli Development Authority which came into being in 1979. From the very inception of the Accelerated Mahaweli Programme he played a key role in guiding this Programme through its formative stages right upto the completion of two major headworks and near completion of a third, before he finally resigned from his post in late 1984. His strong accountancy background and experience as an administrator, together with the fact that he held two other key positions at this time, namely, Chairman of the Monetary Board of the Central Bank and General Secretary of the Ruling Party, gave him a deeper insight and perspective of the overall functioning of the economy and additional strength in managing the situation.

Q. *The Accelerated Mahaweli Project is by far the largest and most ambitious economic development project ever undertaken by any government of Sri Lanka; perhaps it is among the largest of its kind in the South East Asian region. When you started out as Chairman of the Mahaweli Development Board and Director General of the Mahaweli Development Authority how did you foresee the task the Government was attempting of delivering a project intended to relieve major problems facing the country such as unemployment; power shortages; high food prices and the scarcity of foreign exchange.*

A. When the government came into power in 1977 it was realised that there were major problems that had to be tackled. We had to overcome the problem of unemployment, the problem of foreign exchange shortages and the problem of energy and power. We felt that the country could not wait a very long time to find answers to these problems. Soon after this Government came in they looked around at certain plans and projects, to see which area could be tackled first that would help to deal with these three problems. They decided to select the Mahaweli Development Programme but there was a constraint because the planners, including the World Bank, had decided that it should be implemented step-wise over a period of 30 years. In 1977 it appeared that to complete the programme it would take about 50 years, and young people who were in their early 20's would have to wait for a very long time to have their problems resolved; infact some of them would have died without having their problems resolved.

So the idea of acceleration was really thought of by his Excellency the President and he said "Why should we wait for 30 or 40 years? Why should we not do it simultaneously and in a shorter period of time?" He said "Why not in 6 years." So that is how we thought in terms of accelerating the programme and doing it in a much shorter time - infact it gave the country a tremendous shock — because everyone was thinking of a much longer period of implementation and then when they were sudddenly confronted with the challenge of achieving a substantial portion of the plan within 6 years it almost looked impossible. Apart from 3 or 4 public servants everybody else said this could not be done.

That was the situation in existence when I took over the responsibility for planning and carrying out the acceleration of this Mahaweli Programme. I was naturally concerned about it and even more concerned about the problems our programme was intended to resolve, as I outlined earlier, because I found the problem of unemployment accute, and I found that the little foreign exchange we had was being frittered away by the importing of food and other items that we could easily produce locally. So I was deeply committed to the implementation of the accelerated programme, not because of its challenging nature so much as because of the fact that it was the one thing that was geared to giving quick relief to the problems of this country, particularly unemployment. But of course I must say that we had many constraints, but those constraints had to be overcome, and they were in no way going to make us re-think about this. Although there were suggestions that we should postpone this for a longer period, because of very genuine fears of the technical people and advisers from overseas, that we may not have the necessary technical personnel, that we would not have the finances and that the country was not geared to meeting the situation, and also that it might interfere with other projects in the country. We considered all these apprehensions, but we felt that the vision the President had at that time could be achieved and since it was a matter of enormous importance for the youth of the country, apart from anything else, it was worth tackling.

N. G. P. Panditharatne

Q. *More specifically what did you think of the major problems at the initial stages, namely those of (i) raising the necessary funds; (ii) meeting the construction deadlines within the Accelerated Mahaweli Programme.*

A. On the problems of funds, we really had no indication of where the money was coming from, but we knew we had to raise the money overseas, either from friendly governments or through the World Bank. We knew that it would not be possible to get money straight away from the World Bank because they were not quite in favour of the accelerated implementation. And they felt that implementation should take 30 years and step-wise implementation was their objective; and they had very good reasons, because their way of approaching the development scheme was first seeing what the problems are; examining closely the problems of manpower, the problem of inflation, and whether the country would be having enough technical resources to implement such a scheme. They felt that these were constraints, and after they gave it consideration they were of the view that the accelerated programme was not something that they were in favour of. So we approached friendly governments such as Britain, West Germany, Canada, Japan, USA and so on and they were willing to look at it in terms of the problems we had to face. We pointed out to these countries in our meetings that a quick solution had to be found to the problem of unemployment and to the problem of foreign exchange and this programme would provide the answers. When they were willing to assist us the World Bank agreed to act as a coordinating body.

We also approached Sweden. Sweden had already promised us a large amount of commodity aid. But we were able to convince them that our requirements for Mahaweli was more urgent and that is how we came to use that money and how Sweden came to be involved in the Mahaweli Project. We put up our requirements at the Aid Group meeting and several friendly countries were interested.

When we got the feel that these countries were interested and willing to help us, then we were able to demonstrate to them our country's willingness to go all out to achieve our development objectives. It was not only foriegn funds that were required, local funds also had to be found. And one way we did this was by the gradual removal of subsidies where we demonstrated that the people were prepared to forego certain consumption requirements in order to achieve these development objectives. It was not only the foreign financing that was going to cover the expenditure, local funds also had to be found and this was how the public contributed to implementation of this programme. Foregoing the subsidies was one of the major problems the country had faced all these years; it was a cancer on the economy but no government was prepared to tackle this problem. If they did make an attempt either the government was sent out of power or the Minister had to be changed. It was an extremely sensitive issue.

At this stage commitments were made by the Aid Consortium and we were confident that we would receive the necessary foreign funds. A major part of the funds were required for the headworks. For these projects the proportion of foreign funding required was about 60 percent, while local funds was about 40 percent; on the other hand in the downstream works the foriegn funding was about 45 percent and local funding was about 55 percent. There may have been lags in receiving the funds but these commitments helped us to go ahead with the projects.

Meeting the construction deadlines was not an easy task; a great deal of coordination was required when at times more than 5 different contractors were engaged in dam construction, engineering investigations, building tunnels, power house construction, equipment installation, and other engineering services. Even if there were problems at the site and subsequent delays a close coordination of all these activities helped the contractors to catch up on lost time.

It was possible for us to tackle the problems effectively because of the tremendous amount of interest and initiative taken by our Minister, Mr. Gamini Dissanayake, who showed great enthusiasm and energy in pursuing targets and target setting, and in the time he made available for us for discussion and arriving at a solution to the problems.

Q. *On your shoulders lay the responsibility, to many what would have been an inhuman task, of getting this project off the ground. What would you consider were the greatest obstacles the project had to face in the seven years between 1978 and 1984?*

A. In my view there were only constraints and not obstacles. At the start it was felt that we would not have the necessary materials, and equipment, and also the man-power to implement such big projects. But in giving out the projects to reputed international contractors we were able to bring in the expertise and equipment that was not available here and together with the available local resources to implement these projects within the targetted time period.
There were also many technical constraints but these constraints are to be expected in a programme of this magnitude. They only caused certain delays, but we found ways of making up for the delays.

Although the foreign contractors were brought in they used local personnel as far as possible. After all they are business organizations and one of their major concerns would have been to keep down their costs. Local engineers and skilled personnel would have been far less costly to them. Foreign personnel were required because many of these specialised skills were not freely available, even our own engineers were not available. For instance, the Irrigation Department and other development departments needed their engineers and therefore did not wish to release them. We did not face any objections from them on social grounds as such, although terms and conditions for the expatriates differed. For instance, the foreign engineers were paid very much more than the local engineers, but the local engineers appreciated that the expatriates had come here on much higher terms according to their contracts and they were being paid on the basis of salaries in their country. The local engineers and technicians therefore realised why there was a difference in the salaries. They realised that the foreign funding was necessary and the donor governments required these conditions for their personnel.

Q. *You are an Accountant by profession and among the most senior and experienced in Sri Lanka, do you have faith in the cost-benefit analysis for selection of projects in the Mahaweli programme? Were any of the projects selected for the Accelerated Programme scheduled on the basis of the higher cost benefit as against the lower cost benefit or were any projects excluded on this basis. Specifically, was this criteria applied in selection of (a) the Mahaweli project vs other development projects; (b) projects within the Mahaweli programme?*

A. Each project was very carefully analysed according to its economic viability and it was only after they were evaluated on this basis that the foreign governments released funds for these projects. Generally projects were based on a 12 percent Internal Rate of Return. In all projects as time went on the costs of the project increased, but at the same time while expenditure was going up the money value of revenue expected was also going up. For instance, the value of electricity over these years showed a rapid increase and the subsequent return from power was also expected to show an increase.

The result was that ultimately returns on the power could cover a major part of the costs of projects, while the returns from land and agriculture turned out to be a bonus. There were also social benefits to be expected from these projects. The donor countries took all these factors into consideration when evaluating the projects.

Strict financial criteria was applied in selection of the Mahaweli projects but there was no question of a choice between various development projects. The Mahaweli project was a major priority because of its leading objectives, but at the same time the other projects were also considered necessary and a conscious effort was made not to disturb those projects by taking their engineers and other personnel necessary for those projects.

Within the Mahaweli programme a decision was taken to implement only some projects after the NEDECO consultants reported that 3 projects, namely Victoria, Kotmale and Maduru Oya were sufficient to meet the irrigation and power requirements of the accelerated Mahaweli programme. Later Randenigala was also added on in order that it may provide the necessary power requirements after 1986. There was no other criteria for selecting only some projects from the original plan for implementation.

Q. *In reducing the time span from 30 years to 6 years has the effective implementation of the project been hampered in any way?*

A. When we reduced the time span on the original plan we set down very clearly our objectives and selected only those projects that would help to achieve these objectives. The target periods were most important and we even made certain amendments in the projects, as we went along, in order to maintain our targets. But we have made provision for including anything left out in these projects

and so their effectiveness has been ensured. An important aspect of the programme, for instance, is what to do with the excess water. The World Bank is examining this question at the moment and it is possible that they would recommend an implementation of some of the original projects that were held up, or they may suggest entirely new projects.

The studies and the change in conditions also necessiated a change of emphasis in the programme. Instead of thinking of diversification of the Mahaweli there was more emphasis on the power aspect. Project studies also found that diversifying the waters to the North West and further North was not economical. It was the cost benefit analysis that was applied and it influenced this decision.

Q. *What were the main factors, in your opinion, that made the Accelerated construction programme possible?*

A. One of the major factors that helped in making possibe the Accelerated Programme was the people's, particularly farmer's, participation in the programme and their support of the project's objectives. The Worker/Settler scheme tried out in the new settlements was a success and this also helped to keep down costs. There were fears at the outset that with such large amounts of foreign funds coming in that inflation would seriously effect the economy. But as time went on the worker/settler aspect of the programme helped to restore a balance. The increasing production from settlers helped in a general increase of productivity in the economy.

Another factor responsible for the successful implementation was the regular monitoring and coordination of the entire programme by the Mahaweli Authority. A Progress Control Unit was established for this purpose and this unit was able to make a very constructive contribution by monitoring all activity on a regular and objective basis. This Unit has been active in identifying the constraints and bringing them to the attention of the management of the Mahaweli Authority for remedial measures.

Q. *Could we now expect a much lower degree of dependence on foreign expertise; and do you think we now have the necessary expertise, following our experience with the Mahaweli Project, to export our technical know-how to other developing countries for implementing similar projects?*

A. With the experience gained by our engineers in implementing these projects, we certainly can look forward to utilizing them on projects of a similar nature both in our country and elsewhere. In fact, my fear is that the contractors and consultants who worked here with our engineers might inveigle them away from our country for long periods, because they found it easy to get on with our people. They also found that our engineers were quite intelligent in their approach. With the knowledge and experience gained on these projects we must, and it is my hope that we will, provide the opportunities for our engineers to try and implement the balance portion of the Mahaweli Development Programme chiefly on their own initiative. So far we have had to work with foreign organisations, we have benefitted from such experience. We have benefitted not only from their expertise but also from their site management techniques, in which our engineers and organizations may have been weak; but now that we have seen how these aspects are organised I do hope that some of the balance items in the programme will be completed by our own engineers and our own companies. It is my hope that there will be one or two projects in the Mahaweli to which we can turn around and point out to others and say 'these were done entirely by our own local engineers' Of course, in some instances we may need the assistance of one or two foreign consultants and that we are prepared to accept. But I think they would come to supplement some area of deficiency rather than carry the entire responsibility on their own.

Q. *The total investment on this project is expected to exceed Rs 40 billion — do you think there would have been greater benefits by investing on several small projects rather than one big one such as the Mahaweli?*

A. The big outlay of money that you referred to was necessary because this is an enormous scheme with many faceted development objectives. I don't think there is a single scheme outside Mahaweli that could achieve this. The economic benefits that the country would derive in implementing the Mahaweli Project is certainly very much greater than implementing many small projects becuase they could not have hoped to measure up to these standards nor could their benefits have ever reached these heights. For instance, the development of electricity. The electricity available this country will shoot up by about 200%. Now this could never have been the case if we had left out Mahaweli and concentrated on smaller projects.

Q. *The settlement programme was falling behind schedule and was not the problem of the settlers always of great concern to you? What broad solutions had you in mind for these problems?*

A. The settlement programmes certainly in some instances had fallen behind schedule. This was chiefly due to the delays in construction of canals and one of the principal causes of these delays was the incessant rains we have had for well over 3 months in the year 1983. It was not possible for the contractors to get on with their job — the canals which were constructed were damaged and this delay pushed back our settlement programme considerably. The men were ready to come, we were ready to settle them, but we could not keep them on land for more than 15 months without water and our whole programme, the worker-settler programme is geared to the farmers coming in and spending about 12 to 15 months on the land preparing it, cutting the field channels and getting ready for irrigated cultivation. But this period if postponed beyond 15 months could cause a great deal of stress and hardship because within 12 - 15 months, the financial provison made for the manual labour would be over and the farmers will have nothing to live on.

Q. *Were there any such schemes or downstream works where construction had not taken place as scheduled?*

A. Yes. For instance, Maduru Oya Right Bank Canal. We were hoping to start constructing it but there has been some delay in the funding. The Saudi Fund has not yet finally given their consent although they had agreed to a proposal for US$ 50 million for the designs construction and supervision of the Right Bank Main and Branch Canals below what is called the NDK Dam. But they have not finally released the money. So this would naturally push back the settlement programme on the Right Bank and System B.

Q. *You referred to a worker-settler programme, how successful has this been in the Mahaweli areas?*

A. Well, the Worker-Settler programme is essentially a new idea. We thought of introducing this for more than one reason. We wanted the participation of the people and considered that such participation, by people contributing their labour along with their fellow settlers, could promote a sense of belonging to their new gained land and community. Also, we wanted to provide them with work rather than use machinery and other equipment to prepare the land and bring them in after that. Our whole scheme is to bring people in during the early stages, at least 15 months before the main canals are cut, settle the people on the land, get them to clear the land, cut the field channels, get one or two rain-fed crops-chena crops and then when the land is ready and they are ready for cultivation we expected the water

to be coming down the canals; and during this period these worker settlers are paid their salaries and also they receive food provisions under the World Food Programme. So these two factors combined make it possible for them to live on the land comfortably and they could be without hardship either financially or otherwise.

Q. *What type of settlers do you expect to have in these areas?*

A. You might wonder what there is new in Mahaweli Settlement. It is not just another settlement scheme. This is an extensive and costly project which calls for a dynamic settlement and development policy if we are to achieve our objectives. Our objectives under this scheme are to make best use of the land and water resosurces being made available; to expand productivity; and provide the basis for the growth of a stable and prosperous farmer community.

We see that in the old colonization schemes the settlers are still undergoing difficulties, they are still subsidised farmers. Our whole idea was to transform these people from subsistance farmers into commercial farmers. We feel we can bring about this change because our farmers are young men, fairly well educated, and they are motivated. We have worked out their income patterns and feel that they would have the surplus necessary to make them feel independent of government and governmental institutions and really contribute to the development of the countlry in a big way.

It is our belief that we can achieve our objectives if the Mahaweli Settlements are well worked, and here I must say that we need the 100 percent cooperation and participation of the Banks because credit is a vital factor. But I realize that credit can never be given unless there are possibilities of repayment. Here the Mahaweli Authority, which manages these settlers, will ensure that the farmers get an adequate income which will enable them to settle their debts and also put by a little as savings. The young farmers who will be developed in Mahaweli will be part of a new civilization, quite proud of their achievements and there is no doubt that they would make an enormous contribution both to the development of trade and commerce and also to industries in the Mahaweli area, and also the benefits from this development would affect the entire island because the excess monies earned by these farmers and available for investment can be invested outside the Mahaweli areas.

Q. *In your opinion, what are the other factors that would require most attention in this project during the next few years?*

A. Well, I repeat. What would require most attention in the next phase is the provision of satisfactory credit facilities. But we are not only interested in the development of the economic aspects and material prosperity of the settlers, we also want to make sure that they turn out to be good human beings; so their cultural life and cultural pursuits have also to be looked after, their religious needs have to be looked after and the Mahaweli Authority is now concentrating on these aspects. We are also, with the assistance of international organizations and development centres, trying to implement a scheme where family health, traditional way of life, cultural practises etc. are encouraged and developed and the latent skills lying dormant in these people are activated.

Then again, in every project area we are going to have demonstration farms and each of those farms will be developing improved and new products and also going into other aspects of agricultural development, the benefits of which will be available immediately to that project area and later to the other areas.

The whole purpose is that the farmers will be able to respond effectively to the demands of the consumers. We think we can do this effectively by providing and catering to foreign markets. The Mahaweli farmers are a well organized lot, quite receptive to new ideas, especially in the area of scientific farming. They are becoming increasingly commercial minded in the choice of their crops and some of them are even organized into export villages. Now this is where we think we could invite foreign consumers, through their marketing organizations, to come to the Mahaweli area and set up purchasing units and if they indicate to us the kind of products they need I think the Mahaweli Authority will be geared adequately to produce these items and supply them to the foreign purchasers.

There is another important aspect I must deal with. At the start when I questioned the farmers they said when we get money it just disappears, we cannot control it. When I asked the banks why they could not take it in kind, the banks were not very happy about it. But I think they finally came round to the idea that they must try to help the farmer to be free of debt. After all the farmer wants to be free of debt, he is not dishonest, but his method of settlement of debt is to pay it in kind; and in Mahaweli area this could be easily done because there are stores available to the Mahaweli Authority and I think we made arrangements with the Paddy Marketing Board to receive paddy, grade it and take over the paddy, so that within 3 days of harvesting bank loans could be completely recovered and this could avoid bad debts.

Many of these farmers have not had the experience of operating in a money economy. They are not used to parting with their crops and taking the cash. The Mahaweli Authority gave serious thought to this situation and with the cooperation of the Banks and another Government agency, namely, the Paddy Marketing Board, worked out a scheme whereby the farmers paddy could be received and he will get a fair price and his monies will be kept securely without his having to go through a cash transaction. He takes his paddy to the Paddy Marketing Board Stores and thereafter it is a transaction between the PMB and the Banks. The Mahaweli Authority has made all arrangements with the farmer. All we expected of the Banks was for them to formally accept paddy instead of cash as a form of payment for repayment of their loans. The Bank does not have to carry these stocks. The PMB accepts the paddy and sends on the cheques to the banks.

In Mahiyangana area and the System H areas there has been a very close coordination and cooperation between the farmers and the bankers. We have had seminars where the banker has been able to understand the farmer and the farmer was able to understand the banker better. I must say that State Banks have understood the problems and are making a great effort to assist in tackling them. For instance, I am aware that the Chairman of the People's Bank Dr S.T.G. Fernando has made every effort to study the issues and has a clear understanding of these problems and through his bank officers has begun to implement credit arrangements that are of definite benefit to the Mahaweli farmers. I think this development augurs well for the future prosperity of these areas and this type of understanding and cooperation should be fostered at all costs.

Q. *If the private paddy purchasing agents are prepared to pay more, would it not upset the operation of this scheme?*

A. Generally the private purchasers do not purchase on a regular basis and in very large quantities, so that the farmers now appear to be more prepared to go along with the banks who give them credit, rather than with the private purchaser who at times may not pay them the money and also they cheat them when measuring their paddy. And we ourselves also arrange for big purchasers to come there and buy their paddy. For instance, the CWE and reputed Pettah merchants.

This is a typical problem for these pioneering settlers but we have found out from them what needs to be done and have sorted it out. So too with many of the other problems connected with infrastructure facilities, water supplies, cropping patterns etc. we are

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DOWNSTREAM DEVELOPMENT ISSUES

D. J. Bandaragoda

Mr. D. J. Bandaragoda, Additional Secretary, Ministry of Mahaweli Development and the Executive Director of the Mahaweli Authority of Sri Lanka who has been closely involved with the settlement development of the Accelerated Mahaweli Programme for several years, states his observations on downstream construction problems and their relations to the settlement and social developing of these areas.

Pondering their future - Settlers from Dumbara Valley have moved into System C

At the planning stage, necessary consideration was given to issues connected with the irrigation system and subsequent social development, such as:

(a) The construction of channel structures designed in favour of viable social units at the turn-out level.
(b) Hierarchial social groupins such as village centres, area centres, townships, being given attention in the provision of infrastructure packages.
(c) Location of townships being planned in relation to the organization, building of human resources, as well as existing townships.
(d) The construction of infrastructure required for settler welfare.

Problems of Implementation

At the level of implementation, the above-mentioned plans and designs could not be fully translated into reality due to the gap between the technical possibilities and social considerations. Hence, problems with regard to the downstream construction would often lead to social issues at the settlement stage. Some of the problems being raised at the settlement level may be summarised as follows:

(a) Lack of understanding of the planning criteria at the implementation level. All the necessary concepts for irrigation structure and designs were developed at the planning stage. But, at the implementation stage the constructuion was through contractors most of whom cannont be expected to show much interest or responsibility in such concepts. Therefore, supervision was the only means of overcoming such weaknesses. However, the present status of the established system does not speak of the effect of such supervision. Perhaps, due to lack of understanding of planning concepts, or lack of awareness of the overall objectives, if not for a lack of social responsibility, the necessary supervision has not been very effective.
(b) The resultant difficulties in operation and maintenance.

Irrigation infrastructure, mainly the secondary and tertiary network of channels, along with land development work are the immediate concern of the farmer, for his productive work. Their future has to be judged from the stand-point of reasonable and sufficient access to irrigation water, and this was the exact goal of the planned channel construction programme. However, it may be due to lack of detailed engineering surveys, the constructed irrigation network was sometimes plagued with numerous operational problems. Since the settlers are brought in advance of irrigation, once settled they have to be given their assigned lowland blocks in close proximity to their already established homesteads and for this purpose, modifications to the irrigation network and further land levelling have to be effected.

The remedial measures adopted to rectify this problem could in turn lead to another problem. Further levelling of land takes the top soil away and the land may become irrigable but not productive, although it was meant for productive work by the farmers.

The dichotomy of construction and operation means that those who are responsible for construction and the establishment of infrastructure are not guided by any subsequent responsibility for future operation and maintenance. Like contractors their responsibility is limited to the immediate establishment of infrastructure. Therefore, we find a very uncomfortable polarisation between Construction groups, and the Operation and Maintenance groups working under pressure from farmers, although both groups consist of technical personnel of similar background.

The operation and maintenance of some of the infrastructure is meant to be the responsibility of other Ministries and Departments such as Education, and Health. At the planning stage, these agencies show some involvement but at the construction stage their participation is not available although, they tend to complain against the poor quality of buildings at the time of handing over. This could be avoided by obtaining their support at the construction stage of their own buildings, so that they could contribute towards ensuring better quality work. One such instance where it has happened is with the Ministry of Education, which accepted our proposal to locate a School Work Engineer from the Ministry to attend to their building construction in Systems B & C.

Very few tend to realise that the Mahaweli Development Programme is not necessarily a land development exercise alone, but more a social development programme. Most of the eventual beneficiaries of this programme are from the poorest of the poor category of the Country, especially landless and marginal farmers who are becoming settlers. These are the people expected to maintain the system later in order that they may engage in economic development. Therefore, there is an added social responsibility to ensure that the post-construction maintenance cost is at a minimum. To avoid the above type of complications a suggestion has been made to install a post construction evaluation unit within the Downstream Construction so that they could evaluate and monitor the performance of the system built by them and assist the Operation and Maintenance groups to provide the necessary services to the farmers.

monitoring their requirements very closely and attempting to meet all their needs. We are very conscious that with the progressive completion of the major headworks and downstream engineering works we have to concentrate more on the settlers or what is called the "human engineering" aspect of the Accelerated Programme. As I said earlier, we hope that a different type of settler will emerge in the Mahaweli regions, namely one who will be free to take his own decisions whether in marketing his produce or making new investments, decisions that will have a positive bearing on the quality of life and society in these areas.

SRI LANKA AS A WELFARE STATE: AN OVERVIEW*

N. Balakrishnan

Senior Lecturer & Head of the Department of Economics, University of Jaffna.

For a less developed country, Sri Lanka – which is listed among the thirty six (36) low income developing countries in terms of the World Bank classification[1] – has achieved a commendable and unique record of social progress. This has largely been the result of nearly four decades of state sponsored and state financed social welfare services, mainly free education. free medical and health care and subsidised food distribution. The overall impact of social welfare and redistributive policies had enabled the country to achieve a remarkable degree of success in terms of the now widely discussed Physical Quality of Life Index (PQLI – 83/100) and 'Basic Needs' fulfilment, unmatched by many of the other less developed countries with comparable or even higher per capita income levels.

This paper seeks to highlight (i) the circumstances that led to the emergence and continuance of 'social welfarism' as a major component of government socio-economic policy commitments, (ii) the magnitude of social welfare spending, (iii) the overall impact of social welfare services and (iv) the important issues pertaining to social welfare-growth interrelationships. The paper also highlights the serious economic and financial problems that confronted the country in the 1960s and 1970s, in the context of which the social welfare policy commitments themselves proved to be a heavy burden on the government finances.

Socio-Political Foundations

The foundations of social welfare policy in Sri Lanka came to be laid in the decade that prededed the grant of political independence (1948), when the country had already enjoyed a substantial measure of self-government[2]. In the years that followed a more pronounced trend towards 'social welfarism' in state policies became clearly marked.

Since independence successive governments were strongly committed to the policy of providing extensive social welfare services – mostly free or subsidised – to nearly all sections of the country's population. Free education from primary to tertiary levels, free medical and health services and food subsidies formed the major components of the social welfare programmes channelled through the government budget. In addition, public assistance and relief measures to specific groups were also provided through the budget. Moreover, subsidised fares and rents in public transport and housing, respectively, as well as controlled or subsidised prices of essential consumer items also conferred benefits directly and indirectly on the consumers.

The general social welfare services encompassing almost the entire population and channelled through the budget were supplemented by an enlightened system of social security and wage labour regulation through labour welfare legislation. The latter covered largely the organised and formal urban segment of the economy – involving both the private and public sectors – in which there had developed a strong trade union movement since the 1930s dominated by the left-wing and marxist-parties in the fifties and sixties.

Government commitment towards social welfare programmes operated in the context of an expanding role of the state in the post-independence period in directing and guiding the country's socio-economic development within the framework of what may be termed a 'mixed economy'. The increasingly important role that the government assumed was a consequence and a necessary concomitant of the emergence of a 'welfare state' in Sri Lanka. Social welfare and redistributive policies were a significant facet of the enhanced role assumed by the state as a principal agent of socio-economic transformation in the country.

It is important to note that the continued commitment to 'welfarism' in state policy since the mid-1940s arose out of, and was partly determined by, the socio-political system that evolved in the country. Since the granting of adult franchise in 1931, there had developed gradually a liberal and open political system based on parties and parliament in which electoral politics with a high degree of voter participation was a dominant feature.[3] The electoral system also gave a considerable weightage to the rural areas where the majority of the population lived. The political system with a democratic base, despite deficiencies and the challenges it faced, had survived. In this system governments were periodically changed through popular elections. Such a system made the ruling parties and governments very much responsive to popular needs and pressures. This inevitably gave a definite orientation towards social welfare policies – the benefits of which were intended to reach the low

1. See, *World Development Report,* World Bank, 1981 (Table 1 – Basic Indicators) The group of 36 low income developing countries consists of those countries with a per capita income of S 370 or less in 1979 (Sri Lanka had a per capita income of S 230). Sixty (60) middle income countries listed are those with a per capita income of or more than S 370.

2. L. A. Wickremaratne, "The Emergence of a Welfare Policy 1931 - 1948", *University of Ceylon History of Ceylon,* Vol. iii, Colombo, 1973.

3. For a comprehensive account about the evolution of the political system, see James Jupp: *Sri Lanka – Third World Democracy,* London, Frank Cass 1978: A. J. Wilson: *Politics in Sri Lanka* 1947 - 1973, Macmillan, London 1974 and Robert N. Kerney: *The Politics of Ceylon (Sri Lanka)* Tithaca, New York, 1974.

income majority in the rural and urban sectors. It is in this context that commitments to social welfare once initiated had to continue even if they proved burdensome – for their large scale withdrawal would have meant political unpopularity and even political unrest for the government in power. This has generally been the experience of governments in power in Sri Lanka particularly in regard to the question of 'consumer subsidies' which had always remained a politically sensitive issue.

In the perceptions of government socio-economic policies, there has always been an underlying egalitarian element which reflected a concern and commitment to improve the lot of the poor, particularly the rural masses, through direct social welfare measures. This became a guiding principle since the late 1940s, especially when very little basic structural changes were envisaged in the country's economic system. In the context of social and economic backwardness and widespread poverty, particularly in the rural sector, it was understandable that government policies reflected a bias towards direct welfare oriented programmes. Thus partly in response to popular needs and pressures transmitted through the political system – and as a safeguard against political instability and social unrest – and partly out of concern to improve the welfare of the low income majority, social welfare and redistributive measures came to be accorded a significant place in goverment policies and programmes during the post-independence period. It is also important to note that all political parties supported such commitments, though with less enthusiasm while in power.

In the formulation and implementation of social welfare programmes – involving mainly education, health and food subsidies – by the government, a factor that added a significant dimension to policy commitments has undoubtedly been the rapid population growth experienced by Sri Lanka in the 1940s and 1950s. Since the mid-1940s, there was a very marked acceleration in the growth of the country's population and the rate of increase continued to be high till the mid-1960s. During the two intercensal periods 1946 - 53 and 1953 - 63, Sri Lanka's population increased at an average annual rate of 2.6 percent. There was a dramatic fall in the country's crude death rate – largely on account of malaria eradication and the general improvement in medical and health facilities – from 20 per thousand in 1943 – 45 to 14 per thousand by 1947; thereafter it continued to decline steadily, but gradually, reaching 8.4 per thousand in 1960. On the other hand the birth rate has remianed at traditionally high levels for a long period. This upsurge in the growth of population resulted in a near doubling of the country's population within twenty five years – from 6.6 million in 1946 to 12.6 million in 1971. The 'demographic revolution' experienced in the 1940s and 1950s resulted in an age-structure with a high proportion of dependent young age groups. The rapid growth of population, with

TABLE 1 – Social Welfare Expenditure – Sri Lanka (Value in Rs. Million)

	1955/56	1960/61	1965/66	1970/71	1975	1980
Total Government Expenditure	1,322.7	1,976.4	2,609.0	3,973.8	7,186.7	28,532.3
1. Education	182.1	297.6	346.5	527.0	707.6	1,845.7
% of total expenditure	13.7	15.0	13.2	13.2	9.8	6.4
% of GNP	–	4.7	4.5	3.9	2.7	2.4
2. Health	119.4	154.0	173.0	275.8	410.8	1,341.8
% of total expenditure	8.9	7.6	10.4	6.9	5.7	4.7
% of GNP	–	2.4	2.2	2.0	1.9	2.1
3. Food Subsidies (gross)	79.9	248.0	487.4	614.0	1,230.4	1,807.0 *
% of total expenditure	5.9	12.4	18.6	15.4	17.1	6.3
% of GNP	–	3.9	6.3	4.5	4.8	2.3
4. Social welfare expenditure (including special welfare and community services)	436.9	737.5	1,045.1	1,463.7	2,450.2	5,193.2
% of total expenditure	33.0	37.3	40.0	36.8	34.0	18.2
% of GNP	6.2	11.0	13.5	10.8	9.6	7.3
5. Current outlays on social welfare as % of total current expenditure	38.9	44.8	48.3	43.8	42.7	30.7
6. Current outlays on social welfare as % of government revenue	26.7	43.5	52.7	48.3	(45.0)	28.5

Source : *Central Bank of Ceylon – Annual Reports*

a high proportion of dependent groups, had far-reaching implications *vis-a-vis* the social welfare commitments in the 1950s. This inevitably pushed up the financial outlays on the largely population-linked welfare services provided by the government. This trend was clearly reflected in the central government expenditures during the 1950s and 1960s.

Social Welfare Expenditure

The government budget in Sri Lanka operated as a major instrument of welfare and redistributive policies. This marked emphasis was reflected in the central government expenditure throughout the post-independence period. The government commitment to maintain certain per capita levels of social welfare services combined with a rapidly expanding population (until the mid-1960s) led to a substantial increase in outlays on social welfare spending.

Total expenditure — including both current and capital outlays — on education, health, other special welfare and community services and food subsidies (gross), which together constituted the bulk of government social welfare spending, increased nearly six-fold from Rs. 437 million in 1955/56 to Rs. 2,450 million in 1975 (See Table 1). Part of this increase of course reflected the rise in prices. However, the annual rate of inflation had been below 5 percent in the 1950s and early 1960s; only in the subsequent period did the country experience higher rates of inflation exceeding 10 percent.

It would be more meaningful to relate welfare expenditure to total government expenditure and to the country's gross national product (GNP). As a proportion of total government expenditure social welfare spending — as already specified — increased from 33 percent in 1955/56 to 40 percent in 1965/66; thereafter the proportion had tended to decline. Expressed as a proportion of the GNP (at current factor cost) social welfare expenditure ranged from 10 to 13 percent between 1960/61 to 1970/71; this ratio too showed a decline during the 1970s. However, for several years the total social welfare expenditure in relation to the GNP varied between 10 to 12 percent which is indeed a high proportion for a less developed country.

The magnitude of such outlays may be seen in another form. The total current payments incurred on education, health, specific welfare and community services and food subsidies formed 40 - 45 percent of the total current expenditure in the central government budget; they also absorbed 45 - 50 percent of the total Central government revenue in the 1950s and 1960s. The government outlays on social welfare expenditure undoubtedly became a heavy burden on the budget by the end of the 'sixties and contributed to the mounting budget deficits, which contined to be a marked feature. The relative decline in the ratio of social welfare expenditure in relation to total government expenditure (as well as GNP) in the 1970s partly reflected the governmental attempts to limit the increase in social welfare spending on account of budgetary constraints.

Of the three major components of social welfare expenditure, education and health formed more or less stable items of governmental spending not very much influenced by short run policy considerations of the government. Together they constituted 18 to 22 percent of the total central government expenditure and 5 to 7 percent of the GNP. Education absorbed a somewhat greater share of the expenditure than what went to health

Educational development has been a major concern of all governments during the post-independence period in Sri Lanka. Government commitments to education and educational expansion came to be viewed also as a social need providing access to all sections of the population. Such commitments began in a big way with the introduction of universal free education (1949) which continued to be the basis of educational policy in Sri Lanka. The government policy — commitment to educational expansion over the years — had enabled the country to develop a comprehensive system of formal education with an extensive network of schools that covered almost the entire country. The impact of rapid population growth since the mid-1940s came to be felt in the educational sphere as well. The school-going population nearly doubled in the 1950s increasing from 1.2 million in the 1950s to 2.2 million in 1960 and further increased to 2.7 million in 1970.

School enrolment in the 5 - 19 years age group recorded a substantial increase from 40 percent in 1946 to 61 percent in 1971. with a marked narrowing down of the differences between males and females. The policy of 'swabhasha' education formed another important facet of the process of educational expansion with a wider social impact. The 'take-over' of private schools in 1961 was a further landmark in the development of a comprehensive educational system financed and maintained by the state. While it would be inappropriate to speak of an educational system that gave equal access to all citizens, it can not be denied that Sri Lanka has made rapid progress in the direction of equalising educational opportunities for her citizens.

Despite deficiencies that still existed in the country's educational system, many of the social benefits from several years of educational progress bacame visible in the 1950s and the 1960s. The most significant social impact has been the marked improvement in literacy and the average level of educational attainment of the country's population. The percentage of literacy in the population over 10 years in both sexes increased from 40 percent in 1921 to 78 percent in 1971 and 86 percent in 1978/79.[4] For males, literacy rates increased

4. Department of Census and Statistics, *Population of Sri Lanka,* Colombo, 1974, p. 51 and Central Bank of Ceylon, *Report on Consumer Finances and Socio Economic Survey,* 1978/79 Colombo, 1983, 1983 p. 25.

from 56 percent to 85 percent and for females from 21 percent to 71 percent between 1921 and 1971. The substantial increase in the percentage of literates among the females is a good index of the increasing number of females having gained access to the expanding educational opportunities in the country. Sri Lanka's overall literacy rate is much higher than that of may other developing countries with similar or even higher per capita income levels. It has been reported that Sri Lanka's adult literacy rate of 85 percent (1976) was very much higher than the 'low-income' countries (weighted) average of 51 percent.[5] It is further revealed that Sri Lanka's adult literacy rate was the highest among the 36 low income countries excluding Vietnam (86%). The adult literacy rate in Sri Lanka was also found to be above the average (71%) for the 'middle-income' countries and was higher than that of many other individual middle income countries themselves.

The expansion of educational facilities during the past three to four decades in Sri Lanka had raised the educational levels, by and large, of all sections of the population with the notable exception of people in the estate sector who had a strikingly low level of educational attainment. While the rural sector in Sri Lanka also showed a relatively high illiteracy compared to the urban sector the rate of illiteracy was found to be the highest in the estate sector. In the country's population, classified according to educational status by sectors, it is noticed that the 'no-schooling' (illiterate) category constituted 23 percent for the whole island, 18.5 percent for the urban sector, 22.5 percent for the rural sector and 43.6 percent for the estate sector in 1978/79.[6] For the people in the estate sector, schooling proceeds very little beyond the primary level. Persons with secondary education and beyond showed a strikingly low percentage of 8 percent — of the population — in the estate sector, while the corresponding percentages for the rural and urban sectors were found to be 37.0 percent and 46.5 percent repectively. The estate Tamil population of Indian origin had remained largely outside the mainsteam of the national education system and were not beneficiaries of the educational progress that the country in general achieved in the post-independence period.

The state-sponsored and state-financed medical and health care which had developed over the past four decades or so included both curative and preventive services and programmes related to health, sanitation, water supply and health education. People had a fairly broad-based acccess to such facilities despite the many shortcomings — including regional and/or sectoral imbalances — that still persisted in the country's medical and health services.

Some of the important health indices showed, among other things, that Sri Lanka succeeded to a remarkable degree in reducing the death rate and infant mortality, and in raising life expectancy within a relatively short period of time. The country's death rate witnessed a phenomenal decline in the 1940s and early 1950s and reached 8 per thousand around 1960 which was one of the lowest among the developing countries. Infant and maternal mortality rates too recorded a substantial decline in the post-1946 period. The infant mortality rate which was 141 (infant deaths per 1000 live births) in 1946 dropped sharply to 82 in 1950 and more gradually, to 43 in 1971.[7] The maternal mortality rate was less than 2 per 1000 live births in 1971 compared to 15 in 1946. The general improvement in health conditions came to be reflected in a notable change in life expectancy for both males and females. Life expectancy that stood at 44 years for males in 1946 increased to 66 years in 1979; and for females, it increased from 42 years to 70 years during the same period. Among the group of (36) 'low income' Third World countries — according to the World Bank classification — Sri Lanka's life expectancy (66 years) in 1979 was the highest.[8] Sri Lanka's life expectancy is even higher than that of many 'middle income' less developed countries. The state medical and health services in Sri Lanka enabled the benefits to reach all sections of the population, although the health status of the estate Tamils, in many respects, still compares very poorly with the rest of the population.

Food subsidies occupied an important place in government policy aimed at consumer subsidisation. 'income transfer' and stable cost of living. Food subsidies, the bulk of which constituted the subsidy on rationed distribution of rice — the staple diet of the people — had also for a long time remained a highly sensitive issue in Sri Lankan politics. The rice subsidy scheme was initially introduced during the second World War as part of government policy aimed at ensuring the availability of essential food stuffs at controlled prices and/or through rationing.

Since the mid-1950s the food subsidies in general and the rice subsidy in particular had continued more or less uninterruptedly with minor modifications. Under the rice subsidy scheme all persons (income tax payers were excluded after 1972) were entitled to a weekly ration issued through the co-operative stores and other retail outlets. Rice issued under the subsidised rationing scheme comprised both locally produced rice and imported rice — though a major proportion in the 'fifties and sixties' was imported rice. Apart from the domestic budgetary outlays, food subsidies in general and the rice subsidy in particular, also had important foreign exchange implications as the

5. *World Development Report,* 1981, op. cit., (Table I p. 134).

6. *Report on Consumer Finances and Socio Economic Survey* 1978/79, op. cit., p. 28.

7. *Population of Sri Lanka,* op. cit., p. 27.

8. *World Development Report,* 1981, op. cit., (Table I p. 134).

government had to depend on imports to operate its food subsidy schemes. Furthermore, import of rice and its subsidised distribution influenced the open market price with possible disincentive effects on local rice production, which has been the mainstay of the rural economy. The government price-support policy through the Guaranteed Price Scheme has been among the important measures adopted to provide incentives to local farmers. However, this did not always function effectively especially in relation to the cost of production and open market prices.

The cost of food subsidies (on a gross basis) increased rapidly partly reflecting the increase in population. In the later years, especially since 1970, the increase in world prices also played an important part. Total outlays on food subsidies increased from 6 percent (Rs. 79.5 million) of total government expenditure in 1955/56 to 18 percent (Rs. 487 million) in 1965/66. By 1975 the total cost of the food subsidy amounted to Rs. 1230 million – 17 percent of total government expenditure and nearly 50% of the total social welfare expenditure. Food subsidies on the whole claimed 20 to 25 percent of the total current expenditure in the 1960s. The outlays on food subsidies continued to be a heavy burden and contributed to the sharp increase in the current expenditure of the central government budget.

Social Welfare-Growth Relationships

The fiscal system in Sri Lanka – through its expenditure and taxation policies has throughout acted as a principal mechanism effecting a net transfer of 'benefits' from the higher to the lower income groups. One estimate of 'fiscal incidence' showed that for all income groups below Rs. 800 per months the 'expenditure incidence' has out-weighed the 'tax incidence'. The excess of the former over the latter has been particularly marked in the income groups with a monthly income of below Rs. 400.[9]

Sri Lanka's experience in regard to income distribution is particularly noteworthy in that it showed a significant improvement until in the mid-1970s. The data from the Consumer Finance Surveys conducted by the Central Bank provide adequate evidence in this respect. The concentration ratio (Gini coefficient) for income receivers declined from 0.50 in 1953 to 0.41 in 1973 and for spending units the decline was even more marked from 0.46 to 0.35 during the same period. It is significant to note that the share of the bottom 40% (spending units) increased, particularly between 1963 and 1973, from 14.6 percent to 19.3 percent. Also noteworthy is that the share of the top 20 percent declined from 52.3 percent to 42.9 percent in the same period. The middle income groups too have made significant gains during this period.

The more recent statistics on income distribution show a relative deterioration compared to the early 1970s. The Gini Coefficient has increased from 0.41 in 1973 to 0.49 in 1978/79 and to 0.52 in 1981/82 for income receivers (see Table 2). In terms of spending units too, the coefficient increased from 0.35 in 1973 to 0.45 in 1981/82. It is significant to note that while the share of income received by the top 20 percent increased from 45.84 percent in 1973 to 54.30 percent in 1978/79 and to 56.52 percent in 1981/82, the share of the bottom 20 percent of the income receivers declined from 4.97 percent in 1973 to 3.76 percent in 1978/79 and to 3.70 percent in 1981/82; almost similar trends are observed in the share of income received by the spending units. During this period the shares of income deciles in the middle range also declined relatively.

There is little doubt that the period after 1973, particularly since 1978/79, as revealed by the available statistics, shows a greater uneveness in income distribution in contrast to the trends observed in the earlier period. This is probably a reflection of the

TABLE 2
Percentage of Total (one month) Income Received by Each Ten Percent of Ranked Income Receivers and Spending Units

	Income Receivers					Spending Units				
Decile	1953	1963	1973	1978/79	1981/82	1953	1963	1973	1978/79	1981/82
Lowest	1.51	1.17	1.80	1.20	1.21	1.90	1.50	2.79	2.12	2.18
Second	3.56	2.70	3.17	2.56	2.49	3.30	3.95	4.38	3.61	3.55
Third	3.56	3.56	4.38	3.60	3.47	4.10	4.00	5.60	4.65	4.35
Fourth	4.37	4.57	5.70	4.76	4.61	5.20	5.21	6.52	5.68	5.24
Fifth	5.71	5.55	7.10	5.93	5.57	6.40	6.27	7.45	6.59	6.35
Sixth	6.31	6.82	8.75	7.29	6.93	6.90	7.54	8.75	7.69	7.02
Seventh	7.94	8.98	10.56	9.12	8.56	8.30	9.00	9.91	8.57	8.69
Eighth	10.39	11.46	12.65	11.23	10.64	10.10	11.22	11.65	11.22	10.71
Ninth	14.16	16.01	15.91	15.26	14.82	13.20	15.54	14.92	14.03	14.52
Highest	42.49	39.24	29.98	39.04	41.70	40.60	36.77	28.03	35.84	37.29
Gini Coefficient	0.50	0.49	0.41	0.49	0.52	0.46	0.45	0.35	0.44	0.45

Source: *Central Bank of Ceylon Report on Consumer Finances & Socio-Economic Survey, 1981/82, Sri Lanka, October 1984*

9. P. J. Alailima, *Fiscal Incidence in Sri Lanka,* ILO 1977, quoted in Peter de Valk: *The State & Income Distribution – with a Case Study of Sri Lanka,* Institute of Social Studies, The Hague, 1981.

outcome of the 'open economy' policies of the post-1977 period. The greater stress on growth and investment under the influence and direction of market forces (and increasing privatisation) possibly led to greater ineaquality in earned incomes in some of the important sectors of the economy.

On the whole, many of the socio-economic indicators in Sri Lanka showed positive achievements judged by such criteria as educational progress, improvement in health and nutrition levels and reduction in income and wealth disparities.[10] However, it must be noted that such significant improvements have taken place against a background of relatively poor performance of the economy with regard to growth, investment and domestic savings and, furthermore, the deteriorating economic situation in the 'sixties and seventies' as reflected in the high rate of unemployment, the persistent budgetary imbalance and balance of payments disequilibrium. In this background, questions relating to welfare-growth inter-relationships in the Sri Lankan context become relevant.

In terms of the 'growth-oriented' approach – which has, of course, come in for a great deal of criticism in recent years – emphasising mainly the rate of investment, savings and economic growth, Sri Lanka's experience since the late 1950s has been unsatisfactory. In the 'fifties' and 'sixties' the economy experienced no marked upward trend in the rate of overall investment. The investment ratio (investment as a proportion of GNP at current prices) averaged 15 percent during 1959 - 64 increased to an average of 17 percent in the second half of the 1960s and then remained around 16 percent during the first half of the 1970s.[11] Gross domestic savings appeared to have stagnated around 13 percent in the 1960s with only a marginal change in the first half of the 1970s. Since the mid 1960s domestic savings were increasingly supplemented by 'foreign' savings. The overall growth in the economy in the 'sixties averaged 4.4 percent per annum in real terms. This, when adjsuted for the annual rate of increase in population gave an average annual increase of 2 percent in GNP per capita. There was a marked lowering of the overall growth rate in the economy during the first half of the 1970s, averaging only 3 percent per annum.

It is necessary to draw attention to one key factor, namely, the steady deterioration in the country's terms of trade which dominated the Sri Lankan economic scene in the 1960s and 1970s. The persistent and marked decline in the terms of trade – which was of crucial importance to an economy in which exports and imports played an important role – meant a reduction in the country's import capacity with an adverse effect on the potential availability of imported supplies of raw materials, investment goods and consumer goods. Since the early 1960s Sri Lanka faced a worsening balance of payment problem in the context of which – with import controls and exchange restrictions – foreign exchange scarcity became a major constraint on the economy.

The country experienced a very serious unemployment problem since the end of the 1960s. The overall rate of unemployment which stood at 14 percent of the labour force in 1969/70 increased to 18 percent of the labour force by 1973. The problem of unemployment became severe among youths with educational attainments. There has developed a serious imbalance between the pace and pattern of educational expansion and the capacity of the economy for employment generation – resulting also in a serious 'mis-matching' of job aspirations of educated youths and the pattern of employment opportunities.[12]

It has been observed[13] that Sri Lanka's commitment to welfare services, on a significant scale for a long time, has progressively limited the amount of resources that could otherwise have been diverted to investment, contributing directly to increased physical productive capacity (and thereby greater employment potential) in the economy. This is not to be denied, although it has been observed that the "trade-off" between expenditure on human development and growth has thus not been so sharp as it is sometimes suggested".[14] This is based on the reasoning that Sri Lanka's growth rate in the 1960s (4½ percent on average) has not been that low; and that the deterioration in the first half of the 1970s may be attributed to reasons not necessarily related to welfare policies.

It is true that Sri Lanka's unsatisfactory growth and investment and savings performance had also been associated with factors unconnected to social welfare policies – such as, the effect of adverse weather on agricultural production, the effect of government policies on incentives to

10. See Lal Jayawardene, "Sri Lanka" in Hollis, Chenery and Associates, *Redistribution with Growth,* London, Oxford University Press, 1974; and W. D. Lakshman: *Income and wealth Distribution in Sri Lanka – An Examination of Evidence Pertaining to Post 1960 Experience,* International Development Centre of Japan, Working Paper Series No. 16, 1980, Tokyo.

11. N. Balakrishnan, "A Review of the Economy" in Tissa Fernando & Robert N Kerney (Eds) *Modern Sri Lanka; A Society in Transition* Syracuse University, 1979.

12. International Labour Office, *Matching Employment Opportunities and Expections – A programme of Action for Ceylon,* Geneva, 1971.

13. H. N. S. karunathileke, "Impact of Welfare Services on the Economy", *Central Bank Staff Studies,* Colombo April 1973.

14. World Bank: *World Development Report,* 1980 p. 90.

private investment and savings; inefficiency in and mismanagement of public corporations; and foreing exchange constraints largely determined by external factors. Nevertheless, one cannot ignore the fact that a good part of the government resources devoted to social welfare spending did compete with resources that would have been made available for directly growth-inducing and capacity-creating investments. While stating this, one should not also overlook the possible indirect and long term 'productivity' effects of human resource development that has been associated with social welfare policies and programmes in Sri Lanka. Social welfare expenditure would have certainly contributed to the improvement in the "quality" of the people. Improvement in the quality of the people – or human resource development – could give rise to indirect economic or productivity gains though they cannot easily be quantified or assessed. Besides, the Sri Lankan economy was faced with the situation in which the country's human resources were not fruitfully utilised and this was reflected in the large scale unemployment that emerged in the 1970s. This itself was caused by the lack of adequate physical investment in the economy. Thus there emerged a basic imbalance when the human resource development was not matched by the expansion of the physical investment capacity and therefore the potential economic gains from human resource improvement could not be fully realised.

There is substance in the view[15] that some aspects of the welfare and redistributive policies in Sri Lanka conflicted with the incentives for higher growth and productivity in the economy. Government food import policy coupled with consumer subsidisation tended to have a depressing effect on producer prices in the domestic food producing sector – particularly the paddy sector. Food subsidisation with a view to stabilising the cost of living was very much consumer – oriented and was not without conflicts with producer interests. This inconsistency was especially marked in the domestic agricultural sector which is dominated by paddy production. Such disincentive effect of food imports linked to consumer subsidisation on the agricultural producer came to be recognised by the government and important policy changes were effected in the late 1960s – while still retaining the food subsidy scheme – so as to provide stronger price – incentives to the paddy producers.

Government taxation policies aimed at redistribution also could not avoid problems that emerged with some adverse effects on private incentives to save and invest. Redistribution policies directed towards lower income groups with a high propensity to consume may have partly undermined the overall savings capacity in the economy. Moreover, many public enterprises incurred heavy losses in the initial period partly due to inappropriate pricing policies and partly due to inefficient management, and consequently, they were a burden on the government finances.

Another aspect that has been commented upon in the welfare growth relationship is concerned with the question of selectivity,[16] or rather the lack of it for a long time, in the social welfare policies and programmes that were implemented. The social welfare policies and measures were intended to, and did, by and large, cover the entire population irrespective of income levels. In the rice subsidy programme, it was only as late as 1972 that the government decided to exclude the income tax payers. The government could have

TABLE 3 Foreign Trade Indices – Sri Lanka (1978 = 100)

Year	Volume		Prices		Terms
	Exports All	Imports All	Exports All	Imports All	Trade of
1965	111	65	65	11	142
1966	101	89	15	11	137
1967	105	76	14	11	120
1968	108	77	17	14	117
1969	103	82	17	15	110
1970	107	77	17	16	106
1971	104	68	17	17	98
1972	102	67	17	18	94
1973	103	60	20	24	82
1974	89	42	31	42	72
1975	107	52	29	49	58
1976	102	57	34	44	78
1977	94	73	55	54	102
1978	100	100	100	100	100
1979	101	123	109	152	72
1980	99	140	126	217	58
1981	102	145	129	282	46
1982	102	150	119	309	38
1983	109	180	165	375	44

Source; *Central Bank of Ceylon Annual Report – 1983*

$$\text{Terms of Trade} = \frac{\text{Export Price Index}}{\text{Import Price Index}} \times 100$$

15. See Marga Institute, *Welfare and Growth*, Colombo, 1974.

16. W. D. Lakshman, "Economic growth and redistributive justice as policy goals A study of Recent Experience in Sri Lanka", *Modern Ceylon Studies*, Vol. 6, 1975.

evolved at an early stage a food subsidy scheme directed towards the most needy, based on household income criterion (as was done later in 1978) or some other cirterion. Previously, the government did not contemplate such a policy partly due to the inherent administrative problems and partly for political reasons. A selective approach could have been adopted in other areas of social welfare programmes as well to save on costs. But here again the administrative difficulties would have been many and these would have created a different set of problems. There has always been a reluctance on the part of governments to adopt any selectivity criteria — especially in regard to education and health because this might not have been politically feasible as well.

While the government social welfare commitments continued — with only minor modifications — for nearly three decades, the economic situation in the country changed drastically exposing the basic weakness of the economy in many respects as well as its inability to support and sustain the various on-going social welfare programmes.

In the 1960s, the Sri Lankan economy was, by and large, in a more comfortable position. The surpluses generated from the plantation sector gave a substantial strength to the economy. There was no serious unemployment problem to contend with The policy-makers did not see any need for major structural changes in the economy. The government policy perspectives were dominated largely by the need for general infrastructure investment and development and land settlement and development to revitalise the peasant sector. In this context the commitments to direct social welfare measures — in the absence of any major restructuring of the economy — assumed importance and were also found to be less burdensome in the early years. Resource constraints in general did not weigh so heavily on the economy until the beginning of the 1960s.

With the early 1960s, the economic situation in the country changed for the worse and was further aggravated, since then, in many respects. As already observed, the decline in the commodity terms of trade continued to dominate the economic scene. (See Table 3). The substantial decline in the terms of trade inevitably reduced the country's import capacity. Sri Lanka's export sector dominated by the traditional exports, such as tea, rubber and coconut had performed badly in the 1960s and 1970s and appears to have lost the dynamism it had in the past — partly due to poor prices in the world market and partly due to the cost and productivity at home. This particularly affected the major export, tea. The land reform measures adopted by the government in the mid 1970s, nationalising all the estate lands owned by private companies and the problem that emerged had further addded to the difficulties of the traditional export sector. The percentage of the three traditional exports in relation to the value of total commodity exports had declined from 85 percent in 1971 to 58 percent in 1980. The export sector centered around the traditional exports seems to face an uncertain future — particularly in regard to tea — which can seriously undermine the country's efforts to earn the much needed foreign exchange.

In the early 1960s the country's first phase of import substituting industrialisation efforts were launched. This was followed by the imposition of an extensive system of direct controls on imports and foreign exchange. The 'inward-looking' and import-replacing industrial development that took place under a regime of stringent import and exchange controls, with a highly protected market, had reached a critical stage by the end of the 1960s when restricted import supplies led to low capacity utilisation in industy. Foreign exchange scarcity became a major bottleneck that affected productivity not only in manufacturing industry but in other vital sectors as well. Balance of payments deficits became persistent and dependence on external assiatance increased resulting in heavy external indebtedness with the external debt ratio exceeding 10 percent annually in the 1970s.

The persistent budgetary imbalance experiences since the early 1960s became a matter of serious concern. With enormous increase in fiscal commitments and operations in the1960s and 1970s — and expenditure increasing much faster than revenue — the size of the overall budget deficits progressively increased, particularly since the mid-1960s. Already by 1975, the overall budget deficit had exceeded Rs. 2000 million, constituting 35 percent of the total budgetary expenditure. The government had to depend on foreign finance and domestic borrowing to meet its budget deficits. During many years in the 1960s and 1970s the government also had to resort to "money creation" that is, borrowing from the banking system — which contributed to inflationary pressures in the economy.

Sri Lanka experienced a remarkable degree of price stability in the 1950s and a mild rate of inflation till the mid-1960s. However, in later years the economy became increasingly subject to high rates of inflation, exceeding 15 percent annually since early 1970s. The impact of oil price-hikes, world commodity inflation, exchange rate adjustments and cost escalations and internal budget deficits financed by 'money creation' — all of them — contributed to the rapid rise in the domestic price level.

Sri Lanka's socio-economic development experience showed, on the one hand positive achievements in the terms of social welfare and redistributive justice and, on the other, a totally unsatisfactory performance as indicated mainly by large scale unemployment, chronic balance of payments deficits, increased external dependence and external indebtedness and high rates of inflation. In the context of such serious economic difficulties that faced the country the question of maintaining a high level of social welfare spending

TABLE 4 Gross National Product, Real National Income, Investment and Savings (value in Rs. Million)

	(1) GNP at Current factor cost prices	Index (1970 = 100)	(2) GNP at 1970 factor cost prices	Index (1970 = 100)	Implicit GNP deflator (1)/(2)	(3*) Real National Income at 1970 factor cost prices	Index (1970 = 100)	(at current market prices) (4) Gross Investment	% of GDP	(5) Domestic Savings	% of GDP
1970	12,967	100.0	12,967	100.0	100.0	12,967	100.0	2589	18.9	2159	15.8
1971	13,486	104.0	13,034	100.5	103.4	12,975	100.1	2398	17.0	2117	15.0
1972	14,542	112.1	13.474	103.9	107.9	13,220	102.0	2638	17.3	2219	14.5
1973	17,737	136.7	13,995	107.9	126.9	13,554	104.5	2528	13.7	2305	12.5
1974	23,119	178.2	14,449	111.4	160.0	13,801	106.4	3735	15.7	1960	8.2
1975	25,478	196.4	14,837	114.4	171.7	13.812	106.5	4140	15.5	2155	8.1
1976	27,750	214.0	15,258	117.6	181.9	14,558	112.2	4896	16.2	4192	13.8
1977	34.432	265.5	15,934	122.8	216.1	15.715	121.1	5259	14.4	6591	18.1
1978	40,242	310.3	17.329	133.6	232.2	17.144	132.2	8554	20.0	6517	15.2
1979	49,542	382.0	18,430	142.1	268.8	17,595	135.6	13,527	25.8	7218	13.7
1980	61,814	476.7	19,456	150.0	317.7	18,257	140.7	22,465	33.7	7443	11.2
1981	77,469	597.4	20,216	115.9	383.2	18,728	144.4	23,610	27.7	11,851	11.6
1982	89,609	691.0	21,229	163.7	422.1	19,508	150.4	30,608	30.5	11,851	11.8
1983	108,171	834.2	22,076	170.2	490.0	20,625	159.0	35,036	28.6	16,598	13.5

Source: *Central Bank of Ceylon – Annual Reports*

Note: 3*– GNP at 1970 factor cost adjusted for terms of trade effect.
5**- Domestic Savings derived as the difference between gross investment and net import of goods and non-factor services.

assumed far greater significance in the seventies than ever before. In the 1970s, it was increasingly felt at official levels that the opportunity cost of social welfare expenditure – more specifically that which is devoted to food subsidies – in terms of 'developmental spending' was high.

When the present government came to power in 1977 and launched its new package of economic policies and measures it was officially seen as a departure from "a stagnating closed economy with a welfare bias to a dynamic open economy with an investment bias."[17] Thus when the present government withdrew the food subsidies in 1978 – from about half the population – based on the eligibility criterion of household income and later replaced the food subsidies with Food Stamps for eligible families – the decision was implemented without much difficulty at the political level. The cut back on social welfare expenditure did not extend beyond the food subsidies. Any further dismantling would not have been politically feasible and was not contemplated by the government either. However, in the post-1977 major policy orientation – some elements of which conformed to the what may be termed "the IMF-World Bank prescriptions" – 'welfarism' of the past has been over-shadowed by the primary emphasis on 'growth and inverstment' within the frame work of a liberalised 'open economy' supported by substantial foreign capital.

In terms of some key indicators[18] – especially relating to growth, investment and employment – the post-1978 period records significant achievements. An average growth rate of 6.2 percent of the GDP in real terms) – giving an annual increase of 4.4 percent in GDP per capita – achieved by the economy during 1978-82 was indeed a remarkable performance, compared to the past period. The overall rate of investment in the economy also registered a significant advance during the same period (see Table 4). However, domestic savings – performance still remains unsatisfactory. This meant that the high rate of investment, partly due to a heavy public sector investment programme, had to be sustained by substantial 'foreign savings'. During the post-1978 period, the country has been able to make a significant dent on the unemployment problem, partly eased by the migration of sizeable numbers for employment overseas. The overall rate of unemployment had dropped from 22 percent of the labour force in 1978 to 14 percent in 1982 according to official records.

Nevertheless, during this period the economy has been very much troubled by such persistent and serious problems as domestic budgetary imbalance with mounting deficits, external imbalance characterised by large balance of payments deficits and acceleration of the domestic price level and escalation of the cost of living. These continue to be major problem areas for the country's economy.

17. Central Bank of Ceylon: *Review of the Economy,* 1980, p. 70.

18. See, Ministry of Finance and Planning, *Public Investment,* 1983 – 1987, May 1983.

THE TUITION CLASS, SOCIAL CLASS AND EDUCATIONAL DISPARITIES

H. L. Hemachandra
Research Department, People's Bank

The system of free education was introduced in Sri Lanka nearly four decades ago, and free educational programmes have expanded steadily since then, yet all sections in society have not had an equal access to educational opportunities. But this has been subsumed in greater attention paid to the differences in education facilities among the various geographical regions, ethnic groups etc. This study is an attempt to look at some aspect of the unequal education opportunities for the different income groups and social classes.

In a study conducted in 1975 among the students in Peradeniya University to ascertain the extent to which education facilities had been distributed equally among the different social classes, it was revealed that there were large disparities in such opportunities among them. It revealed that a larger number of students entered the university from high income families and *vice versa* in contrast to the income group structure in the national population where higher income groups constitute a small percentage. (see table 1).

For instance though at that time the number of families receiving a monthly income of less than Rs. 200/- amounted to 34.2 percent of the total families in the country, students in the university from this category of families were only 11.3 percent of the total student population in the university. At the same time from the number of families receiving a monthly income of more than Rs. 1,000/-, a mere 2.0 percent of the total families in the country, the students in the university from this income group constituted 14.9 percent of the total student population. When faculties in the university were taken separately these inequalities appeared even more pronounced in the prestigious faculties.

A large number of students in the science faculties were from families of the high income groups while a very small number of students who entered such faculties were from low income families.

Analysis by parental occupations too showd a similar trend. For instance very small percentage of 2.5 percent of students in the university were children of unskilled labourers. But a comparatively larger percentage of 11.9 percent of students in the University were children of doctors and engineers. Once again faculty-wise the differences were greater in the prestigious faculties.

All this suggests that inspite of the free educational system comparatively better education facilities has been provided for the economically privileged social classes or such classes had greater access to such facilities.

Tuition classes as a phenomenon in Sri Lanka's educational system recorded a rapid growth in the 1970's. Today a large number of school going students receive private tuition and it has become a very important aspect of educatin and also been the subject of much discussion. In this once again more attention has been paid to matters such as reasons for students attending tuition classes, quality of education given in the tuition classes, tuition classes as a means to obtain more marks in the examinations etc. But little or insufficient attention has been paid to the socio-economic background of the tuition going students or which social classes have money to spend, on tuition, what proportion of their incomes are spent on tuition etc.

In this study we attempt to see whether there are any relationships between students attending tuition, money spent on tuition on the one hand and parental economic background on the other. This analysis is based on the data collected from school going students in Colombo City and Kegalle District. The necessary data were collected through a questionnaire administered to 729 students in grades 10 and 12 in eight schools in Colombo City and four schools in the Kegalle District. (see table 2).

While Colombo City with its social character and a visible high incidence of tuition attendance was an obvious choice yet those very characteristics it was feared would lead to a skewed data base. To correct this,

TABLE 1

Family Income of a Sample of University Students Compared with National Income Groups

Family Income (monthly In Rupees	Students in the University				
	Arts Faculty %	Science Faculty %	Engineering Faculty %	Total %	Population in the isalnd** %
Upto 199	16.4	2.8	4.2	11.3	34.2
200 - 399	33.6	18.4	18.4	27.7	45.5
400 - 599	19.5	15.5	22.5	19.3	12.7
600 - 799	11.6	15.5	23.9	14.9	3.9
800 - 999	9.4	18.3	14.1	11.9	1.6
1000 and over	9.5	29.6	16.9	14.9	2.0
TOTAL	100.0	100.0	100.0	100.0	100.0

SOURCE: *Hemachandra H. L. The Nexus between Socio-Economic Factors and New Brahmins: A Social Survey of University Students. Economic Review, Vol. 6 No. 1 April 1980

**Survey of Sri Lanka's Consumer Finances 1973. Central Bank of Ceylon.

TABLE 2

Sample Student Population in Colombo City and Kegalle District Classified by Grade and Stream

Area Grades/Streams		Colombo City Schools	Kegalle District Schools
Grade 10		182	75
Grade 12 Arts	25		47
Commerce	84		47
Medicine	108		60
Engineering	74		27
Total		291	181
TOTAL		473	256

four schools from Kegalle District were included. Kegalle District was chosen because it occupies a middle position if the districts are placed on a hierachy on the criteria of access to educational opportunities. (A District placed at the bottom of such a hierarchy e.g. Monaragala, would have been inappropriate for a study of this nature). The schools in Colombo City were selected on the basis of a purposive sample on a hierarchy of educational facilities and the social background of the students; while the four schools in Kegalle District were selected on a urban-rural dimension.

It was observed that a large percentage of children in families with higher income attend tuition while only a small percentage of children in families with low income do so. As shown in Table 3 in Kegalle District only 18 percent of students from families with a monthly income of less than Rs. 2,000/- attended tuition classes. But 58% of children from families with monthly incomes of more than Rs. 1,000/- attended tuition classes. In this district a significant co-relation of 0.94 between income groups and percentage of students attending tuition classes from these groups is apparent. In Colombo City too a similar trend can be observed.

When one examines the parental occupation of children it reveals that while a small percentage of children of manual workers with low income attended tuition classes, a large number of children of fathers in white collar jobs with higher incomes attended tuition classes. For instance, in Colombo City 85 percent of the fathers engaged in professional and executive level jobs send their children to tuition classes while only 34 percent of fathers who work as unskilled workers sent their children to tuition classes (see table 4). The trend in Kegalle District was the same though a little less pronounced. Another interesting feature that was observed in both areas was that a larger percentage of children of teachers attended tuition classes than the children of those in other occupations.

The study also examined whether there was any relationship between money spent on tuition classes and the family income. As presented in the Diagram on page 12 in Colombo City with the increase of family income, expenditure of tuition going students in the families also increases. For instance, a tuition going student in a family with a monthly income of between Rs. 2,200/- to Rs. 4,400/- spent only about Rs. 81/- on his or her tuition fees per month on the average. At the same time tuition going students in a family with a monthly income of over Rs. 1,000/- spent as much as Rs. 199/- on his or her tuition fees per month. Co-relation between tuition going students' tuition fees and their monthly family income in Colombo City was tested and found to be significant at 0.55 level. In Kegalle district too the same relationship between family income and tuition attendance's tuition fees exists.

When tuition going students tuition fees were analysed according to parental occupations it also showed the same trend. In Colombo City a tuition going child of a father engaged in a professional or executive level job spent Rs. 108/- on tuition fees per month on the average, while a tuition going child of a father engaged in unskilled labour occupation spent on the average only Rs. 34/- on tuition per month (see table 5). In Kegalle District, this relationship was not so strongly evident as in Colombo City but resembles it in a less marked manner.

TABLE 3

Tuition Attendance in Colombo City and Kegalle District Classified by Family Income

Family Income (Monthly in Rupees	0 - 200	201 -400	401 - 600	601 - 1000	1001 - 2000	2001 - 5000	5001 and over
In Colombo City	0	55	58	78	85	88	90
In Kegalle District	18	41	47	59		78	

TABLE 4

Tuition Attendance in Colombo City and Kegalle District Classified by Father's Occupation

Father's Occupation	Professional & Executive	Trader & Proprietor	Teacher (non University)	Clerical Workers	Skilled Workers	Paddy Farmers	Unskilled Workers	Total
In Colombo City	85	78	87	71	61	71	34	75
In Kegalle District	67	76	90	58	46	60	57	67

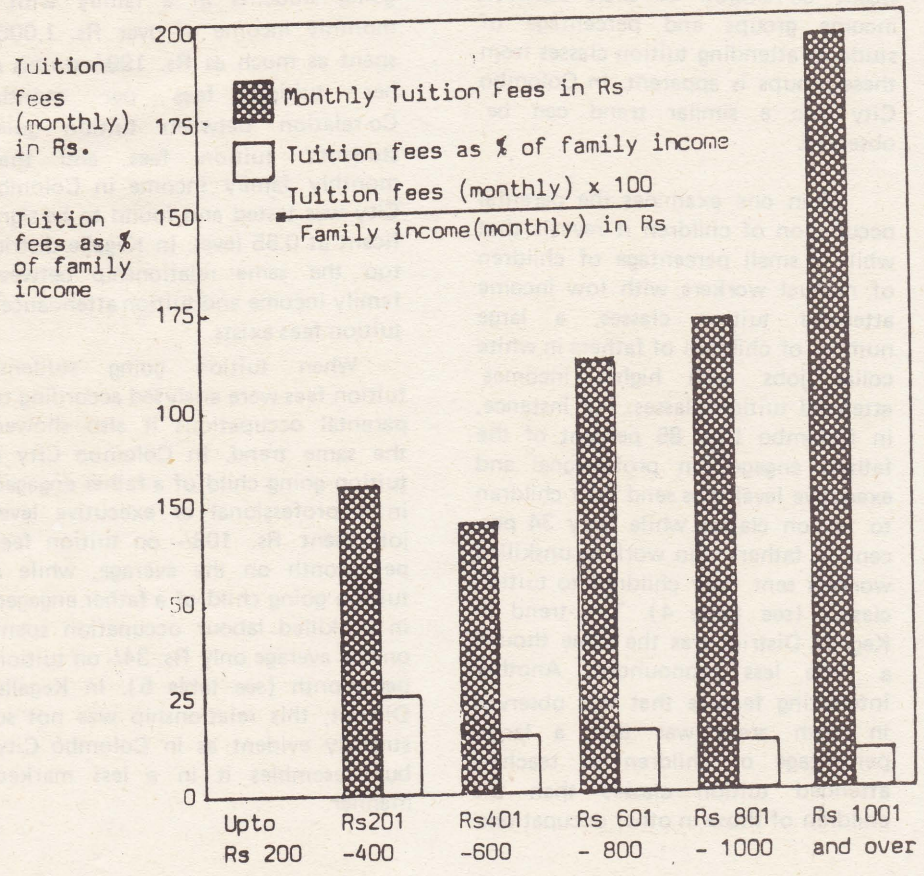
TABLE 5

Average Monthly Tuition Fees paid by a Tuition going Student in Colombo City and Kegalle District Classified by Fathers Occupation

Fathers Occupation	Professional & Executive	Trader & Proprietor	Teacher (Non. Univ.)	Clerical Workers	Skilled Workers	Paddy Farmers	Unskilled Workers
In Colombo City	108.14	83.99	70.04	50.61	38.68	36.00	34.50
In Kegalle District	29.83	26.95	27.89	22.89	24.00	28.19	23.67

DIAGRAM

AVERAGE MONTHLY TUITION FEES PAID BY A TUITION GOING STUDENT IN RUPEES AND AS A PERCENTAGE OF FAMILY INCOME



Though the parents with a higher income spent more money to send their children to tuition classes this expense constituted a smaller percentage of the household expenditure than in the case of parents with a low income. For instance, though a family in Colombo City with a monthly income of between Rs. 200/- and Rs. 400/- spent only Rs. 81/- on their child's tuition fees, this amounted to as much as 27.9 percent of their total income. But for a family with a monthly income of over Rs. 1,000/- the expenditure of Rs. 199/- is only 9.9 percent of their total income (see Diagram).

Conclusion

It is therefor evident that the degree of tuition attendance has a close relationship to family income levels. A larger percentage of students in the higher income groups were found to be attending tuition classes and were paying higher tuition fees than the students from the lower income groups who attended tuition classes.

As indicated at the outset, as a result of the unequal distribution of school educational facilities among the different socio-economic groups a higher proportion of students in the economically unprivileged section of society have been deprived of higher education opportunities.

If the tuition system helps sutdents to gain admission to the Universities, the disparities already existing in the education system, particularly in the field of higher education, are made further disparate by the operation of the tuition system. For this study strongly suggests that a greater number of children from the privileged socio-economic groups or strata have greater access to tuition. Indeed it can be interpreted that this is a mechanism by which such privileged groups are enabled to restrict privileged educational opportunities to themselves and furthermore it is a mechanism which hinders even the limited opportunities of the free educational system infact to provide an equitable access to education to all sections of society of whatever socio-economic background.

SCOPE FOR GOVERNMENT INTERVENTION IN RICE MARKETING IN SRI LANKA

Feasibility of a Buffer Stock Scheme

Palendra Ratnaweera

Palendra Ratnaweera *is a Staff Officer in the Central Bank of Ceylon who completed a disertation on Food Grain Marketing in Developing Countries, with special reference to Sri Lanka. This paper is an abridged version of a larger study relevant to Sri Lanka on the scope for Government intervention in food grain marketing. The views expressed are those of the author and do not necessarily reflect the views of this employer.*

Rice is the traditional staple food of the Sri Lankan people, though it remained neglected during the colonial era. During the three decades following political independence, the rice sub-sector assumed the position of a "dynamic sector" in the economy of Sri Lanka. The Government's direct intervention caused a break-through in rice production by substantial expansion in the area under cultivaton. The widespread dissemination of new bio-chemical technology enunciated since the second half of the 1960's, and the advent of farm mechanisation practices, the emergence of credit and marketing agencies, establishement of land-settlement schemes in the dry zone and tenancy improvements by various legislation all contributed to the increase in yield per acre and thereby an increase in the output.

The local production of rice recorded 612,000 metric tons in 1967 and the estimated self-sufficiency level was then 53 percent. The direct Government intervention in paddy production by way of the above mentioned measures, led to the production of 2,483,000 metric tons in 1984, leading to a position whereby Sri Lanka had reached a level of self-sufficiency in rice of about 93 percent.

The socio-political importance of the availability and market prices of rice in Sri Lanka is indicated by its magnitude in the composition of the per capita expenditure in the family budget of the Sri Lankan people. The Consumer Finance Survey 1981/82 conducted by the Central Bank of Ceylon, revealed that it "accounts for over 28 percent of total food expenditure" (p. 245).

The per capita consumption of rice per month was estimated to be 8.35 kgs. in 1978/79, while per capita consumption in 1973 was 7.97 kgs. The monthly per capita consumption has increased further to 8.40 kgs. by 1981/82. During this time the urban, rural and estate sectors per capita monthly consumption was 7.3, 8.7 and 8.6 kgs. respectively.

The Consumer Finance Survey 1981/82 indicates the "substitution effect" of the price increases in wheat flour and bread, resulting in the increased consumption of rice (p. 247). The variation of quantity of consumption in the family budget has a greater impact due to price changes than the income change. Therefore the stability in market price of rice became an important feature of the national food and nutrition policy formulations in Sri Lanka.

On the other hand, a country where small-scale farmers predominate in the rice sub-sector, the marketable price for paddy (unprocessed rice) has also assumed equal importance. The maintenance of a guaranteed price for rice above the cost of paddy production is a crucial factor in sustenance of the impetus for surplus marketable production of these small-scale farmers. Edirisinghe and Poleman have established a "rough approximation" of effects of the rice ration scheme on the marketing situation in Sri Lanka during the 1960's (p. 96 - 98). This study further reveals that even those with the smallest size of land holding tend to produce principally for sale due to the rice ration scheme. The existence of rationed rice at a subsidised price has necessitated a guaranteed price for the rice producer in order that as much paddy may be procured for distribution of rice among householders.

Private traders could manipulate the farm-gate price to their advantage by various means and would thereby cause disincentive effects on the marketable surplus of paddy within the existing socio-economic set up. It is found that throughout the existence of the Guaranteed Price Scheme (GPS) in Sri Lanka, the procurement price of paddy in the open market has been above the cost of production of paddy. Moreover, a feature of note is that the Paddy Marketing Board (PMB) played the role of a "floor price operator" subsequent to the period of the scrapping of the rationed rice subsidy scheme.

A World Bank (IBRD) study has projected the demand for rice in Sri Lanka from 1964 upto the year 1990. It is observed from this projection that if the present demand and supply trends are continued, there would be a rice surplus in the market. Therefore, the problems of marketing would also have to be anticipated and the importance of rice marketing will overshadow the production emphasis given hitherto.

The increasing strains on the budgetary resources and the prospects of achievement of self-sufficiency in locally produced rice necessiatated to the scrapping of the four decades-long public food distribution scheme with effect from 1st September 1979. The need for a vigorous policy of purchasing locally produced rice for distribution under the rice ration scheme became redundant thereafter. Accordingly the percentage of GPS purchases out of total production dropped form 35.7 percent in 1978 to 13.0 percent in 1983. During the period 1980 - 82 the percentage purchases were very meagre and much smaller than the 1983 purchases.

The declining trend in the PMB procurement is a manifestation of the structural changes that took place in the paddy and rice markets subsequent to the introduction of the package of economic reforms in 1977. These reforms were intended to provide

scope for the expansion of private sector participation in the economic growth and development of Sri Lanka and the private trade began to play a pre-dominant role in the wholesale and retail distribution of rice. It offered attractive prices for paddy in the open market, which were often much higher than the guaranteed price of the PMB. Therefore, the GPS price of the PMB "has come to assure the role of a floor price" asserted the Central Bank of Ceylon's review of the Economy (1981).

The establishement of the PMB was designed exclusively to the procurement of larger quantities of paddy in order to gradually replace the import of rice by the Food Commissioner (FC). The PMB purchased, transported, distributed, stored and milled (processed) paddy within the country. Its monopoly rights enabled the PMB to corner the private trader in rice marketing in 1970's.

The liberalisation of trade and payments provided opportunities for the private miller to update his milling technology and enhance its efficiency. The greater availability of construction materials in the open market enlarged the scope of expansion of private sector storage capacity. De-control of imports also helped to remove transport bottle-necks for private sector transport activities.

The veering away from the rice market structure in the 1960's and first half of the 1970's, was slowed down during 1980 - 82. This was partly due to uncertainity which emanated from the public sector pricing policy. The prevalence of an unco-ordinated Food Commissioner's imports programme with the PMB procurement contributed to the fears of the private trader regarding the dangers of excessive accumulation of stocks in its hands in a possible downward settlement of prices in the consumer market. Another factor that contributed to the reduction of private sector purchases was the liquidity problem encountered by them when carrying heavy stocks. In this respect the PMB is in an advantageous position to obtain credit at subsidised interest rates from the People's Bank, under the Central Bank Re-finance Scheme.

The periodical upward revision of the guaranteed price, in the light of increasing cost of paddy production during 1978 - 83, enabled the small scale farmers to dispose their output in the private market at attractive prices or to the PMB through multi-purpose Co-operative outlets.

The experience during the period under consideration shows that the PMB has played a novel role as a floor price operator in the emergent rice marketing system by arresting the downward movement of paddy prices in the market. But in the emergent marketing system the role of the PMB has apparently beocme a redundant one and its organisational structure is too unweildy to perform the functions assigned to it under the Paddy Marketing Board Act No. 14 of 1971 in the present context.

Fresh thinking is therefore needed to re-constitute the PMB as a full fledged statutory body. The responsibility of integration and co-ordination of domestic and off-shore procurements could be assigned to the reconstituted institution. This institution would have to maintain close laison with other Government sponsored institutions related to domestic rice production. Furthermore, the enlargement of its functions would need to extend to marketing research in order to understand the consumer's needs and his preferences. The collection and compilation of vital statistics with regard to rice marketing, including crop forecasting and demand estimation, would be under the purview of this refashioned institution.

When observing the price movements in both the producer prices and consumer prices, it appears that wide price fluctuations prevail between harvesting and off seasons. The table below shows an 18.0 percent variation of producer prices between January 1982 to April 1982, and 22.1 percent between December 1982 and February 1983.

Similarly, wide variations of consumer prices are discernible between the harvesting season and off-season in the year. For example in the year 1982 between January and May, the all-island average price fluctuated 16.9 percent and again between 1979 December and 1980 April-May it fluctuated 28.0 percent. The table on the next page depicts the price variations in the retail consumer market during 1980 - 1983.

The market forces in developing economies are notoriously deficient in determination of prices. Governments have to intervene in the market more or less directly to regulate the price behaviour as a supplement to the existing market mechanism for efficient allocation of scarce resources. In this context, a buffer stock scheme is necessary to moderate wider price fluctuations of food grain prices.

The aim of a buffer stock scheme is to absorb surplus food grains to make it available at a time of short supply, thereby moderating price fluctuations between the harvesting season and the off-season. There is no doubt that the private sector has to paly a more important marketing function in the emerging rice

FLUCTUTATION OF ALL-ISLAND AVERAGE RETAIL PRICE OF RICE (1980 – 1983)

(Rupees per kg.)

Period			Difference	%
1979 December	5.67	)		
1980 April - May	4.08	)	(–) 1.59	28.0
1980 December	7.41	)		
1981 April	5.69	)	(–) 1.72	23.2
1982 January	7.38	)		
1982 May	6.13	)	(–) 1.25	16.9
1982 December	7.56	)		
1983 March	6.30	)	(–) 1.26	16.6

Source: *Table II Price and Wages Statistics (1983) Central Bank of Ceylon*

marketing system in Sri Lanka than in the past. But the Government also has to fulfill a role of price moderator through the PMB by actively engaging in a buffer stock scheme. Rice price stabilisation in this way would be of considerable benefit both to the peasant community and to the consumer in the non-agrarian and urban industrial sectors in the economy.

The formulation and implementation of a buffer stock scheme to suit our specific national condition could ensure that paddy prices are not depressed below the GPS prices during harvesting seasons by actively engaging in the purchases. In the same way it could also release rice stocks to the market during the off-seasons to avoid price escalations in the consumer market. In this context the idea of a "Rice Bank" or a "Buffer Stock Scheme" is worthy of serious consideration.

The size of the stabilisation is determined by the costs incurred in maintaining and holding stocks; and the demand pattern and market conditions prevailing in Sri Lanka. It is not envisaged here to work out the details of such a scheme, but it is essential to co-ordinate its operations with rice import policy, as mentioned earlier in this paper, to feel its effectiveness towards attainment of its primary objectives. It is also pertinent to mention that a distinction could be made between the stocks intended to meet the seasonal fluctuations (buffer stocks) and stocks held in reserve to meet critical shortages due to adverse weather or any other calamities.

FOREIGN EMPLOYMENT

Sri Lanka Experience – Part II

This study is the product of 3 surveys carried out by the Employment and Manpower Planning Division of the Ministry of Plan Implementation. Part I carried in our June 1983 issue dealt with various aspects of foreign employment agencies and their services, and the demographic characteristics and socio-economic conditions of migrants. Part II deals with the Reasons, Costs and Duration of Migration; Occupational Mobility, Earnings in Foreign Employment, Migrant Remittances, Household Expenditure of Migrant and Investment by Migrants.

Part II concludes the study with an assessment of the Social Impact of Migration.

Reasons for Migration

The survey ascertained the reasons for migration for foreign employment, from the migrants who were interviewed at the Colombo International Airport. Altogether 18 possible reasons were identified and listed in a schedule, and at the interview the migrants were asked to state the three most important factors which influenced their decision to migrate. The majority of migrants disclosed only a single reason (16.7%). The response of migrants both on their leaving Sri Lanka and their return and the main reasons for migrating is provided in Table 10.

About 16 percent of the migrants have stated that they were leaving the country because of the attractive salary they would receive in foreign employment. This could be an under estimate in that a significant number of respondents who stated that they were leaving the country to overcome financial difficulties were motivated by the attractive salaries in foreign employment. The number of high level and managerial level persons who stated that they were leaving the country because of financial difficulties amounted to 18 percent while 41 percent had taken the decision because of the attractiveness of the foreign salary. A significant percentage of over 10 percent had stated that they were migrating because of family problems. Some of the persons who stated this as a reason would have arrived at their decisions because of their low incomes, the financial problems they faced and the relatively high wages in foreign employment. A small percentage of less than 0.5 percent have attributed racial discrimination as the cause for their migration. Dissatisfaction with the job they held here is the reason for migration of 0.5 percent of the migrants. Discrimination in employment has not been given as a factor contributing to migration.

Information was also obtained through the survey of returned migrants on the reason why they left the country for foreign employment. The same factors which were identified and listed in the survey of migrants for employment was used in this survey too. Table 10 also shows that 46.5 percent had stated that the main reason for their leaving the country was to overcome financial difficulties. The relative proportion for the different manpower levels shows that only about 8 percent of professional and managerial workers and 32 percent of sub-professional and clerical workers had left the country for this reason.

FLUCTUATION OF ALL ISLAND AVERAGE PRODUCER PRICES OF PADDY

(Rupees per bushel)

Period		Difference		%
1982 January	79.62			
1982 April	65.21	(–)	14.4	18.0
1982 December	84.95			
1983 February	66.14	(–)	18.8	22.1

Source: *Table VII Price and Wage Statistics (1983) Central Bank of Ceylon*

Table 10

Reasons for Outward Migration

Main Reasons	Response from Migrants Leaving Sri Lanka		Response from Migrants Returned to Sri Lanka	
	Total	%	Total	%
1. Attractive Salary	146	15.8	84	19.8
2. Interest of Spouse and children	07	0.8	06	1.4
3. Further Education/Training	06	0.7	05	1.2
4. Professional Needs	06	0.7	01	0.2
5. Change of work	–	0.0	–	0.0
6. Join Family/Spouse	02	0.2	03	0.7
7. Social/Cultural Preference	01	0.1	–	0.0
8. Influenced by family members	04	0.4	02	0.5
9. Friends already secured foreign employment	04	0.4	05	1.2
10. Desire for travel	03	0.3	06	1.4
11. Unemployed	58	6.3	21	4.9
12. Loss of Jobs	03	0.3	07	1.6
13. Overcome financial difficulties	478	51.6	197	46.5
14. Dissatifaction with present job	05	0.5	05	1.2
15. Discrimination in employment	–	0.0	–	0.0
16. Racial Discrimination	04	0.4	–	0.0
17. Political discrimination	03	0.3	02	0.5
18. Family problems	95	10.3	37	8.7
19. Other	05	0.5	11	2.6
20. Not stated	96	10.4	32	7.6
TOTAL	926	100.0	424	100.0

At these two levels 62 percent of professional workers and 32 percent of sub-professional and clerical workers had accepted foreign employment because of the attractive foreign pay. Family problems had been cited as a reason for foreign employment by 8.5 percent of the respondents. This percentage is significantly high in the case of housemaids, which is around 15 percent. Unemployment has been given as the reason for migration by 5 percent of the respondents, of which 4.2 percent of skilled workers had given this reason for their migration.

Cost of Migration

There are many costs associated with migration, and it is one of the most important factors which determines the volume and composition of migration. Information has not been gathered previously on this condition and even in the survey it was possible to obtain information mainly on the costs directly associated with migration.

In view of the considerable number seeking foreign employment opportunities in relation to available placements the costs of securing foreign employment has increased. There are several direct expenses associated with migration such as agency fees, air tickets, cost of processing travel documents, medical fitness tests travelling and subsistence. Apart from these direct costs there are several indirect expenses incurred in securing an outfit for a prolonged stay, such as purchase of clothes, personal effects and other essentials. In addition married migrants have to make alternative arrangements to provide for household expenditure, until remittances could be effected from the migrants earnings. There are also other commitments the migrants have to bear, the transferring of the family to a friend or relative or the providing for an additional member from the non-nuclear household to take up residence to attend to the needs of the family left behind.

The most important component of expenditure, the migrant had to bear before he left the country were agency fees. A small percentage of migrants find employment on their own or through friends or relatives working abroad. The survey of prospective migrants revealed that the migrants were not aware whether the agency concerned was licensed or not. The main component of migrant expenditure was on agency fees.

Information on direct costs of migration relating to agency fees, air fares, cost of processing travel documents and incidental costs disclosed in the survey of returned migrants are provided in Table 11.

The agency fee has by and large depended on the occupation, salary paid, working conditions and country of employment. The survey of returned migrants revealed that the agency fee had varied between Rs. 500/- and Rs. 55,000/-. In addition

to the fees paid to the firm, it had become necessary to pay fees to middlemen to gain access to these opportunities. This survey also revealed that 30 percent of migrants had paid Rs. 6,700/- on the average as agency fees. On the assumption that about 60,000 migrants find foreign employment annually, the total income accruing to the employment agencies amounted to about Rs. 90 million.

Some migrants were reluctant to declare whether they had paid agency fees or not. Some of the migrant groups were chaperoned by an agent from the firm and this may have contributed their silence on these costs. The amount paid as agency fees disclosed in the survey of returned migrants were those that had prevailed in and around 1981 and 1982 at the time that migrants had secured foreign employment. As a result of the increasing competition, the fees charged by the agency has substantially increased in the recent past. The survey of migrants leaving the country disclosed that the maximum amount charged was as high as Rs. 27,000/-.

It might be stated that the maximum value of fees that could be charged by an employment agency is only Rs. 150 in terms of the Foreign Employment Agency Act. However, it has not been possible to enforce this provision, and agencies have been charging whatever fees they want. It has also been reported in the press that fees as high as Rs. 45,000 – Rs. 60,000 have been charged for finding foreign employment.

The survey also disclosed that some agencies had charged a security deposit from the migrants to defray the costs of repatriation in the event of either the migrant or the employer terminating the contract prematurely. The total number of migrants who reported such expenditure numbered 18 (4.2%) and they had spent Rs. 2,375/- on the average.

Professional and managerial workers have not paid any agency fees, the majority of them find employment on their own. In the case of sub-professional and clerical level manpower categories, the agency fee is approximately half the amount paid by skilled and unskilled workers. In the case of a significant percentage of migrants the costs of securing employment is so high that savings from foreign employment income after defraying costs. can be effected only in the second year of foreign employment, or as some persons have reported on their second trip abroad. earnings, savings and remittances and from this angle it is important both to the individual and the country. Thirdly, the duration of the stay is important for a number of demographic, social and economic considerations which have important implications on population growth, employment and unemployment, wages and on the social, cultural and economic integration of the migrant on return.

About 53 percent of males have indicated that they were migrating for a period of about 2 years. Nearly 20 percent stated that they were proceeding for one years work, and were mainly those who belonged to professional and sub professional categories and those who were migrating for a second time. A small percentage (4%) of males have indicated that they were intending to stay abroad for about 3 years, another 3 percent for periods in excess of 3 years. In the case of females, the majority (78%) were migrating for domestic employment and were to serve a 2 year contract period. About 16 percent of the migrants did not indicate the duration of stay and most of these persons were not aware of the contracted period of work.

A small percentage of females migrating for a one year period were drawn from professional and sub-professional groups and from the category of domestic workers migrating for the second time.

Table 11 **Cost Incurred by Migrants to obtain Foreign Employment**

Item	No. of migrants who provided this information	Percentage in total sample	Total cost (Rs.)	Average Cost (Rs.) Average for Respondents who answered the question	Sample Average
Agency Fees	127	29.9	845,865.00	6,660	1994.96
Air tickets	58	13.7	221,465.00	3,818	522.32
Passports	193	45.5	44,935.00	233	105.98
Medical Reports	228	53.8	61,522.00	270	145.1
Security Deposits	18	4.2	42,790.00	2,377	101.0
Cost of Travelling	124	29.2	132,005.00	1,065	311.4
Other Costs	249	58.7	435,390.00	1,749	1026.9
Total	392	92.4	1,783,972.00	4,553	4207.6

Duration of Foreign Employment

The duration of employment abroad is important for a number of considerations. Firstly the duration of stay indicates the migrants needs and desires and the extent to which he was able to satisfy these needs on the one hand and the extent to which he was able to adjust to the environment on the other. Secondly, the duration of stay largely determines the foreign

The survey of returned migrants elicited information on the migrants duration of stay abroad by occupation and this information categorised by manpower level is provided in Table 13. The average duration of stay of the sub-professional and skilled workers were longer than those unskilled workers and housemaids. In the sample, there were migrants whose

second visit was to another country, and there were those who had visited three or more countries. About 6 percent of the migrants had returned within 3 months. In the case of housemaids the percentage that returned within 3 months was 8.7 percent. It also showed that about 15 percent of the housemaids had stayed less than 6 months.

Table 12 **Cost Incurred by Migrants to obtain Foreign Employment by Manpower Level**

Cost Item	High Level	Middle Level	Skilled	Unskilled	House Maid	Total
Total Cost (Rs.)						
Amount	22,000	131,795	1,022,622	859,610	247,945	1,783,972
No.	07	35	153	56	141	392
Average	3142.86	3765.57	6683.80	6421.61	1758.47	4550.95

Occupational Mobility with Foreign Employment

There were uncomfirmed reports that migrants leaving the country were prepared to accept any kind of work abroad because of the higher remuneration. It is also believed that Sri Lankan migrants generally received inferior or lower status jobs. It has been said that even professional and managerial categories accepted supervisory and clerical jobs because of the high salaries, and the observations made by employment agents tend to confirm this position.

In the competition for jobs migrants from higher occupational grades could displace those from the occupations to which recruitment is made. This generally occurs when higher wages are sufficiently attractive for persons who are over qualified to accept lower status jobs. In order to examine the extent of employment mobility which has taken place in the transition from local jobs to foreign jobs, migrants were classified by the level of jobs they had held locally, as against the ones they had secured abroad. (Table 15)

The information in the Table shows that 61 percent of the migrants secured jobs which were equivalent in level to those they held locally. About 75 percent of the migrants were considered to possess higher skills and received better employment with higher status than the ones they held here; while 32 percent had to be satisfied with lower status jobs but with better pay. Table 15 also shows that 75 percent of the professional and managerial cadres were able to secure foreign employment at the same level, while 20 percent had to be satsified with supervisory and clerical level employment. This employment mobility is most significant in technical and supervisory positions where only one-third of the migrants were able to secure equivalent occupations

Duration of Stay Abroad of returned Migrants

Table 13

Manpower Level / Duration (Months)	High	Middle	Skilled	Unskilled	Housemaids	All Levels	%
0 – 3	1	2	3	8	13	27	6.4
4 – 6	0	0	9	2	9	20	4.7
7 – 9	0	2	10	6	9	27	6.4
10 – 12	1	6	18	5	13	43	10.1
13 – 18	1	5	24	8	18	56	13.2
19 – 24	3	8	32	7	33	83	19.6
25 – 30	1	3	13	4	21	42	9.9
31 – 36	1	4	20	12	12	49	11.6
37 – 48	1	4	21	4	17	47	11.1
49 – 60	3	3	8	1	4	19	4.5
61 – 72	0	2	5	0	0	7	1.6
Above 72	1	1	2	0	0	4	0.9
All Migrants	13	40	165	57	149	424	100.0
Average duration of stay (months)	33.7	27.9	25.6	20.3	20.2	23.5	

Source: *Survey of Returned Migrants*

The data from the survey of returned migrants were classified by duration of residence abroad and the country of migration. (Table 14). The total number of visits to the country of employment and average duration of stay per visit was also computed and is provided in this Table. There is a wide variation in the average duration of stay, migrants to the developed countries having stayed for longer periods. In the case of skilled and unskilled workers and housemaids who migrated to the Middle East the average duration of stay abroad per visit had been less than 22 months.

Table 14 Duration of Stay of Returned Migrants Classified by Host Country & Manpower Level

Country	No. of Migrants	Duration of Stay per Migrant (month)	No. of visits	Duration of stay per visits (month)
High Level	13	33.7	20	21.9
Middle East Countries	46	79.5	08	58.8
Maldives	02	01.0	02	01.0
Nigeria	03	20.3	03	20.3
Other African Countries	02	15.0	02	15.0
U. S. A.	03	62.0	05	37.2
Middle Level	40	27.9	67	18.0
Middle East Countries	32	120.70	43	91.6
Singapore	02	6.5	03	4.3
Other Asian Countries	01	7.0	01	7.0
African Countries	05	87.5	06	77.2
United Kingdom	03	64.3	07	27.5
Other European Countries	03	15.7	03	15.7
U. S. A.	01	23.0	02	11.5
Skilled Level	165	25.6	252	16.7
Middle East Countries	132	178.3	170	154.9
Maldives	02	22.0	04	11.0
Singapore	09	26.4	10	23.8
Thailand	02	6.5	02	6.5
Other Asian Countries	05	19.0	05	19.0
African Countries	06	47.2	08	30.2
European Countries	27	53.0	41	39.4
U. S. A.	09	12.9	11	10.5
Unskilled Level	57	20.3	82	14.7
Middle East Countries	55	79.7	75	60.6
Singapore	04	10.7	04	10.7
Libya	01	35.0	02	17.5
Germany	01	15.0	01	15.0
Housemaids	149	20.2	196	15.8
Middle East Countries	165	127.3	191	115.0
Singapore	03	10.8	04	7.7
Libya	01	12.0	01	12.0

Note: Although the same migrant had visited more than one country, each visit was treated separately. Therefore the number of migrants classified by country would exceed the number in the sample of a particular manpower level.

Table 15 Occupational Mobility through Foreign Employment

Occupation Level in Sri Lanka		All Levels	Occupational Level Abroad High	Middle	Skilled	Unskilled
High Level	No	16	12	03	01	–
	%	100.0	75.0	18.7	6.3	–
Middle Level	No	58	01	20	23	14
	%	100.0	1.7	34.5	39.7	24.1
Skilled Level	No	145	–	06	99	40
	%	100.0	–	4.1	68.3	27.6
Unskilled Level	No	36	–	01	11	24
	%	100.0	–	2.8	30.5	66.7
All Manpower Level	No	255	13	30	134	78
	%	100.0	5.1	11.8	52.5	30.6

while 40 percent had to accept skilled work, and 25 percent unskilled work. More than 25 percent of the skilled workers had accepted unskilled work. On the other hand over 30 percent of the unskilled workers were able to secure skilled work and attendant benefits.

Earnings in Foreign Employment

The comparatively attractive income from foreign employment is undoubtedly the most important determinant that had influenced the migration decisions of the majority of Sri Lankan migrant workers. The wages of a construction labourer or a housemaid in foreign employment when converted into rupees was as high as the wages of a top official in the public sector or that of a senior university teacher in Sri Lanka. This very high wage differential on which information is freely available via foreign job advertisements has had a number of consequences on the labour market. It has naturally resulted in the development of a situation where a large segment of workers from a wide range of occupations, look forward to high salaried foreign jobs. The creation of a supply and demand imbalance for foreign job opportunities in this manner has led to employment agencies raising their fees and other charges they received from the migrants seeking such employment.

Employment income of Sri Lankan migrant workers consists of the regular wage or salary received in the job, and regular and casual payments received such as living allowances, holiday pay, overtime, bonus etc. In addition to the monthly income received from employment he would generally enjoy other perquisites of the job, which include free or subsidised accommodation, medical benefits, meals, transport to place of work etc. Apart from the employment income received the migrant worker could also receive income from investments or other economic activities he undertakes outside his job. The survey elicited information only on the employment income earned by the migrant and not on any other income which he received during his stay abroad from any productive ventures which he or his family may have undertaken.

Wages and Salaries

The survey of migrants for employment disclosed that 465 or 50.2 percent of all migrants had received a contract of employment before they left the country. The distribution of migrants who had received contracts of employment by both sexes revealed that 72.5 percent of the males who were in the sample and 33.3 percent of females had received this document. Of the persons who had contracts of employment, it was 256 males (64% males in the sample) and 128 females (24.3%) who were aware of the wages and salaries they were to receive from their jobs abroad. In other words only 41.5 percent of all migrants knew the employment income they would receive. The migrants had accepted the position that these foreign wages cannot be below certain threshhold levels and that these would be adequate to achieve a minimum standard of living in the host country and also to effect some savings.

Wage Differentials in Local and Foreign Employment

The manifested willingness of Sri Lankan migrants to take up foreign employment must be largely attributed to the wide wage differentials which exist between the countries of migration and Sri Lanka.

Using the available data it was decided to construct two indices on wage differentials in respect of the different manpower levels and for selected occupations. The first index was constructed by adding together the foreign wages in the selected category and dividing it by the total wages received by the same respondents in their local occupations. Persons who were unemployed before migration were excluded in the construction of the index.

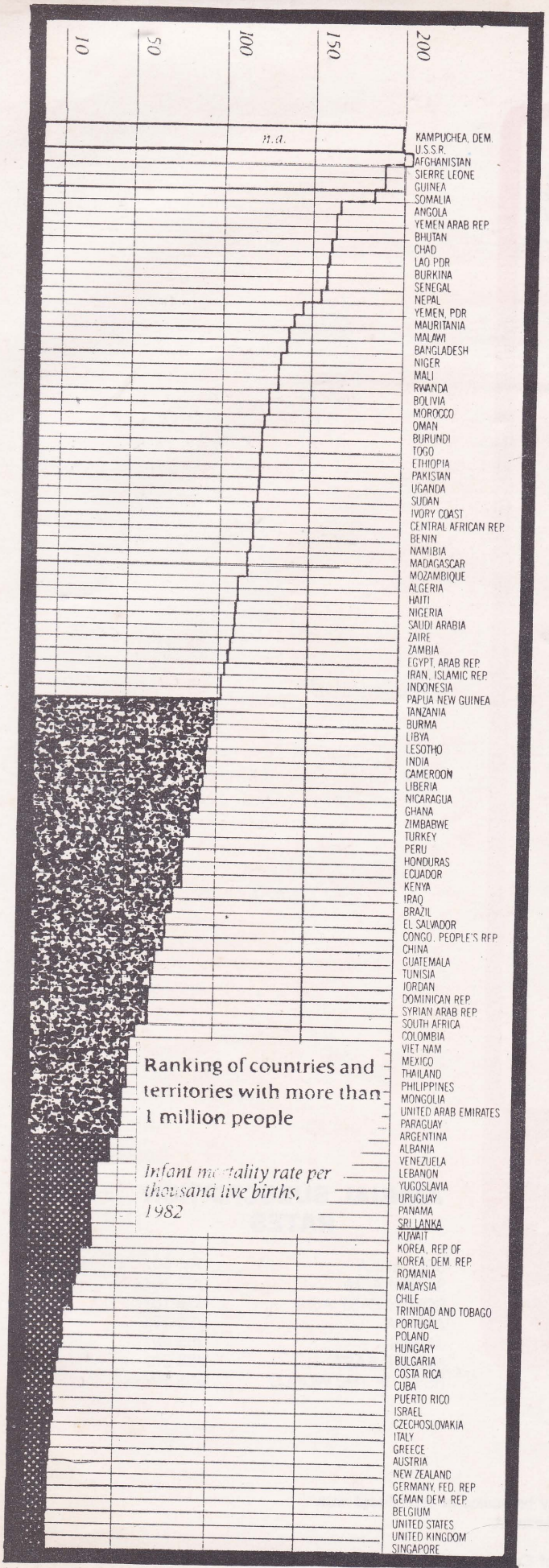
The variations between the two indices depends on the magnitude of wage differentials between local and foreign wages of the sampled population. And the second is a better guide to analyse migration decisions. If the second were to be used to make the observations then the level of differentials between foreign and local wages for sub-professionals and clerical categories is the highest and is over 16. In the case of professional and managerial groups the differential is as high as 12.5. In foreign jobs skilled and unskilled workers and housemaids receive as much as 10 times the wages they recieve in Sri Lanka.

Earnings from Employment

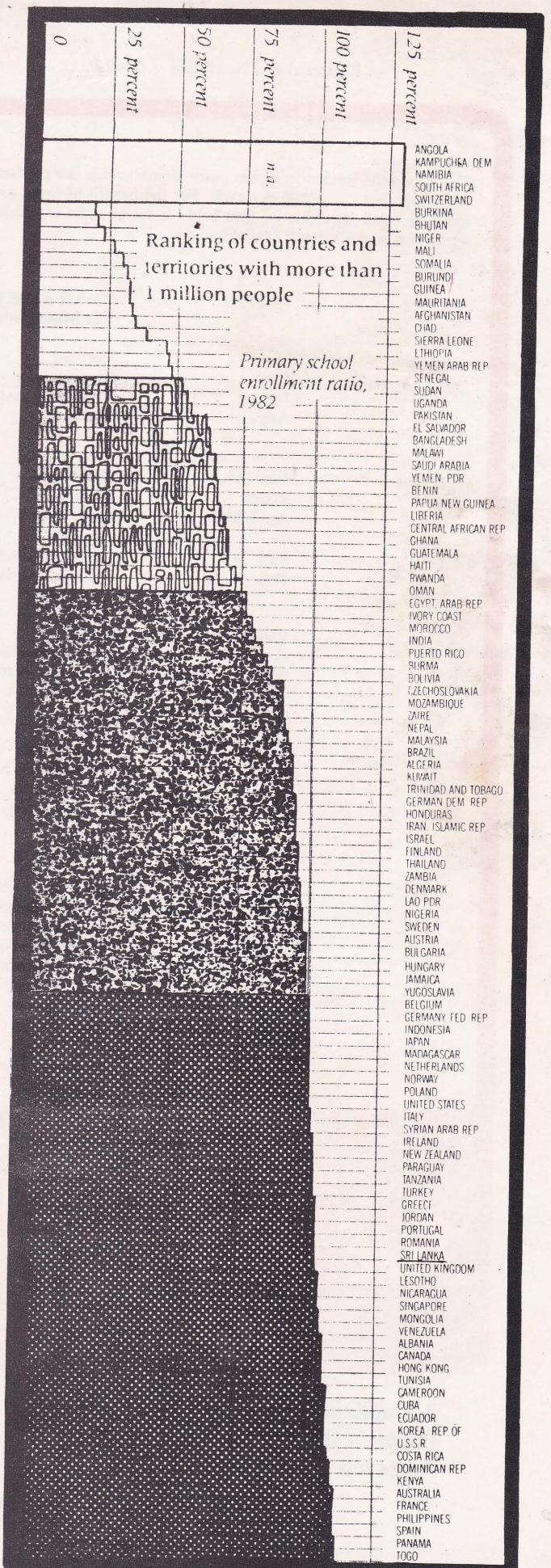
A professional worker had earned over Rs. 1 million during his stay abroad. Sub-professionals and clerical workers had earned about Rs. 415,000 on the average when their earnings were converted into rupees. In the case of skilled workers these earnings worked out to Rs. 235,000 and to Rs. 125,000 in the case of unskilled workers and about Rs. 57,000 for housemaids. An engineer who had worked for a period of 7 years in England had earned an equivalent of Rs. 3.1 million during his stay abroad. This maximum in the case of a sub-professional, and administrative secretary who had worked abroad for 6 year period amounted to Rs. 2.5 million. The maximum amount earned by a skilled worker when converted into Rupees amounted to Rs. 1.5 million, which was by a driller who had worked abroad for 3 years in Saudi Arabia.

A seaman had received Rs. 14,000 per month on average while a heavy vehicle driver had earned this equivalent of Rs. 13,000 per month. At the skilled level operators and mechanics received the next highest average monthly earnings. Carpenters and masons have been able to earn the equivalent of about Rs. 9,000 and Rs. 7,000 per month respectively.

To be continued



14 countries with an IMR of below 11 per 1,000 live births have been left out (See p.32)



15 countries with a primary school enrolment ratio of over 111% have been left out (See p.32)

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	Dec.	National Elections
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