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Main Report (II): Long-term Strategy & Master Plan

Final

The Study on the Red River Inland Waterway Transport System in the Socialist Republic of Vietnam

March 2003

The Overseas Coastal Area Development Institute of Japan (OCDI)
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Master Plan of Hanoi Port (2020)

Master Plan of Khuyen Luong Port (2020)

Master Plan of New North Port (2020)

Master Plan of New East Port (2020)

Master Plan of Channel Stabilization Facilities (2020)

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct a study on the Red River Inland Waterway Transport System in the Socialist Republic of Vietnam and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched a study team to Vietnam three times between December 2001 and January 2003, which was headed by Mr. Takechiho Tabata (December 2001 - June 2002) and Mr. Hisao Ouchi (June 2002 - January 2003) of the Overseas Coastal Area Development Institute of Japan (OCDI), and was comprised of OCDI and Japan Port Consultants, Ltd. (JPC).

The team held discussions with the officials concerned of the Government of the Socialist Republic of Vietnam and conducted field surveys at the study area. Upon returning to Japan, the study team conducted further studies and prepared this final report.

I hope that this report will contribute to this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Socialist Republic of Vietnam for their close cooperation extended to the study team.

March 2003

Takao Kawakami
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

March 2003

Mr. Takao Kawakami
President
Japan International Cooperation Agency

Dear Mr. Kawakami:

It is my great pleasure to submit herewith the Final Report of the Study on the Red River Inland Waterway Transport System in the Socialist Republic of Vietnam.

The study team comprised of the Overseas Coastal Area Development Institute of Japan (OCDI) and Japan Port Consultants, Ltd. (JPC) conducted surveys in Vietnam over the period between December 2001 and January 2003 as per the contract with the Japan International Cooperation Agency (JICA).

The study team compiled this report, which proposes the Long-term Strategy for the Inland Waterway Transport (IWT) System in the Red River Delta for the year 2020 as well as the Master Plan and the Short-term Development Plan for the IWT System in the Red River segment through Hanoi for the year 2020 and 2010 respectively, through close consultations with officials of the Ministry of Transport (MOT) and other authorities concerned of the Vietnamese Government.

On behalf of the study team, I would like to express my heartfelt appreciation to MOT and other authorities concerned of the Government of the Socialist Republic of Vietnam for their diligent cooperation and assistance and for the heartfelt hospitality extended to the study team.

I am also very grateful to your Agency, the Ministry of Foreign Affairs, the Ministry of Land, Infrastructure and Transport and the Embassy of Japan in Vietnam for valuable suggestions and assistance through this study.

Yours faithfully,

大内 久夫

Hisao Ouchi
Team Leader
The Study on the Red River Inland Waterway Transport System in the Socialist Republic of Vietnam

ABBREVIATION LIST

AAGR	Average Annual Growth Rate
ADB	Asian Development Bank
AFTA	ASEAN Free Trade Agreement
APA	ASEAN Ports Association
ASEAN	Association of South East Asian Nations
BCR	Benefit Cost Ratio
BOT	Build, Operate and Transfer
CCTDI	Consulting Center for Transport Development Investment under TDSI
CCWACO	Consulting Company of Waterway Construction under VN Waterway Construction Corp
CFS	Container Freight Station
CIF	Cost, Insurance and Freight
CMB	Construction Consulting Company for Maritime Building under VINAMARINE
CSW	Channel Stabilization Works
CV	Cheval Vapeur (French expression, = HP: horse power)
CY	Container Yard
DC	Distribution Center
DNC Canal	Day - Ninh Co Canal
DSI	Development Strategy Institute under MPI
DWT	Dead Weight Tonnage
EDI	Electronic Data Interchange
EIA	Environment Impact Assessment
EPZ	Export Processing Zone
E/S	Engineering Service
ETA	Estimated Time of Arrival
FCL	Full Container Load
FDI	Foreign Direct Investment
FIRR	Financial Internal Rate of Return
FOB	Free on Board
GDP	Gross Domestic Product
GOJ	Government of Japan
GOV	Government of the Socialist Republic of Vietnam
GPS	Global Positioning System
GRT	Gross Registered Tonnage
GSO	General Statistical Office
GT	Gross Tonnage
HCMC	Ho Chi Minh City
HDI	Human Development Index
HHWL	Highest High Water Level

HNPC	Hanoi People's Committee
HWL5%	5% Occurrence Water Level
ICD	Inland Clearance Depot
IMO	International Maritime Organization
IRR	Internal Rate of Return
IW	Inland Waterway
IWMS	Inland Waterway Management Station
IWPA	Inland Waterway Port Authority
IWT	Inland Waterway Transport
IZ	Industrial Zone
JBIC	Japan Bank for International Cooperation
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JP¥	Japanese Yen
JPC	Japan Port Consultants, Ltd.
LAD	Least Available Depth of waterway
LAW	Least Available Width of waterway
LCL	Less than Container Load
LOA	Length Overall
LSD	National Land Survey Datum
LWL95%	95% Occurrence Water Level
MARD	Ministry of Agriculture and Rural Development
MIS	Management Information System
MOC	Ministry of Construction
MOSTE	Ministry of Science, Technology and Environment
MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
MWL	Mean Water Level
N3	Confluence/Bifurcation
NFEA	Northern Focal Economic Area
MT	Metric Ton
NPV	Net Present Value
NOWATRANCO	Northern Waterway Transport Corporation
OCDI	Overseas Coastal Area Development Institute of Japan
O-D	Origin and Destination
ODA	Official Development Assistance
PAX	Passenger
PC	People's Committee
P/L	Profit/Loss
PMU	Project Management Unit
PMU-Waterways	Project Management Unit of Waterways

Q	Water Discharge
QGC	Quay-side Gantry Crane
RO/RO	Roll-on Roll-off
RTG	Rubber-Tired Gantry
RRD	Red River Delta
SBSTI	Shipbuilding Science & Technology Institute under VINASHIN
SCF	Standard Conversion Factor
SDL	National Survey Datum
Sh	Hydraulic Section
SOC	Ship Operation Cost
SOE	State-owned Enterprise
SPM	Suspended Particulate Matter
SRV	Sea-cum-river Vessel
SS	Suspended Solid
S/W	Scope of Work
SWR	Shadow Wage Rate
TDSI	Transport Development Strategy Institute under MOT
TEDI	Transport Engineering Design Incorporation
TEDI-Port	Port & Waterway Engineering Consultants under TEDI
TEDI-Wecco	Waterway Engineering Consultants under TEDI
TEU	Twenty-foot Equivalent Unit
US$	US Dollar
VAT	Value Added Tax
VCCI	Vietnam Chamber of Commerce and Industry
VICT	Vietnam International Container Terminals
VINALINES	Vietnam National Shipping Lines
VINAMARINE	Vietnam National Maritime Bureau
VINASHIN	Vietnam Shipbuilding Industry Corporation
VINAWACO	Vietnam Waterway Construction Corporation
VITRANSS	Vietnam Transport Strategy Study
VIWA	Vietnam Inland Waterway Administration
VMRCC	Vietnam Maritime Regional Coordination Center
VMS	Vietnam Maritime Safety Agency
VN	Vietnam
VND	Vietnam Dong
VOC	Vehicle Operation Cost
VR	Vietnam Railway
VR	Vietnam Register
VRA	Vietnam Road Administration
VTMS	Vessel Traffic Management System

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PART II

LONG-TERM STRATEGY FOR IWT SYSTEM IN THE RED RIVER DELTA

Chapter 16 Socio-economic Framework

16.1 Population

There are several government documents dealing with population forecast. These documents include population forecast issued by the National Committee for Population and Family Planning (NCPFP) and the Ministry of Construction (MOC). After reviewing the two documents' features, the VITRANSS revised future population, indicating the following points:

(1) The NCPFP is a reliable source and was used as the primary basis for relevant projections, but it is still likely to underestimate rural-to-urban migration caused by urbanization. For instance, provinces considered as growth poles, such as Quang Ninh, Da Nang and Ba Ria – Vung Tau were assumed to have a lower growth rate than other regions to which they belong. Therefore, there is a need to adjust the three provinces' forecast population with that of neighboring provinces to meet urbanization trends.

(2) The MOC expected a sharp increase in the number of urban residents, ie 30.4 million in 2010 and 46 million in 2020 compared with 14.7 million now. This sharp increase which envisions will develop small to medium-sized urban centers all over the country in spite of emerging mega cities, however, does not reflect the trend forecast by the NCPFP and the provincial breakdown made by the MPI/DSI. Therefore, a moderate urbanization trend is needed. The VITRANSS assumed that urban residents would increase up to 35.6 million in 2020, about a third of the country's population.

This study fully adopted the VITRANSS's projection. In conclusion, population will increase from 77.6 million in 2000 to 94.5 million in 2010 and 109.5 million in 2020 at the national level with growth rates of 1.73 for 1997-2010 and 1.48 for 2010-2020. Also the number of urban centers with a population of more than 10,000 will increase from 569 in 1998 to 1,226 in 2010 and 1,953 in 2020. Urban migration will continuously head for the two national centers, i.e., Hanoi and HCMC. In the north, population will increase 28.3 million in 2000 to 38.8 million in 2020. Three million urban residents will reside in Hanoi until the year 2020, strengthening its economic relations with Hai Phong and Ha Long at the same time.

Table 16.1.1 Summary of Population Forecast

(Unit: '000 persons)

Region \ Year	2000[1/]	2010	2020	AAGR (%)	
				1997/2010	2010/2020
Red River Delta	14,971	17,699	20,024	1.44	1.24
Northeast	10,998	13,616	15,613	1.76	1.38
Northwest	2,287	2,764	3,158	1.87	1.34
Whole country	77,686	94,548	109,521	1.73	1.48

Note) 1/ obtained form "Statistical Yearbook(2000)"

Table 16.1.2 Population Forecast by Province

(Unit: '000 persons)

Region	Province	2000[1/]	2010	2020
Red River Delta	Hanoi	2,736.0	2,988.7	3,590.3
	Hai Phong	1,691.0	1,984.3	2,199.6
	Hai Duong	1,668.0	2,035.1	2,275.3
	Hung Yen	1,082.0	1,300.3	1,453.2
	Thai Binh	1,792.0	2,144.9	2,383.2
	Nam Dinh	1,905.0	2,290.5	2,570.6
	Ninh Binh	888.0	1,103.4	1,249.2
	Ha Nam	798.0	988.4	1,069.8
	Ha Tay	2,411.0	2,863.3	3,232.9
	Subtotal	14,971.0	17,698.9	20,024.1
North East	Cao Bang	497.0	664.7	740.2
	Lang Son	711.0	815.3	871.7
	Quang Ninh	1,018.0	1,455.7	1,845.3
	Thai Nguyen	1,054.0	1,104.2	1,183.6
	Bac Can	280.0	378.9	419.6
	Bac Ninh	949.0	1,131.2	1,270.1
	Bac Giang	1,509.0	1,649.7	1,805.6
	Phu Tho	1,274.0	1,715.0	1,998.8
	Vinh Phuc	1,103.0	1,311.1	1,487.3
	Lao Cai	613.0	738.3	842.6
	Yen Bai	686.0	954.8	1,128.1
	Tuyen Quang	686.0	937.5	1,114.4
	Ha Giang	618.0	759.5	905.8
	Subtotal	10,998.0	13,615.9	15,613.1
North West	Son La	907.0	1,037.8	1,187.1
	Lai Chau	613.0	716.8	827.4
	Hoa Binh	767.0	1,009.1	1,143.9
	Subtotal	2,287.0	2763. 7	3,158.4

Note) 1/ obtained from "Statistical Yearbook (2000)"

16.2 GDP

16.2.1 Methodology

Since the Vietnamese economy considerably changed since the Doi Moi initiatives, economic indicators are relatively unstable and their relationships are quite difficult to establish. Nevertheless, the challenge taken in VITRANSS enables to capture the Vietnamese economy based on the available economic data in the past decade. In this study the same methodology was adopted in order to make economic projection. Its base concept is that labor productivity is determined by the level of capital equipment ratio (accumulated capital stock per employee). The outline of the model is depicted in **Figure 16.2.1**.

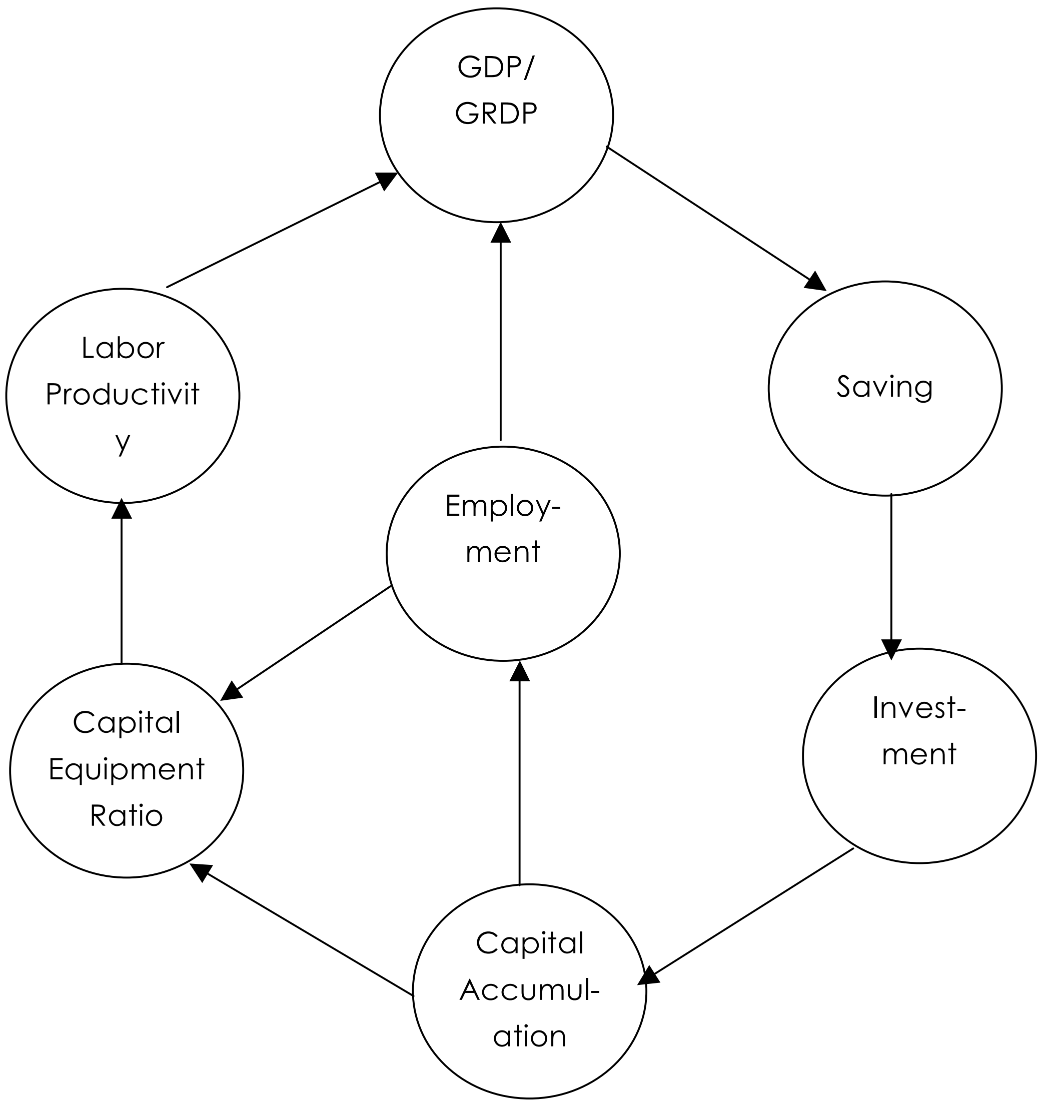


Figure 16.2.1 GDP/GRDP Projection Model (Klein-Kosobud Model)

The model can be described in detail as follow:

Internal Variables:

Y	:	GDP
S	:	Gross Saving
K	:	Capital Stock
ΔK	:	Increase in Capital
N	:	Gross Investment
N_h	:	Total Employment
δ	:	Annual Working Hours
	:	Employment Parameter

External Variables:

P	:	Total Population
W_h	:	Average Daily Working Hours a Day
L_d	:	Annual average Working Days per Person

Klein-Kosobud Model:

(1) $S(t)/Y(t) = f[Y(t)/P(t)]$

(2) $Y(t)/N_h(t) = g[K(t-1)/N(t)]$

(3) $\Delta K(t) = f[I(t)]$

(4) $K(t) = K(t-1)+ \Delta K(t)$

(5) $S(t) = I(t)$

(6) $N(t) = \delta(t)P(t)$

(7) $N_h(t) = W_h(t)*L_d(t)*N(t)$

Formula 1 shows that gross saving ratio is influence by the change of GDP per capital. Formula 2 is the most important one in this model, stating that labor productivity is determined by capital-equipment ratio. One year is assumed as capital gestation period. Formula 3 presents the relationship between increment in capital stock and gross investment, which includes investment for replacement and rehabilitation. Formula 4 to 7 are easily deduced by the definition of variables or the definition itself. National GDP was at first estimated by applying the econometric model above and after it was broken down to regional/provincial levels.

16.2.2 National GDP estimate

Parameters of the econometric model are based on VITRANSS's 1990 data collected for parameter calibration of the econometric model, and taking into account the differences in statistical definition and its reliability[1]. The calibrated results are summarized as follows:

Formula (1) $S(t)/Y(t) = 0.4/[1+\exp(-2.1341*(Y(t)/P(t))+4.2187)]$

Formula (2) $Y(t)/N_h(t) = 0.3442*(K(t-1)/N(t))+3.088$

Formula (3) $\Delta K(t) = a(I(t))$, where a, which was as high as 0.6 as of 1997, was assumed to decline to 0.4 until the year 2020 since future investment will replace and repair old stock.

Formula (4)(5) Additional parameters are not needed.

Formula (6) Employment parameter, $\delta(t)$, was assumed to increase from 49% in 1997 to 54% in 2020.

Formula (7) Additional parameters are not needed.

Values for exogenous variables were assumed as **Table 16.2.1**.

Table 16.2.1 Input Data for National GDP Estimate

Year	Sunday	Holiday	Saturday	Paid Holiday	Total	Working Days	Daily W.H.	Annual W.H.	Population
1997	52	8	26.0	3.9	89.9	275.1	7.5	2,063	78,059
1998	52	8	26.8	4.0	90.8	274.2	7.4	2,039	78,864
1999	52	8	27.7	4.1	91.8	273.2	7.4	2,014	79,677
2000	52	8	28.6	4.2	92.7	272.3	7.3	1,990	80,499
2001	52	8	29.5	4.3	93.7	271.3	7.2	1,966	81,815
2002	52	8	30.4	4.4	94.7	270.3	7.2	1,941	83,152
2003	52	8	31.4	4.5	95.8	269.2	7.1	1,917	84,512
2004	52	8	32.3	4.6	96.9	268.1	7.1	1,893	85,893
2005	52	8	33.4	4.7	98.0	267.0	7.0	1,869	87,297
2006	52	8	34.4	4.8	99.2	265.8	7.0	1,861	88,702
2007	52	8	35.5	4.9	100.4	264.6	7.0	1,852	90,128
2008	52	8	36.6	5.0	101.6	263.4	7.0	1,844	91,578
2009	52	8	37.8	5.1	102.9	262.1	7.0	1,835	93,051
2010	52	8	39.0	5.2	104.2	260.8	7.0	1,826	94,548
2011	52	8	40.1	5.3	105.5	259.5	7.0	1,817	95,678
2012	52	8	41.3	5.4	106.8	258.2	7.0	1,808	96,821
2013	52	8	42.5	5.6	108.1	256.9	7.0	1,798	97,977
2014	52	8	43.8	5.7	109.4	255.6	7.0	1,789	99,148
2015	52	8	45.0	5.8	110.9	254.1	7.0	1,779	100,332
2016	52	8	46.3	5.9	112.3	252.7	7.0	1,769	101,919
2017	52	8	47.7	6.1	113.8	251.2	7.0	1,759	103,531
2018	52	8	49.1	6.2	115.3	249.7	7.0	1,748	105,168
2019	52	8	50.5	6.4	116.9	248.1	7.0	1,737	106,832
2020	52	8	52.0	6.5	118.5	246.5	7.0	1,726	108,521

[1] Details concerning the parameter calibration can be obtained from the VITRANSS, Main Text Vol. 2, Transport Demand Forecast, 2000.

In the econometric model above, it should be noted that GDP growth heavily relies on investment and investment in turn largely depends on saving. Experiences showed that an increase in GDP by 1% requires a corresponding investment increase in investment of 3% in developing countries. In Viet Nam where foreign investment has offset insufficient gross saving, such available resources should be sufficiently encompassed. Thus Viet Nam enjoyed large investments during the period 1992-1997, ranging from 30% to 40% per GDP. However, this seems to be continuing, judging from the economic performance of the country since 1998. The regional economic perspective is also unclear. Experiences of neighboring countries, whose market economies were built much earlier than Vietnam's, showed that economic recession at intervals are inevitable and that there is a need for continuous economic reform.

Under this consideration, GDPs were estimated according to the following assumptions: i) scenario 1: Economic growth will continue at the same pace as current (trend-based forecast), ii) scenario 2: Foreign investment will decline to half of the current amount (low–assumption forecast) and iii) scenario 3: Investment amount will be placed between scenario 1 and scenario 2 (high-assumption forecast). Reflecting scenarios' features, investment per GDP rate was set up as **Table 16.2.2**.

Table 16.2.2 Economic Development Alternatives

		Scenario 1	Scenario 3	Scenario 2
Investment per GDP Rate	-2005	Ascending to 40%	31-32%	25%
	2006-2010	40%	Declining to 28%	Declining to 20%
	2011-2020	40%	28%	20%

The estimate results are indicated in **Table 16.2.3** and **Figure 16.2.2**. Their annual growth rates during the project period are 9.28% for the trend-based forecast, 7.39% for the high-assumption forecast and 6.20% for the low-assumption forecast. As economy is thought to increase at a growth rate of trend-based forecast, the high- and low-assumption scenarios were mainly taken for transport demand forecast.

Table 16.2.3 GDP Estimate Results

(Unit: VND Billion at 1994 constant Price)

Scenario	2005	2010	2020	Annual Growth Rate
Scenario 1	454,253	730,550	1,709,072	9.28
Scenario 2	385,046	531,225	885,634	6.20
Scenario 3	409,327	598,574	1,143,799	7.39

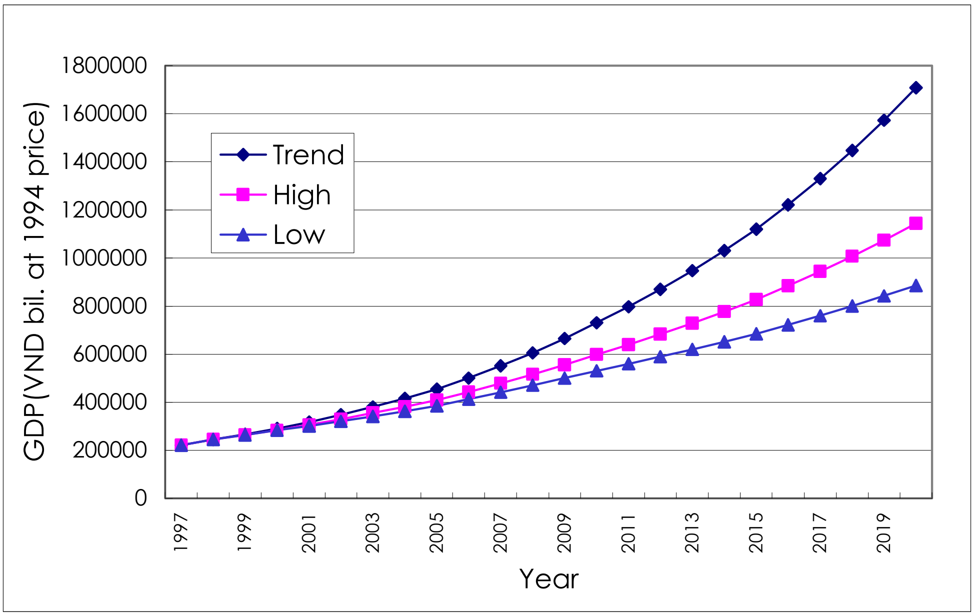


Figure 16.2.2 GDP Forecast Results Between 1997 and 2020

16.2.3 Sectoral and regional breakdown

The economy has become less dependent on the primary sector and more on secondary and tertiary sectors during the past 10 years. This trend will continue in the future. In estimating sectoral GDP, the sectoral growth rates were set up as Table 16.2.4, taking into account historical growth rate of sectoral GDPs and population growth in urban and rural areas.

Table 16.2.4 Sectoral Growth during Project Period

(Unit: % p.a.)

	Primary	Secondary	Tertiary	All Sectors
High-assumption Scenario				
2000-2005	4.95	8.82	8.03	7.62
2005-2010	5.10	8.91	8.30	7.90
2010-2020	3.76	7.44	7.09	6.69
Low-assumption Scenario				
2000-2005	3.01	7.40	7.42	6.35
2005-2010	3.78	7.34	7.42	6.63
2010-2020	2.66	5.84	5.70	5.24

Further, sectoral GDPs were broken down into regional levels with consideration of present labor productivity (GDP/labor force). **Table 16.2.5** shows regional breakdown results.

Table 16.2.5 GDP Estimation Results by Region

Year / Region	Scenario	GDP Estimates (bil. VND at 1994)		Annual Growth Rate (%)		GDP/Capital (mil. VND)	
		2010	2020	1998-10	2010-20	2010	2020
Red River Delta	Low	94,879	158,957	7.00	5.29	5.36	8.98
	High	107,360	207,356	8.11	6.80	6.95	11.72
Northeast	Low	40,634	67,036	6.36	5.13	2.98	4.92
	High	44,989	84,919	7.27	6.56	3.87	6.24
Northwest	Low	6,795	11,180	7.09	5.11	2.46	3.11
	High	7,318	13,720	9.37	6.49	4.05	4.96
Subtotal	Low	142,308	237,173	6.82	5.24	4.18	6.11
	High	159,667	305,995	7.85	6.72	4.69	7.89
Whole Country	Low	531,255	885,634	6.67	5.24	5.62	9.37
	High	598,574	1,143,800	7.74	6.69	7.44	12.10

16.2.4 Provincial breakdown

GDP at provincial level estimated in the VITRANSS seems to fail in reflecting historical trend of each province's GDP share in each region. **Figure 16.2.3** shows the historical trend of Hanoi's GDP share in RRD's GDP. It reveals that its share steadily increased during 1995-2000 and will continue. However, the VITRANSS estimated that the share would decline in 2010 and 2020.

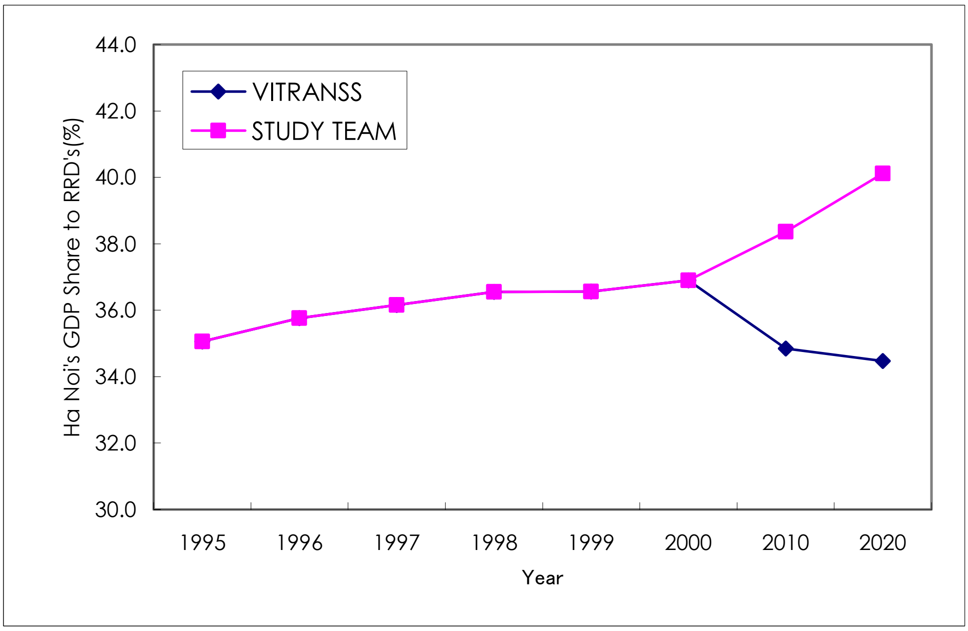


Figure 16.2.3 Historical Trend of Hanoi's GDP Share to RRD's

For this reason, GDP at the provincial level was newly estimated by the study team taking into account each province's per-capita GDP share to region's. As a result, Hanoi's GDP share to RRD's was, as shown in **Figure 16.2.3**, estimated to increase to 38% in 2010 and 40% in 2020 respectively. Conclusively, GDP results by province were estimated as **Table 16.2.6**.

Table 16.2.6 GDP Estimate Results by Province

Region	Province	2010				2020			
		Total	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary
Red River Delta	Hanoi	38683.9	570.1	18449.7	19664.1	73271.2	339.8	35944.9	36986.5
	Haiphong	14143.6	1531.9	6765.3	5846.4	24720.1	1753.0	10408.9	12558.2
	Hai Duong	9271.2	1733.1	4387.3	3150.8	16343.5	1868.1	7994.3	6481.1
	Hung Yen	5913.1	1526.8	2399.4	1986.9	10419.6	1717.3	4280.6	4421.7
	Thai Binh	8065.3	2062.6	3042.7	2960.0	14129.6	2289.4	5580.9	6259.3
	Nam Dinh	7872.8	1159.9	3123.0	3590.0	13931.3	1255.6	5499.2	7176.5
	Ninh Binh	2996.0	736.3	1449.4	810.3	5348.1	897.6	2678.2	1772.3
	Ha Nam	3458.3	657.0	1407.5	1393.8	5901.8	698.1	2327.6	2876.1
	Ha Tay	10724.0	2334.1	5146.1	3243.8	19091.4	2789.9	9346.2	6955.2
	Subtotal	101128.3	12311.8	46170.4	42646.1	183156.6	13608.8	84060.9	85486.9
North East	Cao Bang	2005.0	1053.2	306.0	645.7	3426.4	1557.8	621.0	1247.6
	Lang Son	2669.7	1271.9	461.7	936.1	4380.4	1812.1	911.4	1656.9
	Quang Ninh	7978.9	534.4	3849.1	3595.4	15521.8	895.1	7495.7	7131.0
	Thai Nguyen	2928.9	1051.7	1045.7	831.6	4817.9	1283.6	2040.1	1494.2
	Bac Can	686.6	439.2	141.3	106.1	1166.9	712.7	295.4	158.8
	Bac Ninh	4227.1	862.5	2083.3	1281.2	7283.6	974.7	3796.9	2512.0
	Bac Giang	4074.9	1480.1	1557.1	1037.7	6844.4	2347.0	2769.5	1727.8
	Phu Tho	5495.0	1123.5	2301.1	2070.3	9828.1	1498.6	4425.3	3904.2
	Vinh Phuc	4746.4	1574.4	936.5	2235.5	8262.8	2125.3	1789.0	4348.5
	Lao Cai	1745.1	694.9	497.9	552.2	3056.5	1041.8	1012.5	1002.2
	Yen Bai	2482.2	1045.6	967.3	469.3	4500.6	1449.1	2178.7	872.8
	Tuyen Quang	2412.3	951.5	642.3	818.4	4400.4	1552.1	1387.8	1460.5
	Ha Giang	1359.4	739.4	324.9	295.1	2487.9	1202.4	706.2	579.3
	Subtotal	42811.5	12822.4	15114.2	14874.8	75977.6	18452.4	29429.4	28095.7
North West	Son La	2509.9	1666.3	503.8	339.7	4435.2	2837.1	958.3	639.8
	Lai Chau	1665.7	508.3	724.3	433.1	2970.3	739.0	1408.8	822.4
	Hoa Binh	2880.6	1154.7	1008.4	717.4	5044.6	1845.7	1859.9	1339.0
	Subtotal	7056.2	3329.4	2236.5	1490.2	12450.2	5421.8	4227.0	2801.3
Total		150995.9	28463.6	63521.1	59011.1	271584.3	37483.1	117717.3	116383.8

(Unit: VND billion at 1994 constant price)

Note) Figures mean the average of high- and low-assumption forecasts.

16.2.5 Comparison with DSI projection

The Development Strategy Institute (DSI) under MPI worked out an estimate of long-term economic growth to review and modify the target down ward after the regional economic crisis. Master plan of inland waterway sector1 published in 2000 is based on the DSI estimate. The economic growth estimate proposed in this study is needed to compare with the DSI projection.

The DSI estimate is based on the following assumptions:

- Low assumption
  - Average consumption per capital will maintained at the growth rate of 4% in 2001 – 2010; and
  - Share of domestic funds will be about 55% and 60% of total investment capital in 2001 – 2005 and 2006 – 2010 respectively
- High assumption
  - FDI growth rate will be about 10% and ODA growth rate will be disbursed by 6%; and
  - Total investment capital will increase by 8%.

The economic development proposed by DSI is illustrated in **Table 16.2.7**. The estimate of the study has wider range particularly during the period 2010 – 2020 and the DSI estimate falls between the low and high assumption of the estimate in the study.

Table 16.2.7 Comparison of Economic Development Estimates

(Unit: VND Billion at 1994 Constant Price)

Year	Estimate of the study		Estimate by DSI	
	Low	High	Low	High
2005	385,046	409,327	366,109	389,054
2010	531,225	598,574	460,774	535,540
2020	885,634	1,143,199	961,540	

Chapter 17 Basic Policy for the IWT System in the Red River Delta

17.1 Advantages and potential of the IWT system

The IWT system in the Red River Delta plays an important role in the socio-economic development as well as bettering the lives of people living there, by making full use of its advantage such as:

- Dense and convenient waterway network
- Low utilization of inland waterways
- Ideal port locations
- Low energy consumption
- Low CO_2 discharge

There are two major river systems of Red River and Thai Binh River in the Northern region. Together with Duong and Luoc Rivers which link these two major river systems, both make a convenient waterway network.

The density of exploited inland waterways in Vietnam is 0.034 km/sq.km equivalent to almost 2 times of that of 6 countries in Europe where the IWT system is considerably developed. The density of inland waterways in Northern region is 0.170 km/sq.km equivalent to almost 2 to 14 times of those of nearby countries (see **Table 17.1.1**).

Table 17.1.1 International Comparison of Inland Waterways

Country	Land Area (sq. km)	Population (million persons)	Inland Waterway						
			Total Length (km)	IW Density per area (km/sq.km)	IW Density per person (km/ million persons)	Exploited Length (km)	Exploited IW Density per area (km/sq.km)	Exploited IW Density per person (km/million persons)	Exploited Ratio
Vietnam	331,688	77.7	41,900	0.126	539	11,226	0.034	144	27%
Northern Region				0.170					
Central Region				0.070					
Southern Region				0.190					
Bangladesh	144,000	126.9	9,000	0.063	71	5970	0.041	47	66%
Myanmar	600,000	46.4	8,251	0.014	178	3238	0.005	70	39%
China	9,600,000	1265.8	430,000	0.045	340	108600	0.011	86	25%
Thailand	514,000	61.8	6,000	0.012	97	2633	0.005	43	44%
6 countries in Europe	1,520,054	283.8	(-)	(-)	(-)	28,055	0.018	99	(-)
Egypt	1,000,000	66.5	(-)	(-)	(-)	3,100	0.003	47	(-)

Note) 6 countries in Europe: France, Germany, Nederland, Belgium, Italy and UK.

Source) M/P on Vietnam Waterway Transport Development up to 2020 (Dec. 2000, VIWA) and other sources

Furthermore, there is a great potential to exploit the inland waterways since at present only 27% of inland waterways in Vietnam are being utilized.

There are also dozens of river ports such as Hanoi, Khuyen Luong, Viet Tri, Ninh Binh & Ninh Phuc, Pha Lai, as well as sea ports such as Hai Phong, Cai Lan, Quang Ninh. These ports connected by the inland waterways are located at capitals of province, other major cities, major industrial plants or major mines where cargoes such as coal, construction material, cement and fertilizer are produced or consumed.

Table 17.1.2 Distance Table among Major Ports in the RRD

(km)

Port	Mode	Cam Pha (Cua Ong)	Cai Lan & Quang Ninh	Hai Phong	Hanoi	Viet Tri
Cai Lan & Quang Ninh	Road Railway	30 (H18) -				
	IWT	**37**				
Hai Phong	Road Railway	116 (H18+H10) -	86 (H18+H10) 277 (A+C+A)			
	IWT	**99**	**62**			
Hanoi	Road Railway	160 (H18) -	130 (H18) 175 (A+C+B)	106 (H5) 102 (A)		
	IWT	**249 (Duong)** 309 (Luoc) 368 (Cua Day)	**212 (Duong)** 272 (Luoc) 363 (Cua Day)	**150 (Duong)** 210 (Luoc) 337 (Cua Day)		
Viet Tri	Road Railway	244 (H18+H2) -	214 (H18+H2) 226 (A+C+B)	190 (H5+H2) 164 (A+C+A)	84 (H2) 73 (A+C+A)	
	IWT	**304 (Duong)** 364 (Luoc) 443 (Cua Day)	**267 (Duong)** 327 (Luoc) 438 (Cua Day)	**205 (Duong)** 265 (Luoc) 412 (Cua Day)	**75**	
Ninh Binh	Road Railway	233 (H18+H10) -	203 (H18+H10) 289 (A+C+B)	117 (H10) 216 (A)	94 (H1) 114 (A)	178 (H1+H2) 187 (A+C+A)
	IWT	318 (Luoc) **266 (Cua Day)**	281 (Luoc) **261 (Cua Day)**	**219 (Luoc)** 235 (Cua Day)	**161**	**236**

Note) 1. Coastal distances are measured by the Study Team and set as follows:

	Cam Pha (Cua Ong)	Cai Lan & Quang Ninh	Hai Phong
Lach Giang	181km (98NM)	176km (95NM)	150km (81NM)
Cua Day	194km (105NM)	189km (102NM)	163km (88NM)

2. Three types of railway are used in Vietnam (A: 1m, B: 1.435m, C: triple rails)

Source) 1. Temporary Classification of Waterways (Decision No.862/QD-CDS issued by Director of VIWA on 25/5/2000)

2. Vietnam Transport Infrastructure 2000, published by MOT

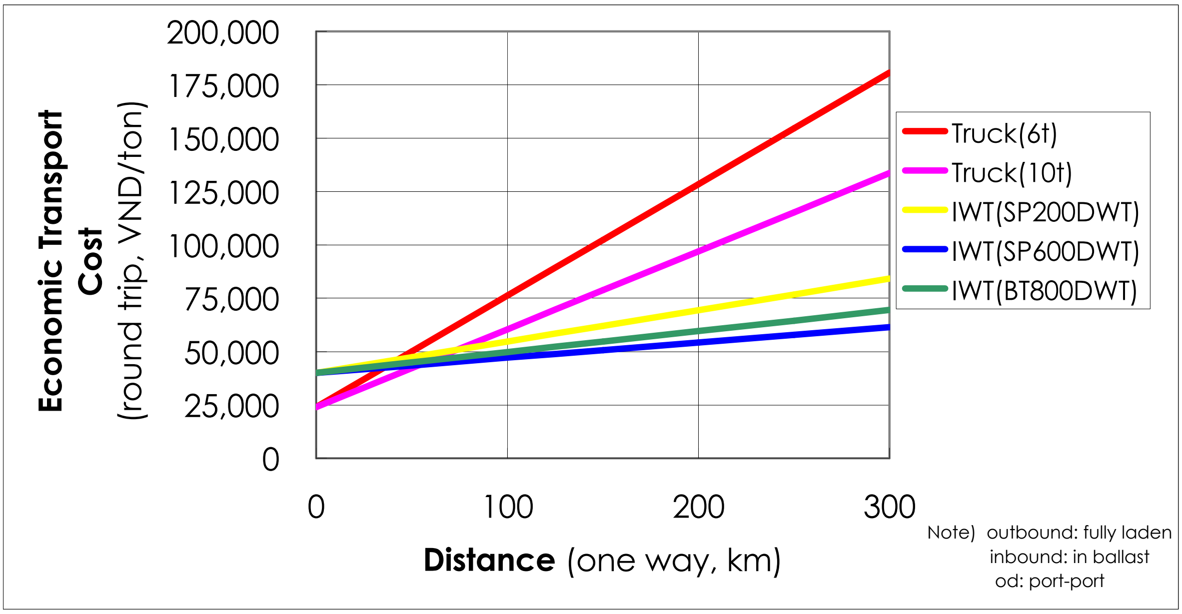
3. Chart: Gulf of Tongking, Admiralty 3990 (latest correction: 2001)

In addition, it should be noted that energy consumption of road transport by commercial truck is about 6 times as much as that of railway and waterway transport according to the investigation conducted by Japanese Ministry of Transport. As to CO_2 discharge, railway and waterway transport have also significant advantage (see **Table 17.1.3**). In other words, these factors bring about an another advantage in terms of transport cost (see **Figure 17.1.1**).

Table 17.1.3 Energy Consumption and CO_2 Discharge by Transport Mode

Transport Mode	Energy Consumption (kcal/ton-km)	CO_2 Discharge (g/ton-km)
Railway	118	6
Waterway (domestic)	126	10
Road (long-haul service truck)	(-)	22
Road (commercial truck)	696	48
Road (commercial small truck)	(-)	180
Road (private truck)	2,298	(-)
Road (private small truck)	(-)	599
Air	(-)	402

Source) Japanese Ministry of Transport, 1995



Source) JICA Study Team

Figure 17.1.1 Transport Cost Comparison

17.2 Necessity of improving the IWT system

Vietnam has been undergoing major economic changes as part of its transition from a centrally planned economic system to a more market oriented economy since the formal adoption of "Doi Moi Policy" in 1986. Deregulating policies towards a market economy have greatly encouraged economic development in Vietnam and has resulted in high economic growth.

The GDP in 2000 reached VND 276 trillion which is more than double compared with that in 1990. Once beset with a serious scarcity of goods, Vietnam can now produce enough to satisfy the essential needs of the population and the economy, increase exports and have some reserves.

The economic structure in GDP share has also made a shift in these 10 years. The share of agriculture has dropped from 38.7% to 24.3%, that of industry and construction has risen from 22.7% to 36.6%, and that of services from 38.6% to 39.1%.

In the Strategy for Socio-economic Development (2001 - 2010), the target of GDP is set to have at least doubled the level of 2000 and the economic and labor structures been vigorously transformed toward industrialization and modernization. The Five -year Plan for Socio-economic Development (2001 - 2005) also strives for high average GDP growth rate of 7.5% a year.

Along with high economic growth that is expected to continue for the future, the transport demand is constantly increasing and therefore the capacity of the transport sector has to be strengthened to cope with the increasing transport demand.

Reflecting the above situation, the IWT system in the Red River Delta is expected to play an important role in the socio-economic development as well as bettering the lives of people living in Vietnam and in the Northern region in particular, by making full use of its potential and peculiarity as an environment friendly and cost effective mode of transport.

Table 17.2.1 Historical GDP & Population Change

Year	GDP (billion VND)	GDP Growth Rate	Population (1,000)	Population Growth Rate	GDP per Capita (million VND)
1990	131,968	5.1%	66,017	1.92%	2.0
1991	139,364	5.8%	67,242	1.86%	2.1
1992	151,782	8.7%	68,450	1.80%	2.2
1993	164,043	8.1%	69,645	1.75%	2.4
1994	178,534	8.8%	70,825	1.70%	2.5
1995	195,567	9.5%	71,996	1.65%	2.7
1996	213,833	9.3%	73,157	1.61%	2.9
1997	231,264	8.2%	74,307	1.57%	3.1
1998	244,596	5.8%	75,456	1.55%	3.2
1999	256,272	4.8%	76,597	1.51%	3.3
2000	273,582	6.8%	77,686	1.42%	3.5

Note) In constant 1994 prices. Data of 2000 are estimated.

Source) Statistical Yearbook 2000, GSO

17.3 Identified problems and issues on IWT system

The IWT system in the Red River Delta is facing difficulties such as insufficiency of port facilities and related services as well as insufficiency and instability of navigation channel due to topographical restrictions, hydrological effects and sedimentation. Management and operation aspects of IWT system also have some problems and issues to be solved.

17.3.1 Problems and issues on navigation channels

The rivers are subject to the meteorological and hydrological regime of the Northern region. Peculiarity of rivers in the Northern region are summarized as follows:

- Minimum width of channel bottom: 30m - 60m
- Minimum depth: 1.5m - 2m
- The flood season: from June to October
- The low water season: from November to May
- The water level difference between the two seasons: 5m - 7m (over 10m in some parts)
- In the flood season, the flow speed is high.

- In the low water season, the depth and the curving radius are limited.
- After the flood, shoals are usually formed, which change year by year.
- In river mouths, the sediments develop complicatedly.

There are many rivers that can be used to enhance living standards and promote socio-economic development, but they have not been fully exploited. General problems related to the navigational channel are as follows:

(1) Severe river conditions

The rivers are exploited mainly in their natural state. They meander largely and sometimes change their course. In some areas, the water depth in dry season is shallow and width is insufficient. They do not meet the technical standards in water depth, width and bend radius.

(2) Shortage of clearance

Many bridges have not met the clearance height and span requirements for vessel. Bridge piers become new horizontal obstacles when the alignment of navigational channel is forced to change due to natural forces. Some electric power lines are also short of clearance.

(3) Obstacles

There are many trees from upstream, dumped scrap iron and other objects that need to be removed from the channels.

(4) Sedimentation

The river mouths, that of the Red river in particular, are shallow in water depth and unable to accommodate large vessels. Other parts of the rivers suffer from sedimentation problems. Sedimentation in rivers is serious and complicated. To cope with this issue, dredging is usually carried out rather than constructing facilities such as groins. However, there are some cases where the construction of such facilities is more economical in the long term.

(5) Accidents

Vessel accidents occur frequently in narrow sections of the Red River Hanoi segment, Kinh Thay River, Lach Tray River, Phi Liet River, etc., although main reasons of accidents are reported to be carelessness and violation of traffic regulations.

(6) Inadequate navigation aids

The navigation aids system and equipment are still inadequate. The navigation aids equipment should be replaced as the need arises, but this is not being done or not being done properly in some cases.

(7) Shortage of investment fund

Above-mentioned problems are mainly due to a shortage of investment funds.

17.3.2 Problems and issues on ports

Major river ports in the Red River Delta do not make full use of their designed capacity in general except some ports. The main reasons why these ports cannot make full use of their designed capacity can be summarized as follows:

(1) Competition among major ports and other berths

Since different economic sectors participate in IWT after Doi Moi Policy was adopted, about 68% of vessel fleet in total DWT in the Northern region are said to be private vessels. Other berths tend to be operated 24 hours a day and handle cargos in three shifts, and their handling fee may be cheaper. Therefore, private vessels can call at other berths than major ports taking account of service cost and quality of major ports and other berths.

(2) Outdated and Inefficient handling equipment

Handling equipment such as quay crane, mobile crane and forklift is very old. For example, some cranes in Hanoi Port have been used for more than 30 years. In addition, there is a lot of equipment which is not dedicated for port but diverted from road transport means (at second-hand). Frequent breakdown or troubles make handling efficiency decline. Moreover, there is no handling equipment which can handle container box of 40ft nor 20ft.

(3) Low mechanization

Mechanization of packed cargo handling in port area is still at a low level, since the unitization is not introduced. Human-wave tactics by porters in cargo handling are sometimes observed.

(4) Insufficient and damaged port facilities

Some port facilities such as quay and fender system are damaged or lacking. The capacity of warehouse is insufficient. Many yards are in natural condition and paved yards are few. There is no clear distinction between berth and yard for dirty and dusty bulk cargoes and for other clean cargoes. In Hanoi Port, there is no enough space for future development.

(5) Poor access to hinterland

Some ports are poorly connected to the national transport network due to insufficient road access. It makes smooth access to hinterland difficult.

(6) Shortage of investment fund

Above-mentioned problems are mainly due to a shortage of investment fund.

17.3.3 Problems and issues on management and operation aspects

As to management and operation aspects, identified problems and issues can be summarized as follows:

(1) Absence of comprehensive law

To date there hasn't been a comprehensive law in the IWT sector. Administration of inland waterways has been done by decisions and decrees according to needs. Consequently, some inconsistencies among such decisions and decrees can occasionally be found. To rectify this situation, MOT is currently drafting a new law covering the IWT sector.

(2) Complicated management and operation body of ports

Since the adoption of the Doi Moi Policy in 1986, more and more private sector participation has been observed in Vietnam. In addition state organizations have been restructured or privatized. Consequently, organizations in charge of management and operation are various and complicated. As the relations between organizations become increasingly complex, responsibilities tend to be obscured and this is accompanied by a decline in efficiency. From now on, the number of newcomers is expected to increase with the progress of privatization. It is therefore necessary to regulate and consolidate organizations in charge of management and operation.

(3) Lack of adequate information service

In order to transport cargo safely and efficiently, it is indispensable to know the condition of inland waterways, specifically the condition of navigation channel (position, width, depth, clearance, obstacles etc.) and condition of river (water level, current velocity etc.). Generally an authority makes this information available to users by chart, buoy, beacons, facsimile, radio, etc. And unlike a sea channel, the navigation channel of a river changes frequently. Especially in Red River Delta, the channel (particularly the water depth) changes not only by year but also by seasons (dry season, flood season). Accordingly, more precise information is required.

(4) Insufficient port statistics

Port statistics is the information systematically recorded about vessels (number, size, type etc.) and cargoes (volume, commodity, origin/destination etc.). Port statistics are indispensable not only for planning and management of port but also for city planning, transport planning, energy planning etc. However, at river ports, reliable port statistics about vessels and cargoes are not kept. In particular, activities at the privately owned small-scale landing stages, which are scattered at various places, are hardly known.

17.4 Basic Policy for the IWT System in the Red River Delta

Taking account of advantages and potential of the IWT system, necessity of improving the IWT system as well as its identified problems and issues, the basic policy for the IWT system in the Red River Delta should include the following items:

(1) To contribute to socio-economic development aiming at industrialization and modernization of Vietnam as well as international and regional integration in closer connection with other modes of transport.

(2) To meet the transport demand with higher quality and efficient services as well as safety navigation.

(3) To gradually improve the IWT system consisting of navigation channels, ports with handling equipment and transport means in a synchronous manner.

(4) To contribute to environmental preservation by making full use of its peculiarity as an environment friendly mode of transport.

(5) To enhance state management of the IWT system and to develop its capacity by allocating proper budget, personnel and equipment.

Advantage & Potential of IWT System

- Dense and convenient waterway network
- Low utilization of inland waterways
- Ideal port locations
- Low energy consumption
- Low CO_2 discharge

Necessity of Improving IWT system

- Doi Moi Policy
- High economic growth
- Toward industrialization and modernization
- Expected transport demand
- Important role of IWT in socio-economic development

Problems on Navigation Channel

- Severe river condition
- Shortage of clearance
- Obstacles
- Sedimentation
- Accidents
- Inadequate navigation aids
- Lack of investment fund

Problems on Ports

- Competition among major ports and other berths
- Outdated and inefficient handling equipment
- Low mechanization in cargo handling
- Insufficient and damaged port facilities
- Poor access to hinterland
- Shortage of investment fund

Problems on Management & Operation Aspects

- Absence of comprehensive law
- Complicated management & operation body of ports
- Lack of adequate information service
- Insufficient port statistics

Basic Policy for the IWT System in the Red River Delta

(1)	To contribute to socio-economic development aiming at industrialization and modernization of Vietnam as well as international and regional integration in closer connection with other modes of transport.
(2)	To meet the transport demand with high quality and efficient services as well as safe navigation.
(3)	To gradually improve the IWT system consisting of navigation channels, ports with handling equipment and transport means in a synchronous manner.
(4)	To contribute to environmental preservation by making full use of its peculiarity as an environment friendly mode of transport.
(5)	To enhance state management of the IWT system and to develop its capacity by allocating proper budget, personnel and equipment.

Source) JICA Study Team

Figure 17.4.1 Basic Policy for the IWT System in the Red River Delta

Chapter 18 Transport Demand Forecast

18.1 Methodology

This study applied the methodology[1] developed in the VITRANSS to estimate the future passenger and cargo transport demand of inland waterway in the Red River Delta region. Taking into account the strong relationship between transport demand and socio-economic activities, the methodology used socio-economic indicators, such as GDP and population, as exogenous variables. This procedure follows the conventional four-step method:

- Generation and attraction of transport demand;
- Traffic distribution;
- Modal split; and
- Traffic assignment.

Models for generation and attraction of transport demand were developed based not only on socio-economic indicators but also on surplus and deficit of commodities in all provinces. The surplus and deficit can also be calculated from production and consumption of commodities. Then OD traffic in terms of interprovincial movement was estimated by applying future generation and attraction of transport demand as a control total. Transport demand by mode and on inland waterway routes was at the same time calculated while assigning OD traffic on each mode's route to minimize total transport costs composed of operating and maintenance cost, loading/unloading cost and time-related cost to some extent.

Transport demand of inland waterway is estimated through the following steps:

Step-1 Generation and attraction of transport demand
Regarding cargo transport, applicable and suitable commodities for IWT were at first selected and then their production and consumption were carefully examined. Only when production and consumption of commodities were determined were they used as an exogenous variable with socio-economic indicators together to forecast generation and attraction of commodities in each province. It should be noted that a province with positive surplus would ship out supplementary amount of commodities to other areas and with negative surplus would absorb

[1] In detail, refer to "VITRANSS Main Text Vol. 2, Transport Demand Forecast", 2000

surplus amount from other areas. Additionally, location and future capacity of industrial plants were considered when determining generation and attraction of IWT. Regarding passenger transport, socio-economic indicators, such as per capita GDP and urban population, were used to determine its amount of generation and attraction.

Step-2 Traffic distribution

With a control total of generation and attraction of passenger and cargo transport, future OD traffic was estimated through the "Fratar" approach for cargo transport and the "Gravity Model" for passenger transport. In applying the "Fratar" approach on cargo transport, if generation and attraction will take place in a province where no generation and attraction are present, future generation and attraction are considered.

Step-3 Modal split

If competition between other transport modes is thought to be considerable for OD pairs, cargo volume of inland waterway is determined by taking into account transport cost of OD pairs, commodity characteristic itself and other factors such as accessibility and convenience. Nested binary logit model was adopted for determining probability to choose IWT in terms of passenger transport.

Step 4 Traffic assignment

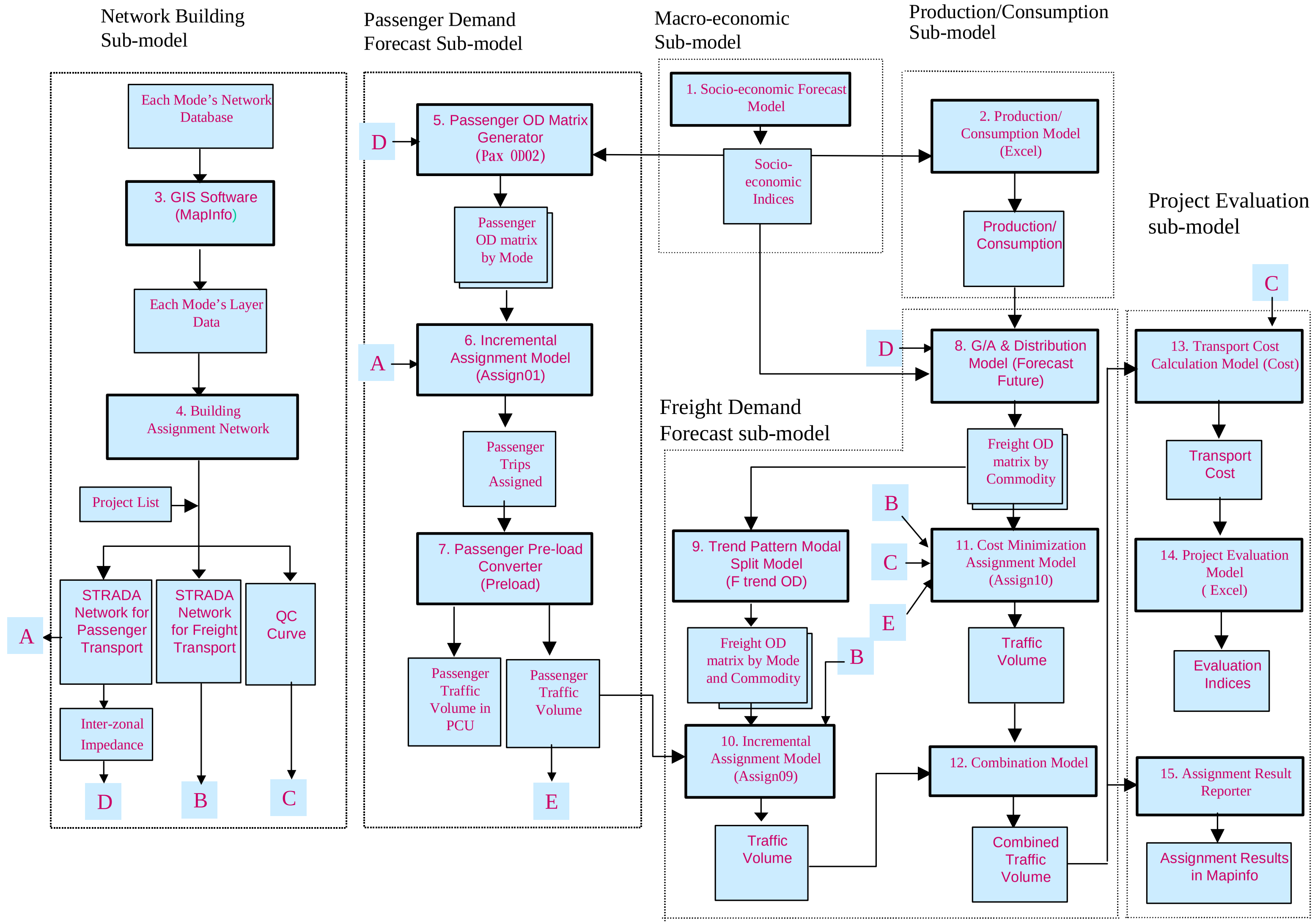
Traffic volume of inland waterway is assigned on the shortest inland waterway routes in terms of generalized cost.

Step-5 Adjustment and check

The cargo volume assigned on stretches are examined with reliable and proven data, eg cargo-handling volume at ports, anticipated macro cargo volume increase due to economic growth, etc.

It should be noted that the approach above was taken to forecast future cargo demand, but OD traffic of IWT was adjusted considering loading/unloading cargo throughput at major IW ports. In other words, OD traffic of IWT estimated through the above procedure was adjusted to satisfy the condition that it should be equal to or higher than the loading/unloading cargo throughput at IW ports.

Figure 18.1.1 General Framework for Transport Demand Forecast



18.2 Cargo transport demand

18.2.1 Summary of cargo transport demand forecast

Through the above processes, cargo transport demand in 2010 and 2020 was forecast. Its results are summarized in **Table 18.2.1** and **Figure 18.2.1**. According to the results, the total cargo transport demand will increase to 32.3 million tons in 2010 and 51.2 million tons in 2020 with annual growth rate of 6.3% in 2001-2020 and 4.7% in 2010-2020. Values of elasticity to GDP were calculated at 0.87 in 2001-2010 and 0.78 in 2010-2020. Both the growth rate and value of elasticity are lower than those of the present and will continue to decrease over time.

In Viet Nam, although cargo transport demand steadily increased at a growth rate of 7.47% during 1991-2000, modal share of inland waterway is predicted to be low since the cargo volume transported by truck will substantially increase, resulting in a decline of cargo transport demand of inland waterway, as experiences in developing and developed countries showed. Economic growth certainly increases transport demand, but it is believed that it will not increase the annual growth rate of inland waterway. In fact, it will even decrease over time.

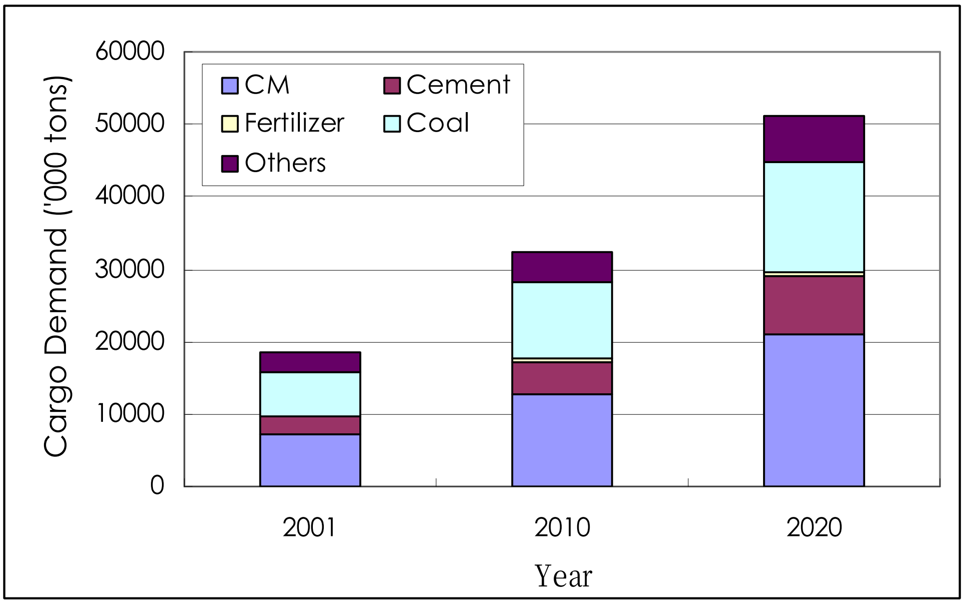


Figure 18.2.1 Cargo Transport Demand Forecast

Table 18.2.1 Summary of Cargo Transport Demand Forecast

(a) Interprovincial movement

(Unit: '000 tons/year)

Item		2001	2010	2020	AAGR('01-'10)	AAGR('10-'20)
Construction Material	stone	916	1,763	2,851	7.5	4.9
	sand	5,122	9,527	16,061	7.1	5.4
Cement		1,897	3,627	7,034	7.5	6.8
Fertilizer		175	371	563	8.7	4.3
Coal		5,594	9,642	14,057	6.2	3.8
Others		1,955	3,077	4,681	5.2	4.3
Total		15,659	28,007	45,247	6.7	4.9

(b) Intraprovincial movement

(Unit: '000 tons/year)

Item		2001	2010	2020	AAGR('01-'10)	AAGR('10-'20)
Construction Material	stone	227	322	439	4.0	3.1
	sand	794	1,191	1,633	4.6	3.2
Cement		596	787	1,015	3.1	2.6
Fertilizer		27	45	65	5.8	3.7
Coal		522	855	1,193	5.6	3.4
Others		785	1,129	1,672	4.1	4.0
Total		2,951	4,329	6,017	4.3	3.3

(c) Total

(Unit: '000 tons/year)

Item		2001	2010	2020	AAGR('01-'10)	AAGR('10-'20)
Construction Material	stone	1,143	2,085	3,290	6.9	4.7
	sand	5,916	10,718	17,694	6.8	5.1
Cement		2,493	4,414	8,049	6.6	6.2
Fertilizer		202	416	628	8.4	4.2
Coal		6,116	10,497	15,250	6.2	3.8
Others		2,740	4,206	6,353	4.9	4.2
Total		18,610	32,336	51,264	6.3	4.7
Ton-Km(million)		2,010	3,446	5,580	6.2	4.9

18.2.2 River section traffic volume

Traffic volume on river sections is obtained after traffic assignment calculation. Assigned results of selected river sections are seen in **Table 18.2.2** (regarding section number, refer to **Figure 21.1.1**). They show that the importance of Quang Ninh-Hanoi, Quang Ninh-Ninh Binh and Hanoi-Viet Tri sections will further strengthen.

Table 18.2.2 Traffic Volume on the Selected River Sections

(Unit: million tons/year)

Stretch No.	Name of River	2001	2010	2020	2010/2001	2020/2001
1	Coastal	8.3	12.6	18.8	1.5	2.3
2	Chanh	4.4	6.1	7.6	1.4	1.7
3	Da Bach	4.5	6.1	7.6	1.4	1.7
4	Mao Khe	0.5	0.7	1.1	1.5	2.3
5	Mao Khe	1.1	2.1	3.9	1.9	3.5
6	Phi Liet	4.0	5.3	6.5	1.3	1.6
7	Bach Dang	-	-	-	-	-
8	Cam	3.9	6.6	11.2	1.7	2.9
9	Cam	1.7	2.8	4.9	1.7	2.9
10	Han	5.6	8.2	11.4	1.5	2.0
11	Kinh Thay	6.8	10.3	15.3	1.5	2.3
12	Kinh Thay	6.5	9.9	14.7	1.5	2.2
13	Thai Binh	4.7	7.1	9.9	1.5	2.1
14	Thai Binh	0.9	1.6	2.3	1.8	2.7
15	Duong	3.1	4.7	7.3	1.5	2.3
16	Red	4.7	8.4	14.1	1.8	3.0
17	Lo	4.5	8.2	14.0	1.8	3.1
18	Red (Thao)	0.2	0.9	0.9	4.0	4.0
19	Da	0.1	0.8	0.8	5.7	5.8
20	Lach Tray	2.4	4.1	6.9	1.7	2.8
21	Van Uc	2.5	4.2	7.1	1.7	2.9
22	Luoc	2.5	4.2	7.1	1.7	2.9
23	Red	3.0	5.3	9.7	1.8	3.2
24	Dao ND	2.6	4.0	7.3	1.5	2.8
25	Day	2.6	4.0	7.3	1.5	2.8
26	Day	0.6	1.2	2.3	2.1	3.8
27	Day	0.6	1.2	2.3	2.1	3.8
28	Ninh Co	0.1	0.2	0.3	2.0	3.0
29	Ninh Co	0.1	0.2	0.3	2.0	3.0
30	Red	0.1	0.2	0.3	2.0	3.0
31	Tra Ly	0.3	1.3	2.5	4.1	7.6
32	Red	0.7	1.4	2.9	1.9	4.0
33	Red	3.1	4.8	9.8	1.6	3.2

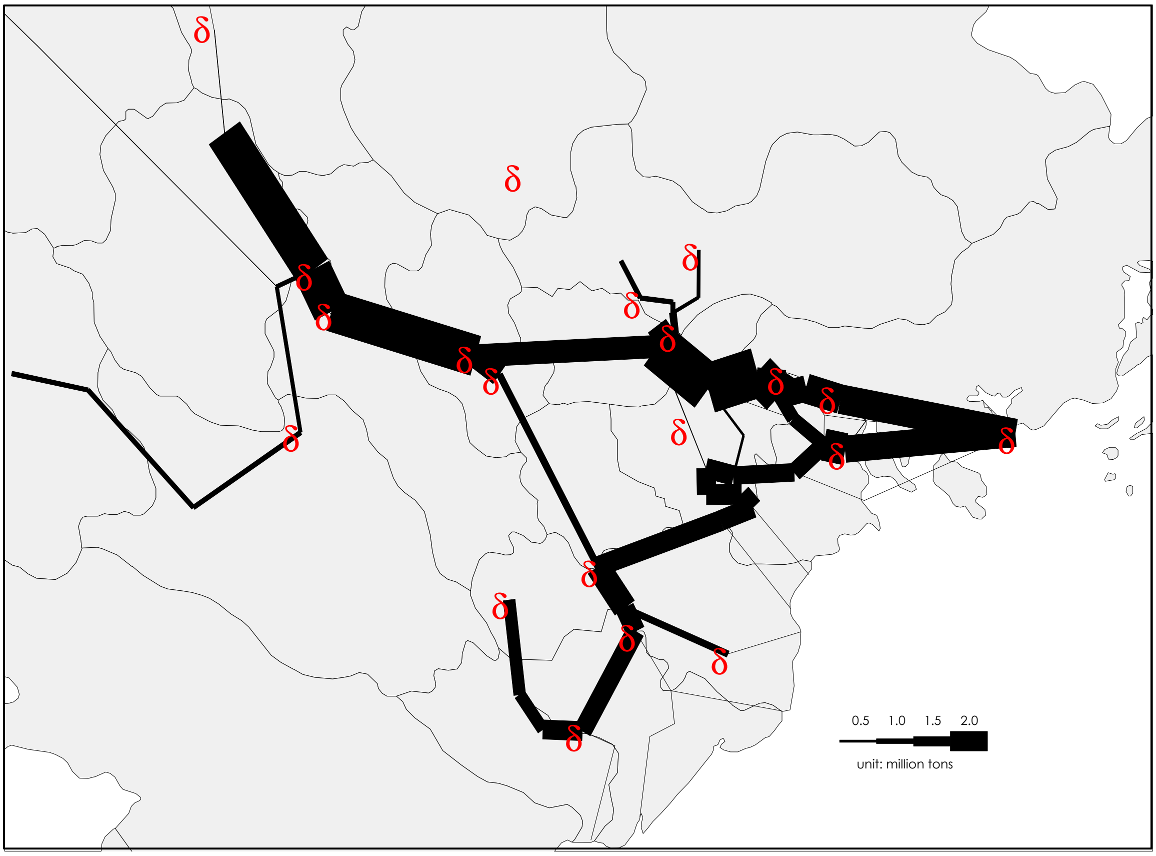


Figure 8.2.2 Cargo Transport Demand on River Sections, 2010

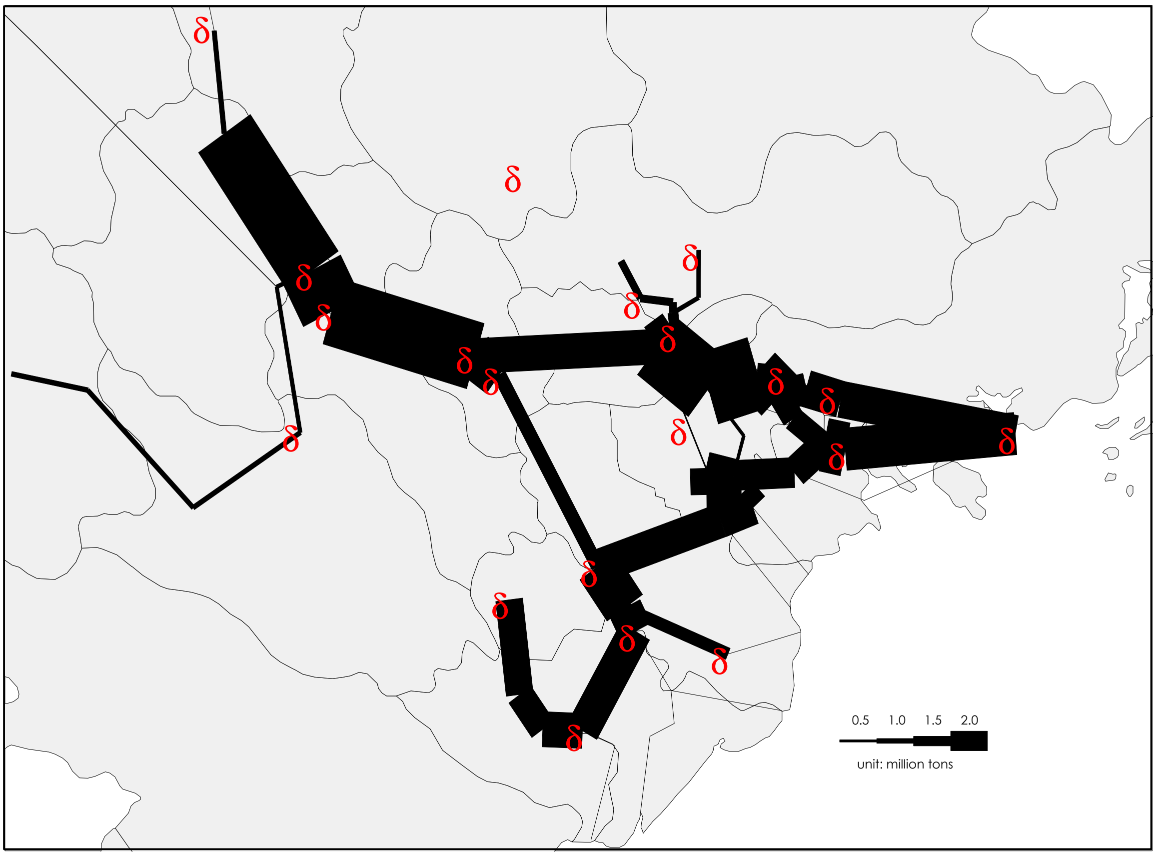
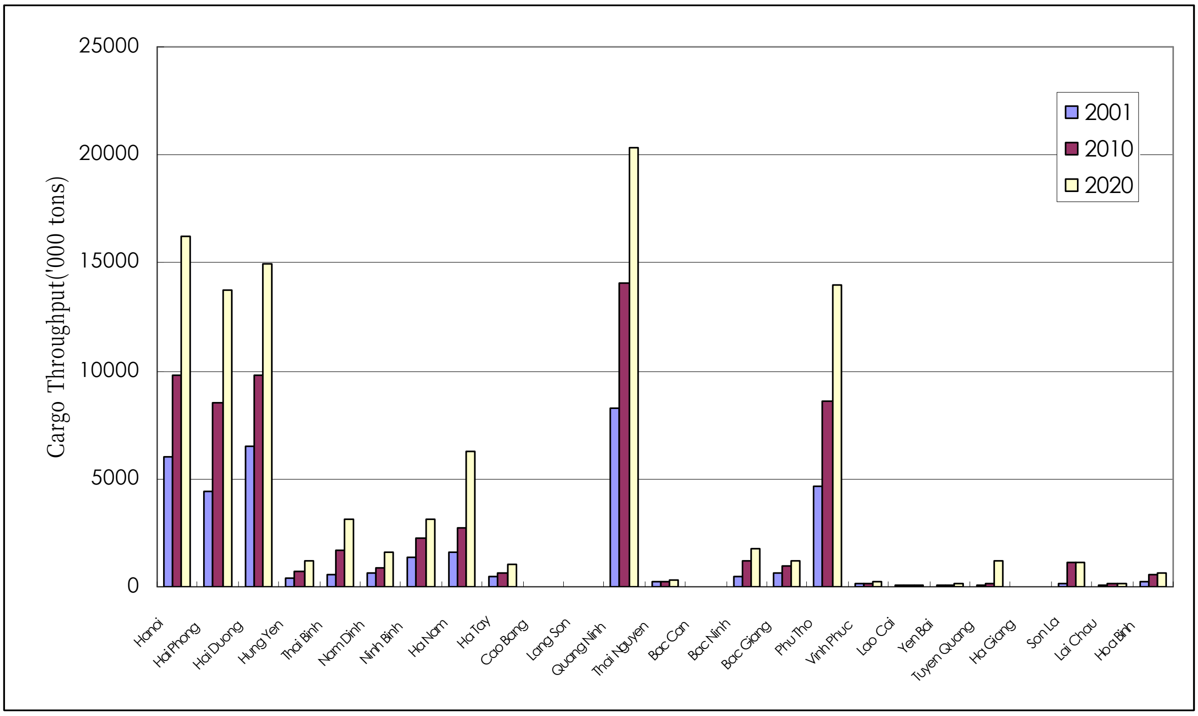


Figure 8.2.3 Cargo Transport Demand on River Sections, 2020

18.2.3 Cargo throughput by province

Based on cargo transport demand forecast, cargo throughput including loading and unloading cargo volume was accumulated by province, which helps to implement the IW port plan. Provinces including IW ports which will handle a cargo volume of more than 10 million tons in 2020 include Hanoi, Hai Phong, Hai Duong, Quang Ninh, and Phu Tho (see **Figure 18.2.3**). Quang Ninh province will continue to provide a lot of coal to other provinces via inland waterway for industrial plants such as thermal power, cement and fertilizer plants. In 2020, coal's share to cargo throughput in Quang Ninh will amount to 80.9%. The growth of construction and industry in Hanoi and neighboring provinces needs construction materials especially from Phu Tho. Its share will account for about 90% in 2020. On the other hand, Hai Phong and Hai Duong will produce a great deal of cement in 2020 with a new construction or extension plan of cement plants, requiring coal. More than 50% will be occupied by cement and coal in these provinces. Whereas, as an economic center, Hanoi will need construction materials and cement to satisfy the construction and industrial sector's demand. In the north, these provinces will be key IW port zones for cargo movement via inland waterway.



note) not considering sea-cum-river vessel and container's effects.

Figure 18.2.3 Cargo Throughput by Province

18.2.4 Comparison with past studies

Relevant studies which worked out the master plan for the RRD region were done by ADB (1998) and VIWA (2000). Each study's results on transport demand are mutually compared in **Table 18.2.3**.

The VIWA's estimate is twice than the ADB's. That is, the former estimated cargo transport demand would reach 61.7 million tons in 2020, whereas the latter forecast about 30 million tons. There remains a substantial gap between the two studies. The ADB took a very conservative approach, resulting in an annual growth rate of less than 4% during 2001-2020. On the contrary, VIWA's approach seems to be too generous with an annual growth rate of more than 7% even in 2010-2020. Values of elasticity are 0.4 for ADB and 1.15 for VIWA. Judging from the historical trend of cargo transport demand and empirical evidences in other countries, the former value is too low and the latter too high.

The study team's approach is more moderate, lying between ADB's and VIWA's with an annual growth rate of 6.3% in 2001-2010 and 4.7% in 2010-2020. Transport demand in 2010, forecast at 32.3 million tons, is almost the same as the VIWA's but that in 2020, estimated at 51.3 million tons, is lower than the VIWA's. As mentioned earlier, the value of elasticity will decline from 0.87 in 2001-2010 to 0.78 in 2010-2020, which is higher than the ADB's but lower than the VIWA's.

Table 18.2.3 Comparison with Other Studies

(Unit: million tons/year)

Study	Traffic Type	1995	2001	2010	2016	2020	AAGR('01-'10)	AAGR('10-'20)
JICA[1/]	Inter-provincial	-	15.7	28.0	-	45.2	6.7	4.9
	Intra-provincial	-	3.0	4.3	-	6.0	4.3	3.3
	Total	-	18.6	32.3	-	51.3	6.3	4.7
ADB[2/]	Inter-provincial	7.2	11.9	-	21.5	-	4.1	4.1
	Intra-provincial	3.0	4.0	-	6.2	-	3.0	3.0
	Total	10.2	15.9	-	27.7	-	3.8	3.8
VIWA[3/]	Inter-provincial	-	-	-	-	-		
	Intra-provincial	-	-	-	-	-		
	Total	-	-	31.4	-	61.7	7.8	7.0

Note) 1/ "The Study on the Red River Inland Waterway Transport System", JICA, 2002

2/ "Red River Waterways Project Vietnam", ADB, 1998

3/ "Master Plan of Inland Waterway in Vietnam to the Year 2020", VIWA&TDSI, 2000

18.3 Passenger transport demand

18.3.1 Current situation

Hanoi passenger port was constructed in Chung Dung in 1998 to serve passengers in the provinces of Hanoi, Hung Yen, Nam Dinh, Thai Binh, and Viet Tri. Until now, it has been mainly operated for tourism, connecting Hanoi and the provinces. It is expected that when a regular passenger ferry operates in the future, it will attract transport demand from the neighboring areas of Red River.

Besides there are regular passenger ferries which ply between Quang Ninh and Hai Phong. The number of passengers using inland waterway between these two provinces was 0.2 million passengers. Transport demand on this route is expected to progressively increase in the future since it also has a potential for tourism.

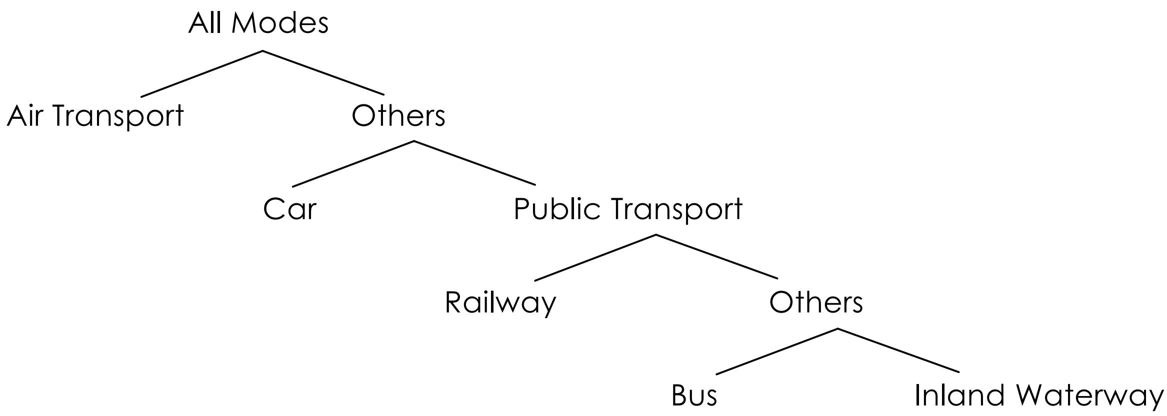
In general, the facilities and service level of inland waterway for passenger transport are considerably poor and its usage will reduce, if no actions are taken. If there are potential routes ensuring sufficient passengers to assure financial viability, they will certainly be connected with the economic and political center that is Hanoi. Therefore, passenger transport demand of inland waterway was herein forecast for the routes proposed to be connected with Hanoi, some of which were already included in the "Passenger Demand Forecast for Hanoi Passenger Port (2000)", as follows:

- To-east route, which will operate between Hanoi and Quang Ninh or Ha Phong via Hai Duong, Bac Ninh and Bac Giang;
- To-south route, which will operate between Hanoi and Hung Yen or Ninh Binh via Thai Binh and Ha Nam; and
- To-west route, which will operate between Hanoi and Phu Tho via Vinh Phuc and Viet Tri.

The passenger demand forecast for existing route plying between Quang Ninh and Hai Phong was also done.

18.3.2 Selection of potential routes

Among the routes above, potential routes that will attract sufficient passengers to ensure financial viability were chosen based on road conditions, service characteristics of alternative transport modes and so on. Nested logit model was also applied with the following binary choice structure:



At the final stage of estimating, inland waterway will be in competition with bus transport, which can be interpreted as a binary choice of bus and inland waterway. Against the service level of bus, the probability of choosing inland waterway can be calculated through the binary choice model, which could be a clue to determine potential inland waterway routes, expressed as:

$$P_{iw} = \exp(U_{iw}) / (\exp(U_{iw}) + \exp(U_{bus}))$$

where, P_{car} = Probability of Choosing Inland Waterway
U_{iw} = Utility of Inland Waterway
U_{bus} = Utility of Bus

In general, the utility of the alternative transport modes is a function of attributes, including access time, waiting time, in-vehicle time and fare, weighted by estimated parameters reflecting the importance attached to each attribute. A constant can also be included to represent the net effect of other attributes not explicitly included in the model (eg comfort, status, safety, reliability, etc.). Parameters for binary choice model were herein borrowed from the VITRANSS. However, as it was developed for macro analysis model, there are some limitations, ie though a lot of factors have an impact on transport behavior, it only took into account travel time and mode specific variable. Therefore, trade-off of travel cost and travel time was considered by converting travel cost (fare) into travel time according to value of time.

Table 18.3.1 IW Potential Route Selection

Direction	OD	Distance(Km)		Travel Speed		Travel Time(hr)		Probability of IW(%)[1/]	Road Accessibility	Path Road	Potential Route[2/]
		Road	IW	Bus	IW	Bus	IW				
To East	Ha Noi <--> Hai Phong	106	150	36	29	2.9	5.2	3.5	Very Good	NH5	X
	Ha Noi <--> Hai Duong	56	95	36	29	1.6	3.3	5.3	Very Good	NH5	X
	Ha Noi <--> Quang Ninh	130	212	36	29	3.6	7.3	1.1	Very Good	NH18	X
	Ha Noi <--> Bac Ninh	31	117	34	29	0.9	4.0	1.7	Good	NH1	X
	Ha Noi <--> Bac Giang	69	114	34	29	2.0	3.9	4.6	Good	NH1	X
To South	Ha Noi <--> Hung Yen	64	60	30	29	2.1	2.1	19.6	Poor	Local Road	O
	Ha Noi <--> Thai Binh	109	101	32	29	3.4	3.5	18.0	Moderate	NH1, NH21, NH10	O
	Ha Noi <--> Nam Dinh	90	106	34	29	2.6	3.7	0.1	Good	NH1, NH21	X
	Ha Noi <--> Ninh Binh	94	161	34	29	2.8	5.6	2.2	Good	NH1	X
	Ha Noi <--> Ha Nam	55	204	36	29	1.5	7.0	0.2	Very Good	NH1	X
To West	Ha Noi <--> Viet Tri	84	75	34	29	2.5	2.6	17.5	Good	NH2	O
	Ha Noi <--> Phu Tho	123	115	32	29	3.8	4.0	17.4	Moderate	NH2	O
	Ha Noi <--> Vinh Phuc	52	77	34	29	1.5	2.6	8.3	Good	NH2	X
	Ha Noi <--> Hoa Binh	78	148	32	29	2.4	5.1	1.3	Moderate	NH6	X

Note) 1/ Calculated by binary logit model

2/ Routes with probability of more than 15% were selected.

The probability of choosing inland waterway was calculated under the assumption that bus operates at a speed of 30-36 km/h according to road condition and passenger ferry operates at a constant speed of 29 km/h. Then the probability of choosing inland waterway was calculated as shown in **Table 18.3.1**. The probability to choose to-east route is very low since travel distance of road is shorter than that of inland waterway and the road network is well developed. Also, the IW route between Hanoi and Ninh Binh is less preferred due to the same reason. As potential IW routes for passenger transport, to-south route operating between Hanoi and Thai Binh via Hung Yen and to-west route operating between Hanoi and Phu Tho via Viet Tri were selected because of the comparatively high probability of passengers choosing inland waterway. Thus passenger demand of inland waterway was forecast, given that passenger ferry will ply on the two potential routes.

18.3.3 Results of passenger demand forecast

According to the VITRANSS, total passenger demand traveling in the northern region was estimated at 142.7 million trips in 2010 and 202.2 million trips in 2020. Then OD traffic, which was calculated based on gravity model, shows that about 2 million trips in 2010 and 3 million trips will take place between OD pairs for potential routes which were selected in the previous section (see **Table 18.3.3**). As a result of applying nested binary choice model, potential passenger demand of inland waterway was estimated at 0.6 million passengers in 2010 and 0.9 million passengers in 2020.

Table 18.3.2 Total Number of Passenger Trips in the North

Year	1999	2010	2020	AGR (1999-10)	AGR (2010-20)
No. of Passenger Trips(million)	71.4	142.7	202.2	6.5	3.5

Note) excluding intraprovincial trips.

Source) VITRANSS

Table 18.3.3 Summary of Passenger Transport Demand Forecast

Direction	Section	Distance(Km)		Travel Time(hr)		All Modes('000)		IW('000)	
		Road	IW	Bus	IW	2010	2020	2010	2020
To South	Ha Noi <--> Hung Yen	64	60	2.1	2.1	1,691	2,516	210	309
	Ha Noi <--> Thai Binh	109	101	3.4	3.5	2,391	3,436	159	224
	Hung Yen <--> Thai Binh	45	41	1.3	1.6	299	590	32	64
	subtotal					4,381	6,542	402	597
To West	Ha Noi <--> Viet Tri	84	75	2.5	2.6	1,285	1,794	135	189
	Ha Noi <--> Phu Tho	123	115	3.8	4.0	964	1,345	101	141
	Viet Tri <--> Phu Tho	39	40	1.4	1.4	25	45	3	5
	subtotal					2,274	3,184	239	335
Total						6,655	9,725	641	932

It should be noted that passenger demand of inland waterway was estimated under the following assumptions:

- Travel cost of inland waterway is the same as that of bus. Fare of high-speed ferry operating between HCMC and Vung Tau is about three times costlier than bus.
- Passengers can get on a passenger ferry without waiting at terminals, ie waiting time of inland waterway is almost the same as that of bus.

In reality, inland waterway fare would be more expensive than that of bus and the waiting time at passenger ports would be longer than at bus terminals due to fewer trips of passenger ferry. A sensitivity analysis reveals that passenger demand will, if waiting time is 30 minutes longer or if fare is more than VND 5,000, decrease up to about 30%. Therefore, focus should be given on providing the same service level as that of bus to ensure as many passengers as possible, eg increasing travel speed of passenger ferry, minimizing waiting time at passenger port or setting up a fare at the same level as that of bus. For instance, if passenger ferry operates at a speed of 40 km/h from 29 km/h, passenger demand of inland waterway is estimated to increase by around 30%.

Table 18.3.4 Sensitivity Analysis

		Waiting Time Difference(IW-Bus)				
		0	0.5	1	1.5	2
Fare Difference (IW-Bus)	0	-	-29.8	-51.7	-67.2	-78.0
	5000	-27.8	-50.2	-66.2	-77.3	-84.8
	10000	-48.7	-65.1	-76.5	-84.3	-89.6
	15000	-64.1	-75.8	-83.8	-89.3	-92.8
	20000	-75.0	-83.3	-88.8	-92.6	-95.2

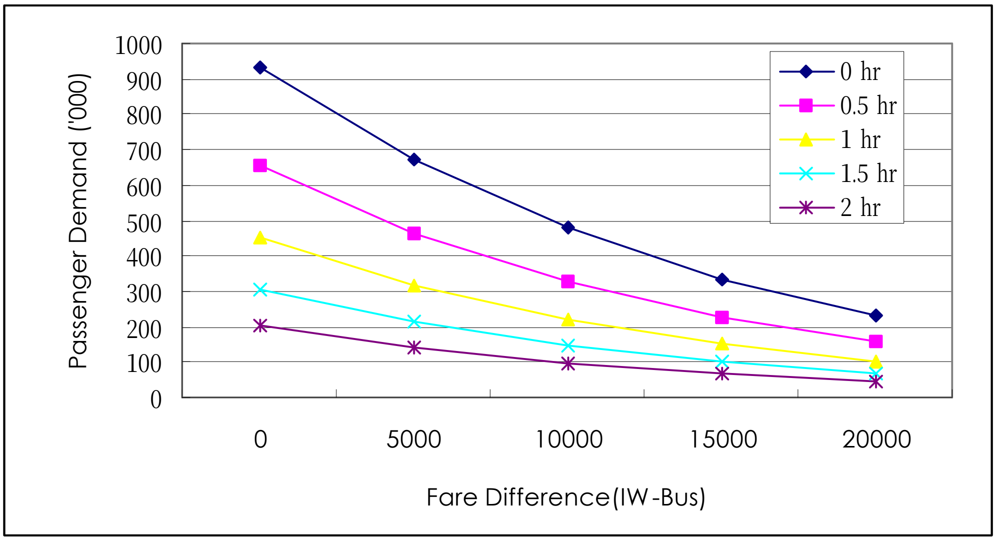


Figure 18.3.1 Impact of Fare and Waiting Time on IW Passenger Demand

As for existing IW passenger route between Hai Phong and Quang Ninh, it was, as shown in **Table 18.3.5**, estimated to have a potential demand of 0.4 million passengers in 2010 and 0.6 million passengers in 2020.

Table 18.3.5 Passenger Demand Forecast for Existing IW Route

(Unit: '000 passengers)

Year	1999	2010	2020	AGR (1999-10)	AGR (2010-20)
Hai Phong <--> Quang Ninh	237.25	421.21	603.71	5.4	3.7

18.3.4 Comparison with relevant study

The VIWA (2000) also estimated passenger demand of inland waterway for some selected routes from Hanoi toward Hung Yen, Thai Binh and Phu Tho, in the master plan of inland waterway. Demand forecast for existing route of Quang Ninh to Hai

Phong was also done. The results are summarized in **Table 18.3.6**. Although there are some differences between the two studies, these are minor.

Table 18.3.6 Comparison with VIWA's study

(Unit: '000 passengers/year)

Section	JICA[1/]		VIWA[2/]	
	2010	2020	2010	2020
Hanoi <--> Hung Yen	210	309	190	320
Hanoi <--> Thai Binh	159	224	95	160
Hanoi <--> Phu Tho	101	141	37	60
Hai Phong – Quang Ninh	421	603	500	850

Note) 1/ "The Study on the Red River Inland Waterway Transport System", JICA, 2002

2/ "Master Plan of Inland Waterway to the Year 2020", VIWA&TDSI, 2000