9.4 Policy Option

9.4.1 Airport Management

(1) General

There are various kinds of airport management system to confirm with the change in the situation of each country. The airport management system has been changed to match the political and economical systems. Roughly, there are five types of the airport management systems, as follows:

1) Airport owned and operated by the central government.

2) Airport owned and operated by municipal organizations.

3) Airport owned and operated by public corporations.

4) Airport operated by private sector.

5) Airport owned and operated by national or municipal organizations with terminal building and other real estate invested and operated by private corporations.

Most of airports have been owned and operated by central or municipal governments through the world. In the United States, commercial airports are owned and operated by the non-federal local public sectors such as states, cities, countries, etc., except three international airports operated by the Federal government.

In Europe, many airports were operated by public sectors of airport authorities. Privatization or private sector participation is becoming increasingly popular especially in developing countries. The most remarkable of this trend in Europe is the full privatization of the British Airport Authority in 1987.

(2) Airport management system in Japan

In the case of Japan, the organizations are different according to the class of airport and separated by the division or responsibility between air-side and land-side as shown in Fig. 9.4.1.1.

The above systems refer to the facilities of air-side as being owned by the state should provide the services for civil convenience. The land-side, on the other hand, is the complex which contributes to the economic activities of the region for the airport concerned.

New Tokyo International (Narita) Airport and Kansai International Airport are exceptional cases in relation to the other general airports in Japan. For each airport, an airport authority established by law owns and manages all basic facilities and the terminal building.

(3) Recommendation

It is considered that progress of the airport development in Pakistan has not been sufficient in comparison with constant increase of traffic demand in recent years. Since traffic demand is expected to increase in future, development of the airport is continuously required. Taking the current situation into consideration, it is important to improve the management system of the airport and the finance of CAA, which is financially self-sufficient and an autonomous body.

a. Ownership of the Airport

Every country has their own management system for the airport since the purpose of transport service, financial policy, importance of air transport and political system are different in each country. However, in many countries airports are managed by the state since air transport is one of the nation-wide transport system, and also the airport is the gateway for international transport.

In many countries, some trials have been made to transform the airport administrator to public corporation, or to transfer to the local government, or to reform to private body, or to be sold to the private sectors, in accordance with the growth of the local government, development of public sectors, severe financial condition of the country, and increase of air traffic demand.

In case that the airport is transferred to the local government, they are required to have the ability of management and operation of airports and or air traffic control. Financial strength for maintaining the unprofitable airport is also necessary.

In case that the airport is transferred to the private sector, for example, by BOT scheme, the financial burden of the government is relieved. However, since they do not participate airport management directly, the government policy, which does not contribute to the airport management such as regional development through airports and expression of the nation's dignity by airports, may not be well reflected.

Therefore, the desirable airport administrative body may be decided by CAA's basic objective for airport management, whether all airports are developed up to the certain level or only profitable airports are developed.

b. Finance of Airports

CAA is the financially self-sufficient and autonomous body, and is operating the airports without financial support from the state. Several charging systems have been established, and current balance sheet indicates that finance of CAA is profitable. The Revex ratio of CAA (one of financial indexes, derived by dividing expenditure before taxation by revenue) is 1.11, which indicates good financial condition referring to so-called good managed airports in Europe.

The structure of good financial condition is mainly supported by the Karach airport. The income of Karachi airport, which handles most of the international traffic of the country, has been utilized to compensate the loss of other local airports which are not profitable because of generally small traffic demand. (cross-subsidization)

CAA is planning to implement the large-scale projects, however it is not realistic to raise airport tariffs and charges so as to cover the necessary fund, based on the current financial system. It will bring the extremely high level of tariffs and charges. It may hamper the airport traffic demand.

It is general that the cost of the big projects are to be subsided by governments, or the project is to be executed directly by governments and afterwards transferred to airport administrative bodies in order to save the financial risk caused by the big project cost. If the existing system without any subsidies by the central government is continued, the possible methods are grant aid and long-term loan with low interest (soft loan) of international agencies.

This financial aids does not have a harmful effect on the national balance. It should be noted that these kinds of public finance are clearly advantageous to private finance, in terms of conditions, such as law interest late and long-term repayment. And there are many experiences of grant aids and soft loans provided by the Japanese government to projects in Pakistan. Although the fund from the private sector is available, there are some restriction and constraints to be imposed. In the airport projects, non-profitable facilities such as a runway and air navigation system are not attractive to the private sectors. Participation of private sectors seems to be feasible in BOO or BOT scheme for some limited facilities such as a passenger terminal building, a cargo terminal building and a car park where profitable commercial activities are feasible (This is popular in airport management of Japan).

c.BOT Scheme

Development by BOT is under consideration for construction of new Islamabad airport and new terminal facilities of Lahore airport. This scheme is feasible when private sectors' fund is available and when some benefit is expected in projects. BOT will require

higher tariffs and charges to return the investment. The point of the issue is how these funds will be collected and how profit will be produced. These conditions will be decided through the negotiation between CAA and developers. Although high level of the tariffs and charges will be settled politically, these level must be acceptable for airport users who are to be charged and acceptable in the society referring to the effect on other public charges.

From the view point of airport finance and industry development, it is now in airport competition. It is necessary to set reasonable tariffs and charges to win the competition. Although high charge level is required in order to maintain self-sufficient finance system, it should be considered that it would lessen the demand.

As this is a delicate matter, it is highly recommended to conduct more detail feasibility study on BOT scheme.

9.4.2 Non-Aeronautical Revenue

Since the Revex Ratio of CAA is more than 1.0, there is no reason to increase and secure new revenue sources at the moment. Because to achieve cheaper fares and high quality service is expected by users as the role of the public transport system.

However, in order to increase the non-aeronautical revenue, the following measures are considered:

(1) To add the new items generally adopted in the other airports

Possible items to be added as the source for the airport revenue are:

sales of concession, hotel, bank, leisure facilities, etc.

(2) To raise airport charges

Amount of raised charges should be studied by comparison with charges in other airports or other fees for public services

(3) To supply new services

Services are to be studied which are not supplied at the moment due to the limit of the existing terminal buildings but desired by airport users. Especially at the international airports, some specified services are required such as bank, hotel, business center, duty-free shop, restaurants, snack bar, barber and flight caterer. Those services required for international operation are generally contribute to the revenue of the airport. Together with these increase of revenue, it is naturally important to take into account of decrease of expenses by cost saving and work efficiency.

At the some of the large airports in the world, income from concession accounts for major portion of airport revenue as mentioned below:

At some airports in Europe, 40 to 50 % of the airport revenue is income from sales in the concession.

In case of United Kingdom, BAA owns and operates the major seven airports which handle about 70 % of total passenger traffic. In the revenue of BAA, airport charge accounts for about 40% of the revenue of BAA, while commercial activities account for 35% which includes retailing activity and advertising.

Singapore Changi International Airport is famous for large-scale passenger service facilities including concession, restaurants, business center, transit hotel, and movie theater. Among these, concession has been the most important facility to contribute the increase of airport revenue. Income from concession accounts for about 40% of operating revenue, which is greater than the aeronautical revenue such as landing fee and passenger service charges.

At the large airports in the United States, revenue from concessions accounts for about 40%, against 30% from landing fees and fuel sales.

Figure 9.4.1.1 The Entities Responsible for Establishing and Administering Airports in Japan

Function of the Airport	Classification		CLASS I Airport		CLASS II Airport		CLASS III Airport	Commuter Airport	Heliport
			Tokyo/Osaka	Narita/Kansai	(A)	(B)			
	Establishment		◎	☆	◎	◎	□	□	□
	Administration & Management		◎	☆	◎	□	□	□	□
Function of Aircraft Operation	Basic Facilities	Runway Strip Runway Taxiway Apron	◎	☆	◎	□	□	□	□
	Other Facilities	Radio Communication	◎	☆	◎	◎	◎	□	□
		Airport Lighting System	◎	☆	◎	□	□	□	□
		Meteorological Facilities	◎	◎	◎	◎	◎	□	□
		ATS Facilities	◎	◎	◎	◎	◎	◎/□	□
Function of Passenger & Cargo Services Handling	Passenger Terminal Building		★	☆	★	★	□/★	□/★	□/★
	Cargo Terminal Building		★	☆/★	★	★	□/★	□/★	□/★
	Inspection Facilities for International Passenger and Cargo (CIQ)		◎	◎	◎	◎	◎	-	-
	Road and Parking		◎	☆	◎	□	□	□	□
Function of the Aircraft Operation Services	Aircraft Maintenance Facilities		★	★	★	★	★	★	★
	Fuel Supply Facilities		★	☆/★	★	★	★	★	★
Number of Airport	(as of Februry,1994)		2	2	21	5	54	6	19

Note:

◎ : Ministry of Transport
☆ : New Tokyo International Airport Authority
☆ : Kansai International Airport Company, Ltd.
□ : Local Government
★ : Private Company

In order to achieve high rate of the revenue from concession in the airports, following points are to be considered.

- sufficient space for concession is to be prepared in the terminal building
- to increase of the space of duty-free shops (At some airports such as Changi Airport, duty-free shops are available even in the arrival area)
- type of concession is to be sophisticated
- concession fee is to be proportional to the turnover

9.4.3 Non-Profitable Airport

Almost all of the airports in Pakistan are still facing financial problems because of low revenue. The role of airports which support an extensive air transportation network becomes more vital in the socioeconomic development. Therefore, the remaining lack of the revenue will have to be made up with loans or by government subsidy. It is considered that feeder airports will be handed over to respective provinces or local administrations for their maintenance and management.

9.4.4 Role of Private Airlines

It is general tendency in the world to privatize the state-operated airlines or to introduce new private airlines in order to accelerate the competition between airlines which normally accompany better service and low fare. In fact, some examples indicate that hard competition between airlines to attract more passengers brings about the reduction in air fare and it causes to generate new demand.

On the other hand, disadvantage of competition between airlines has been appeared such as suspension or discontinuance of some unprofitable routes with small demand. In order to avoid such a situation, it is necessary to subsidize the deficit or to fill deficit in unprofitable routes by allowing operation on the profitable routes with high demand. Sufficient guidance to newly joined airlines will be required for operation safety since they are not accustomed to operate, and countermeasures to secure safe operation.

Administration with flexibility is required in order to develop private airline companies so that sound competition may be continued in these circumstances.

9.4.5 Financial Arrangement

There are several kinds of financial source of the project. The following types of the financial aids by the Japanese government will be recommendable for the airport development projects. Those financial arrangement are already popular in Pakistan and there are many experiences of projects applied.

(1) Loan (Yen Credit)

The loan is normally provided to the developing countries by Overseas Economic Cooperation Fund (OECF) based on the Loan Agreement (L/A) on the basis of the Exchange of Notes (E/N) between both of governments. The funds are provided for the project to a government or an executing agency in long-term repayment with low interest rate.

(2) Grant Aid

The grant aid is provided at official requests of governments to provide funds for implementing social and economic development projects without the obligation of repayment. This is dealt by Japan International Cooperation Agency (JICA).

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10.1 Introduction

Serious analysis of the prospects appears to have been given an impetus by the need to construct a number of major link canals to feed water from other river catchments into the Ravi and Sutlej irrigation systems following the Indus Waters Treaty of 1960.

These studies have included site visits, identification of engineering and depth of water problems, estimates of engineering feasibility and estimates, to varying degrees of detail, of the cost of the works required to permit navigation. A number of other conference papers and desk studies have also been presented on the feasibility or desirability of using the rivers and canals since 1960.

The most recent major study, the Indus River Navigation Study (Louis Berger International, for Ministry of Communications, 1992 :IRNS), is also the most comprehensive of these studies, incorporating the most detailed analysis to date of the economic and financial viability of a range of possible inland waterway networks.

10.2 Engineering and Hydrological Feasibility

The studies performed to date considered the feasibility of navigation for three distinct sections of waterway:

(1) North of Sukkur

Irrigation Department expressed doubts about the safety of navigation in the Rohri and Sukkur gorges in the flood season, but concluded that there was only a problem in very high flood. WAPDA also estimated that larger craft, up to 6' (1.8m) draft, could use the Indus between Kalabagh and Sukkur for 9 months in a year.

Water supply was also found to be inadequate for navigation for long periods in the Chenab and Jhelum rivers. This study noted the findings of the WAPDA study on the year round depth of water in the Indus and that the regularity of flow had improved since the Tarbela dam became fully operational. It considered that the construction of a dam at Kalabagh would permit even greater regulation of flows, giving year round navigation for larger vessels (this study proposed of 1.4m draft, ideally requiring 2.4m of water). It also noted that the country boats operating below the Guddu barrage were of 1.8m draft when loaded.

(2) Sukkur - Kotri

A variety of new still water channels, of varying length and engineering difficulty, have been proposed to link the Nara/Jamrao system with Kotri pond. Canal routes would be navigable 11 months in a year, allowing a one-month closure for maintenance.

(3) South of Kotri

The preferred route for the still water link takes the route of the existing Khui Gharo drain. Some dredging and re-alignment of Gharo Creek is required for proposals using larger vessels. This route would be navigable at least eleven months of the year.

It involves a new barrage on the Indus below the Kotri barrage, with a new lock in the Kotri barrage and a canal link between the KBF upper and the new Indus pond south of the Nai Baran crossing and Kotri. The period of navigation possible on the Indus below Kotri has not been established.

Two studies have examined prospects for navigation on the Ravi/Chenab, and concluded that navigation is not possible without major works or adjustment of the allocation of water between areas.

10.3 Demand, Modal Split and Economic Viability

(1) This was done for both the whole waterway and for the sections north and south of Sukkur barrage.

(2) The analysis was done for a large number of different combinations of input assumptions. It was undertaken using a complex spreadsheet model which performed both modal split and economic evaluation functions. There were numerous inputs, many of which did not change in value from one test to another. All tests assumed that IWT services were provided by two dumb barges pushed by a tug, i.e. the capacity of the barge train is double the size of an individual barge.

(3) No customer loyalty tests were needed for the Nara canal route option, as this is open for eleven months. The capital cost tests were only run for the 900 and 1200 tonne barges with the optimistic demand growth scenario. Very few nominal cost (financial evaluation) tests were run, given the low levels of economic viability indicated.

(4) Rail costs were taken from data supplied by Pakistan Rail (PR). PR costs per tonne-km are derived by allocating costs to a number of classes of traffic and dividing by the number of tonne-km or passenger km actually carried. Two costs are calculated, full (in which all PR expenditure, including pension payments and transfers to the depreciation fund, are allocated to traffic) and variable. In the data supplied to the IRNS team, these were identified as "F" and "V". These were interpreted as fixed and variable costs, and added to give the full costs of rail transport. Table 10.3.1 compares the PR allocations for full and variable costs in 1990-91 with the costs used by IRNS in the spreadsheet for the classes of freight for which IWT was considered potentially competitive.

Table 10.3.1 Comparison of PR and IRNS Cost per Tonne-km by Rail

Type of Traffic	PR Full Cost	PR Variable Cost	IRNS Cost
Petroleum	0.492	0.333	0.825
Wheat	0.366	0.245	0.611
Fertiliser	0.368	0.249	0.617
Iron Scrap	0.362	0.240	0.602
Cement	0.373	0.251	0.542
Rice	0.324	0.218	0.542
Coal (& Iron Ore)	0.332	0.223	0.555

Source: PR costs from Corporate Plan 1992/3
IRNS costs from IRNS Draft Final Report, Table IV.5

(5) Waterway lengths for the sections actually surveyed by IRNS were calculated in miles. Distances for the sections not surveyed (above the Sukkur barrage) were taken from earlier reports, which gave distances in kilometres. When these distances were combined to create inputs to the spreadsheet, all figures were treated as km. Table 10.3.2 compares the distances used in the spreadsheet with waterway lengths in km.

Table 10.3.2 Comparison of Waterway Length in km With Length in IRNS Spreadsheet

Section	IRNS	IRNS *1.609	Earlier Studies	
Port Qasim - Kotri	106	170	166	1)
Kotri - Sukkur	305	490	454	2)
			454	3)
Sukkur - Kalabagh	823	(823)	809	1)

Source: 1. Devepment Workshop, 1984
2. JICA from Development Workshop, 1984 by subtraction
3. JICA from US Trade & Development Program, 1987, 282 miles = 454 km
IRNS distances from IRNS Draft Final Report, Table V.8

(6) A simple spreadsheet was constructed to replicate the modal split and some of the economic evaluation functions of the IRNS spreadsheet. As a result it does not replicate the IRNS modal split in 1990-91 exactly, but the allocation to IWT, shown in Tables 10.3.3 to 10.3.5, is sufficiently close to indicate that the JICA spreadsheet incorporates the main features of the IRNS model. The option run is Port Qasim - Kalabagh, 900 tonne barge, 8 month working, high customer loyalty, no rail efficiency improvement.

(7) Tables 10.3.6 to 10.3.8 show the impact of substituting waterway distances in km in the spreadsheet. Modal split is hardly affected (some rice traffic is lost), but tonne-km by barge rises by over 20% because of the "additional" distance involved, and transport cost savings are reduced by more than 10% as barge transport costs rise.

(8) Tables 10.3.9 to 10.3.11 show the impact of substituting PR full cost per tonne-km in the spreadsheet. Modal split is very different. Only POL, wheat and some fertilizer traffic is retained, tonnes for which IWT is beneficial are reduced by 31% in 1990/91 and nearly 50% in 2020. Cost savings fall to around 15% of those implied by the IRNS model.

(9) Tables 10.3.12 to 10.3.14 show the impact of substituting both km based distances and PR full cost per tonne-km in the spreadsheet. In this run some POL and wheat traffic forecast by the IRNS model is lost, and only one (port to port) fertilizer movement is retained. Tonnes for which IWT is beneficial are reduced by 38% in 1990/91 and 56% in 2020. Cost savings fell to around 8% of those implied by the IRNS model.

Table 10.3.3 IRNS Modal Cost, Distance Assumptions, 1990/1991 Traffic

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	651,002	566,293	83,207	-660,940	274,324	421.39
Rice	142,550	105,712	39,462	-130,712	17,934	125.81
Wheat	310,816	372,268	58,601	-470,517	149,765	481.84
Cement	26,422	20,646	12,686	-29,630	3,770	142.70
Fertilizer	226,512	176,078	40,056	-208,990	44,559	196.72
Iron Scrap	18,832	16,327	8,098	-22,987	4,099	217.66
Total	1,376,134	1,257,324	242,110	-1,523,776	494,451	359.30
IRNS Total	1,436,644					

Table 10.3.4 IRNS Modal Cost, Distance Assumptions, 2000 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	653,476	566,445	83,523	-663,452	275,367	421.39
Rice	472,739	350,573	130,867	-433,481	59,474	125.81
Wheat	697,073	834,892	131,427	-1,055,238	335,881	481.84
Cement	19,830	15,495	9,520	-22,238	2,830	142.70
Fertilizer	493,796	383,850	87,322	-455,597	97,139	196.72
Iron Scrap	381,348	330,629	163,980	-465,483	83,003	217.66
Total	2,718,262	2,481,884	606,639	-3,095,489	853,694	314.06
IRNS Total	2,754,000					

Table 10.3.5 IRNS Modal Cost, Distance Assumptions, 2020 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	653,476	568,445	83,523	-663,452	275,367	421.39
Rice	472,739	350,573	130,867	-433,481	59,474	125.81
Wheat	1,258,992	1,507,908	237,371	-1,905,878	606,638	481.84
Cement	19,830	15,495	9,520	-22,238	2,830	142.70
Fertilizer	891,851	693,276	157,713	-822,859	175,445	196.72
Iron Scrap	611,249	529,952	262,837	-746,106	133,043	217.66
Total	3,908,137	3,665,649	881,831	-4,594,014	1,252,797	320.56
IRNS Total	4,005,000					

Table 10.3.6 IRNS Modal Cost, Actual Distance 1990/1991 Traffic

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	651,002	727,721	83,207	-660,940	238,165	365.84
Rice	102,268	114,488	35,559	-111,887	14,899	145.69
Wheat	310,816	448,790	58,601	-470,517	137,369	441.96
Cement	26,422	25,833	12,686	-29,630	2,930	110.90
Fertilizer	226,512	231,195	40,056	-208,990	35,631	157.30
Iron Scrap	18,832	20,998	8,098	-22,987	3,342	177.48
Total	1,335,852	1,569,025	238,207	-1,504,951	432,336	323.64
IRNS Total	1,436,644					

Table 10.3.7 IRNS Modal Cost, Actual Distance 2000 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	653,476	730,486	83,523	-663,452	239,070	365.84
Rice	339,151	379,676	117,924	-371,051	49,411	145.69
Wheat	697,073	1,006,510	131,427	-1,055,238	308,080	441.96
Cement	19,830	19,387	9,520	-22,238	2,199	110.90
Fertilizer	493,796	504,006	87,322	-455,597	77,675	157.30
Iron Scrap	381,348	425,203	163,980	-465,483	67,683	177.48
Total	2,584,674	3,065,268	593,696	-3,033,059	744,118	287.90
IRNS Total	2,754,000					

Table 10.3.8 IRNS Modal Cost, Actual Distance 2020 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	653,476	730,486	83,523	-663,452	239,070	365.84
Rice	339,151	379,676	117,924	-371,051	49,411	145.69
Wheat	1,258,992	1,817,869	237,371	-1,905,878	556,427	441.96
Cement	19,830	19,387	9,520	-22,238	2,199	110.90
Fertilizer	891,851	910,290	157,713	-822,859	140,290	157.30
Iron Scrap	611,249	681,542	262,837	-746,106	108,487	177.48
Total	3,774,549	4,539,250	868,888	-4,531,584	1,095,884	290.34
IRNS Total	4,005,000					

Table 10.3.9 PR Cost, IRNS Distance Assumptions, 1990/1991 Traffic

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	651,002	566,293	83,207	-660,940	54,231	83.30
Rice	0	0	0	0	0	
Wheat	310,816	372,268	58,601	-470,517	33,209	106.84
Cement	0	0	0	0	0	
Fertilizer	34,386	29,813	3,375	-33,865	1,116	32.45
Iron Scrap	0	0	0	0	0	
Total	996,204	968,374	145,183	-1,165,322	88,556	88.89
IRNS Total	1,436,644					

Table 10.3.10 PR Cost, IRNS Distance Assumptions, 2000 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	653,476	566,445	83,523	-663,452	54,437	83.30
Rice	0	0	0	0	0	
Wheat	697,073	834,892	131,427	-1,055,238	74,477	106.84
Cement	0	0	0	0	0	
Fertilizer	74,961	64,992	7,357	-73,825	2,433	32.45
Iron Scrap	0	0	0	0	0	
Total	1,425,510	1,466,329	222,307	-1,792,515	131,347	92.14
IRNS Total	2,754,000					

Table 10.3.11 PR Cost, IRNS Distance Assumptions, 2020 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	653,476	568,445	83,523	-663,452	54,437	83.30
Rice	0	0	0	0	0	
Wheat	1,258,992	1,507,908	237,371	-1,905,878	134,514	106.84
Cement	0	0	0	0	0	
Fertilizer	135,389	117,382	13,288	-113,336	4,394	32.45
Iron Scrap	0	0	0	0	0	
Total	2,047,857	2,193,735	334,182	-2,682,666	193,345	94.41
IRNS Total	4,005,000					

Table 10.3.12 PR Cost, Actual Distance 1990/1991 Traffic

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	608,498	678,475	72,983	-616,249	19,352	31.80
Rice	0	0	0	0	0	
Wheat	280,082	414,521	53,838	-437,386	21,338	76.18
Cement	0	0	0	0	0	
Fertilizer	2,882	3,213	0	-2,646	453	157.21
Iron Scrap	0	0	0	0	0	
Total	891,462	1,096,209	126,821	-1,056,281	41,143	46.15
IRNS Total	1,436,644					

Table 10.3.13 PR Cost, Actual Distance 2000 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	610,810	681,053	73,261	-618,590	19,426	31.80
Rice	0	0	0	0	0	
Wheat	628,146	929,655	120,743	-980,934	47,855	76.18
Cement	0	0	0	0	0	
Fertilizer	6,283	7,005	0	-5,768	988	157.21
Iron Scrap	0	0	0	0	0	
Total	1,245,239	1,617,713	194,004	-1,605,292	68,269	54.82
IRNS Total	2,754,000					

Table 10.3.14 PR Cost, Actual Distance 2020 Moderate Traffic Growth

	Tonnes Attracted	'000 Tkm by Barge	'000 Tkm by Truck	'000 Tkm by Rail	Cost Saving '000 Rs.	Rs. Cost Saving/tn
POL	610,810	681,053	73,261	-618,590	19,426	31.80
Rice	0	0	0	0	0	
Wheat	1,134,501	1,679,061	218,075	-1,771,676	86,431	76.18
Cement	0	0	0	0	0	
Fertilizer	11,347	12,652	0	-10,417	1,784	157.21
Iron Scrap	0	0	0	0	0	
Total	1,756,658	2,372,766	291,336	-2,400,683	107,641	61.28
IRNS Total	4,005,000					

(10) A further examination of IRNS input assumptions was made in an attempt to identify reasons why IWT is economically efficient in other countries, but apparently not so in Pakistan, despite the presence of a major waterway. This investigation is summarized under:

- rail movement costs,
- barge movement costs,
- truck movement and transfer costs,
- capital costs, and
- socio-geographical reasons why IWT may not be viable in Pakistan.

1) Except where branches could be closed because all traffic had transferred to other modes, track maintenance and train control costs would still be incurred for other traffic, and PR's record on shedding labor made redundant by modernization or service reductions is poor.

2) This assumption, taken with IRNS's barge costs, would make IWT wholly uneconomic, as PR's variable costs (which, as noted, probably overstate the avoidable costs) are only just above the "no back haul" operating cost for a 900 tonne barge.

3) Any capacity freed up on rail by transfers to IWT could immediately be filled by other traffic appropriate to rail but forced by lack of capacity to go by road. In this case it is the road transport costs that are being avoided, not the rail costs. If all capacity freed up by IWT were used by goods transferring from road, this approach would increase the viability of IWT, as truck costs per tonne-km (as calculated by IRNS) are close to the level of rail costs used by IRNS.

4) The average annual wage assumed for barge crew is Rs39,700, Rs79,400 per month per barge for 8 months = Rs635,200 per year per barge, for 16 crew members.. PR's average wage for 1990/91 was Rs19,300, truck drivers earned around Rs25- 30,000, assistants somewhat less. In particular the rate assumed for a (unskilled) deck hand, at Rs3,000 per month for a job providing food and accommodation on the barge seems high.

5) UK limits, on very narrow channels, are 6.5 km per hour for stretches with earth banks and 9.6 km per hour with concrete banks. It is possible that IRNS intended to use 7.25 miles per hour (11.6 km per hour), and this, along with distance, was transposed to km without factoring. As barge costs rise largely on an hourly basis, an increase in speed results in a decrease in cost per tonne-km.

6) There seems little prospect at present of maximizing use of the barges by obtaining backhauls. There is only one sizeable southbound bulk movement, of rice, for which rail and truck, with routes running through the rice exporting areas and surplus southbound capacity, are very competitive.

7) If it were possible to halve labor costs and run at 11.6 km per hour for 11 months of the year, the cost per tonne-km by barge would be around 66% of that assumed by IRNS. The net cost, around Rs0.15 per tonne-km, would make IWT competitive with PR's variable rail cost, provided no additional transfer costs were involved.

8) For fuel oil moving to an oil fired power station this may be true, but many of the bulk good movements by rail also involve truck transfer between the origin/ destination and the railyard. The important question is whether transferring the main part of the haul to IWT will require an ADDITIONAL (or significantly longer) truck trip when compared to the same journey by rail.

9) While it would probably need a truck trip to serve the existing storage facility, a new store at the port would avoid the need for this (although the construction cost of the new store, and any change in the final distribution costs, would need to be taken into account in any economic analysis).

10) While Port Qasim specializes in bulk cargoes, it has not been established that all these goods could move through the port (in particular the rice deliveries to inland stations, possibly for processing, and oil products which have been refined at the Keamari refineries). It may have been assumed that IWT could also serve Karachi port, but no distance has been allowed for this in the spreadsheet, and the feasibility of sailing flat bottomed, shallow draft

vessels on the open sea is unproven.

11) Table 10.3.15 shows the required transport cost savings based on IRNS estimates of construction cost for their four options, and assuming that cost savings double in real terms between year 1 of operation and year 20.

Table 10.3.15 Required Annual Cost Savings for 15% Internal Rate of Return

	Cost	Year 1 Savings		Year 20 Savings	
Waterway	(mil'n US$)	('000 US$)	(mil'n Rs)	('000 US$)	(mil'n Rs)
Port Qasim - Sukkur					
river	334	61,030	15,257	122,060	30,515
canal	627	113,600	28,400	227,200	56,800
P.Q - Kalabagh	454	83,850	20,962	167,700	41,925
Sukkur - Kalabagh	120	22,840	5,710	45,680	11,420

Source: Costs from IRNS
Required savings by JICA

Comparing the year 20 required saving of 42 billion (1990/1 Rs.) with the IRNS estimate of 1.25bn in Table 10.3.5 and the revised estimate of 108 million in Table 10.3.14, it can be seen that a waterway would need to attract much more traffic than appears to be on offer to be economically viable.

12) While the capital cost estimated in IRNS are explained in some detail in the report (and are on a par with the $1bn estimate of US Trade and Development Program (1987), including a branch to Lahore), it is noted that they are considerably higher than costs estimated in 1984 by the Development Workshop (but for smaller vessels). Table 10.3.16 compares the cost estimates, at 1984 exchange rate of Rs15 = $1 has been used, with no adjustment for inflation.

Table 10.3.16 Comparison of Capital Costs

Waterway	IRNS Cost (mn US$ 1991)	Dev't Workshop (mn US$ 1984)
Port Qasim - Sukkur		
river	334	35.3
canal	627	73.3
P.Q - Kalabagh	454	42.6
Sukkur - Kalabagh	120	7.3

Source: Costs from IRNS, Dev't Workshop (1984), conversion to US$ by JICA.

13) The busiest inland waterways in the world, including the Mississippi, Rhine and Yangtze, became sufficiently established as transport links when river and canal were the best means of inland movement of goods to resist the challenge of rail and road. Cities and industries developed along the river that were dependent on it for import and export of goods. Once trade links were established, the river remained the most efficient means of transport even with other modes available.

14) While it was used for commercial and military navigation in 19th Century, this was at a time when there were no railways or roads. Motorized shipping ceased as soon as an alternative, the railway, became available to transport men and machinery between Karachi and the North West Frontier.

15) The major industrial towns of the Punjab, Multan and Lahore, are located in other river

valleys, but the waters of those rivers are nearly all used for irrigation purposes. Almost 100% of Indus waters are also diverted to irrigation, but the southern location of the main take-off points, Sukkur and Kotri, means that enough water is left in the river to permit navigation, for at least part of the year, above Kotri.

16) The proposed waterway has a capacity of over 30 million tonnes per year (At 20 minutes per lock transfer, each lock can handle 6 barges (3 up, 3 down) in two hours. If all barges are loaded (1800 tonnes each) capacity is 130,000 tonnes per day. Over the 8 months of navigation this is 31 million tonnes), but the maximum traffic forecast by 2020 by IRNS is just over 10 million tonnes. While some re-design in recognition of the low maximum demand may be possible, construction of only one third of the waterway would not be a viable option.

17) Even if IWT speed is 11.6 km per hour, as suggested above, minimum transit time from Port Qasim to Kalabagh would be 131 hours - 5.5 days. PR unit trains, even at current low levels of efficiency, would take about 3 days less. Private road haulage, with some disregard for the safety of other road users, would make the trip in 36 hours or less. This restricts IWT to competing for low value goods. IRNS notes that the transport savings for containerized manufactured goods could be more than offset by the cost to traders of carrying the cost of the goods for a few more days.

10.4 Development Potential

(1) Thus a site which IWT could not serve, or not serve well, but which was closer to Port Qasim and to markets for the steel, might have lower overall transport and running costs.

(2) This figure assumes IRNS's IWT operating costs with 100% backload, a 25% efficiency gain for rail from the operation of dedicated block trains, base rail costs and IWT distances as in Tables 10.3.1 and 10.3.2 This would realize savings of Rs915 million (1990/91) a year, which is only a fraction of the savings needed to justify the capital costs estimated by IRNS, as indicated in Table 10.3.15.

(3) With appropriate rolling stock - high capacity buggy hopper wagons and high power freight locomotives - meeting the demand would need only an additional 4 trains (each carrying 2,100 tonnes) each way a day, which could be accommodated within the existing surplus track capacity of the Shershah-Kalabagh section. The section between Shershah and Lodhran would need a second track to cope with the additional train movements. Improved freight wagons and this double tracking are included in PR's investment plans, and need not be counted as a cost of the development if they have already been undertaken as part of wider rail improvements. Upgrading of the line north of Shershah would probably be needed to cope with increased train weight, and extensive rail works would be needed at Kalabagh (It is an interesting comment on PR's current efficiency that, even allowing 48 hours for transit, 24 hours to unload and 24 hours to load (long times by international standards for this kind of service), a fleet of 25 locomotives and 32 sets of wagons (1320 including spares) would move 7.1 billion tonne-km a year, more than 142 locomotives and nearly 30,000 wagons achieved in 1992/3)

(4) Any transit traffic will need to use road between northern Pakistan and Central Asia, IWT would need to compete against the traffic also using truck between the ports and northern Pakistan or switching to rail, with a number of potential railheads between Peshawar and Rawalpindi, which would result in a saving of 150km on road compared to transshipment at Kalabagh.

(5) Given the high cost of trucking goods through the mountains, which may exceed Rs1000 per tonne for the section between northern Punjab and Central Asia alone, it is doubtful that low value bulk goods will use this route if an alternative (rail) route is available north of the mountains.

(6) As with the Kalabagh steel plant, such developments might need a navigable waterway to be economically feasible, a careful analysis of the overall costs of alternative industrial development strategies, one based on IWT, others based on road or rail transport, with alternative sites and sources of raw materials, would be needed.

10.5 Environmental Considerations

(1) While none of the environmental aspects identified pose a major obstacle to proceeding, their recognition at an early stage could allow the design to avoid certain ecologically sensitive areas, and environmentally unacceptable practices. These are discussed below.

(2) Much reference is made to the use of other waterways such as the Rhine being used as transport routes. The recent fire in the Sandoz Chemical works, and the flushing of chemicals into the Rhine by fire fighting water caused a major environmental incident. Comprehensive safety measures, lane separation, and contingency plans in the event of a spill should be considered particularly as the waters are intended for irrigation purposes. Doubled hulled vessels should be considered for oil transportation where even a small quantity of oil can have organoleptic effects, cause tainting of fish, and prevent spawning due to oxygen depletion.

(3) The proposed route and possible future extensions will utilize large sections of the Indus river, its tributaries, and its associated system of irrigation canals. Many of these pass through areas of high ecological significance and these are described below. The reference numbers refer to Figure 1 which uses the reference numbers as given in the Directory of Asian Wetlands, IUCN, 1989. The location of the barrages is shown in Fig. 10.5.1.

(Rasool Barrage)

It is used for flood control and covers 1100 hectares. It supports important fisheries, and reeds from the marshes are used in cottage industries. (Reference Number 12)

(Quadirabad Barrage)

It is used for flood control and covers 2,850 hectares. It supports fisheries and weaving of the reeds from the marshes is a cottage industry. It is an important wintering area for waterfowl with an established population of 45,000 birds. (Reference Number 14)

(Kharal Lake)

It was formerly a waterlogged area with very saline waters. In 1984 the Fisheries Department introduced exotic species for recreational purposes such as angling. It relies on flooding for its freshwater supply and could be adversely affected if waters were diverted. It is an important wintering area for waterfowl with an established population of 66,000 birds, and is one of only three wetlands in Pakistan where the endangered white headed duck "Oxyura leucocephala" winters in large numbers. (Reference Number 16)

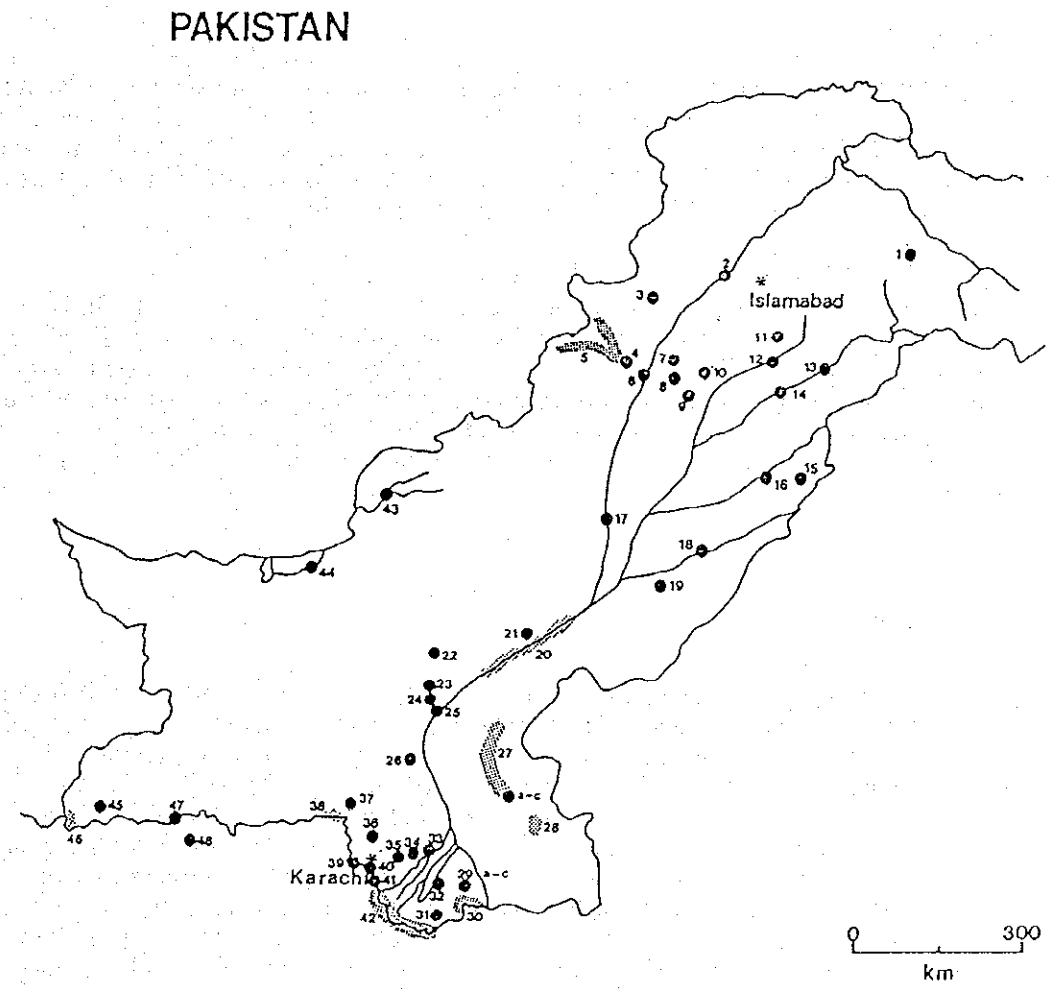
(Taunsa Barrage)

It covers 6,500 hectares and is important for fishing, water supply, reeds for cottage industries and recreation. Fisheries are thought to generate an income of over 1 million rupees per year. It is an important wintering site for waterfowl notably Anatidae, cranes, and the Bar-headed goose "Anser indices". Over 24,000 waterfowl have been observed there. It provides a habitat for the smooth coated otter and the Indus Dolphin "Platanista indi". (Reference Number 17)

(Islam Headworks)

It is a staging area for autumn migration of waterfowl but dries out completely in winter so is not so important in winter. It is owned by the Government of Punjab and administered by the Irrigation Department. It covers 3,100 hectares and is important for fishing and water supply. (Reference Number 18)

Figure 10.5.1 Map of Directory of Asian Wetland, IUCN



(Indus Dolphin Sanctuary)

There is no large scale commercial fisheries but fish are caught in pools of water when the waters recede in winter. Before this the dolphins were hunted for food and oil by the local people but now the Sind Wildlife Management Board attempt to prevent illegal poaching. The Indus Dolphin is a blind cetacean endemic to the Indus whose route to the river estuary has been blocked by the barrages. It is thought to number about 400 and the area is a proposed World Heritage Site. (Reference Number 20)

(Kinjhar Lake)

It covers 13,500 hectares and is the largest freshwater lake in Pakistan. It is an important water source for Karachi, assists in flood control, and fishing in its waters supports 15 villages. It is an important breeding, staging and wintering area for wildlife and over 200,000 birds were counted there in 1988. Under the Ramsar Convention of 1976 it was listed as a Wetland of International Importance. (Reference Number 33)

(The Outer Indus Delta)

The salinity of the waters fluctuates drastically due to the flow in the Indus river. The wetlands are state owned and under the administration of Sind Forest Department, Sind Board of Revenue and Port Qasim Authority. The delta supports a very rich ecosystem yet is under considerable threat from deforestation, pollution, overfishing, increasing salinity, and overgrazing. It provides a habitat to a wide variety of flora and fauna, the latter including resident and migratory. Two large portions of the delta have been declared protected forests.

(Reference Number 42)

10.6 Conclusions

(1) Previous studies have generally concluded that, subject to detailed feasibility studies of engineering problems in a few locations near Kotri, conversion of the Indus and its associated irrigation canals into a navigable waterway is feasible between Kalabagh and the sea at Port Qasim. This would certainly involve the use of irrigation canals between Kotri pond and Kalri Lake, a new still water canal between Kalri Lake and the head of the Gharo Creek at Bhambore, and dredging of Gharo Creek to a navigable depth. Some studies conclude that the Indus is adequate for navigation between Sukkur and Kotri, others that the use of the Nara irrigation canal is necessary for reliable navigation between these points. All studies assume the Indus above Sukkur can support navigation by craft drawing: 1.4m for most of the year; and 1.8m for 8-9 months. The navigability of this section of the Indus by larger vessels, for example of the size proposed by IRNS, has not been established.

(2) All studies conclude that navigation of the Chenab and Ravi to Multan (Shershah) and Lahore is not possible without substantial new still water canals or the re-allocation of irrigation water between river systems.

(3) The nature and slow transit speed of IWT means that there is a limited range of goods movements (mostly by low value bulk goods) for which it is appropriate. The potential market for IWT in Pakistan is further restricted by a mismatch between the origin and destination areas of those goods movements and the areas most easily served by IWT, leading to low forecasts of demand.

(4) On the basis of this level of demand, the construction and IWT operating costs estimated by IRNS, any Indus based waterway would fall well short of economic viability - the benefits of lower transport costs for a limited range of goods movements would not justify the cost of constructing the waterway.

(5) Downward revision of the IRNS construction and operating cost estimates would narrow the gap between annual benefits forthcoming (Table 10.3.14) and annual benefits required for economic viability (Table 10.3.15). On the other hand, the benefit calculations shown above

do not take into account possible improvement in the efficiency of operation of the railways.

(6) Future riverside industrial and commercial developments may create additional transport demand appropriate to IWT which would enhance the economic viability of a waterway, particularly if substantial capital spending on infrastructure for rival modes (road and rail) would be needed to facilitate the development. Under these circumstances the economic viability of the whole project - industrial development plus associated transport works - would need to be considered.

(7) Environmentally, there are no overriding reasons why a waterway project should not proceed but there are serious environmental considerations which must be taken into account. These include avoidance of areas of high ecological value, use of dedicated vessels for transport of potentially toxic materials, and contingency plans in the event of total catastrophic loss of a vessel. All of these could have cost implications.

(8) In conclusion, the limited transport cost savings available from diverting some current transport flows (even at increased future volumes) to IWT seem unlikely to justify the considerable capital outlay required and the potential disruption to irrigation water supplies and the environment. Investment of a far smaller sum in increasing the capacity and efficiency of the railways would yield much better returns. Inland waterways in Pakistan should only be considered further if:

1) at least one more major dam is constructed on the Indus, Jhelum or Chenab, justified on irrigation and/or power generation grounds - this would give greater control over water depths, increasing the length of time for which the waterway would be navigable each year and the size of vessel that could be accommodated;

2) industrial or commercial developments are planned which, if they had a waterside location, would bring substantial traffic to a waterway - IRNS considered an iron ore mine and steel mill at Kalabagh that would result in over 7 billion tonne-km transport demand annually; and

3) the development plus waterway would have a greater economic rate of return than a similar development served by rail or road.

10.7 Recent Study

A steering committee for IWT was formed on the Prime Minister's directive to review the prospects of development of IWT in Pakistan. The first meeting was held on 12th June,1994.

According to the detailed deliberation, the field survey was carried out by the National Transport Research Centra (NTRC) to obtain the existing condition of water-borne transport operation on the river Indus from 31st October to 8th November, 1994. The survey team visited Kotri (Hyderabad), Sukkur, Kot Mithan (Rajanpur) and Ghazi Ghat (D.G. Khan).

Survey report was published on January, 1995. Recommendations from that report are summarized as follows;

(1) The river between Mithankot, Guddu Barrage and Sukkur Barrage has the potential for being used as an inland waterway route. Water craft with a draft of 1.4 m can be deployed on this section. A successful operation on this section would open up other sections of the river Indus for IWT operations.

(2) The local fishermen and boatmen may be provided with modern river craft on favorable terms. There is a demand of the local people for such assistance from the Government.

(3) There is a need for navigational information. This would necessitate the establishment of a survey and beacon/buoy system.

(4) The local boatmen are constantly in danger of being attacked by dacoits at "Katcha" area in the northern section of Indus in Sindh, therefore, some means of protection should be provided for the safe passage.

(5) It is further proposed that some of the places such as Mithankot, Rojhan and Sukkur, to name a few, which have the potential of becoming recreational resorts, may be developed for attracting tourism. For this purpose private sector participation may be involved.