Section 8 Financial Study

1. Summary of capital cost expenditure

(1) Total investment (Total of Steps 1, 2 and 3)

Categories		Amount US$ million	Cost per ton US$/t-steel	Make up percentage %
	Direct construction cost	5,231	1,211	91.3%
	Engineering fee	157	36	2.7%
	Initial	78	18	1.4%
	Interest during		0	0.0%
	Contingency	157	36	2.7%
Construction cost total		5,623	1,302	98.2%
	Operation spare parts	105	24	1.8%
Total required capital		5,728	1,326	100.0%

Alternative 1 (Hot strip mill, cold strip mill and CGL)

Categories		Amount US$ million	Cost per ton US$/t-steel	Make up percentage %
	Direct construction cost	1,245	288	91.3%
	Engineering fee	37	9	2.7%
	Initial organization	19	4	1.4%
	Interest during construction		0	0.0%
	Contingency	37	9	2.7%
Construction cost total		1,338	310	98.2%
	Operation spare parts	25	6	1.8%
Total required capital investmen		1,363	316	100.0%

(2) Bases of estimation

(a) Time of estimation

- Import : October 1997 -International market price
- Domestic Procurement : August 1997 -Vietnamese domestic market price

(b) Currency and Exchange Rate

- Currency Import : US$
  Domestic Procurement : VND (exchange to US$)
- Exchange Rate 1US$ = 11,700VND (August 1997)

(c) Division between import and domestic procurement

Equipment to be purchased : Import
Civil works , erection & installment : Domestic

(d) Price fluctuation : Not considered

2. Summary of estimate of product cost

(1) Production cost

Profit-loss by product type (ordinary year) (Unit: 1,000t, US$/t)

	Shipment	Total cost					Selling price	Profit		
		Product cost	Transportation	General administrative expenses	Interest	Total cost		US$/t		Amount (US$ mil.)
Billet	1,095.0	233.4	28.5	0.1	-6.6	255.4	267.5	12.1	(4.5%)	13.2
AsRolledHC	802.9	283.5	28.5	0.1	-6.6	305.4	369.2	63.7	(17.3%)	51.2
Skin passed HC	400.0	295.9	28.5	0.1	-6.6	317.9	384.2	66.2	(17.2%)	26.5
Slit recoild HC	240.0	303.5	28.5	0.1	-6.6	325.5	409.2	83.7	(20.5%)	20.1
Plate	120.0	307.7	28.5	0.1	-6.6	329.7	429.2	99.5	(23.2%)	11.9
HR sheet	240.0	307.3	28.5	0.1	-6.6	329.3	429.2	99.9	(23.3%)	24.0
P/O coil	203.1	306.3	28.5	0.1	-6.6	328.3	389.2	60.9	(15.6%)	12.4
CR coil	350.0	405.4	28.5	0.1	-6.6	427.4	509.3	82.0	(16.1%)	28.7
CR sheet	350.0	417.4	28.5	0.1	-6.6	439.4	539.3	99.9	(18.5%)	35.0
CG coil	100.1	532.3	28.5	0.1	-6.6	554.2	686.9	132.7	(19.3%)	13.3
CG sheet	100.0	548.3	28.5	0.1	-6.6	570.3	716.9	146.6	(20.5%)	14.7
Tin sheet	100.0	667.8	28.5	0.1	-6.6	689.8	909.5	219.7	(24.2%)	22.0
Total	4,101.1									272.8

(2) Construction of production cost

Table 1-6 Cost Structure

		Slab		Billet		Hot Rolling Coil		Cold Rolling Coil	
		US$/t	%	US$/t	%	US$/t	%	US$/t	%
Total Cost		247.9	100.0%	239.8	100.0%	286.5	100.0%	340.2	100.0%
Material total		145.7	58.8%	144.4	60.2%	148.7	51.9%	155.6	45.7%
	Ore	100.0	40.3%	98.9	41.3%	102.0	35.6%	106.8	31.4%
	Coal	8.3	3.4%	8.2	3.4%	8.5	3.0%	8.9	2.6%
	Other mate	37.4	15.1%	37.3	15.6%	38.1	13.3%	39.9	11.7%
Variable total		19.9	8.0%	20.0	8.3%	36.3	12.7%	54.5	16.0%
	By-produc	-53.0	-21.4%	-51.6	-21.5%	-55.3	-19.3%	-63.3	-18.6%
	Refractry	14.4	5.8%	14.1	5.9%	14.7	5.1%	17.2	5.1%
	Energy	9.5	3.8%	8.6	3.6%	15.0	5.2%	27.1	8.0%
	Other	49.0	19.8%	48.9	20.4%	61.9	21.6%	73.4	21.6%
Fixed cost		82.3	33.2%	75.4	31.4%	101.6	35.5%	130.1	38.2%
	Dep.	35.2	14.2%	32.3	13.5%	43.0	15.0%	54.2	15.9%
	BF relining	5.1	2.1%	5.0	2.1%	5.2	1.8%	5.4	1.6%
	Maintenan	15.2	6.1%	13.3	5.6%	20.2	7.0%	27.2	8.0%
	Interest	24.8	10.0%	22.6	9.4%	30.9	10.8%	39.6	11.7%
	Labor	1.3	0.5%	1.4	0.6%	1.6	0.5%	2.4	0.7%
	Welfare	0.7	0.3%	0.7	0.3%	0.8	0.3%	1.2	0.4%

(3) Sensitivity analysis

Sensitivity analysis (Effect to operating cost) (Unit: US$/t)

	Condition		Effects			
	Items	Variation	Slab	Billet	Hot rolling coil	Cold rolling coil
Base case	Operation cost		247.9	239.8	286.5	340.2
Sensitivity	Capital expenditure cost	±10%	±3.5	±3.2	±4.3	±5.4
	Iron ore price	±10%	±10.0	±9.9	±10.2	±10.7
	Coal price	±10%	±0.8	±0.8	±0.8	±0.9
	Variable	±10%	±7.3	±7.2	±9.2	±11.8
	Fixed	±10%	±8.2	±7.5	±10.2	±13.0
	Operation rate	-10%	+9.1	+8.4	+11.3	+14.5

3. Summary of financial analysis

(1) Premises for financial analysis

(a) Forecast period : 2001-2029

(b) Source of fund from capital : 30% of total investment

(c) Borrowing condition of loans

Long-term loans : 5.3%

Short-term loans : 15.0%

(d) Taxes

Income tax : 25%

Sales tax : 2%

(2) Investment efficiency and sensitivity analysis

Investment effect analysis and sensitivity analysis

	Base Case	Alternative1
IRROI		
(After tax)	**6.67%**	**9.34%**
IRROI		
(Before tax)	**7.57%**	**11.18%**
IRROE	**12.00%**	**17.98%**
<Sensitivity analysis of IRROI (Before tax)>		
Selling price		
10%up	10.63%	17.48%
10%down	4.04%	0.67%
Variable cost		
10%up	5.85%	3.78%
10%down	9.22%	16.30%
Operating Fixed cost		
10%up	7.30%	11.00%
10%down	7.83%	11.37%
Total investment		
10%up	6.51%	10.13%
10%down	8.77%	12.40%
Slab import price		
10%up	7.27%	8.08%
10%down	7.88%	13.98%

Base case: Total of Steps 1, 2 and 3

Alternative 1: Construction of hot strip mill and cold strip mill including CGL

Section 9 Economic Analysis

1. General

Financial analysis is concerned with whether the project will be able to secure the funds it will need and be able to repay these and whether the project will be able to yield reasonable profits. Economic analysis is directed toward determining whether the project is likely to contribute significantly to the development of the economy as a whole and if the contribution of the project is likely to be great enough to justify the use of the scarce resources (including foreign exchange) which will be needed. The former evaluates the financial viability of the project based on the market prices, while the latter evaluates the economic viability of the project based on the economic values (shadow priced values) from a viewpoint of the national economy.

2. Procedure for economic analysis

Firstly, the financial analysis is reviewed from the viewpoint of economic analysis.

Secondly, shadow pricing of the financial costs and benefits is carried out by the following procedures:

1) Classification of shadow pricing
2) Calculation of standard conversion factor (SCF)
3) Calculation of shadow exchange rate (SER)
4) Calculation of shadow prices of traded and nontraded goods
5) Calculation of shadow price of land
6) Calculation of shadow wage rate of unskilled labor
7) Identification of taxes applied to the project (transfer item)

Thirdly, economic cash flow analysis is undertaken to compute the economic internal rate of return (EIRR) by a DCF method. Sensitivity analysis is also made in this phase.

Finally, the impact of the project is assessed on: (i) foreign exchange, (ii) employment, (iii) industrial development, and (iv) regional development.

3. Shadow pricing of financial cost and benefit

The shadow pricing of financial cost and benefit is summarized for the economic analysis in the following table.

	Before 2005	After 2006
Standard conversion factor (SCF)	0.940	0.980
Shadow exchange rate (SER)	VND 12,447/US$	VND 11,939/US$
Traded and nontraded goods in VND	Adjustment by SER	Adjustment by SER
Shadow price of land	US$ 47,722/y	US$ 49,753/y
Shadow wage rate of unskilled labor	US$ 133/y	US$ 139/y

4. Economic cash flow analysis

4.1 Economic internal rate of return (EIRR)

EIRR = 5.66 %

4.2 Sensitivity analysis

	-10%	Base case	+10%
Construction cost	7.20 %	5.66 %	4.03 %
Selling price	5.99 %	5.66 %	5.33 %
Operation cost	6.79 %	5.66 %	4.68 %

5. Impact of the project

5.1 Savings of foreign exchange

The foreign exchange savings will be aggregated at US$14.4 billion for the whole project period.

5.2 Improvement of unemployment situation

The following employment will be made annually by the project.

	New employment
During construction (max.)	10,000
During operation (employee)	6,500

5.3 Promotion of industrial development

It is necessary for establishment of the steel industry to develop the supporting industry. It involves industrial sectors of machine manufacturing, machining, refractory manufacturing, etc. Contractors and subcontractors for undertaking plant maintenance and expansion works are also considered to be grouped in the supporting industry. Without such a supporting industry, smooth operation of integrated steelworks seems difficult.

Most of the supporting industry will become more capable through the introduction of foreign technologies and/or training by foreign companies and are located around the integrated steelworks.

On the other hand, a transportation industry will be developed for conveying a big volume of raw materials and final products of the integrated steelworks and a shipbuilding industry will take place along with its development. It is also expected that heavy industries as well as a metal manufacturing industry will mature by using quality steel products from the integrated steelworks.

5.4 Promotion of regional development

A lot of people will work in the integrated steelworks. A new community will be necessary for not only the workers but also their families. Services for drinking water supply and sewage treatment will be well established and available for the community, where such facilities as schools, hospitals, parks and a public hall will be also constructed.

In addition, wide roads and networks for electricity supply and communication will be well constructed in connection with the project, which will benefit the community as well.

The construction of the integrated steelworks will, therefore, greatly contribute to the promotion of regional development.

Section 10 Environment Protection

1. Concept of environmental control measures

1) The meteorological conditions at the planned construction site of the new steel plant were investigated in order to determine which environmental control measures should be taken. Furthermore, water quality was investigated and noise measurements carried out as part of the environmental survey of the site.
2) Environmental control measures that meet Viet Nam's regulatory standards are first taken. However, when Japan's regulatory standards are more rigorous than those of Viet Nam, measures that meet the former are taken. The technologies for environmental control measures are based on the measures presently taken by the Japanese steel industry.
3) For the environmental control measures and energy-saving measures considered necessary in the future, a layout that enables these measures to be established as a future concept is planned.

2. Energy-saving measures

1) O_2 control of combustion exhaust gas necessary for ordinary combustion control, waste heat recovery of hot stoves equipped with standard facilities, installation of recuperators in reheating furnaces, etc., are conducted as general energy-saving measures. Furthermore, the control of OG necessary for operation, hot charge to the reheating furnaces of hot strip mill, etc., are also conducted.
2) For the environmental control measures and energy-saving measures considered necessary in the future, a layout that enables these measures to be established as a future concept is considered. Large-size energy-saving facilities, such as those for enabling sensible heat recovery from sinter main exhaust gas and CDQ of coke ovens, are not installed at the initial stage of the new steel plant from the standpoint of equipment cost reduction.
3) These large-size energy-saving facilities are to be installed after their economic efficiency is evaluated in terms of energy-saving cost and equipment investment after the start of the operation of the steel plant. However, equipment layouts which enable these large-size energy-saving facilities to be installed in the future are planned. It is desirable from an environmental view, however, to carry out the measures related to large-size energy-saving facilities soon after the start of operation.

3. Air

1) For air pollution control, SOx control measures are taken by installing desulfurizing equipment in the sinter main exhaust gas system, substantially reducing the amount of SOx emissions by COG desulfurization, use of low-sulfur fuels, etc. For NOx also, the amount of emissions is reduced by the adoption of low-NOx burners, etc. Furthermore, combustion exhaust gas is diffused into the air from high stacks.
2) The ground concentrations of SOx and NOx near the steel plant when these above measures are taken were simulated. As a result, it was found that the obtained values were far lower than those of Japan's environmental quality standards and there is no special environmental problem.

4. Water quality

1) Regulatory standards for water quality are met by removing suspended solids by thickeners, the coagulation and sedimentation process, etc., removing oil by pressure floatation, etc., removing COD in ammonia liquor and harmful substances by activated sludge treatment, etc.
2) The greater part of the fresh water used in each process at the steel plant is circulated and reused (circulation ratio = 94%), thereby reducing the industrial water volume and the amount of effluents.

5. Noise

1) General noise control measures are taken against principal sources of noise, namely, blast-furnace septum valves, main blowers of sintering machines, large-size dust-collection blowers, fans, etc.
2) However, the sound level is highest in that part of the site boundary that is nearest to the blast furnaces and thus the target sound level is achieved by enhancing noise control measures in the septum valves of blast furnaces, large-size dust collection blowers, etc.

6. Generated substances

1) Substances generated at the steel plant are recycled when they can be used. The amount of generated substances that is discharged from the steel plant is thus minimized. Landfill areas are secured within the steel plant and generated substances that cannot be recycled or sold outside are dumped and used for landfilling.
2) However, generated substances that cannot be dumped or can be incinerated are incinerated. For this purpose, an incineration plant is installed within the steel plant. Blast-furnace slag and converter slag, of which the largest amounts are generated, can be used as raw material for cement and a road base material. However, because their applications and demand are unclear, both kinds of slag are dumped near the steel plant and used for landfilling in the initial stage.

7. Investment for environmental preservation

1) The total investment for environmental preservation equipment is about 8 % (US$ 400 million) of the total capital expenditures.
2) The investment cost for environmental preservation equipment is incorporated in the estimate of each plant equipment.

Part 3 Recommendations

Section 1 Recommendations

Contents

1. Viewpoint of Investigation of Supply and Demand

According to the investigation executed by JICA on supply and demand to the year 2010, it is predicted that the annual demand for steel products, which is presently 1.3 million tons, will increase to 6.4 million tons. This prediction was made through projections of the national economic growth and the growth of each industrial sector in Viet Nam, i. e., from the two aspects of macroscopic projection and microscopic projection. This is a methodology which is usually adopted. Whether demand expands as predicted can be judged only from results. It is needless to say, however, that as described in the recommendations of master plan (III-5), it is necessary for the government to take various measures for carrying out industrialization policies and for creating demand for steel.

Judging from analogy with growth patterns of the neighbouring countries, it is not difficult to imagine that Viet Nam will eventually enter a period where demand for steel products exceeds the above level. In particular, how to cope with an increase in demand for flat products that are not presently produced may be an urgent issue.

As a matter of course, it is one of the conceivable means to import such necessary products. This investigation work was carried out, however, from the viewpoint that a system for domestically producing such necessary products should be realized by promoting a national industrialization policy.

Incidentally, the production facilities for non-flat products are not included in the equipment of the integrated steel plant, on Viet Nam's understanding that these facilities are to be constructed near the consuming region of such products as required in the form of joint ventures with equity participation from abroad, as the case may be, because the construction of such facilities does not require great cost. For the rolling equipment considered to be necessary, however, three types of equipment were taken into consideration. They are described in IV-16 attached, for reference, to the end of the prefeasibility study report.

2. Viewpoint of Situation of Raw Materials and Fuels

It has been widely recognized that Viet Nam is a country rich in natural resources such as iron ore and coal for steelmaking. On the basis of the results of later investigations, it was announced (July 1997) that the exploitation of the Thach Khe iron mine would be suspended in terms of profitability, and it is pointed out that the Hon Gai coal which is produced in the northern part is anthracite coal, and hence poses problems in the ironmaking by BF process, if it is widely used without special treatment.

In other words, it is necessary for Viet Nam to recognize that the country is not rich in resources for steelmaking, when it intends to construct and operate a large-scale integrated steel plant.

Furthermore, it is necessary to recognize that natural gas, which is indispensable for gas based direct reduction (DR) process whose production technologies have been established, produces only in the southern part of Viet Nam, whereas in the middle to the northern part (where the proposed sites of steel plant are situated) there are no gas fields which produce enough gas to meet the volume required by the steel plant.

Scrap is also a raw material necessary for steelmaking. By many projections, the scrap market will become tighter and tighter in the future owing to the worldwide spread of electric arc furnaces and mini mills. Good-quality scrap is necessary for producing flat products. It is also widely recognized that it is very difficult to procure for a long period large amounts of good-quality scrap stably.

Therefore, when the construction of a large-scale integrated steel plant is aimed at, it is inevitable to examine the appropriate processes on the basis of the importation of iron ore and coal.

Incidentally, the Thach Khe ore may possibly be used, to some extent, for the small- and medium-scale processes such as DR process, although the chemical composition of the ore may limit its consumption in the case of the integrated steel plant.

3. Viewpoint of Selection of Process Technology

Although technologies are progressing constantly, processes to be applied should be determined by consideration on the kind of products and their amonut to be produced, available raw materials and energy resources.

If a process is selected from the presently established proven technologies on the basis of the production scale of 4.6 million tons/year, which includes approximately 3.0 million tons of flat products, it would be the BF-BOF process.

However, because the funds required by the integrated steel plant are immense, a proposal has already been made to construct the steel plant from the downstream processes of comparatively high profitability on a step-by-step basis. Therefore, whether the BF-BOF process is the most appropriate process at the time of construction of the upstream processes may be re-examined by comparing this process with other processes that might be established by that time (the engineering for construction will be started four years prior to the operation commencement).

In selecting process technology, attention should be paid to environmental consideration. In the present examination, the installation of desulfurization equipment is proposed for the exhaust gas from the sintering plant, which accounts for the greater part of SOx emissions from the steelworks. However, investment cost for the environmental preservation equipment is limited to a minimum essential scale as far as any emissions and effluents clear the evironmental regulations.
The same concept applies to the energy-saving equipment, which is proposed for only minimum essential portions.
The introduction of environmental preservation equipment and energy-saving equipment on a step-by-step basis should be examined in consideration of the surrounding environmental conditions, energy price, etc., when the operation of the integrated steel plant is started and a definite operation level is achieved.

4. Viewpoint of Site Selection

The ten sites for the steelworks initially proposed by the Vietnamese side were all in the coastal zone from the middle to the northern part. This proposal from the Vietnamese side can be judged to be appropriate from the standpoint of the construction of a deep-sea port necessary for the steel plant. The ten proposed sites were narrowed down to three, and Mui Ron in Ha Tinh Province was nominated as the site for pre-feasibility study. Dung Quat in the middle district was added as an object of investigation, and the details are described in III-4.

Whether the construction of another integrated steelworks is planned in a different place or the first integrated steelworks is expanded in the site planned this time is an important factor in judgment. When an existing steelworks is expanded, an increase in production is generally possible with relatively small funds because the existing infrastructure can be utilized. It is needless to say that a huge investment is required again when the second steelworks is to be constructed in a completely different place.

For the site conditions of a steelworks, a site of high profitability should be selected on the basis of pure market principle. However, it could not be rejected that area development and the economic development of the district may sometimes be great objectives.

5. Viewpoint of Investment Scale

There was a time when steel analysts of the world estimated the investment necessary for constructing an integrated steelworks in a green field at US$ 1,000 per ton of crude steel/year (the 1970s). However, this figure is greatly influenced by the kinds of products and the quality required by the market.
After the two oil crises and a rise in price, a price breakdown is presently to be observed, due to the export offensive lead by low-price materials from the former USSR, in the aftermath of the end of the cold war, with the global mega-competition, and with the world economy being in the doldrums.

The prices of equipment to be made to order, such as plant equipment, vary greatly depending on the economic situation at the time of order placing and the power relationship between the purchaser and the manufacturer. Furthermore, prices are also influenced by the method of procuring equipment; that is, prices naturally differ depending on the method of procurement; for example, the case where purchased articles such as equipment are imported and the installation work itself is carried out by the purchaser by requesting the dispatch of advisors who give guidance in installation (the FOB method), the case where installation is conducted by the manufacturer, and not by the purchaser (the turn-key method), and the case where equipment is constructed by the manufacturer with the manufacturer's funds and products are purchased by the purchaser having the manufacturer operate the equipment for a given period (the BOT method).

If equipment prices are to be strictly estimated, it is advisable, after the determination of the procurement method, to request the manufacturer to submit reference estimates on the condition that orders are placed with that same manufacturer. The method adopted in the present estimation is based on the results (FOB Port of Japan and converted it in CIF landed at port of Viet Nam) of the construction work of similar equipment executed relatively recently (not only within Japan, but on a global scale). It may be said that the accuracy of estimation is high if equipment is procured in a timely manner.

If the operation of the rolling equipment in the downstream process among the equipment of the integrated steelworks is to be planned at a certain timing, then orders for the equipment must be placed three and a half years prior to such timing, at latest. Estimates should be obtained again at this point of time by determining various conditions such as the method of procuring equipment.

Attention should be paid to the fact that detailed site conditions (ground conditions by boring tests, etc.) are not taken into consideration because this is a stage of pre-feasibility study.

6. Viewpoint Related to Profitability and Future Developments of the Construction of the Integrated Steelworks

As described in IV-10, the profitability of an integrated steel plant is not always high.
The measures to improve the profitability should be taken at first.

A case is first proposed in which facilities of downstream processes are first constructed, and then cold-rolled sheets and strips, metal-finished products, and hot-rolled plates, sheets and strips, etc., are produced using these facilities. In such a case, slabs, which are semi-finished products, must be imported. The difference between the import price of slabs and the selling price of products manufactured produces a profit as added value.

Although profitability is unequivocally determined by the import price of semi-finished products and the selling price of products, attention should be paid to the fact that the import price of semi-finished products tends to rise, as described in IV-5, and that even when steel products are domestically sold, their prices are influenced by international prices because they are international goods. Furthermore, it is necessary to carefully examine whether large quantities (not less than 1.7 million tons per year) of semi-finished products can be continually procured in a stable manner.

If the self-sustenance of Viet Nam with steel products is the national policy, the above difficulties must be inevitably conquered, and how to construct and operate a steelworks that has worldwide competitiveness is the most important point. Concretely speaking, competitiveness means whether good-quality steel products can be produced at low cost and supplied to customers timely.

For this purpose, it is necessary to construct equipment according to a careful thought-out plan, and to operate the steelworks using the most up-to-date technology under the consistent concept of engineering and operational technology.

The next page shows the principal steps to be taken by the Vietnamese side after this prefeasibility study in a case where the construction of the steel plant is carried out in the schedule planned by the Vietnamese side.

Year	Master Schedule (by VSC)	Major Job Items	Financial Aspects, Others
1998.01 02 03	⇩ JICA Pre-F/S completed	Explanation of Draft Final Report Submission of Final Report	Support from foreign organization
	(Support) Gov't appraisal: Organization of promoting team Decision of site	Designation of consultant for F/S	Fund for F/S (Source?)
1999.01	(Detailed F/S)	1. Site: Soil investigation (boring), climatic/infra-st detail survey (port, road/railway, power/tele-com) 2. Setting raw materials conditions: brand, price, storage days, source, etc. of ores/coals 3. Production conditions: Steel grade, mix, transp cond 4. Equipment plan: Scope, quality level, productivity	Preliminary idea for procurement of loan (ODA, IBRD, ADB, Exim Banks, Private Banks, etc.)
2000.01	F/S completed Gov'tl appraisal, finance Appointment of consult't Contract with consult't	5. Estimate condtn: Procurement method 6. Collection of cost data 7. Financing source 8. Concept plant design, estimate 9. Management method, productn cost, financial study	Concrete plan of finance scheme Negotiation with financing institutions Fund for engineering service agreement with consultant Confirmation of financing sources ⇩
2001.01	▼Beginning of engineer'g Preparation for procurement	Basic engineering 1. Document preparation for procurement Inquiry demnt, GTS, technical inquiry for each pckge 2. Bidding Pre-qualify, announcement, PBC, bid evaluation, negotiation with bidders 3. Selection of suppliers, contract	
2002.01	Civil work start ▼Hot/Cold: Contract	4. Design meeting with suppliers 2-Step: Basic engineering for Step-2 equipment	
2003.01	Design/manufacture/ erection	5. Attendance at suppliers' shop test 6. Erection advisor	
2004.01	Prodct berth; Hot/Cold: Erection start completed	2-Step: Same nature of engineering services as Step-1	
2005.01	Hot/Cold: Erection/Test run **1-Step**	7. Test run guidance 2-Step ▼Contract with suppliers	Securing financing sources for Step-2 construction
2006.01	Hot/Cold Strip Mill **Start-Up**	8. Start-up operation assistance 3-Step: Basic engineering for Step-3 equipment	Fund for engineering service agreement with consultant
2007.01			
2008.01			
2009.01	**2-Step**	3-Step ▼Contract with suppliers	ecuring financing sources for Step-3 construction
2010.01	No.1 BF/BOF Start-Up Cold Expansion		
2011.01		3-Step: Same nature of engineering services as Steps-1 & 2	
2012.01			
2013.01	**3-Step** (Final)		
2014.01	No.2 BF/BOF Start-Up		

Figure 1-1 Future Steps to be Taken for the Development of Integrated Steelworks

7. Suggestions for promotion of integrated steelworks construction

As already described, the construction of an integrated steelworks is enormously expensive and does not always prove highly profitable.
Since upstream processes require very large amounts of investment, it is suggested that work should first proceed on downstream processes with relatively high profitability.
Joint ventures now manufacturing construction materials in Viet Nam are engaged in the construction of their plants by following the same idea. If they bring their production right on track, have the prospects of purchasing enough scrap, and think it possible to earn profits with the current electricity rates, they will go into the construction of electric arc furnaces. (For example, Vinakyoei is reported to be studying the timing of electric arc furnace construction.)

In some countries, integrated steelworks have been successfully constructed, operated and developed into a core industry. If Viet Nam is to promote the construction of an integrated steelworks as a national project, all of its leaders must be ready to raise necessary funds and to organize a construction promotion body by themselves.

If Viet Nam, about to take off as a modern industrializing nation, starts with the construction of downstream processes, it may later think it necessary to build an integrated steelworks complete with both upstream and downstream processes. Here are introduced some of the information that may help Viet Nam in that event.

Conditions required for construction of integrated steelworks as a national project

(1) Improvement of social and economic bases
The section "market study" has discussed in detail that demand for steel in a country increases with the growth of its economy. If this situation is left to market principle, many foreign companies will participate in the construction of downstream steel production processes with relatively high profitability, and the steel market of the country will be dominated by such small and medium-sized joint ventures.
Of importance here is that the shortage of foreign companies willing to participate in the construction of upstream steel production processes of relatively low profitability will force the country to continue import of slabs semi-permanently.

The construction and subsequent operation of an integrated steelworks greatly impacts the society and economy of the country, such as reduction in imports of semifinished steel products or in foreign currency payments, development of refractories, lubricants and other supporting industries, and increase in employment opportunities.
The construction of an integrated steelworks, especially for flat-rolled products, requires a huge capital expenditure and involves many risks, however. Herein lies the reason why foreign private firms are reluctant to enter this field.
As stated in the section on raising funds for projects in general (III-4-4), Viet Nam will have to prepare its own funds, including state bonds, equivalent to about 25 to 30% of the total amount required for the construction of an integrated steelworks as a national project.
The total cost of the integrated steelworks project is estimated at US$5.7 billion as described in IV-2-8-1. This means that Viet Nam will have to prepare its own funds of US$1.4 to 1.7 billion.
The total cost of constructing downstream processes alone is put at US$1.36 billion (refer to IV-2-8-1). The amount of self-financing by Viet Nam in this case is US$300 million to 400 million. This is the reason why the construction of downstream processes is suggested at the beginning.
If Viet Nam plans to introduce official funds from the ADB, IBRD or other international financing organizations, it will have to improve its social, economic and legal bases to accept such funds. These bases will have to be improved as rapidly as possible while respecting the opinion of experts. For this very reason, the governments of Brazil, Korea, Taiwan, Malaysia and Indonesia, to name a few, took the initiative in constructing integrated steelworks.
It is a well-known fact that the integrated steelworks in these countries were privatized as they got on the right track.

(2) Organization of construction promoting body
The leaders of many countries committed themselves to the construction of their integrated steelworks.
An organization, named something like "XX steelworks construction promotion headquarters" is established, centering on the department to plan the construction. The organization is headed by a powerful person who can represent the country concerned.
The head of the organization is given the rights to budget, personnel and negotiation with foreign companies, and has the trust and confidence of the leader of the country.
The functions of the organization and its main departments may be illustrated as shown below.

Example of the organization

- XX steelworks construction promotion headquarters
  - Consultation committee composed of members representing relevant ministries and agencies
  - General construction planning department
    Real estate, budget acquisition, foreign capital financing, and laws and regulations
  - Construction promotion department
    Technical planning (including employment of consultants) and overall engineering, such as equipment planning and construction
    - Consultant (A)
  - Operation preparation department
    Overall operational preparations (such as procurement of operating materials and supplies, and recruitment and training of operating personnel)
    - Consultant (B)

It is usually desirable that consultant (A) should be the same as consultant (B). This is because the equipment design philosophy must be fully reflected in the operating technology of the integrated steelworks.

A steel engineer will be soon dispatched from Japan to VSC for about two years under the expert dispatch system of JICA. It is essential that VSC should consult him as a good adviser about the techniques for organizing the integrated steelworks construction promotion body and carrying out the integrated steelworks construction project.

(3) Other necessary considerations
One way for reducing the initial capital outlay required for constructing an integrated steelworks is the build, operate and transfer (BOT) system as already noted in item 5 above.

The following plants can be built on a BOT basis, and products from them can be purchased by the integrated steelworks:

Coke oven plant
Sintering plant
Lime calcining plant
Metal finishing lines (CGL and ETL)
Power plant
Oxygen plant

This BOT system seems worth studying because the initial investment outlay required for the construction of the integrated steelworks can be substantially reduced if foreign companies interested in participation are invited with favorable conditions.