Sri Lanka

"Port of Colombo Expansion Project (IV)・Port of Colombo Extension Project (I) ~ (IV)"

Report Date: March 1999

Field Survey: January 1999

Project Summary

Borrower	Government of Sri Lanka				
Executing Agency	Sri Lanka Ports Authority: SLPA				
Project	Port of Colombo Expansion Project (IV)	Port of Colombo Extension Project (I)	Port of Colombo Extension Project (II)	Port of Colombo Extension Project (III)	Port of Colombo Extension Project (IV)
Exchange of Notes	08/1987	01/1990	01/1991	03/1992	06/1993
Date of Loan Agreement	10/1987	03/1990	03/1991	03/1992	08/1993
Date of final disbursement	01/1994	06/1995	05/1996	05/1998	12/1998
Loan Amount	¥1,955 million	¥6,329 million	¥11,021 million	¥21,055 million	¥7,728 million
Loan Disbursed Amount	¥1,952 million	¥5,703 million	¥10,432 million	¥19,962 million	¥6,828 million
Procurement Conditions	Partial Untied	Partial Untied	Partial Untied	Partial Untied	General Untied
Interest Rate	2.75% a year	2.5% a year	2.5% a year	2.6% a year	2.6% a year
Repayment Period	30 years (10 years for grace period)	Same as left	Same as left	Same as left	Same as left

Note 1 Port of Colombo Extention Projects (I) and (II) have identical content but were split between two separate loan agreements due to the demand for funding.

Reference

(1) Currency SLRs

(2) Fiscal Year January 1 ~ December 31

(3) Exchange Rate (IFS annual average market rate)

Year	1986	1987	1988	1989	1990	1991
Rs/US$	28.017	29.445	31.807	36.047	40.063	41.372
Yen/US$	168.52	144.64	128.15	137.96	144.79	134.71
Yen/Rs	6.01	4.91	4.03	3.83	3.61	3.26

Year	1992	1993	1994	1995	1996	1997
Rs/US$	43.830	48.322	49.415	51.252	55.271	58.995
Yen/US$	126.65	111.20	102.21	94.06	108.78	120.99
Yen/Rs	2.89	2.30	2.07	1.84	1.97	2.05

(4) Terminology

Berths

A berth is a specific space within the port for a ship to moor during cargo handling activities. It is a general term for the mooring facilities and the anchorage in front. One berth is an area usable by one vessel. A wharf is a group of facilities, including facilities for the disposal and storage of goods as well as berths, intended to carry out the functions of a port efficiently.

Container yard

A container yard is one of the facilities of a container wharf, where containers are transferred and stored. The marshaling yard, which is adjacent to the apron and is used for arranging containers which are to be loaded or have been unloaded, is also part of the container yard.

Feeder services

Feeder services are transport services between main ports, where mother vessels of major liner route call directly, and other ports where such vessel does not call directly. Ships which are used for feeder services are called feeder ships and the berths they use are feeder berths.

Container cranes (container gantry cranes, wharf cranes)

Container cranes are specialized cranes for transferring containers between ships and the shore. They move on rails set in the apron. Trolleys move along the protruding crane beams and containers are gripped between spreaders to be hoisted and lowered. (When the capacity of container cranes is stated in this report, it refers to their lifting capacity in tons. The same is true of transfer cranes).

Transfer cranes

Transfer cranes are specialized cranes for moving and stacking containers within the container yard. The gantry beam is supported by drive legs spaced at a set interval. The legs have wheels to run on rails or tires to run on paved areas. The gantry is equipped with a trolley that can move the load sideways.

Prime mover

A prime mover, also known as a tractor, is an engine-driven vehicle which hauls trailers laden with containers.

Vapor return lines

When liquefied gases such as LPG are moved through pipelines between tanks, some gas may evaporate if there is a high proportion of volatile, lighter fractions. This evaporated portion must be returned to the tank, and the pipes provided for this purpose are called vapor return lines.

Purging

In order to clean the insides of a pipe, either the fluid which normally passes through the pipe or another fluid which will not remain in the pipe (such as steam or nitrogen gas) is passed through the pipe at increased pressure. Purging becomes necessary when different fluids must be transported using the same pipe, and impurities must be eliminated before each change, or for maintenance and inspection.

TEU (Twenty-feet Equivalent Unit: conversion into equivalent number of 20' containers)

Containers come in various sizes, including 20 feet (8 x 8 x 20') and 40 feet. TEU is a unit to express the volume of containers handled, converted into the equivalent number of 20' containers.

(5) Abbreviations

MPS.....Ministry of Ports and Shipping

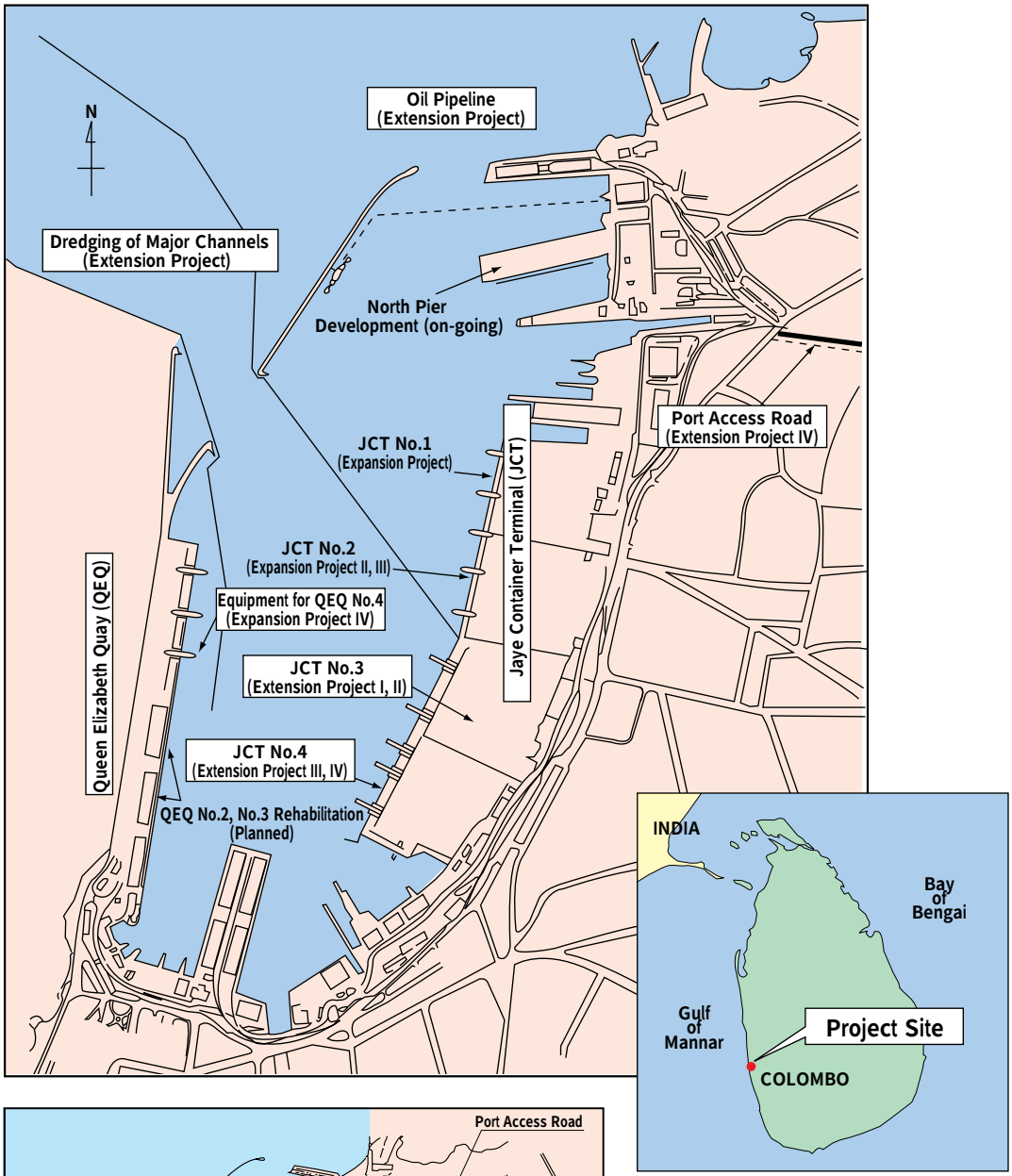
SLPA .....Sri Lanka Ports Authority

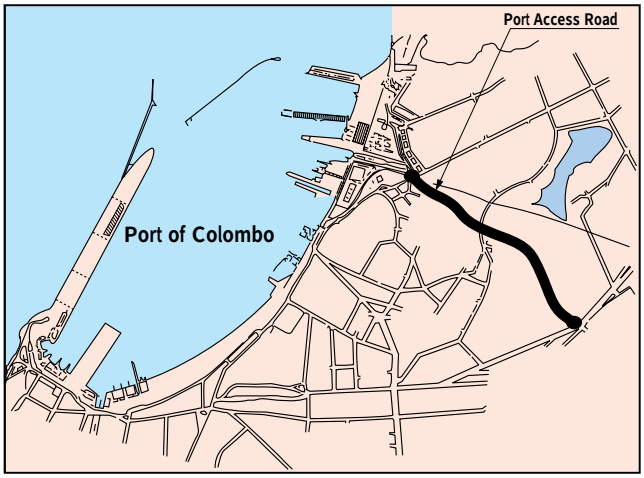
JCT .....Jaye Container Terminal

QEQ.....Queen Elizabeth Quay

Project Location

Layout of Colombo Port and ODA Loan Project Sites





Port Access Road

1. Project Summary

1.1 Project Summary and JBIC Portion

1.1.1 Project Summary

Port of Colombo is a hub situated in the center of the broad Indian Ocean with links to ports in South Asia, the Gulf and East Africa. In recent years its container handling volume has been rising steeply, particularly for trans-shipment (transferring containers between ships). Colombo is highly regarded by shipping companies as an international port with the most modern container handling facilities in South Asia. Demand for container handling at Colombo is still growing. However, it will be difficult for the existing container handling facilities to meet any additional demand. Expansion of the facilities is urgently required. A series of ODA loan projects for Port of Colombo, concentrating on container handling facilities, have been implemented to solve the problem.

The specific ODA loan projects which have been implemented for the development of Port of Colombo are the Port of Colombo Expansion Projects (I)~(IV), Port of Colombo Extension Projects (I)-(IV) and Port of Colombo North Pier Development Projects (I)~(II) (for details refer to section 1.3.2 "History of Port of Colombo's Development" in this report). Of these, the subjects of this evaluation are as listed in the table below (Table 1-1 Evaluated Projects). (Detailed evaluations of the Port of Colombo Expansion Project (I) were conducted in February 1987, and of phases (II) and (III) in March 1990).

Table 1-1 Evaluated Project

Loan Agreement Date	Project Name (Loan Amount)	Project
October 1987	Port of Colombo Expansion Project (IV) (¥1,955 million)	Construction of port access road Equipment procurement for existing berths
March 1990	Port of Colombo Extension Project (I) (¥6,329 million)	Construction and equipment procurement of new berths Equipment procurement of existing berths
March 1991	Port of Colombo Extension Project (II) (¥11,021 million)	
March 1992	Port of Colombo Extension Project (III) (¥21,055million)	Construction and equipment procurement of new berths, equipment procurement for existing berths, dredging of major shipping channels, oil pipeline construction, improvement of port operation system, management consulting
August 1993	Port of Colombo Extension Project (IV) (¥7,728 million)	

1.1.2 ODA Loan Portion

The ODA loan was applied to the foreign currency portions and some of the local currency portions of the project costs for the evaluated projects.

1.2 Background

1.2.1 Sri Lanka's Ports Sector

(1) The position of the ports sector

Sri Lanka is an island nation with limited resources, heavily dependent on imports and exports of agricultural produce and industrial goods. Therefore good ports are essential as doorways to the country. The ports of Sri Lanka serve as a container relay hub and are visited by large numbers of vessels. Container handling earns substantial amounts of foreign currency and is one of the country's most important industries. However, competition for the international container business is intense and the continuing development of Sri Lanka's container relay industry requires more work to raise the level of port services.

(2) Port management

The operational management of Sri Lanka's ports is the responsibility of the Sri Lanka Ports Authority (SLPA) under the authority of the Ministry of Ports and Shipping. The SLPA was established on 1st August 1979 by the Sri Lanka Ports Authority Act, which merged 3 organizations, the Port of Colombo Management Committee, the Port Freight Authority and the Weights, Measures and Security Authority which had been managing Port of Colombo. The new organization had a full workforce of 22,000. At the time of its establishment, the SLPA was under the authority of the Ministry of National Security, but it was later transferred to the jurisdiction of the Ministry of Ports and Shipping (MPS). The MPS was created when its functions were separated from the Ministry of Trade and Shipping. (It has now been renamed the Ministry of Port Development, Rehabilitation and Reconstruction.)

(3) The three main ports of Sri Lanka

The SLPA manages all four of the commercial ports in Sri Lanka which handle marine freight shipping, namely Port of Colombo in the Western prefecture, Trincomalee in the Eastern prefecture, Port of Galle in the Southern prefecture and Port of Kankesanturai in the Northern prefecture. The first three ports are known as the main ports.

Port of Colombo was originally developed artificially, mainly by the British. The water area of the port is 240ha and it is responsible for a majority of Sri Lanka's port freight handling (in 1997 it handled 93.6% of the national total).

Trincomalee port is the country's second most important port after Colombo, with a 5.7% share in 1997. Situated on the northeastern coast, facing the Bay of Bengal, it is the largest natural harbor in Asia and one of the largest in the world. It has a water area of 6,261ha in three bays divided by four promontories. While it has considerable development potential, security in the region is a problem due to civil war and there is no possibility of beginning development.

Port of Galle, which is Sri Lanka's oldest port, is situated approximately 120km south of Port of Colombo. It has decayed as Port of Colombo has grown. Port of Galle has a water area of 320ha and its development as a container port to supplement Port of Colombo is planned.

1.2.2 History of Port of Colombo's Development

(1) Development before ODA loans

The development of Port of Colombo dates back to the arrival of the Portuguese on the island in 1505. Since then is has developed as a hub port for European, Asian and Arab route under the Portugal, then Holland and Britain. Construction of the Southwestern Breakwater and the Northeastern Breakwater began in 1875, followed by the expansion of Southwestern Breakwater in 1912 to secure a safe anchorage area of 224.5ha. The port became the foundation of Colombo's subsequent development. All later development was added within the same space and today's port relies heavily on those earlier infrastructure developments. Recent projects for the expansion of Port of Colombo began with planning deliberations by foreign consultants in 1950. In 1956 provision of a total of 15 berths measuring 3,200m began, and rail and road access were improved at the same time.

After that, the character of Port of Colombo began to change from the 1970s, with the advent of containerized shipping. Recognizing the global movement towards containerization, the Sri Lankan government took the opportunity of the foundation of the SLPA to conduct independent projects to build a container yard and procure handling equipment (completed in 1980).

(2) JICA " Port of Colombo Improvement Plan" and JBIC " Port of Colombo Expansion Project"

Aiming to push ahead with the further containerization of Port of Colombo, the Sri Lankan government petitioned the Japanese government for technical assistance in the development of the port. Acting on this request, JICA prepared a master plan ("M/P" below) for the port's development in March 1980. The main elements of the M/P were the construction of No.1 and No.2 berths of the Jaye Container Terminal. This plan was realized through ODA loans of Port of Colombo Expansion Projects (I)-(IV). The same M/P proposed the containerization of Queen Elizabeth Quay, which had previously been used for general cargo. This development would involve the demolition of the existing warehouses, preparation of the ground and the installation of container cranes etc. The SLPA completed this project with their own funds.

(3) JICA "Port of Colombo Expansion Plan Survey" and JBIC "Port of Colombo Extension Project"

Once the JCT No.1 and No.2 berths were provided, these facilities and the port's favorable location brought it large amounts of container trans-shipment business and it became unable to keep pace with demand. This situation led the Sri Lankan government to petition the Japanese government for a new M/P, which was prepared by JICA in November 1989. This M/P aimed to maximize the port's untapped potential without any major construction works such as the construction of new breakwaters. It proposed the construction of new JCT No.3 and No.4 berths and the expansion of cargo handling equipment for JCT No.1 and No.2 berths. These works were achieved through an ODA loan for the Port of Colombo Extension Project.

(4) JBIC "Port of Colombo North Pier Development Project"

Despite the completion of JCT No.3 and No.4 berths, it was anticipated at the time of the appraisal for this project that demand would exceed container handling capacity by 1999 and the supply and

demand gap would go on growing thereafter. In September 1996, the M/P for the JICA "New Port of Colombo Expansion Plan Survey" was drawn up, but the measures outlined in the plan involved large-scale development which would take a long time to complete and could not cover the problem of the short-term supply and demand gap. The Port of Colombo North Pier Development Project aims to meet the growing demand for container handling by containerizing the QEQ No.2 and No.3 berths that were then used for general cargo. The North Quay, which was then used as an oil berth is being reconstructed as a general cargo berth. This project is under way as of March 1999.

Table 1-2 shows the relationship between JICA studies and JBIC projects.

Table 1-2 JICA Studies and JBIC Projects

JICA Studies (completion time of M/P)	JBIC Projects	Loan Agreement Date	Main Project Contents	Handling Capacity of Total Containers
Port of Colombo Improvement Plan Survey (March 1980)	Port of Colombo Expansion Project (I)	10/80	Construction of JCT No.1 and equipment procurement	166
	Port of Colombo Expansion Project (II)	04/84	Construction JCT No.2 and equipment procurement	397
	Port of Colombo Expansion Project (III)	11/84		
	Port of Colombo Expansion Project (IV)	10/87	Equipment procurement of QEQ No.4, Port access road construction	629
Port of Colombo Expansion Plan Survey (November 1989)	Port of Colombo Extension Project (I)	03/90	Construction JCT No.3 and equipment procurement	1,029
	Port of Colombo Extension Project (II)	03/91		
	Port of Colombo Extension Project (III)	03/92	Construction of JCT No.4 and equipment procurement, Management consulting	1,469
	Port of Colombo Extension Project (IV)	08/93		1,800
	Port of Colombo North Pier Development Project (I)	07/94	Construction of north pier and equipment procurement, Reexpansion of QEQ and equipment procurement	
	Port of Colombo North Pier Development Project (II)	08/95		
New Port of Colombo Expansion Plan Survey (September 1996)	(Unplanned)			

Note The unit of capacity for container freight handling is 1,000 TEU/year.

1.2.3 Project Need

The graph below shows Port of Colombo's container handling capacity and actual volumes handled.

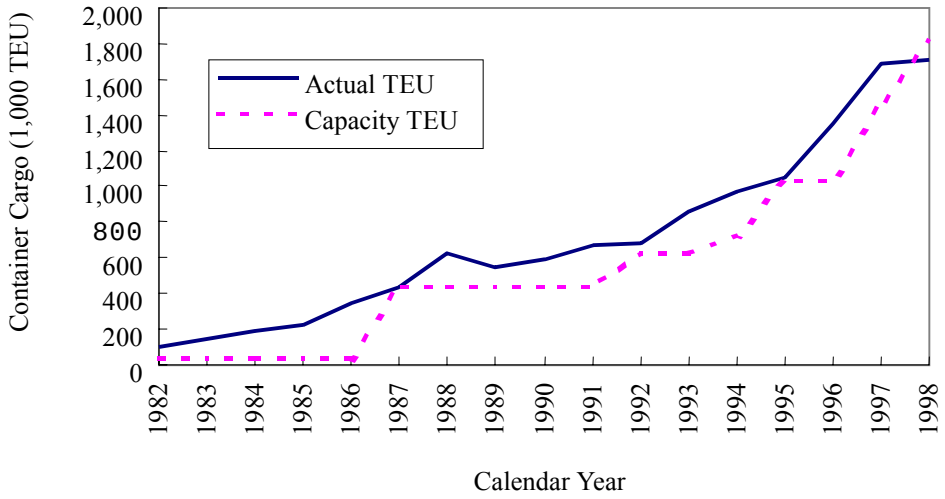


Figure 1-1 Port of Colombo's Container Handling Capacity and Volume Handled

(Source: JBIC materials)

This graph shows that the values of volume handled and capacity are running at similar levels. Taking the accuracy of the evaluation of the port's nominal capacity, Port of Colombo is clearly running continuously at full capacity or beyond its capacity(Note 1). Port of Colombo is in a favorable position in the center of the Indian Ocean and it always had a high potential demand. The increased capacity afforded by ODA loan projects in recent years appears to have started off the boom in container traffic. While the economic recession among Asian countries has been a negative factor, latent demand remains higher than the port's current container handling capacity. If Colombo continues to improve its port services, the volume it handles can be expected to go on growing (refer to Table 2-8 for trans-shipping volume). The JICA "New Port of Colombo Expansion Plan" survey mentioned above forecast demand rising to 2.344 million TEU by 2005 and to 3.78 million TEU by 2015, which was the study's low-end forecast. The plan suggested the need to build a new port outside the Queen Elisabeth Quay (QEQ).

Port of Colombo is an important foreign currency earner for Sri Lanka and it is very important for the country's economy that the container handling capacity of the port continue to grow to avoid losing demand. That is why the series of projects concerning Port of Colombo, including the five evaluated by this report, have been implemented.

(Note 1) Once handling volume exceeds the capacity, idle shipping (ships forced to moor and wait their turn for cargo handing) occurs.

1.3 Project History

History of the evaluated projects is shown in Table 1-3.

Table 1-3 Project History

Port of Colombo Expansion Project (IV)		
1989	January	Request of ODA loan made to the Japanese government by Sri Lankan government
	February	Visit to Sri Lanka by the Japanese government mission
	February	Visit Sri Lanka by JBIC appraisal mission
	August	Exchange of Notes
	October	Loan Agreement signing
1993	September	Completion of project
Port of Colombo Extension Project (I)		
1988	September	Request of ODA loan made to the Japanese government by Sri Lankan government
	November	Start of "Port of Colombo Expansion Survey" by JICA (completed in November 1989)
1989	February	Implementation of Feasibility Study as a series of survey above
	March	Visit to Sri Lanka by the Japanese government mission
	March	Visit to Sri Lanka by JBIC appraisal mission
1990	January	Exchange of Notes
	March	Loan Agreement signing
1994	December	Completion of project
Port of Colombo Extension Project (II)		
1990	April	Request of ODA loan made to the Japanese government by Sri Lankan government
	August	Visit to Sri Lanka by the Japanese government mission
	August	Visit to Sri Lanka by JBIC appraisal mission
1991	January	Exchange of Notes
	March	Loan Agreement signing
1994	December	Completion of project
Port of Colombo Extension Project (III)		
1991	June	Request of ODA loan made to the Japanese government by Sri Lankan government
	November	Visit to Sri Lanka by the Japanese government mission
	December	Visit to Sri Lanka by JBIC appraisal mission
1992	March	Exchange of Notes
	March	Loan Agreement signing
1996	December	Completion of project
Port of Colombo Extension Project (IV)		
1992	September	Request of ODA loan made to the Japanese government by Sri Lankan government
1993	January	Visit to Sri Lanka by the Japanese government mission
	February	Visit to Sri Lanka by JBIC appraisal mission
	June	Exchange of Notes
	August	Loan Agreement signing
1996	December	Completion of project

2. Analysis and Evaluation

2.1 Project Scope

2.1.1 Port of Colombo Expansion Project (IV)

Original plan and actual of project scope for the Port of Colombo Expansion Project (IV) are shown in Table 2-1.

Table 2-1 Project Scope of Port of Colombo Expansion Project (IV)

Item	Plan	Actual	Difference
1. Construction of port access roads Number of lanes Total extension Number of gates	 4 lanes Approx. 1,735m 7	 Same as left Approx. 1,815m Same as left	 — +80m —
2. Equipment procurement of QEQ No.4 Container crane	35.5 ton capacity×1	Same as left	—
3. Consulting service	Survey, contract assistance, design, construction management	Same as left	—

(1) Construction of port access roads

The port access road is 1.5km long with two lanes in each direction, linking the internal roads of the port with general public roads (see Figure 1-3). It includes a bridge and gates within its length. The purpose of the construction was to secure access for future development around the periphery of the port and to alleviate traffic congestion in the city of Colombo.

At the time of the plan, Colombo was suffering from grave traffic congestion and one of the causes was truck traffic to and from Port of Colombo. Three quarters of port-related traffic used roads through the city center, accounting for some 20% of the total freight traffic in the city. The flow of port-related traffic was expected to increase with the growth in the volume of freight handled by the port. In addition, the planned development of industry promotion zones to the north and east of the city was expected to increase the volume of freight traffic further. Therefore it was anticipated that traffic congestion would become an even more severe problem without remedial action.

The SLPA had planned to use the wet land along the planned route of the access road construction for building port-related facilities which did not need waterfront locations (repair shops, long-term storage warehouses, empty container parks, container repair shops etc.). The road was constructed ahead of other projects so that it could be used to bring in construction materials during the project implementation stage. After project completion the access road serves for freight. Thus it is used effectively at all stages. As described above, the construction of the port access was already incorporated in the future plan for roads to be built by the Department of Roads to link the center and north of Colombo, but the sharp increase in port-related traffic in recent years made the construction of the access road even more necessary. Therefore it was finally decided that the SLPA should construct the access road for itself.

Thus the access road was apparently extraordinarily important and it combined well with the future development plans for the surrounding area. Considering these factors, the plan was deemed to be

appropriate. The SLPA's action in recognizing the importance of the access road, which was included in the Department of Roads' plan, and building it for itself, is highly commendable.

Comparisons show that the actual length of the road is somewhat longer than the planned specifications. This was due to a change in planned location of the intersection with the existing road and is not a significant problem.

(2) Procurement of equipment for QEQ No.4

The two container cranes installed on QEQ were constructed on lease from a foreign leasing company. The lease on one of the cranes expired in January 1987 and it was scrapped. The reduction in port capacity caused by the scrapping of the crane was compensated for during 1987 by construction of a JCT berth using an ODA loan, but it was predicted that the port would be unable to cope with the demand from 1988 onwards.

The equipment procurement for QEQ No.4 consisted of one new container crane (capacity 35.5 tons) to cope with the demand. The new crane was of higher capacity than the crane that was scrapped (capacity 30.5 tons) and was basically the same as the cranes installed in the other terminals of Port of Colombo. The scrapped crane was inferior in terms of both capacity and outreach. This meant that the time the old crane took to handle each container was longer. It could only handle approximately 10TEU/hour compared to the 15TEU/hour handled by the 35.5ton crane installed on the same QEQ.

Considering the urgent necessity of expanding container handling capacity in Port of Colombo, the 35.5ton crane was an excellent choice for increasing capacity and enhancing efficiency.

(3) Consulting services

The access road was built over soft ground, necessitating a cautious design based in thorough surveying and testing. The installation of the container crane required a design based on careful consideration of the structure of the quay and the underlying soil conditions, and thorough construction management. Therefore a consultant was employed with terms of reference including surveying, detailed design, contract assistance and construction management. This appears to have been a very wise choice.

2.1.2 Port of Colombo Extension Project (I), (II)

The original plan and actual of the project scope for Port of Colombo Extension Project (I), (II) are shown in Table 2-2.

Table 2-2 Project Scope of Port of Colombo Extension Project (I), (II)

Item		Plan	Actual	Difference
1. Construction of JCT No.3				
Main berth	Length	330m	Same as left	—
	Depth	13.5m	14.0m	+0.5m
Feeder berth	Length	140m	169m	+29m
	Depth	9.0m	14.0m	+5.0m
2. Procurement of equipment for JCT No.3				
Container crane		41.0 ton capacity×2	41.0 ton capacity×3	+1
Transfer crane		41.0 ton capacity×6	41.0 ton capacity×9	+3
Tractors and trailers		10	0	–10
3. Procurement of equipment for JCT No.1 and No.2				
Transfer crane		35.5 ton capacity×2	Same as left	—
4. Consulting service		Design, contract assistance, construction management	Same as left	—

(1) Construction of JCT No.3

The capacity of Port of Colombo was 740,000 TEU per year in 1990, but it was anticipated that from 1991 onward the port would be unable to keep pace with the growth of container freight (the forecast volume was 818,000TEU in 1991 and 927,000TEU in 1992). Therefore a new main berth for containers, JCT No.3, (water depth 13.5m, berth length 330m) was constructed to increase handling capacity. The construction of JCT No.3 involved the demolition of existing temporary feeder berths and the construction of new feeder berths (water depth 9.0m, berth length 140m and width 60m).

The necessity of building JCT No.3 is explained in "1.2.3 Project Need". In short, the construction of JCT No.3 was expected to generate more container trans-shipment volume which necessitated more feeder berths. These feeder berths were also constructed as an advance element of JCT No.4, which was planned for the future, enabling the eventual construction of JCT No.4 to proceed more rapidly.

Comparing planned and actual figures, the depth of both the main berths and feeder berths were changed to 14.0m deep. This change was made in the light of the worldwide trend towards larger container vessels and matches the specification for the subsequent construction of JCT No.4. The reasoning behind the change was sound and the construction cost for the main berth was increased by around ¥100 million. As the feeder berths are to form a part of berth JCT No.4, the depth had to be made a consistent 14m. The total length of feeder berth quay was extended in anticipation of later servicing this as part of JCT No.4 and the change of design was not for change of usage.

(2) Procurement of equipment for JCT No.3

The procurement of this equipment was necessary for the operation of JCT No.3. At the planning stage, the equipment comprised two container cranes and six transfer cranes. In fact, three container cranes and nine transfer cranes were procured, an increase of one crane and three cranes respectively. This change was made because the situation was reviewed before procurement and it was judged that with only two container cranes it would not be possible to fully use the potential capacity of the berth. The additional transfer cranes follow from the decision to buy an additional container crane, because three transfer cranes are required for each container crane.

The changes in procurement quantities were prompted by fear that with the planned number of cranes the capacity would become inadequate in the near future. The increased number of cranes was an effective way of increasing the capacity, and around the world one container crane to three transfer cranes is an ordinary configuration. Therefore this change does not constitute a significant problem.

All procurement of tractors and trailers was cancelled. This was not because these items were not procured, but because the SLPA used its own funds to buy cheaper equipment from a US manufacturer and deleted those items from the list to be procured within this project (under partially untied terms, it was impossible to buy US products within the ODA loan).

(3) Procurement of equipment for JCT No.1 and No.2.

For the same reason as in the construction of JCT No.3, the capacities of JCT No.1 and No.2 were also increased with the addition of two transfer cranes. Also an additional container parking space for 1,980 TEU was constructed.

In 1989 a total of four container cranes were installed in JCT No.1 and No.2, but a total of ten transfer cranes were bought to serve them. As noted above, it would be good to use 12 transfer cranes for four container cranes. At the time, as there was a shortage of transfer cranes, the container cranes had to wait for service by transfer cranes, reducing their work rate. Therefore the number of transfer cranes was increased by two to solve the problem.

This plan was an appropriate one, having a suitable composition of equipment within the berths concerned and a good balance between berths (including the No.4 berth scheduled for future construction).

(4) Consulting services

A consultant was employed with terms of reference including detailed design, contract assistance and construction management for the construction of the container berths and the installation of cranes. This was an appropriate step with no significant problems.

2.1.3 Port of Colombo Extension Project (III), (IV)

The original plan and actual of the project scope for Port of Colombo Extension Project are shown in Table 2-3.

Table 2-3 Project Scope of Port of Colombo Extension Project

Item		Plan	Actual	Difference
1. Construction of JCT No.4				
Main berth	・Length (total extension)	190m (330m)	163m (332m)	- 27 m (+ 2 m)
	・Depth	14.0 m	Same as left	—
Feeder berth	・Length	170 m	182 m	+ 12 m
	・Depth	9.0 m	Same as left	—
Working boat Berth	・Length	132 m	122 m	- 10 m
	・Depth	5.0 m	Same as left	—
2. Procurement of equipment for JCT No.4				
Main berth	Container crane	41.0 ton capacity×3	3	—
	Transfer crane	41.0 ton capacity×9	9	—
	Monitoring system	5 sets	6 sets	+ 1 set
Feeder berth	Container crane	41.0 ton capacity×1	2	+ 1
	Transfer crane	41.0 ton capacity×3	3	—
3. Procurement of equipment for JCT No.1 and No.2				
Container crane		35.5 ton capacity×1	2	+ 1
Transfer crane		35.5 ton capacity×3	10	+ 3 + 4
4. Dredging of major shipping channels				
Dredging volume		1,500,000m^3	1,471,000m^3	Dredging position altered.
Water depth		15.0 m	Same as left	
5. Oil pipeline construction				
Number of pipes		9	11	+ 2
Seabed part (Note 1)		1,000 m	685 m	- 315 m
Overland part (Note 1)		700 m	770 m	+ 70 m
Water depth		13.5 m	14.0 m	+ 0.5 m
6. Consulting service		Survey, contract assistance, construction management	Same as left	
7. Port operation and maintenance systems				
・Development of operation and maintenance system for container terminal		New system development (including improvement)	Additional procurement of host computer	Additional procurement of host computer
・Procurement of navigation aid facilities		Radar, channel light, wind speed gauge	One addition of tugboat	One addition of tugboat
8. Management consulting		Stage 1, 2	Same as left	
9. Others				
Procurement of diesel generator		Nil	Additional procurement	Additional procurement
Procurement of TV system for JCT yard operation		Nil	Additional procurement	Additional procurement
Procurement of spare parts		Nil	Additional procurement	Additional procurement

(Note 1) Pipeline lengths stated are for each pipe and not total lengths.

(1) Construction of JCT No.4

In order to cope with further increases in container handling volume, a new container berth (water depth 14.0m, berth length 330m) was constructed for JCT for increased handling capacity (the new construction length was only 190m because a portion of the berth length was completed during the construction of No.3 feeder berth).

When JCT No.4 was planned (in 1991), some vessels were being forced to wait for long periods before unloading, and container handling volume was above capacity. The SLPA sought to remedy this situation by adding equipment to existing berths and constructing JCT No.3 for increased container handling capacity. However, it was expected that even when JCT No.3 was completed, the capacity would be unable to keep pace with demand, necessitating the construction of a new berth.

With the construction of JCT No.4, feeder berths which have been in temporary use were used as main berths. Therefore new feeder berths (water depth 9.0m, berth length 170m) were added to the side of JCT No.4, as well as a working boat berth (water depth 5.0m, berth length 132m) for the numerous small vessels which work around the harbor (tugs, pilots, oil and water suppliers etc.).

Comparing the actual results against the plan, there was some difference noted in the length of the wharf, but there was no problem because the final difference was only an additional 2m to match the ground conditions. The length constructed was shorter because, as noted above, the temporary feeder berth had been extended for convenience during the construction of JCT No.3. The depth of water at the main wharf and feeder wharf for the main berth of JCT No.4 was changed from the 13.5m planned at the E/S stage to 14.0m, in order to accommodate the increasing size of vessels.

(2) Equipment procurement for JCT No.4

The necessary equipment was procured for the constructed JCT No.4

The number of container crane monitoring systems was changed from five sets to six sets, but this step was taken because one more crane was added to those installed at JCT No.3 under the Port of Colombo Extension Project (I) and (II), bringing the number of container cranes in JCT No.3 to six.

The number of cranes installed in the feeder berths was changed, but the procurement content was changed following a review to match the configuration of cargo handling equipment to the expanded capacity of the main berths. There does not seem to be any problem in the procurement content. The change increased the cost of the project and lengthened the construction period, but there was no significant problem because the cost was still within the amount permitted in the L/A and the construction was completed within the time limit of the L/A.

(3) Equipment procurement for JCT No.1 and No.2

When Port of Colombo Extension Projects (III) and (IV) were planned, JCT No.3 was still under construction, but the gap between container demand and handling capacity had to be filled until the work was complete by augmenting the capacity of the existing berths. This project added equipment (one container crane and three transfer cranes) to each of JCT No.1 and No.2.

At the time, JCT No.1 and No.2 were equipped with a total of four container cranes and twelve transfer cranes, but as explained in 2.1.2 (2), three container cranes per berth is a desirable

configuration. Therefore the additional equipment maximizes the potential capacity of the existing berths.

In fact, one container crane and seven transfer cranes were added. Of these, four transfer cranes were installed in the container yard which only handles empty containers. The remaining one container crane and three transfer cranes were intended to further increase the capacity of JCT No.1 and No.2, and the alteration enabled three container cranes each in these berths as well. Therefore these alterations appear to have been appropriate.

(4) Dredging of major shipping channels

The main shipping channel used by major container ships (the West Channel) was 13m deep at the time. Considering the need for a 20% margin of safety in depth, a 15m channel depth was required. Therefore the channels were dredged (including dredging of rock) and buoys were installed along the channels.

In order to enhance safety, the channel was changed from the broadly curved dredged channel initially planned to a more direct channel. The initial plan (based on the JICA F/S) took an angle of curvature in excess of international standards. This decision was taken to avoid the risk of damage to the pipeline (see below) during dredging of the new channel and when large vessels pass through the channel, and also to avoid potential extra dredging costs due to stones in the path of the channel. However, a detailed investigation by a consultant found that it would be possible to prevent any damage to the pipeline by the adoption of appropriate construction methods, and that there were no rock formations in the path of the channel that would impede its construction. Therefore, as the more direct path was easier and safer to navigate and was also cheaper, the reasonable decision was taken to alter the path of the dredging.

(5) Oil pipeline construction

The existing oil pipelines were used for imports of crude oil, jet fuel, lubricant oil, LPG and other types, and for the export of heavy oil for ship fuel, light oil, naphtha etc. They were constructed in the 1970s and were severely dilapidated. Therefore the decision was taken to build new pipelines of approximately 1,000m on the seabed and approximately 700m on land. The plan also included construction of related facilities to receive and send liquids through the pipes.

In fact, as the depth of dredging was increased from 13.5m to 14.0m, it will be able to accommodate large tankers in future, which require 14.0m water depth. Considering the economic efficiency of the construction works, it was considered desirable that the dredging of 14m depth should be carried out in this project and it was not a problem.

The number of pipelines was also increased from nine to eleven, the overland length was increased from 700m to 770m and the seabed length was decreased from 1,000m to 685m.

One of the additional pipelines was added when heavy oil and crude oil were given separate pipes rather than sharing one. Another addition was a vapor return line to allow the escape of evaporated LPG. If crude oil and heavy oil shared the same pipeline, the necessary purging would require large amounts of work and space and carries a high risk of marine pollution. The vapor return line was necessary because the LPG which Port of Colombo has recently been handling in large volumes

contains high amounts of volatile gas. Therefore the additions to the pipelines appear to have been appropriate.

The extension of the overland section of the pipelines was caused by a review of land usage plans in connection with the construction of the port access road (Port of Colombo Expansion Project (IV)), which necessitate a relocation of the junction with the existing pipelines. The reduced length of the seabed section was due to a route change following a detailed survey.

(6) Consulting services

A consultant was employed with terms of reference including detailed design, contract assistance and construction management for the construction of the container berths, the installation of cranes and the dredging of the main channel. This was an appropriate step with no significant problems.

(7) Port operation and maintenance systems

- Development of container terminal operation and maintenance systems

In order to keep pace with the growing demand for container handling, the expansion of the hardware must be accompanied by effective use of that hardware. The software side, in the form of computer systems for container terminal operation and maintenance, has a vital role to play. At the time, systems had already been installed in JCT No.1 and No.2, but they were not necessarily successful. Therefore the project was to develop computer software (including improving existing software) and examine and improve operation systems and methods.

In the end the software development was accompanied by an improved host computer which was not in the initial plan. The development of the system had already improved its processing power through the improvement of existing software and development of new software, but once the software was put into operation it was judged that software development alone would not be adequate to cope with the rapidly growing volume of container handling (which had grown at 25% per year over the preceding two years). Therefore it was decided that a new host computer would be required. The scale of Port of Colombo means that its operation system is complex and extensive and it is impossible to gauge the system's performance without trying it in operation. Therefore it was unavoidable that the initial plan only called for software development without including procurement of a new host computer. The procurement change was unavoidable because if the terminal was run without adequate processing power for the system, it would have been difficult to make it run at full capacity.

- Procurement of navigational aid facilities

In order to guarantee the safety of increasing numbers of vessels passing through the port, a new harbor radar was installed, the number of shipping channel lights was increased and the wind speed gauges were replaced.

Procurement of all this equipment went according to plan, but one tug boat was added to the procurement list. This change was made because the construction of new berths and the dredging of the main channel enabled larger vessels to use the port and their safety could not be guaranteed with the existing number of tugs.

(8) Management consulting

The SLPA are one of Sri Lanka's top enterprises, earning a steady flow of foreign currency from their container handling operations at the Port of Colombo. However, they suffer from the following problems in their management.

- They lack an industrial policy direction for the development and operation of all the ports in Sri Lanka.
- The accounting systems in their accounts department are under-developed, depriving them of the accounting information required to devise new management strategies.
- They have not set clear business targets and have no firm approach to improving their business.

Management consulting should be able to contribute to solutions to these problems and enhance the SLPA's management ability. The first stage was to conduct an extensive survey ranging from business activities such as organization, personnel, education, pay, labor, finances, accounting and procurement to ways of improving terminal services through port fees, port safety, berth and yard usage rates and shift composition. Suggestions were made on the basis of this survey. Some of the suggestions, including fee reform and changes in the re-loan conditions of ODA loans, have been implemented and have succeeded in enhancing the management ability of the SLPA. The second stage consisted of consulting and training focused on improving the operation of the terminals. Specific elements included the following:

- The establishment of target setting and monitoring systems to improve productivity in container handling.
- Training for pilots and crane operators.
- The adoption of plans for enhancing computer systems
- The adoption of plans to improve the composition of the staff in managerial departments.
- Clarification of staff job descriptions.

The most intensive study was devoted to improvement of the management efficiency of the container terminal and it went on to propose specific actions. Stage two made use of the results of stage one and narrowed the focus to the most important matters, adding experts with practical experience to the team and maintaining a close working relationship to the SLPA. This approach seems to have worked effectively.

The implementation of this program added enhancement of systems to the hardware improvements that had been made through added berths and equipment by the series of projects for Port of Colombo. The SLPA is not yet reaching a container handling capacity in line with the quality of its hardware. Therefore this management consultancy program was a very suitable step towards solving the problems, and it was well received by the SLPA.

(9) Other matters

The procurement of diesel generators, totaling 2,500kVA in capacity, was necessitated by the additional cranes. The procurement of a television system for JCT yard operations was essential as this equipment allows centralized control from the central operation room. The spare parts procured were

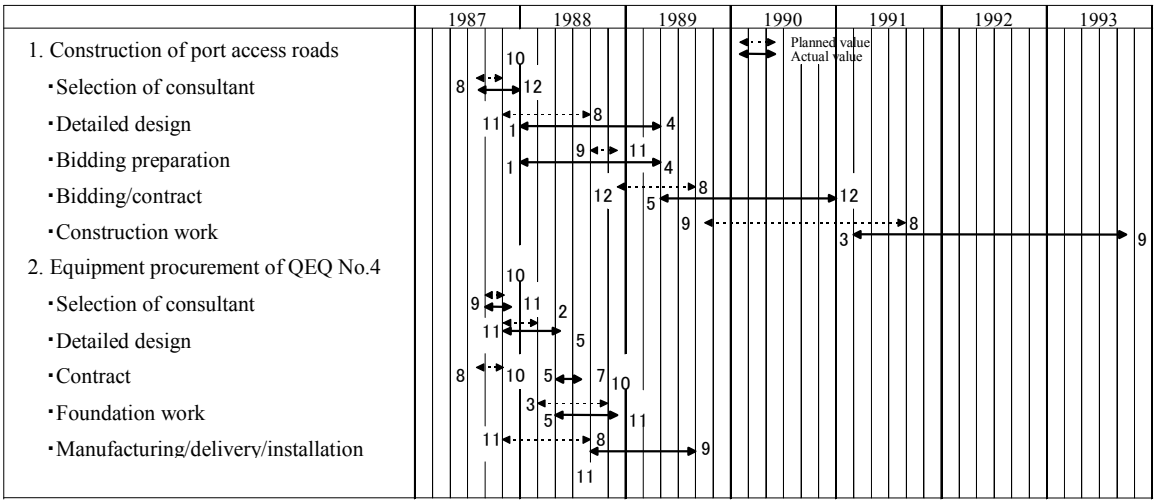
also necessary for the existing and additional container cranes.

2.2 Implementation Schedule

2.2.1 Port of Colombo Expansion Project (IV)

The comparison of original plan and actual of implementation schedule for Port of Colombo Expansion Project (IV) is shown in Figure 2-1.

Figure 2-1 Implementation Schedule of Port of Colombo Expansion Project (IV)



The construction of the port access road was delayed by 25 months, which included delays of eight months in the detailed design and 16 months in the construction works contracting. The main reasons for this delay were delays in land acquisition and P/Q. By the initial estimate, approximately 6ha of land would be procured, involving the resettlement of 365 households. However, the Ministry of Ports and Shipping was slow in tackling the delicate problems of land acquisition and resident resettlement in the run-up to the presidential election of December 1988 and the subsequent general election of 1989. The number of households resettlement from the acquired land eventually rose to 700(Note 1). This doubled the volume of administrative work for the compensation payments. The SLPA entrusted this task to the National Housing Development Authority, which has abundant experience in land acquisition procedures, but completion of the acquisition process was still behind schedule. After the elections there were major changes in personnel and the members of the bid evaluation committee were changed in a reorganization by the cabinet. These personnel changes caused stagnation in the P/Q procedures, delaying the preparation of detailed designs and tender documents and setting back the construction.

As a result of these delays, the port access road was not completed by 13th October 1992, the time limit of the initial loan agreement. Therefore, in response to a petition from the SLPA, JBIC agreed to an extension of the L/A loan implementation period to 31st December 1994.

(Note 1) The number of residents (households) asserting their rights of residence in the affected area was put at 700 households following a final census. Some of the increase was due to people moving into the area after the initial census, but the SLPA compensated all 700 households.

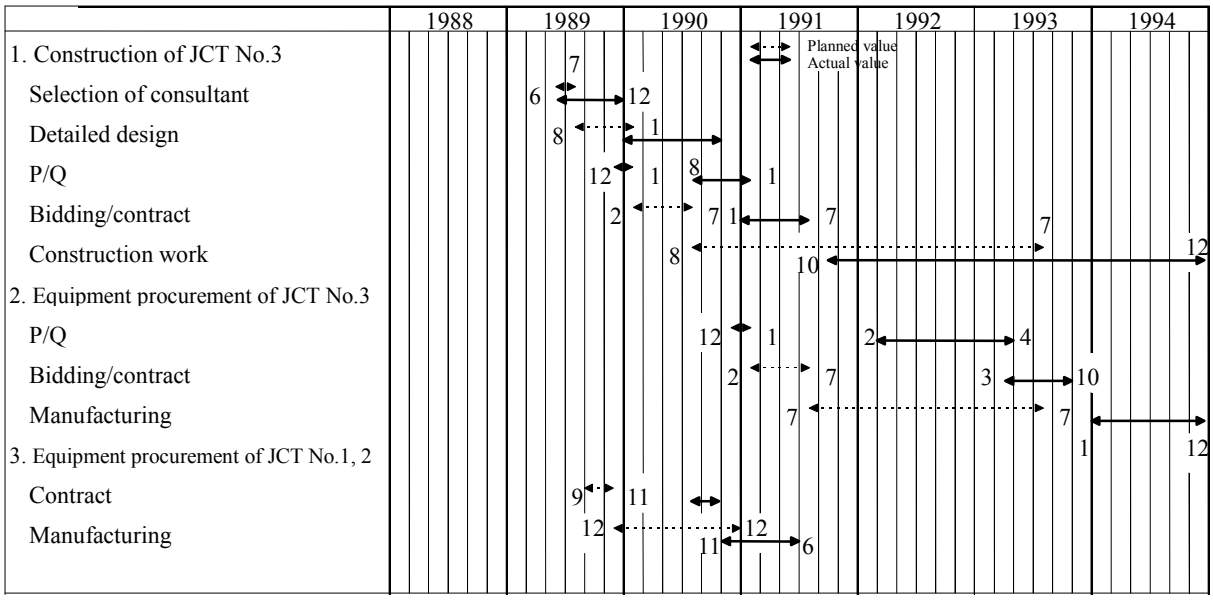
However, the delays do not seem to have had a major impact on the project as a whole.

The procurement of equipment for QEQ No.4 suffered no major delays or significant problems.

2.2.2 Port of Colombo Extension Project (I), (II)

The comparison of original plan and actual of implementation schedule for Port of Colombo Extension Project (I), (II) is shown in Figure 2-2.

Figure 2-2 Implementation Schedule of Port of Colombo Extension Project (I), (II)



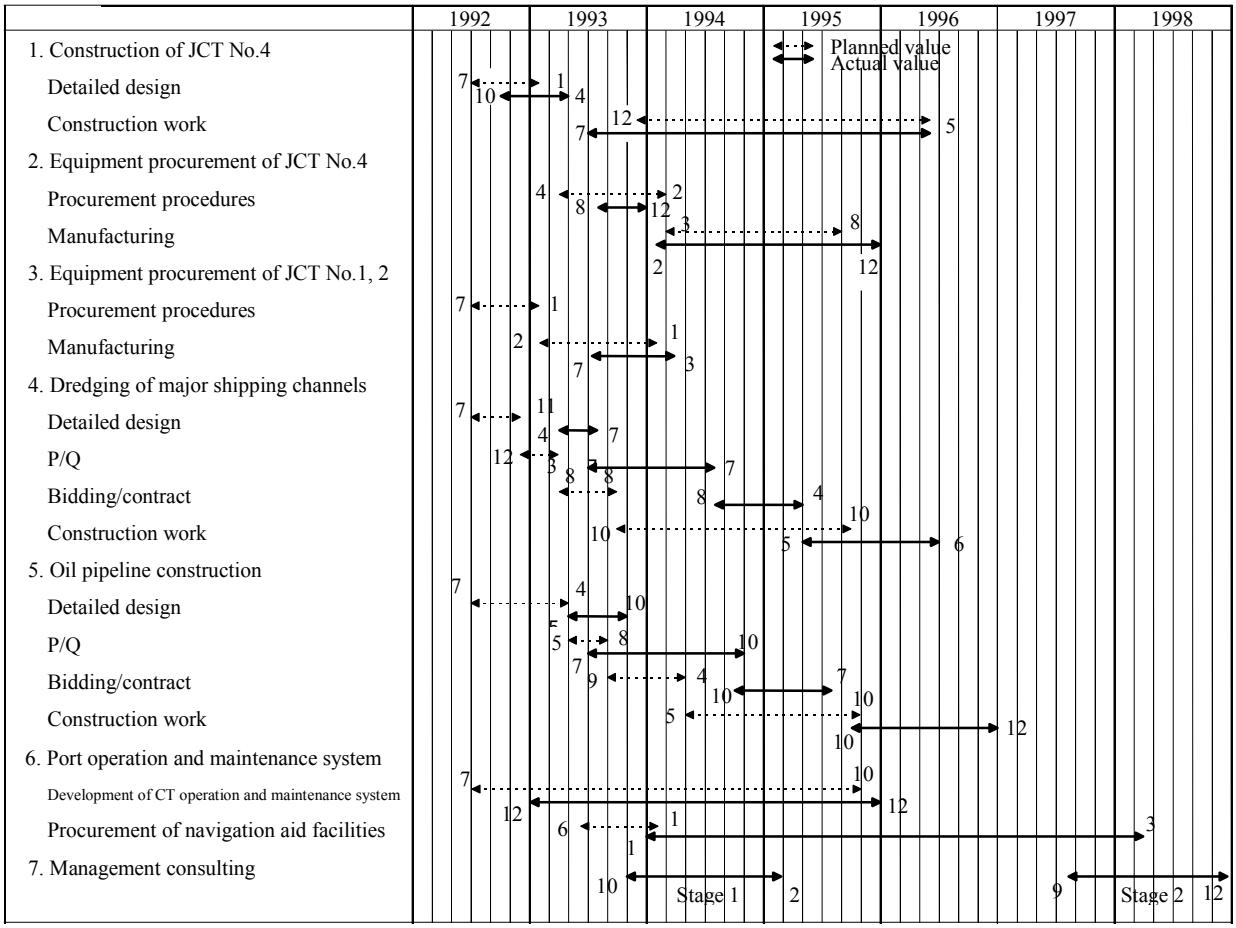
Note The additional equipment procurement for JCT No.3 was ordered in December 1995 and delivered in June 1996.

The project as a whole was delayed by approximately 18 months, but the delay was caused by Sri Lanka's internal procedures concerning contracts for the civil works (similar delays occurred in equipment procurement, but delivery and installation were completed in time).

2.2.3 Port of Colombo Extension Project (III), (IV)

The comparison of original plan and actual of implementation schedule for Port of Colombo Extension project (III), (IV) is shown in Figure 2-3.

Figure 2-3 Implementation Schedule of Port of Colombo Extension Project (III), (IV)



The construction and equipment procurement for JCT No.4 and the equipment procurement for JCT No.1 and No.2 went largely according to plan. All the projects up to the Port of Colombo Extension Project (II) ran constantly one year behind schedule, but there were no major delays in this project. This success was achieved because the specification of the equipment was the same as that for JCT No.3 berth (the subject of Port of Colombo Extension Project (I), (II)), which operates cooperatively with the other berths, and it was ordered from the same supplier on a free contract basis.

The dredging of the main shipping channel and the construction of the pipeline were delayed by one year due to the time consumed with Sri Lanka's internal procedures (cabinet approval of contracts), as was the case with the JCT No.3 berth.

Of the port operational management systems, the procurement of the navigational aid facilities was delayed by four years. Specifically, the delay was in the procurement and installation of the radar

system due to the delayed construction of the radar room, which was the responsibility of the SLPA. The procurement of additional tug boats, which do not appear in the diagram, was accomplished without significant problems.

2.3 Project Cost

2.3.1 Port of Colombo Expansion Project (IV)

Table 2-4 shows the project cost of the Port of Colombo Expansion Project (IV) (the ODA loan covered the entire foreign currency portion).

As the table clearly shows, the actual cost was largely as planned. Additional costs in any items were within the range that could be covered by reserves and did not cause any significant problems.

Table 2-4 Project Cost of Port of Colombo Expansion Project (IV)

(Units: Foreign currency: ¥ 1 million, Local currency: SLR1 million)

Item	Plan		Actual		Difference	
	Foreign currency	Local currency	Foreign currency	Local currency	Foreign currency	Local currency
1. Construction of port access road						
Consulting service	237	8.4	252	21	+ 15	+ 12.6
Civil works	738	91.6	868	158	+ 130	+ 66.4
2. Equipment procurement of QEQ No.4						
Consulting service	102	2.6	106	12	+ 4	+ 9.4
Procurement and installation	551	5.1	620	0	+ 69	- 5.1
Foundation work	126	7.5	106	18	- 20	+ 10.5
3. Reserve fund	201	20.4	0	0	- 201	-20.4
Total	1,955	135.6	1,952	209	- 3	+ 73.4
(Portion covered by ODA loan)	(1,955)	(0)	(1,952)	(0)	(-3)	(0)
Total of foreign and local currencies (¥1 million)	2,687		3,081		+ 394	
(Portion covered by ODA loan)	(1,955)		(1,952)		(-3)	

Note The planned values for items 1 and 2 include an element of price escalation (0.0% in foreign currency and 5.0% in local currency).
Exchange rates: 1SLR = ¥5.4 (planned), 1SLR = ¥3.36 (actual).

2.3.2 Port of Colombo Extension Project (I), (II)

Table 2-5 shows the project costs of the Port of Colombo Extension Project (I), (II) (the ODA loan covered the entire foreign currency portion and some of the local currency portion).

As the table clearly shows, the actual cost was largely as planned. Additional costs in any items were within the range that could be covered by reserves and did not cause any significant problems.

Table 2-5 Project Cost of Port of Colombo Extension Project (I), (II)

(Units: Foreign currency: ¥ 1 million, Local currency: SLR1 million)

Item	Plan		Actual		Difference	
	Foreign currency	Local currency	Foreign currency	Local currency	Foreign currency	Local currency
1. Construction of JCT No.3	8,740	946	9,914	830	+ 1174	-116
2. Minor work	0	27	0	290	0	+263
3. Equipment procurement of JCT No.3	2,918	0	2,998	0	+ 80	0
4. Equipment procurement of JCT No.1,2	351	0	351	0	0	0
5. Consulting service	734	62	883	56	+ 149	-6
6. Interest during construction	898	0	638	0	- 260	0
7. Reserve fund	593	49	0	49	- 593	0
Total	14,234	1,084	14,784	1,225	+ 550	+141
(Portion covered by ODA loan)	(13,579)	(1,011)	(14,784)	(590)	(+1,205)	(-421)
Total of foreign and local currencies (¥1 million)	18,277		17,920		-357	
(Portion covered by ODA loan)	(17,350)		(16,135)		(-1,215)	

Note The planned values are at the time of appraisal for Port of Colombo Extension Project (II).
The planned values for items 1 and 3 include an element of price escalation (3.5% in foreign currency and 14.0% in local currency).
Exchange rates: 1SLR = ¥3.73 (planned), 1SLR = ¥2.29 (actual).

2.3.3 Port of Colombo Extension Projects (III), (IV)

Table 2-6 shows the project costs of the Port of Colombo Extension Projects (III) and (IV) (the ODA loan covered the entire foreign currency portion and some of the local currency portion).

A portion of the JCT NO.4 berth was constructed in advance as feeder berths during the construction of JCT No.3 berth under the Port of Colombo Extension Projects (I) and (II). Therefore the cost of Port of Colombo Extension Projects (III) and (IV) was reduced, but the reduced cost was not due to any reduction in the scale of the finished berth.

Despite the fact that the equipment procurement for JCT No.4 was increased by one container crane, the cost of the project was less than planned. This was possible because the tender values for the equipment were lower than expected. On the other hand, the equipment procurement costs for JCT No.1 and No.2 were nearly doubled because the quantity procured was more than double that planned.

Items six, seven and eight were carried out by the same consultants. The cost overran by approximately ¥1 billion, but this increase was largely due to improvements to the computer system. Within the increase in the cost of the port operational maintenance system, ¥150 million was the cost of the new host computer and ¥290 million was due to the development of the container crane monitoring system and the purchase of the television system. As noted in the section on project scope, the additional installation of a new host computer and the development of the system were necessary. The increased consultant fee due to these changes were also unavoidable.

Table 2-6 Project Cost of Port of Colombo Extension Project (III), (IV)

(Units: Foreign currency: ¥ 1 million, Local currency: SLR 1 million)

Item	Plan		Actual		Difference	
	Foreign currency	Local currency	Foreign currency	Local currency	Foreign currency	Local currency
1. Construction of JCT No.4	7,677	751	6,955	525	-722	-226
2. Equipment procurement of JCT No.4	6,430	0	5,212	0	-1,218	0
3. Equipment procurement of JCT No.1,2	1,543	6	3,026	0	+1483	-6
4. Dredging of major shipping channels	1,588	63	1,203	79	-385	+16
5. Oil pipeline construction	3,317	196	3,435	419	+118	+223
6. Consulting service	1,171	123	1,635	154	+464	+31
7. Port operation and maintenance systems	811	11	1,369	21	+558	+10
8. Management consulting	384	* 35	358	15	-26	-20
9. Interest during construction	2,220	0	1,554	0	-666	0
10. Reserve fund	1,580	92	0	0	-1,580	-92
Total	26,721	1,277	24,747	1,213	-1,974	-64
(Portion covered by ODA loan)	(25,143)	(1,177)	(24,747)	(600)	(-1,974)	(-34)
Total of foreign and local currencies (¥1 million)	30,669		27,403		-3,266	
(Portion covered by ODA loan)	(28,783)		(26,790)		(-2,722)	

Note The planned values are at the time of appraisal for Port of Colombo Extension Project (IV).
The planned values for items 1, 2, 4~6 include an element of price escalation (4.1% in foreign currency and 4.7% in local currency only for item 2, and 3.9% in foreign currency and 4.7% in local currency for other items).
Exchange rates: 1SLR = ¥3.10, article 8 * is 1SLR = ¥2.79 (planned), 1SLR = ¥2.19 (actual)

2.4 Implementation Scheme

2.4.1 Executing Agency

The executing agency for each of the projects evaluated in this report was the Sri Lanka Ports Authority (SLPA). The origin and development of the SLPA was described in 1.3.2 (2), but its current organization is as shown in the diagram below.

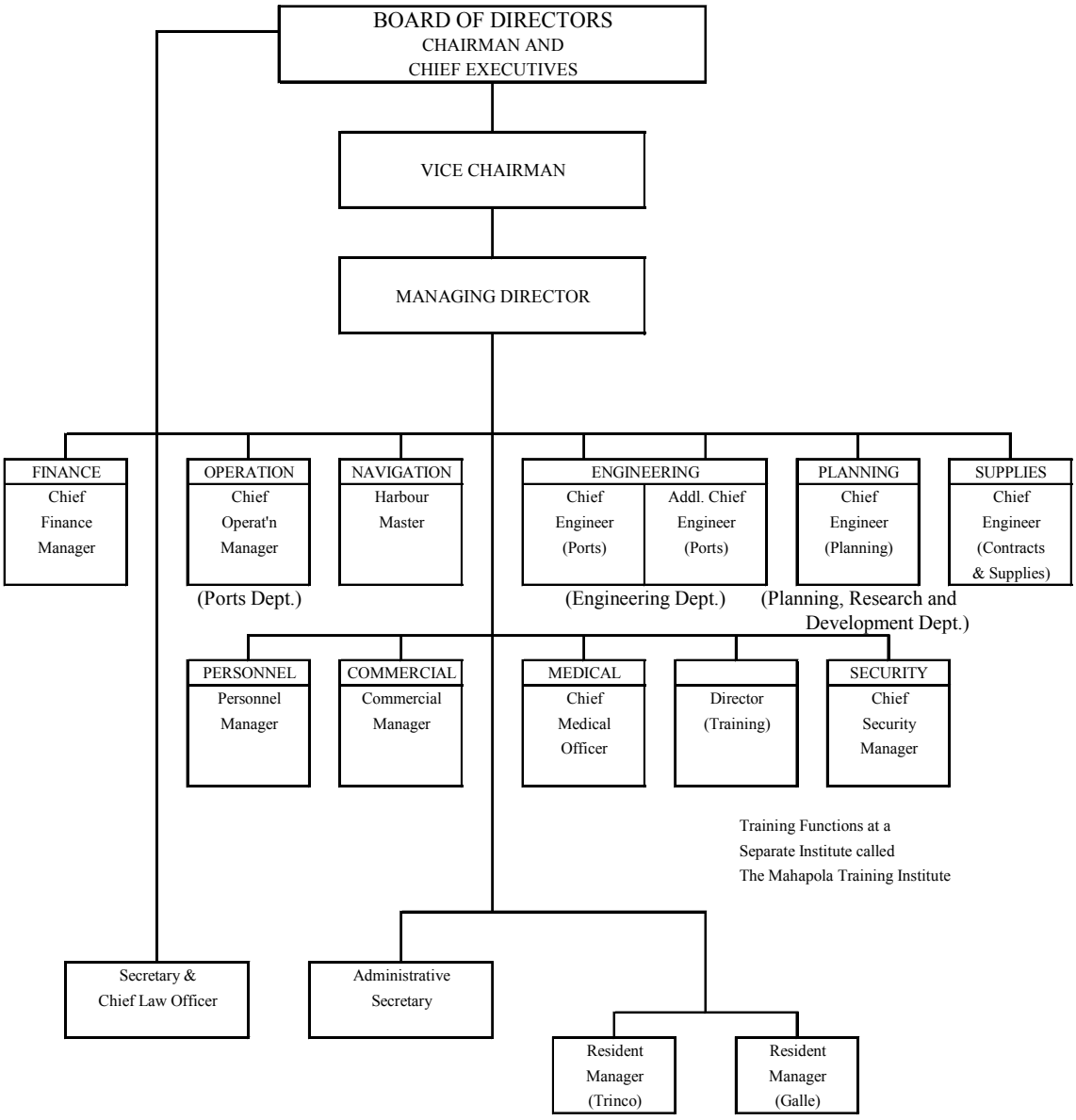


Figure 2-4 Organization Chart for the SLPA

The organization of the SLPA has been largely unchanged between the signing of the L/A for the Port of Colombo Expansion Project (IV) in October 1987 and the present day. The highest decision-making body is the board of directors headed by the chairman. The Managing Director is the main contact concerning ODA loan projects while the Chief Engineer (Ports) is the contact for technical matters. The holders of both these posts have had long careers in the SLPA and had been involved with ODA loan projects before reaching their current positions. Thus they are highly experienced in such projects and performed well in the implementation of these projects.

The planning, formulation, design and procurement stages before implementation of the project, and cooperation with consultants, are the responsibility of the Planning, Research and Development (PR&D) Department. The Ports Department handles construction, relations with contractors and other aspects of project implementation. Both departments handled the same duties in the Port of Colombo Expansion Projects (I)~(III), giving them experience in the content of the project. While there were no significant problems in the implementation of this project, there were occasional delays in procurement procedures and there is room for improvement.

The table below shows SLPA revenues and expenditures for the last three years.

Table 2-7 Revenues and Expenditures for Port of Colombo (1994~1997)

(Units: Millions of SLRs)

	1994	1995	1996	1997
Revenues	4,967	6,581	8,775	10,731
Freight handling (container, import/export)	2,212	2,666	3,195	3,963
Freight handling (container, trans-shipping)	553	1,062	1,728	2,344
Freight handling (mixed freight)	249	362	763	1,014
Other port services (Note 1)	1,604	2,019	2,429	2,701
Other	349	472	660	709
Expenditures	4,967	6,581	8,775	10,731
Operation costs	1,620	1,917	2,423	3,386
Repair and maintenance costs	854	1,038	1,201	1,304
Management costs	880	1,283	1,421	1,820
Taxes	249	396	547	648
Interest payments	791	495	596	651
Pretax profits	573	1,452	2,587	2,922

Note 1 Other port services include mooring charges, port entry fees, pilot fees, tug fees, storage fees etc.

2.4.2 Consultants

Consultants were employed in each of the five projects evaluated here. Their duties are as described in Section 2.1 " Project Scope".

The consultant employed in all cases was a Japanese consultant (although the management consulting was by a joint venture with a Japanese consultant). They performed well and are well regarded by the SLPA.

2.4.3 Contractors

The main contractors can be divided into five groups, berth construction, supply of equipment (cranes), supply of the host computer, supply of other equipment, and construction of the port access road. The nationality of the companies receiving the orders was Japanese, with the exception of a Sri Lankan company who supplied the tug boats.

None of the contractors caused any overruns in the implementation schedule, they had no technical shortcomings and their performance was good. Therefore there were no significant problems with the contractors.

2.5 Operations and Maintenance

2.5.1 Operations and Maintenance Scheme

The SLPA conducts the operations and maintenance of Port of Colombo, with the Ports Department playing the central role in administering the operation of the port. The SLPA runs internal training programs in fields of cargo handling, management and machinery to raise the ability and technical skills of the staff who are essential for smooth port operation. For the construction of JCT No.3 and JCT No.4, the training of the workers concerned was completed in advance and there were no problems in the administrative system. In 1998, pilots received training in Tokyo as part of the management consulting program, but not all pilots were included in the program. Therefore the SLPA had the remainder of the pilots trained in Tokyo at its own expense. This illustrates their enthusiasm for staff training.

The Engineering Department is central to the port's maintenance management. They have separate repair and maintenance workshops for cranes and for prime movers within the port, each with nearly 100 trained technicians. They also have approximately 45 staff who work on the civil engineering structures.

There were no significant problems in the two separate organizations of the Ports Department and the Engineering Department, but some problems were observed in the functions of these organizations and the cooperation between them. These problems will be described in detail later.

2.5.2 Operations and Maintenance

(1) The working status of Port of Colombo

This data appeared in part in Figure 1-1, but the volume of containers handled in Port of Colombo between the '80s and the present is as shown in the table below. The table shows that all the facilities built under the projects evaluated here were immediately operating at full capacity from the time of their completion. To put it another way, the series of projects managed to steadily increase container handling capacity, but that capacity is still unable to fully keep pace with the demand. It appears that capacity is not keeping pace because demand has far exceeded all estimates. Demand rose by 29% between 1995 and 1996, and by a further 24% between 1996 and 1997. It is difficult to keep pace with such increases through a phased expansion of capacity.

Table 2-8 Container Handling Volume of Port of Colombo (1982 ~ 1998) (Unit: 1,000 TEU)

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Handling volume	106	147	188	220	348	436	628	552	595
(Note 1)	32	66	88	113	220	300	486	385	411
Year	1991	1992	1993	1994	1995	1996	1997	1998	
Handling volume	669	676	858	973	1,049	1,356	1,687	1,714	
(Note 1)	470	451	591	666	700	980	1,233	1,191	

Note 1 The trans-shipment portion of the container handling volume.

(2) Operational Performance

According to the management consulting report, the operation of Port of Colombo still needs improvement in the management efficiency of the JCT terminal. The inefficiency is caused by a failure to make sufficient use of computers. The computers installed for terminal operation should be used only for the management of the terminal, but personnel and accounting applications have also been installed on them, necessitating data backup operations. This data backup work ties up the computers three times a day for a total of two hours. If containers enter or leave the yard while the computers are busy making data backups, the administration is first recorded on paper and the data is input later when computer availability is restored. Around 10% of containers passing through the JCT terminal must be processed in that way. If the backup operations were eliminated, the management of the terminal could be made approximately 20% more efficient (the number of containers handled by one crane in one hour could be raised from 15 to 18).

Another factor reducing efficiency is that the number of available prime movers is inadequate. The four JCT berths have a total of approximately 100 prime movers, but normally only around 75 are in operation. A minimum of 85 are required for smooth operation of the terminal, which means the current situation inevitably hinders the operation of the terminal. The work rate is low because the prime movers are prone to breakdowns (the prime movers were USA products and are outside the scope of the ODA loans) and many breakdowns are caused by the operators' laxity and failure to observe regulations. The maintenance managers also say that the uneven surface of the container yard caused frequent tire punctures.

Privatization of the port is being considered as a way of making it run more efficiently. One specific move is contracting out the development of the QEQ to the private sector, for which contracts have already been signed (although construction has not yet started). The World Bank has suggested that the operation of the JCT could be subdivided into separate companies, but the SLPA has not agreed to this proposal. (The SLPA, which is making an independent profit, say hiving off the profitable JCT would have a major impact on their revenue and they do not anticipate any great improvement in efficiency).

(3) Maintenance Performance

[1] Cranes

There are no significant problems in the maintenance of the cranes. Preventive maintenance (PM) comprises 65% of the Engineering Department's crane maintenance work, and this has prevented any major crane-related accidents to date. The other 35% of maintenance work is repairs from breakdowns, with the major cause of breakdowns apparently being accidental damage caused by

operator errors. Crane maintenance is managed through logging of all maintenance operations and observance of a prepared schedule for preventive maintenance.

[2] Prime Movers

When a prime mover breaks down, the Ports Department calls on the Engineering Department to carry out the repair, but the Ports Department indicated that long repair times are a problem. The problem is that even very simple problems (tire punctures, oil changes etc.) are referred to the Engineering Department, which does not respond quickly. There is a fundamental difference of attitude between the Ports Department, which operates 24 hours, and the Engineering Department which only works during normal business hours. Another reason for the slow pace of repairs is that there are not enough mechanics to cope with the large number of breakdowns. There is also a problem with the long time taken for approval of spare part procurement within the SLPA (the SLPA department head has procurement authority for purchases not exceeding SLR5 million (approximately ¥10 million at 1997 exchange rates)). There is no particular shortage of budget for the maintenance of mechanical equipment, but the SLPA needs to work on faster administrative processes and more efficient port management.

[3] Civil works

The unevenness of the container yard surface could be remedied very easily with a small-scale repair, but it is left unattended. Another problem that the SLPA cannot handle on its own is the subsidence of the level of the yard. Some degree of subsidence was anticipated from the design stage and it could be simply solved with an order to a construction company. When it rains, the yard subsidence allows puddles to spread over wide areas. The standing water could cause malfunctions in the sensors of the transfer cranes and the problem must be remedied quickly. Compared to the maintenance of mechanical systems, the budget allocation for civil engineering maintenance is inadequate.

[4] The computer Y2K problem

The measures taken by the SLPA under this project for Y2K compliance in their computers can be divided into three areas, hardware, operating systems and application software, as follows. The computer hardware can be expected to be free of Y2K-related problems because it was Y2K compliant from the beginning. The operating system is still not Y2K compliant and must be urgently upgraded to a Y2K-compliant version. The SLPA plans to do that with their own funds. Finally, the application software for terminal management was Y2K compliant from the time of installation and will not cause any problems. However, the host computer which the SLPA originally introduced for terminal management is also used for accounting and payroll systems which were developed independently by the SLPA. These systems have not been made Y2K compliant. The SLPA Systems Management Department is now making the adaptation of these systems for Y2K compliance their highest priority.

Table 2-9 SLPA's Maintenance Budget (1994~1997)

(Units: millions of SLR)

	1994	1995	1996	1997
Total expenditure (including profits)	4,967	6,581	8,775	10,731
Total of operation costs, maintenance costs and management costs	3,354	4,238	5,045	6,510
Maintenance costs within the above	854	1,038	1,201	1,304
Procurement costs for parts etc. within the above	180	239	400	434

For mechanical equipment, simple maintenance operations have been sufficient so far, but some have been in service for more than ten years and are nearing the time when they will need major repairs or replacements for important elements such as the engines. Therefore problems in the mechanical equipment could surface in the near future.

2.5.3 Summary of operation and maintenance

To recap on the above, the SLPA's organization for operation and maintenance is divided between two departments (the Ports Department and the Engineering Department), including the allocation of personnel. Looking at the port as a whole, there is still some room for improvement in efficiency. The need for greater efficiency is recognized within the SLPA and they have started working on improvements. The management consultancy program has suggested organizational improvements which should be put into practice. Consideration should be given to accelerating decision making in procurement procedures by raising the price limits which each management level can decide on, based on actual conditions.

2.6 Project Effects and Impacts

2.6.1 Quantitative Effects

(1) Increased container handling volume and foreign exchange earnings

Of the range of anticipated effects of the series of projects targeting Port of Colombo, the quantitative ones are the increased container handling volume and foreign exchange earnings. The former of these benefits was described in section 2.5.2 (1)."The working status of Port of Colombo".

The latter has been progressing as shown in the table below. All fees for port services at Port of Colombo are Dollar based. As the table shows, Sri Lanka's foreign currency reserves have been stagnating, but Port of Colombo's foreign exchange earnings have been rising steadily. In 1997 the port's foreign exchange earnings amounted to 8.5% of the country foreign currency reserves. The expansion of Colombo's capacity is accompanied by steady growth in its foreign exchange earnings, making it a very important source of foreign currency for Sri Lanka.

Table 2-10 Container Handling Volume and Foreign Exchange Earnings for Port of Colombo

Year	Container handling volume (1,000 TEU)	Trans-shipment portion (1,000 TEU)	Port service revenue (millions of SLR)	Foreign exchange earnings (millions of US$)	Foreign currency reserves (millions of US$)
1994	973	666	4,618	93	2,016
1995	1,049	700	6,109	119	2,057
1996	1,356	980	8,115	147	1,931
1997	1,687	1,233	10,022	170	1,996

(2) Financial Internal Return Rate (FIRR)

For the FIRR calculation, we will examine the effects of constructing berths JCT No.3 and JCT No.4. The project duration is taken as 30 years from the time of completion (35 years from the time of first investment).

Cost is divided between initial investment cost and running costs.

For initial investment cost, we will consider the recorded values of the following costs. It was also assumed that the cranes would have to be replaced 20 years after installation.

- The entire costs of construction and equipment procurement for JCT No.3 and No.4.
- Costs of channel dredging and oil pipelines etc. according to berth capacity (one third of the cost for the whole of Port of Colombo).
- The relative share of consulting services (95% of Extension Projects (I) and (II), 70% for (III) and (IV)).

Running costs include operation costs, personnel costs, management costs and maintenance and repair costs. The figures used are shares of the total costs for the whole of Port of Colombo, divided proportionally according to berth capacity.

The benefits are calculated from the container handling revenue and port service fees from the whole of Port of Colombo, divided proportionally according to berth capacity. The benefit figures for 1997 are used for 1998 and subsequent years.

Calculating the costs and benefits over the years according to the above conditions, the FIRR for 2025 is 7.97%. This is somewhat lower than the figures estimated at the times of the initial studies (11.6% for Port of Colombo Extension Projects (I) and (II) and 11.4% for (III) and (IV)). The difference arises because the actual running costs are higher than those estimated and used in the calculations at the time of the studies.

2.6.2 Qualitative effects

(1) Alleviation of traffic congestion in Colombo due to the construction of the port access road

There is a constant two-way flow of large trucks along the port access road, but by contrast, such trucks have almost disappeared from the center of Colombo. No quantitative evaluation of the effects is possible because there is no available data comparing the traffic volumes, but it is certain that the port access road was effective in relieving traffic congestion in Colombo city center.

(2) Technical transfer

The implementation of these projects appears to have promoted technical transfer. The early development of QEQ in Port of Colombo was achieved by the SLPA, including the design and construction, without the aid of foreign contractors, which indicates that the SLPA was fertile ground for technical transfer. At present, the SLPA is building berths at Galle and Trincomalee ports. The SLPA handled the design and the tender documents, which is evidence of the effect of technical transfer achieved in projects for Port of Colombo.

Other anticipated qualitative effects included a contribution to affecting foreign investment, and enhanced safety in the port. It is difficult to establish a causal relationship for the former, and there is no reason to conclude that adequate safety in the port has been attained because the rate of accidents in the port has not declined.

2.7 Environmental Impact

2.7.1 Environmental Assessment and Monitoring Systems

Environmental standards were enacted in Sri Lanka in 1980 and the National Environmental Agency was established on the basis of these standards. Environmental impact assessment rules were promulgated in 1993, making environmental impact assessment mandatory for large-scale projects. The Marine Pollution Prevention Act against marine pollution was enacted in 1981, forming the basis for the establishment of the Marine Pollution Prevention Authority in 1988.

2.7.2 The environmental impact of Port of Colombo

(1) Impact before and during the implementation of the projects

Pollution of the water in Colombo bay due to urban waste water flowing into it has been a serious problem since 1985. While this kind of pollution does not appear to be directly connected to the projects evaluated in this report, the Port of Colombo Extension Project (II) included a consulting service aiming to ascertain the state of water quality in the port and prepare an independent system for consideration of the environment. This was intended to support the SLPA, which manages the water in the port, to know the condition of the water and clarify the causative factors.

The likely environmental impact during the implementation of the projects was clouding of the water during the land filling and dredging operations, but as the port is an isolated body of water bounded by breakwaters, this was not deemed to be a major problem. The discarding of dredged material offshore has been done before with no problems and was not expected to pose any problem in these projects. Therefore no special consideration was given to environmental impact assessment, but no impact likely to cause problems was observed during the implementation of these projects.

The construction of the port access road involved land acquisition and resettlement of residents, as described in section 2.2 "Implementation Schedule". There are now some squatters living near one part of the access road, but they moved in after the road was built and are not directly related to the residents who were relocated before the construction began.

(2) Impact from port operation

The SLPA regularly tests the soil in the port and tests water quality as appropriate, but no significant problems have been detected. The construction of the new berths narrowed the area of water in the port, raising concerns that the problem of water pollution from urban waste water could be exacerbated, but no such impact has been observed to date. However, the SLPA should carry on making regular tests of soil and water quality.

No significant problems have been observed in any other matters.

3. Lessons Learned

For the smooth execution of projects and their appropriate maintenance, it is sometimes effective to transfer the authority of making decisions on practical works to responsible persons of on-site operations. It is important for JBIC to discuss the creation of such authority transfer systems with executing agencies and work together with them in their application.

Overall, the series of Port of Colombo projects have been handled well in the project implementation and maintenance stages, but there are some problems such as delays in equipment procurement at the implementation stage, and delays in spare part procurement at the maintenance stage. These are not problems of technical ability but rather of SLPA systems. Particularly, there are delays in the decision making by the board of directors which has authority over procurement decisions and there is not enough mutual understanding between the board of directors and those in charge on site (the terminal director). These are not problems that have emerged in recent years. Rather, they are structural problems left from past projects.

The lesson to be learned here is that there are cases where delegation of decision-making authority in administrative work (such as use of budgets for new procurement and for maintenance) to those in charge in the field can be an effective measure, leading to smoother project implementation and better maintenance. The executing agency should give consideration to the construction of implementation and maintenance systems which enable this kind of delegation of authority. JBIC should keep track of the level of delegation through the initial project study, interim monitoring and policy discussions. Based on this awareness, JBIC should discuss the potential for delegation of authority with both the executing agency and the counterpart government. Of course, in doing so JBIC should give due consideration to the relationship between such delegation and the counterpart country's procurement guidelines as they concern decision-making authority.

① View of the Whole of Port of Colombo (aerial photograph from the Northeast)

② QEQ Terminal

③ JCT Terminal No.1 container handling