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The Current Vietnamese Steel Industry and Its Challenges

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Abstract

The Vietnamese steel industry is confronted with three challenges; industrial development, shift to market-oriented economy, and participation in international economic integration.

In part I, the author discusses the structure and policy of the Vietnamese steel industry. The system of mass production and mass distribution has not been established in the Vietnamese steel industry. Although competitiveness is generally weak, significant differences are also observed between company groups and among individual companies. The immediate policy objective should be to give companies the incentive for improving competitiveness while making preparations for the tariff reduction schedule of AFTA. For that purpose, it is necessary to remove inconsistency between competition policy and trade policy.

In part II, the author comments on the master plan of the Vietnamese steel industry. Though the steel industry does not occupy a decisive position in the industrialization strategy of Viet Nam, it should be given public support to a certain extent. The realistic development plan based on partial import substitution strategy should be designed and implemented.

Difficulty of the Vietnamese steel industry comes not only from global structural constraints but also from local institutional incapability. The Vietnamese government and enterprises have to improve their technological, managerial, and policymaking capabilities.

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Introduction

This paper consists of two parts. In Part 1, the current state of the steel industry in Viet Nam and the problems it is facing are analyzed. Part 2 comments on future production and investment plans from the aspect of technology policies. In the course of restructuring and investing, due consideration should be given to conventional problems and their lessons.

Viewing the Vietnamese steel industry in context of the Vietnamese economy as a whole reveals the following complexities.

First, from the viewpoint of macro-economy the necessity of developing the steel industry has increased. According to study results of phase 2 of Joint Viet Nam-Japan Research, the steel industry's ratio of imports to total demand stood at 0.8722-to-1, and the import inducting coefficient was 1.3915, the largest figures across all industries from 1989 to 1995.[1] Although the figures for the late 1990s are not available, they are estimated to be quite high. Accordingly, leaving the steel industry undeveloped is expected to have a strong negative effect on the country's trade balance as well.

Second, development of the steel industry is a part of corporate reform. The Vietnam Steel Corporation (VSC), a state-owned enterprise (SOE), and their affiliated enterprises control the core of the industry. In addition, foreign affiliates and private companies have their own roles and challenges.

Third, steel industry in Viet Nam has two challenges in international economic integration: reinforcement of competitiveness and participation in the international division of labor. Due to inconsistencies in policies for the steel industry concerning trade and competition, it is doubtful whether the country can maintain and develop its competitiveness under the new trade structures such as AFTA (ASEAN Free Trade Area) and WTO (World Trade Organization).

As briefly described above, the Vietnamese steel industry is facing industrial development, common among developing countries, and restructuring of SOEs, common among marketizing economies. These issues also prevail in the Vietnamese economy as a whole.

The author assumes the following viewpoints in his analysis.

First, long-term competition in international economic integration should be envisaged. The author establishes a contrast between "competition" and the absence of competition in the centrally

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[1] Hideki Imaoka and Koichi Ohno, Globalization Ka No Boeki Sangyo Seisaku (Trade and industrial policies under the globalization), in Shigeru Ishikawa and Yonosuke Hara eds., *Viet Nam No Sijokeizai Ka (Marketization of the Vietnamese Economy)*, Toyo Keizai Shinpo-sha, 1999, p.215 (Japanese).

planned economy, and a contrast between "international competition" and domestic competition. "Long-term competition" is viewed in contrast to short-term rent-seeking or opportunistic behavior. International competition is important even when import substitution is aimed at because domestically manufactured products must compete with imported products in the domestic market.

Second, importance should be attached to a systematic introduction and diffusion of technologies. To this end a consistent policy is required. Both government agencies and the steel industry should exercise due caution to prevent fragmentation of technology and imbalance in production processes.

Third, both structural and historical limitations and the capabilities of institutions should be given attention. Development of the Vietnamese steel industry has been hampered by war-related damage and its low standing in international economy. However, we should not place the entire responsibility on these factors. The author would like to emphasize that the situation may undergo great change depending on the policies and design of institutions in the country.

Improvement of institutional capability suited to long-term competition, does not necessarily mean privatization or liberalization. Though it is certain that the vitality of the Vietnamese steel industry will be tested in the shift toward a market economy, privatization and liberalization are not always the single best choices in a specific phase. In this report, the author will explore the suitability of policies and institutions to long-term competition on a case-by-case basis.

Part 1. Current State of the Vietnamese Steel Industry

I. Historical Background

The contemporary history of the Vietnamese steel industry can be broadly classified into before the unification of the South and North in 1975 and after that.[2]

Prior to 1975, steel industries in the South and North existed under different economic systems, and their technological characteristics differed as well.

In the North, construction of the Thai Nguyen integrated steelworks for production of long products started in 1959.[3] The site was near an inland iron ore mine. The initial target for crude steel production was 200,000 tons per year. At the outset, iron ore mine was developed and an iron-making division was set up. In 1963, No.1 blast furnace began operation. Eventually three mini blast furnaces were constructed, each with an internal volume of 100 cubic meters.

At that time, developed countries constructed blast furnaces with a volume of 700 to 1,700 cubic meters, while some developing countries relied on small-blast furnaces. Small furnaces in Viet Nam were designed and built with technology assistance from China. In the 1950s, China was pursuing an economic policy to mobilize the masses and utilize medium and small plants. As part of such efforts, a large number of small blast furnaces were constructed to utilize regional natural resources.[4] That technology was transferred to Viet Nam. The location and technology of Thai Nguyen steelworks was selected with a view of utilizing the technology of socialist countries and domestic resources to develop the country's economy. It was a reasonable selection for the North in those days.

However, after the 1960s, changes in international relations and steelmaking technology brought difficulties to Thai Nguyen steelworks. Construction was delayed and production targets were lowered. Though details are not known, it is believed that blast furnace operations were in trouble, because the scientific bases in facility design and operation were lacking in the construction of mini blast furnaces. In China, many of them ended in failure. Furthermore, American bombing seriously obstructed construction and operation. It took more than 15 years from the start of construction of Thai Nguyen steelworks until realizing the integrated production of

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[2] Concerning the history, the relevant information was gained through interviews at VSC, TISCO, and SSC.

[3] As for construction of Thai Nguyen steelworks, refer to the following. Japan Economic Research Institute, *Indosina Fukko Kaihatsu no Houto (Ways to Reconstruct and Develop Indochina)*,1973 (Japanese).

[4] Yoshiro Hoshino, *Gijutsu to Seiji (Technology and Politics; Contrast of the Technology Modernization between Japan and China)*, Nihon Hyoron-sha, 1993, Chapter 6-8 (Japanese).

iron and steel. In that period, the world's leading integrated steelworks set up large blast furnaces with volume exceeding 2,000 cubic meters. Also, the increasing portion of the long products was produced by electric arc furnace (EAF) mills in many countries, while technology at Thai Nguyen turned obsolete.

Meanwhile, in the South, capital from the overseas Chinese was used to build EAF mills in the late 1960s. These mills are situated near Saigon City and had EAFs with capacities of 5-15 ton/charge and long-product rolling mills with an annual production capacity of less than 50,000 tons. A system in which long products were produced at EAFs near the site of consumption was the new one that was introduced to the world steel industry after the 1960s. At that time, mills in the South enjoyed the benefits of relatively new steel technology transferred from Taiwan and Japan despite their small-scale facilities. Those mills were nationalized in 1975 due to the unification.

The years after 1975 can be divided into three periods. In the first period, from 1975 to 1978, the organization of production was arranged at Thai Nguyen Iron and Steel Corporation (TISCO) in the North and Southern Steel Corporation (SSC) which integrated nationalized enterprises in the South. The second period, from 1979 to 1989, was the industry's most difficult period, according to VSC, due to stagnation of steel production as well as the whole Vietnamese economy. In addition, difficulties arouse when the supply of bituminous coal to TISCO from China was suspended due to worsened diplomatic relations. Crude steel production in Viet Nam in 1989 totaled a mere 85,000 tons and consumption totaled only 194,000 tons.[5] The third period, after 1990, saw the establishment of VSC through integration of TISCO, SSC, trading companies and other related organizations. Since then, attempts at reform of the steel industry have continued.

Based on the above, two issues must be considered about the history of the Vietnamese steel industry.

First, industrialization was difficult in Viet Nam prior to Doi Moi reform, hindering steel production growth. Unlike other wartime economies or centrally planned economies, Viet Nam was unable to afford investments in the steel industry. Namely, the Vietnamese steel industry before Doi Moi was not developed even by market needs or by the planned policy orientation to the heavy industry.

Second, the industry was undeveloped as a whole, but there were some differences between the North and South. Such differences have significance even today.

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[5] International Iron and Steel Institute(IISI), *Steel Statistical Yearbook*, Brussels, IISI, 1996, p.24, 143.

II. Basic Structure of the Vietnamese Steel Industry

1. Supply-demand structure

Table 1 shows the supply-and-demand relationship in the steel industry in East Asian countries. The Vietnamese steel industry lags developed countries and other ASEAN countries in production and consumption of steel. However, the industry escaped severe damage during Asian monetary crisis and the growth in demand has continued.

Table 1. The steel consumption and crude steel production in East Asia (Unit: million ton)

		Apparent steel consumption				Crude steel production			
		96	97	98	99	96	97	98	99
China		97.3	103.5	113.9	125.0	101.2	108.9	114.6	123.3
Japan		80.6	82.1	70.3	68.3	98.8	104.5	93.5	94.2
Korea		37.6	38.1	24.9	32.1	38.9	42.6	39.9	41.0
Taiwan		18.0	21.0	20.2	20.3	12.4	13.0	16.9	15.4
ASEAN	Indonesia	6.3	6.8	2.8	3.5	4.1	3.8	2.7	2.8
	Malaysia	7.9	8.1	3.6	n.a.	3.2	3.0	1.9	2.0
	Thailand	8.8	7.6	4.1	n.a.	2.1	2.1	1.8	1.9
	Philippines	2.8	4.2	3.0	3.0	0.9	1.0	0.9	0.9
	Singapore	3.8	4.0	3.3	2.9	0.5	0.4	0.5	0.5
	Viet Nam	1.6	1.7	1.9	2.3	0.3	0.3	0.3	0.3
		31.2	31.8	19.5	n.a.	11.2	10.6	8.1	8.5
Total East Asia		264.7	276.5	248.8	n.a.	262.5	282.6	273.0	282.4
Total World		658.7	698.2	693.3	698.8	750.0	798.8	775.9	784.2

Source: Edited by Japan Iron and Steel Federation, from data of South East Asia Iron and Steel Institute

Table 2 shows supply and demand in the Vietnamese steel industry. It indicates that production cannot keep pace with the growth in consumption of steel products and imports are increasing. Table 3 provides a breakdown of imported steel materials, with flat products being the main import. Apart from finished steel materials, the imports of billet, semi-finished product for long products, are increasing as shown in Table 4. Figure 1 shows a prediction of material flow estimated in the fall of 2000. As Tables 2 and 3 show, the production figure for 2000 is known but breakdown of demand is not. Accordingly, Figure 1 is considered to provide an approximate picture.

Table 2. Steel production, consumption and import situation from 1992 to 2000 February 5, 2001

1. Steel products Unit: 1,000t

	1992	1993	1994	1995	1996	1997	1998	1999	2000 (est.)	2001 (expect.)
Steel consumption	**560**	**863**	**854**	**1,180**	**1,638**	**1,822**	**2,128**	**2,379**	**2,850**	**3,170**
Domestic production (Long product)	**220**	**280**	**360**	**490**	**865**	**977**	**1,150**	**1,300**	**1,588**	**1,770**
VSC	190	230	270	370	464	443	464	464	524	540
JVs of VSC	0	0	0	68	351	484	586	678	814	837
Others	30	50	90	52	50	50	100	150	250	393
Import	**343**	**686**	**600**	**866**	**947**	**807**	**917**	**1,146**	**1,429**	**1,400**
Stock										
at beginning	**0**	**3**	**106**	**0**	**176**	**350**	**312**	**251**	**318**	**485**
at ending	**3**	**106**	**0**	**176**	**350**	**312**	**251**	**318**	**485**	**485**

Source: VSC (from Mr. Tanaka, JICA Expert).

Table 3. Imports of finished steel products
(Unit: 1.000 tons)

Year	1998	1999
Total	**846**	**1,144**
Flat Products	**685**	**966**
Plate	234	292
Sheets and strip	342	564
Hot rolled sheets and strip	166	273
Cold rolled sheets and strip	176	291
Surface treatment sheets	100	103
Tin plate	25	26
Galvanized sheets	27	16
Colored galvanized sheets	48	62
Electrical sheets	9	7
Non flat products	**162**	**178**
Stainless steel	22	42
Steel products for constructi	11	13
Sections and shapes	53	47
Structural steel	22	26
Spring steel	0	0
Wire rod	11	14
Other products	43	36

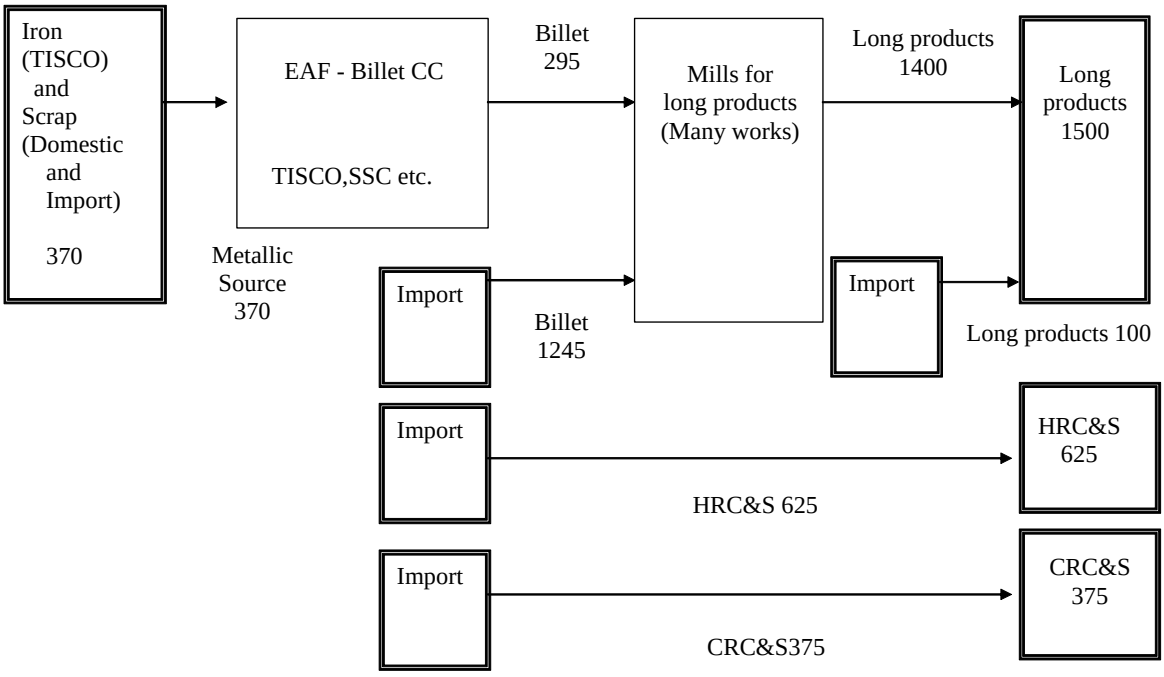
Source: General Customs Office, VSC.
Quoted from CRM F/S Report, III-2-2.

Table 4. Billet demand and production/import Unit: 1,000t

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000** (est.)	**2001** (expect.)
A Steel	220	280	360	490	826	976	1,150	1,300	1,550	1,770
B Billet demand*	265	333	424	576	918	1,073	1,265	1,430	1,712	1,956
C Billet (domestic production)	(219)	(270)	(301)	(271)	(311)	(314)	306	307	306	396
D Billet (outside) **(B-C)**	**46**	**63**	**123**	**305**	**607**	**759**	**959**	**1,123**	**1,406**	**1,560**

( ) : from IISI statistics
* : estimated A/B (yield of rolling) = 83% ~ 90.5%
Source: VSC (from Mr. Tanaka, JICA Expert).

Figure 1. Material Flow of the Vietnamese Steel Industry in 2000 (estimated in Autumn, 2000) (1000t)



Source: VSC.

Two reasons for increased imports of flat products and billets are: i) production facilities that are somewhat concentrated on the downstream sector and ii) a limited product line. For iron-making, there are only two blast furnaces, each with a volume of 100 cubic meters and only one of which is in operation. The industry's steelmaking capacity totals 368,600 tons a year and rolling capacity is 2.6 million tons. However, steelmaking is based entirely on EAFs, while rolling

mills produce only long products; there are no rolling mills producing flat products. Production capacity of galvanized sheets using imported flat product totals 332,000 tons a year, while the figure for welded pipes using flat products is 293, 000 tons a year. [6]

While the industry is dependent on imported flat products and billets, there is now an overproduction of long products and galvanized sheets. In 1999, long-product production reached 1.3 million tons out of an annual production capacity of 2.6 million tons, at an operating rate of only 50%. Production of galvanized sheets registered 120,000 tons out of a yearly production capacity of 333,000, at an operating rate of merely 36%.[7]

2. Steel production in three sectors

The Vietnamese steel industry consists of three sectors: i) VSC and its affiliated state-owned enterprises; ii) joint ventures beteween foreign capital and VSC, or its affiliated enterprises; and iii) domestic companies not under VSC control. In addition, as of autumn 2000, there was one steel pipe company wholly owned by foreign capital that was constructing an additional rolling mill for long products.

Table 5 shows production levels at major enterprises. Output from joint ventures has exceeded VSC's since 1997.

[6] VSC and Mr. Nobuyoshi Tanaka, JICA Expert. *Draft Final Report, The Feasibility Study on Installation of Steel Flat Product Mills (Phase1: F/S on Cold Rolling Mill) in The Socialist Republic of Viet Nam*, JICA, 2000 (*CRM F/S Report*).

[7] VSC and Mr. Tanaka, JICA Expert.

Table 5 Main Steel Companies of Vietnam Steel Corporation and the Related JVs

Name of company	Form	Production amount (1000t/year)						Steel plants	Production capacity (1000T/Y)	Products
		1995	1996	1997	1998	1999	2000			
Vietnam Steel Corporation (VSC)	**Head Quarters VSC total**	**362.2**	**463.6**	**442.7**	**464.3**	**464.4**	**524.2**	**TISCO, SSC, Danang and JVs**	**total rolling capacity (1,590)**	**Wire rod, Bar Angle/sectio**
Thai Nguyen Iron and Steel Corporation	VSC Member	147.5	178.2	177.9	163.3	145.2	166.3	Luu Xa, Gia Sang (BF, EAF, CC, Rolling)	240	Wire rod, Bar Angle/section
Southern Steel Corporation (SSC)	VSC Member	207.9	278.9	256.6	284.9	292.0	321.8	BienHoa, Thu Duc, NhaBe, Tan Thuan (EAF, CC, Rolling)	460	Wire rod, Bar Angle/section
Danang Steel Corporation	VSC Member	6.8	6.5	8.3	13.9	20.4	25.5	Danang (EAF, Rolling)	40	Wire rod
Cevimetal	VSC				2.1	7.0	10.4			Bar
Vinakyoei	VSC JV (Japan)	13.0	130.1	197.5	235.7	229.0	257.1	Phu My (Rolling)	240	Wire rod, Bar
VSC-Posco Steel	VSC JV (Korea)	13.0	85.6	147.8	151.6	198.0	223.4	Hai Phong (Rolling)	200	Wire rod, Bar
Natsteel Vina *	VSC JV (Singapore)	33.4	62.1	69.3	72.5	82.3	98.2	Thai Nguyen (Rolling)	110	Wire rod, Bar
Vinausteel	VSC JV (Australia)	8.9	75.1	69.9	80.2	114.3	158.5	Hai Phong (Rolling)	180	Wire rod, Bar
Tay Do Steel	SSC JV (Taiwan)	-	-	2.0	37.7	65.0	76.9	Can Tho (Rolling)	120	Wire rod, Bar
JV total (hot rolled product)		**68.3**	**353.6**	**484.5**	**577.6**	**688.6**	**814.1**			
Vinapipe	VSC JV (Korea)	12.6	17.6	19.3	20.7	11.4	14.1	Hai Phong	piping 30	Welded pipe
Vingal	VSC JV (Aust.)				4.5	7.1	8.4	Dong nai	piping 40	Welded pipe
POSVINA	SSC JV (Korea)	41.1	39.2	20.0	10.0	22.0	19.05	HCM City (Galvanizing Line)	galva. 50	Galvanized sheet
SSSC	SSC JV (Japan, Malaysia)	-	-	7.0	17.7	38.7	42.3	Phuong Nam (Galvanizing Line)	galva. 50	Galvanized sheet

* JV share of TISCO transferred to VSC since 1999

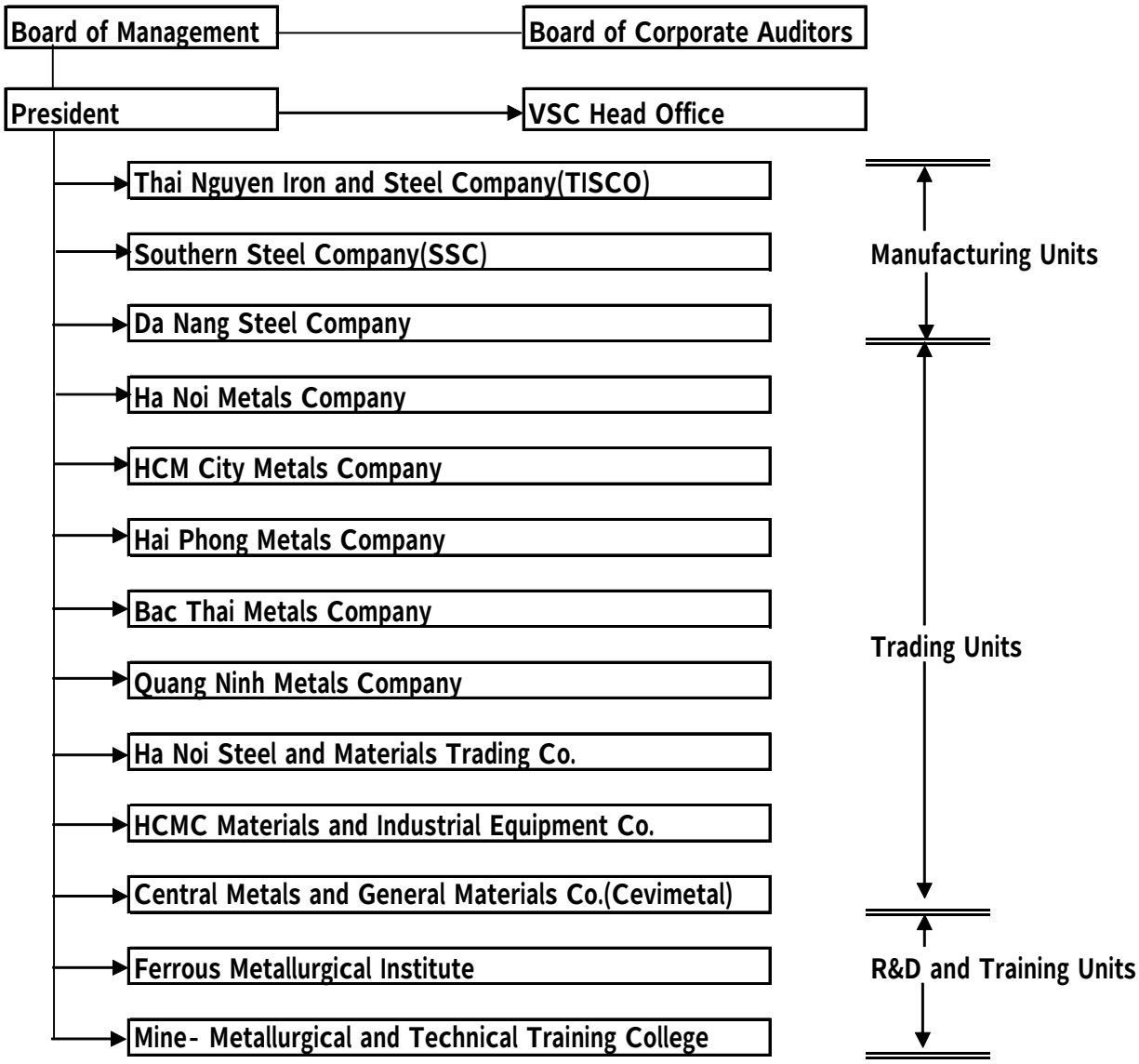
2-1. VSC and affiliated enterprises

i) Outline of VSC

VSC is a SOE engaged in steel production and steel marketing. It was established in 1990 when major enterprises in the North and the South were integrated. It was reestablished and reorganized under Decision No. 225/TTg, dated April 29, 1995, of the Prime Minister, Decree No. 03/CP, dated January 25, 1996, and Business License No. 109612, dated February 5, 1996. VSC is among the 17 enterprises of the "91 General Corporation" under the direct control of the Prime Minister. The government controls the appointment of VSC executives and large-scale investments, while VSC controls its affiliated units. VSC and its units are required to maintain a self-supporting accounting system. Affiliated enterprises can set the product price by themselves, though VSC sometimes coordinates the ceiling and bottom price.

The organizational structure of VSC is illustrated in Fig. 2. VSC owns three manufacturing enterprises, eight trading enterprises and one R&D unit and training unit. Cevimetal is a trading enterprise, but it owns a rolling mill. The production facilities owned by VSC include two small blast furnaces, steel-making capacity of 368,600 tons and rolling capacity of 760,000 tons per year.[8] In addition, TISCO owns coal fields and an iron ore mine. In Viet Nam, VSC-affiliated enterprises exclusively own iron- and steel-making facilities. The following are characteristics and problems at the manufacturing enterprises.

Figure 2. Organizational Structure of Vietnam Steel Corporation



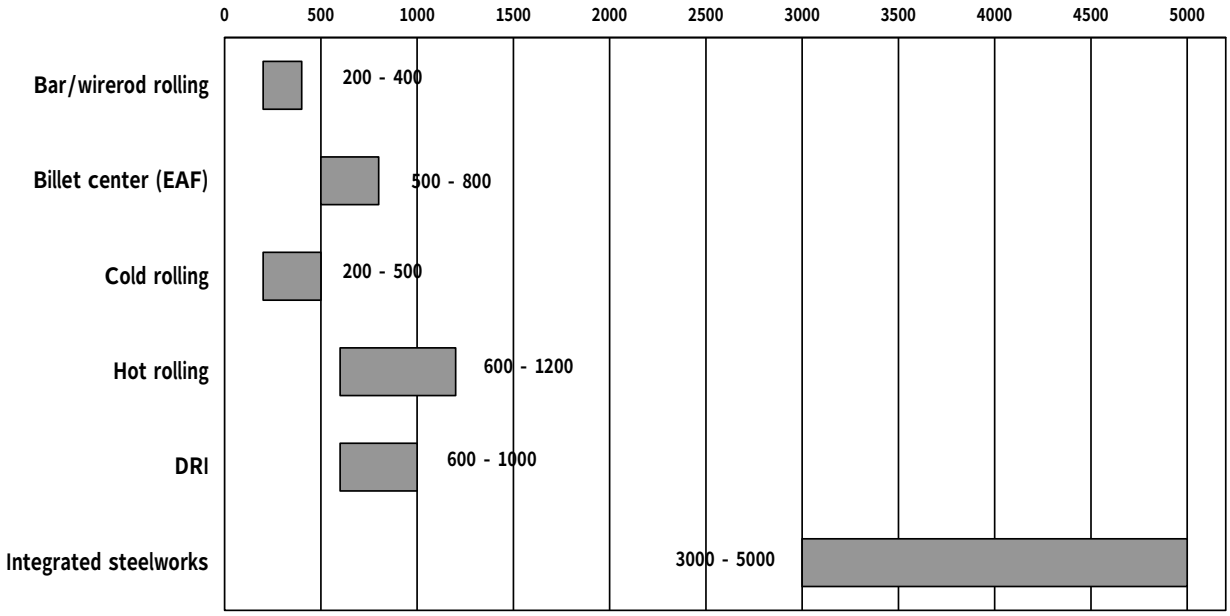
Source: VSC.

[8] *Ibid*.

ii) Production Problems

The first problem is outdated technology and equipment that is small-scale and obsolete. The standard size of equipment adequate for ordinary steel production is shown in Fig. 3. Production capacity of main equipment at TISCO, SSC, Da Nang Steel and Cevimetal does not satisfy the minimum scale required, dampening their productivity and economies of scale. For example, VSC-affiliated enterprises own 20 EAFs, but the largest has a production capacity of a mere 96,000 tons a year, while the others have a production capacity of less than 50,000 tons.[9] The volume of TISCO's each blast furnace is only 100 cubic meters, while standard furnaces in developed countries have a volume of 2,000 cubic meters or more. In recent years, those with a volume exceeding 3,000 cubic meters have become the standard in the world.

Figure3. Appropriate Production Capacity of Medium-Sized Mills
(Thousand tons per year)



Source: Prof. Ohno's estimate based on information by JICA expert and F/S team and in light of Viet Nam's circumstances.

Working conditions are often outdated. One example is the Cevimetal's rolling mill.[10] The new plant, built in 1996, is dependent on manual labor in rough rolling more than either TISCO or SSC. Cevimetal has two units of reversed-type rough rolling mills placed in a roll, and two billets are simultaneously extended to several meters by rough rolling. However, since there is only one intermediate-finishing rolling line, one of the two extended billets cannot be directly forwarded to the intermediate-finishing rolling line. Therefore, one of the billets must be moved in parallel. To

[9] *Ibid*.

[10] Plant visit.

accomplish this, several workers use tongs to draw in such billets toward their feet, a hazardous task. Although there is a mechanical conveyor carrying billets, it cannot make parallel transfers. In addition, workers wear sandals and sometimes kick a heated billet to correct its direction, also a dangerous task.

At other state-owned rolling enterprises, processes are comparatively automated. Roughly rolled billets are moved directly to an intermediate-finishing line moved on a conveyor. However, at some steelworks, billets are pushed into a rolling stand with tongs for rough rolling. Also, the bundling of hot wire rods shortly after rolling is done manually. Working conditions for these manual workers tend to be poor.[11]

The second problems are inconsistencies in the production process. This is the case particularly at TISCO.[12]

TISCO lies inland near an iron ore mine, offering easy access to raw materials. However, it is far from Ha Noi, the important consumption area of steel products, and Hai Phong, where raw materials from abroad are unloaded. Despite its convenient location for raw materials, TISCO is forced to purchase scrap and import billets since effective capacity of blast furnace is smaller than those of EAFs, and those of EAFs are smaller than those of continuous casting machines and rolling machines. Land transportation costs lead to higher costs. Also, at TISCO, pig iron produced by a blast furnace is cast entirely on casting floor as cold pig iron, removed from the die manually and again melted at a steel-making plant. The advantage of a blast furnace is that it allows molten iron to be placed in an oxygen furnace or EAF to raise thermal efficiency, a benefit unavailable to TISCO.[13]

SSC's location in the South, which accounts for 65% of domestic steel consumption, is not problematic.[14] However, as with TISCO, SSC's capacity for steelmaking is smaller than that for its rolling, and thus it must import billets.

Third, there is a problem concerning operation methods. TISCO's coke rate (the quantity of coke required for producing one-ton of pig iron) is reported as 1.17 ton/ton. In Japan, the coal rate (the total of coke and pulverized coal) is 0.522 ton/ton. Thus, coke rate at TISCO is quite high.[15] It is due not only to obsolete equipment but the lack of a scientific knowledge in operation. In Shanxi province, China, a site of many small blast furnaces, coke rate of some furnaces was lowered as

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[11] Plant visit.

[12] Interviews and plant visit at TISCO.

[13] The problems are scheduled to be solved by an on-going rehabilitation program supported by China.

[14] *Final Report, Master Plan Study on the Development of Steel Industry in the Socialist Republic of Viet Nam,* JICA, 1998 (*Master Plan Report*) IV-15-1.

[15] *Tekko Tokei Yoran (Steel Statistical Abstract),* The Japan Iron and Steel Federation, 1998, p.126-127.

shown in Table 6, through operational assistance from Japanese engineers.

Table 6. Improvement of Coke Rate at the Mini- Blast Furnace in Shanxi Province, China

(t/t)

Company	A	A	B	B
Internal Volume	$28m^3$	$47m^3$	$34m^3$	$125m^3$
1994	1.65	1.60	1.50	1.20
1995	1.65	1.60	1.50	1.20
1996	1.30	1.30	1.20	1.00
1997	1.30	0.90	1.50	0.90
1998	1.20	1.00	1.10	0.90
1999	1.10	1.15	0.80	0.80
2000	0.95	0.85	0.80	0.74

Source: Society on the Environment of China, Tohoku University.

Improvements were made in coke properties and control of raw material grain size, which required relatively small investments. For Viet Nam, as JICA is proposing quality improvement of ore and coke, there is ample possibility for improvement.[16] Also, scrap to be placed in EAF is not sufficiently selected, causing considerable rust. As a result, this adversely affects on product quality and electricity intensity. However, in the Vietnamese market, product quality seems not to be a major concern or an impediment in sales performance. [17]

iii) Existence of surplus workers

VSC considers that its affiliated companies are overstaffed, and it is trying to reduce work force mainly by not filling vacancies made by retirement.[18] VSC as a whole had 25,400 employees in 1997, and the number was reduced to about 18,700 persons in 1999, when VSC considered 6,500 persons were still surplus.

Overstaffing is particularly serious at TISCO. Under the centrally planned economy modeled after that of the former Soviet Union, various indirect and welfare divisions had been included at TISCO, leading to a bloated work force compared with its production capacity. In 1999, a hospital and school were moved to Thai Nguyen Province, bringing the number of employees down by 2,200 persons. In 2000, however, there were still 10,800 employees. In contrast, SSC has 4,000 employees, which is less than TISCO, with fewer non-production divisions, since the plants of SSC

[16] *Master Plan Report*, II-2-2-3.

[17] Interviews at various enterprises.

[18] The description in this paragraph is based on interviews at VSC, TISCO and SSC by the Japanese members of Industry and Trade Group and the General Commentary Group.

were established as a private company at first.

Due to problems with production processes and staffing, productivity of VSC-affiliated enterprise is extremely low. Production of steel products per capita in 1999 was 13.4 tons at TISCO, 68 tons at Da Nang Steel and 73 tons at SSC.[19] These contrast sharply with the corresponding figures at Nippon Steel Corporation, an integrated steel company in Japan, of 887 tons and at Kyoei Steel Ltd., an EAF mill in Japan, of 1,987 tons. The gap is obvious. [20]

iv) Common Features and Differences Among Enterprises

VSC-affiliated businesses overall are facing serious production problems, while each company has its own unique set of challenges. The biggest ones at TISCO are related to technology and staffing, while Da Nang Steel and Cevimetal struggle with undersized plants in addition to technology problems. On the other hand, SSC enjoys comparatively fewer difficulties related to technology, location and staffing. The VSC group posted a profit of some $3.5 million in fiscal 1999. Interviews by Japanese members of Industry and Trade Group(JITG) at companies indicated that SSC was the biggest winner, while TISCO edged into the black. SSC also came out ahead in estimated operating rates in 1999 and 2000, with about 70-85% for electric arc furnaces and about 65% for rolling processes. The figures at TISCO were about 50% and about 60%, respectively. Also some SSC plants are operating at almost full capacity.[21] This data reflects the relatively strong competitiveness that SSC maintains among SOEs. However, precise judgment requires the effects of protective trade measures.

2-2. Joint-venture companies with foreign capital

Foreign-capital joint ventures are engaged in long product rolling and the manufacturing of welded pipes and galvanized sheets. They are not engaged in iron making or steel making. Long product rollers use imported billets, welded pipe manufacturers use hot coils, and galvanized sheet manufacturers use cold coils, respectively.

The total rolling capacity at the five enterprises engaged in production of bars and wire rods for construction is 910,000 tons.[22] Of these, Vinausteel, Natsteel Vina and Tay Do Steel own slightly small semi-continuous rolling mills and manufacture standard quality products. This is thought to reflect a strategy to offer low prices. Vina Kyoei and VSC-POSCO, meanwhile, own continuous rolling mills of standard scale in developed countries. Detailed information on

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[19] Calculated according to numerical figures obtained through interviews at various enterprises.

[20] *Shin Nittetsu Gaido (Basic Facts about Nippon Steel)*, 2000, p.2, *Tekko Nenkan (Yearbook of the Steel Industry)*, Tekko Shinbun-sha, 1999, p.380, 474 (Japanese).

[21] Interviews at VSC and other enterprises.

[22] Production capacity is based on information provided by the VSC head office and JICA Expert Mr. Tanaka.

VSC-POSCO is not known, but it is known that Vina Kyoei manufactures high-quality products using advanced equipment and pursues a strategy of premium prices. Comparisons of Vinausteel and Vina Kyoei follow.[23]

Vinausteel uses Taiwan-made semi-continuous rolling mills. Though numerical values are not available, the use of such rolling mills reduces the burden of depreciation and interest payments, according to an interview by JITG. Its rough rolling mill is the reverse type but requires no handling of billets by tongs and control tasks are operated in a pulpit. The rolling process is automated but bundling of bars after cooling is done by manual work. Billets are imported from Russia, China, Korea, Turkey and India. With a work force of 210 persons, the company realized a production level of 114,300 tons in 1999, or 544.3 tons per capita. Vinausteel's product prices are comparable to those of other companies.

Vina Kyoei products are priced higher than those of other companies in the South due to their high quality and corporate efforts to establish a reputation for the brand. There are several reasons for the high-quality products produced by Vina Kyoei. One rests in advanced production equipment. Japanese-made continuous rolling mills are used in Vina Kyoei. Rolling and bundling works are automated and the use of vertical- and horizontal-type rolling mills results in high productivity and high quality. Another reason lies in operation. Stable operations are secured through personnel trained in Japan. And another reason is the strict selection of raw materials. Billets imported from China and India are used, while the use of materials from Russia is avoided with the purpose of maintaining high quality and stable operation. Vina Kyoei does not automate some tasks because of lower labor costs in Viet Nam. However, it has only 180 employees, less than Vinausteel that has employees. Moving rate of employees in Vina Kyoei is low due to good working conditions. Production at Vina Kyoei in 1999 totaled 229,000 tons, or 1,272.2 tons per capita.

Joint-venture companies encounter various problems in availability and costs of infrastructure. One example is unstable electric power supply and high electricity rates. Concerned about the power supply, Vina Kyoei introduced a private electric generator despite the Phu My power plant at an adjacent site. The second problem is high distribution costs. Executives of Vinausteel cited high expenses in transporting materials from Hai Phong port to its plant.

SSSC and POSVINA, major manufacturers of galvanized sheets, are SSC-joint ventures with foreign capital. Each utilizes inexpensive equipment to manufacture standard products for construction. The production line at SSSC line was imported from Malaysia, while that at POSVINA is self-manufactured. It is assumed that both companies have low burdens in depreciation and interest payments. However, due to a lack of non-oxidation furnaces, they are

[23] Interviews and plant visits for Vinausteel and Vina Kyoei.

unable to produce high-quality products for household electric appliances and automobiles. However, SSSC produces colored galvanized sheets and is making efforts to realize high added value.

In 1999, all joint-venture companies in rolling enjoyed profits and posted a total profit of $12.5 million, far exceeding the total of VSC-affiliated enterprises.[24] Their average plant-operating rate was 75.7%. Meanwhile, some manufacturers of steel pipes and galvanized sheets reported losses.

2-3 Enterprises Unaffiliated with VSC

Enterprises with no VSC affiliation can be classified into four groups. The first group is comprised of wholly foreign-capital companies, to which only Vina Ta Phong belongs. The second groups are state-owned enterprises engaged in major business outside the steel industry. The third group comprises private small and medium-size companies that produce several thousand to tens of thousands of tons of steel products a year. The fourth group is companies in the petty home industry. In this section, enterprises in the latter three categories are discussed. They have held their positions in the long products market.

Entry by companies unaffiliated with VSC was triggered by suspended imports of steel from the former Soviet Union when it collapsed in the early 1990s.[25] Driven by increasing demand for steel, many companies invested in various types of furnaces and rolling machines. Thereafter, protected trade policies, described later in this report, served to expand their production.

Raw materials, used by companies in the above three groups, are cut scrap pieces or pencil ingots. Pencil ingots are made by casting scrap melted in induction furnaces.[26] These materials are rolled into small steel products at small rolling mills. Some companies are engaged in both melting and rolling, while others participate in one or the other. Some state-owned machine manufacturers own EAFs and long-product rolling mills. Also, some enterprises are engaged in rolling of imported billets or shearing of imported coils. Some rolling mills are large, operating at a capacity greater than 10,000 tons a year, while others are very small. At one petty plant, the author witnessed workers picking up materials with pinchers for reverse rolling to produce very small hoops. According to VSC, such businesses, in the North alone, had a rolling capacity of 288,500 tons in 1999.

Of these businesses, those that are state-owned have analyzing facilities and register product quality at agencies concerned. Meanwhile, private companies and the home industry do not have

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[24] Hearing from executives of VSC and Mr. Tanaka, JICA Expert.

[25] *Viet Nam News*, September 1, 2000.

[26] The description in this paragraph is according to VSC, JICA Expert Mr. Tanaka and visits to home industry.

analyzing facilities and are less attentive to product quality. Highlighting the differences in product quality is the use of domestic scrap as raw material. Scrap is refined to clean steel in an EAF, but in an induction furnace, ingredients are not adjusted. The result is that steel products made mainly from cut scrap and pencil ingots tends to be poor in quality. According to VSC, of the 1.4 million tons of steel products used for domestic construction in 1999, 30% was substandard.[27] The poor durability and rusts of these substandard products also elicits concerns about the safety of construction works and buildings.

Smaller companies and the home industry in the Vietnamese steel industry have remained in business by offering low-priced products to small users. However, the technology in steelmaking and long-product rolling make these processes suited for economies of scale. As large mills increase, production and distribution systems are improved, products manufactured by small and petty companies will gradually lose competitiveness.

3. Distribution of steel products

Abolishment of the government's monopoly in the steel business paved the way for entry by many distributors. However, foreign-affiliated trading companies may not engage in international trade, although they may open local offices.[28]

Given the country's centrally planned economy in the past, it is assumed that long-standing business ties continue between state-owned enterprises and major steel users. However, it is worth noting that under Doi Moi policy many small companies can be found engaged in business, and little shops marketing steel products line the streets in the cities of Ha Noi and Ho Chi Minh City.

Ex-factory is a standard practice in which customers hire a transport company to move products from plants' warehouses.

There are eight VSC-affiliated metal companies that do business in domestically produced as well as imported steel materials, while the ratio of imports has been increasing recently. In the central region, Cevimetal controls 50-75% of the market, dominating all billets to relatively large factories. In the south, HCM City Metal holds a 15% market share and a 70% share in the flat-product segment.[29] VSC-affiliated metal companies still have a significant role in product distribution.

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[27] *Viet Nam News*, September 1, 2000.

[28] Trade Agreement Administration Division, the Ministry of International Trade and Industry ed., *2000 Ban Hukosei Boeki Hokokusho (1999 Report on the WTO Consistency of Trade Policy by Major Trading Partners)*, Tsusyo Sangyo Chosa-kai, 2000, p.453 (Japanese).

[29] Interviews at metal companies.

However, we observed inconsistent practices among the metal companies.[30] For example, they prefer not to hold stock of imported billets in order to avoid risk, and therefore they cannot balance supply and demand of billet. Such practice is thought to be one reason behind sudden price increases for billets when the market is brisk. On the other hand, the metal companies remain as agencies of planned government policies to stabilize the market. They sell products in stock even if the sales yield no profit when such a move will help stabilize the market.

According to several executives of metal companies, the most serious problem facing corporate management are 30-day credit given to customers that frequently result in payment delays. Loose credit between companies, a common phenomenon in the transitional economies, impairs financial discipline and masks true corporate performance.

The widespread sales of substandard steel products reflect problems in the country's steel market. Among the reasons attributed to such sales is the no-availability of standard products to promptly meet customer demand. VSC admits that products of home industry satisfy demand for low prices as well as varying types and quantities of materials. Also, both producers and customers make their deals based on price rather than quality. Some companies have been found producing substandard products with pirated trademarks of SOEs, while customers, unfamiliar with product quality, select their purchases based on price. And unsatisfactory storage conditions have been found at some steel trading companies.[31]

Currently, the government does not control activities of private companies and the home industry. From 1999, however, it began requiring companies making steel products for construction to comply with product-quality standards, obligating them to register product quality and attach government-issued labels to their products. Still, VSC forecasts a further increase in sales of substandard steel materials.[32]

As the measure to cope with fragile distribution mechanisms for steel products, joint-venture companies are seeking to build long-term relationships with reliable distributors. Vina Kyoei takes designated distributor system and aims to establish a solid brand image, while assisting the management of the distributors. Thanks to such efforts, some customers specifically demand Vina Kyoei's products. Vina Kyoei is aiming to become the company like "Honda" which has established itself as a leading brand in Viet Nam's motorcycle industry.[33]

4. Summary

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[30] Interviews at metal companies.

[31] Visit to inventory yard of a metal company.

[32] *Viet Nam News*, September 1, 2000.

[33] Interview at Vina Kyoei.

An overview of production and distribution in the Vietnamese steel industry reveals a flow of goods that is narrow and uneven with small-scale imbalanced facilities. Also, stagnation is seen in the full process from purchase of raw materials to sales of products. The size of business in each process is small. In short, mass production system is not established. The situation is serious for a industry in need of economies of scale. A close look at the industry, meanwhile, shows conditions that are not uniform. For example, technological compositions vary considerably among SOEs, and some of joint -venture companies have excellent mills. Concrete conditions such as these should be taken into consideration in evaluating and predicting the industry's survivability and future development.

III. Protectionism and Nurturing Policies for the Steel Industry

1. Historical and structural restrictions

Current states that the various types of small equipment are flooding, and that billets and flat products are in short supply, are in part due to historical and structural restrictions. The reasons behind the selection of TISCO's technology and location as well as the challenges it now faces in operation can be understood only in context of the country's economic development under the Cold War and damage of aerial bombardment. And SOEs' overstaffing is a negative legacy from the nation's past as a centrally planned economy. In short, difficulties at SOEs reflect the historical condition before the Doi Moi era. Also, it is important to understand the impact of the Asian financial crisis. Reform efforts were slowed and plans for investments in new equipment in the 1990s were never realized due to difficulty in raising funds.

Although these conditions should be taken into account, the role of the government's protectionist policies and corporate behavior too should be pointed out. These will be discussed in the following sections.

2. Relationship between policies in trade and competition

2-1 Protection of domestic long product market

The Vietnamese government is currently protecting the domestic steel industry through import restrictions and tariff rates of 30 to 40% on seven steel items, including bars of a certain size, wire rods, small angles, galvanized welded pipes and galvanized sheets, all of which are produced domestically. Tariff rates for hot coils and cold rolled sheets, which are not manufactured domestically, are 0-3%, and that for billets, required by many long product mills, stands at 3%(August 2000).

Let us look at how competition in long products was fueled or not fueled by government policies in trade and competition. Imports of long products for construction have been prohibited

since 1997, when Russian-made imported products were offered at extremely low prices. Following the collapse of the former Soviet Union, the Russian steel industry saw demand plummet. To prevent massive unemployment, the steel industry has continued operation and exported large quantities of product in the latter half of 1990s. Stricken by chaos and unable to fulfill its debts, Russian industry engaged in barter trade domestically and, exported products with no profits for cash and foreign currency. Ukraine faced a similar situation.[34] Quality, packaging and delivery of steel products from the two countries was rated lowest among the world. Actions by them caused trade friction around the world. The steel industry was hit with the largest number of dumping investigations of all industries.[35] Fearing that cheap imports would hurt its domestic industry, the Vietnamese government understandably adopted protective trade steps.

However, the issue was complicated by the fact that these measures of import prohibition did not spell out a time frame. Following Viet Nam's accession in 1995 to ASEAN Free Trade Area (AFTA) and the Common Effective Preferential Tariff (CEPT), the Vietnamese government is required to cut tax barriers on various products, including steel, by 2006. However, relationship between import prohibition and time limit for CEPT is not clearly explained even in 2000. Such policies gave incentives to enterprises to expand their production neglecting international competition. As there were different behavior patterns among business sectors, the author explores each of them.

2-2 Excessive growth of small and medium-size private companies and home industry

The domestic market for long products was on one hand protected from international competition due to the government's policies and on the other hand was liberalized to new entrants under Doi Moi reform. Private companies did not have the financial and technological capabilities for investment in rolling mills that met minimum efficient scale. They were small private companies and petty home industry that were motivated by high prices to increase investment and production. The result was an oversupply and flood of substandard products. Neither protectionism itself nor profit-seeking action itself can be blamed for that result. Rather, to be blamed is inconsistency in policies that invited opportunistic behavior in pursuit of short-term profits and led to the expansion of companies with no long-term possibilities. A similar experience was seen in markets for galvanized sheets and welded pipes.

2-3. Investment policies of state-owned enterprises

Da Nang Steel and Cevimetal set up their mills in 1992 and 1996, respectively. As mentioned,

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[34] U.S. Department of Commerce, *Global Steel Trade: Structural Problems and Future Solutions*, July 2000, pp. 40-64. (http:www.ita.doc.gov/media /steelreport726.htm). *Geppo (Monthly Report)*, Japan Iron & Steel Exporters' Association, November 1999, *Joho (Information)*, Japan Iron & Steel Exporters' Association, April 2000 (Japanese).

[35] *Ibid*.

employees are found engaging in hazardous work at extremely small facilities. Though details concerning investment decisions are not known, it can be safely assumed that investments were made based on the view that mills could be set up in the central region to satisfy local demand rather than from a view of international competition.

The division of labor between two enterprises is also open to question. Da Nang Steel had two very small EAF units, with a capacity of 1.5 tons/charge and one wire rod mill. Cevimetal, meanwhile, was started as a trading enterprise. If a bar rolling mill was to be constructed, it would have been desirable to integrate it with Da Nang Steel's EAF mills. Combining a steelmaking plant and two types of rolling mills could have created economies of scale. In reality, however, Cevimetal constructed its rolling plant at different site from Da Nang Steel's. This decision, it is said, was made to smooth the reassignment of surplus employees at Cevimetal.[36] As a result two plants are located separately and managed independently. Though Da Nang Steel plans to expand its equipment, it cannot solve a problem of a small-scale operation.[37]

2-4. Incentives for foreign capital investment

The Vietnamese government offers various incentive schemes to attract foreign capital, including tax incentives in the steel industry. Aiming to expand in the industry, VSC is participating in joint ventures with foreign capital. VSC reportedly stepped forward to propose to the government that tariffs on billets, the material for long-product rolling, be reduced from 5% to 3%. Competition between joint-venture companies and state-owned enterprises in the South has disciplined both sectors to reduce costs.

However, inconsistencies are observed in the incentive policies for foreign capital. Many executives point to the high costs for electricity and harbor loading and unloading that foreign-affiliated companies pay. While domestic enterprises pay a loading/unloading rate of $1.3 per ton at Hai Phong harbor, joint ventures pay $4.5 dollars/ton.[38] This is a heavy burden on joint-venture companies located in Hai Phong.

Joint-venture companies also face problems stemming from policies combining international trade barrier and domestic free market entry. A number of joint-venture companies began production between 1995 and 1997. It is believed that protective measures raised their operating rates and facilitated startup of full-scale operations. Production at joint-venture companies rose from 353,600 tons in 1996 to 484,500 tons in 1997, surpassing that at state-owned enterprises. (Table 5)

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[36] Interviews at VSC-affiliated enterprises.

[37] Interview at Da Nang Steel.

[38] *Cold Rolling F/S Report,* VIII-5-15.

Thereafter, the number of venture companies that were licensed and set up rolling mills grew, while oversupply was appearing. In 2000, rolling capacity reached 2.6 million tons, 500,000 tons of which was from new plants built by foreign-affiliated companies during 2000. The mills constructed by foreign affiliates have become the factor of oversupply. VSC predicts that rolling capacity in 2001 will exceed 3 million tons.[39] However, it predicts that consumption of long products will not hit 3 million tons until 2010. Moreover, it is predicted that consumption of long products in 2006, the limit for CEPT, will total 2.29 million tons, of which about 200,000 tons are large section steel and other products that are not produced in Viet Nam and thus imported. Accordingly, the market size for domestic long-product rolling enterprises is limited to 2.09 million tons. Continued over-capacity until 2006 may hamper development of the Vietnamese steel industry. The larger the excess capacity means the larger effects on regional economy and employment when some are weeded out.

3. Competitiveness of existing enterprises

How have import prohibitions and liberalization affected Viet Nam's steel industry's competitiveness? Can existing EAF mills and long-product rolling mills survive if tariffs on steel materials are cut to below 5 percent by 2006?

A critical matter is the drop in prices of bars and wire rods each year due to oversupply, regardless of import prohibition. Domestic prices in 2000 were around $275-288, down from $341 in 1997. According to VSC, the price is 10-15% higher than Russia's export prices but only about 5% higher than export prices from Japan and South Korea.[40] Thus it is expected that effects of protectionist measures are being reduced for good or bad.

The enterprises that can post profits at current price levels are joint-ventures of long-product rolling and SSC. Joint-venture companies are seen capable of maintaining business performance based on their relatively advanced technology and marketing abilities. Also, it appears that SSC rationalization efforts, corresponding with market trends, are seeing positive results. SSC recently saw improvements in its scrap rate and consumption rates of electricity and electrodes. It is assumed that other SOEs are less competitive than SSC due to production problems and excessive work forces.

Assuming that Japan and South Korea prices can be considered to international prices and that Vietnamese enterprises can attain the same pace of rationalization as in the two countries, joint-venture companies and SSC could maintain international competitiveness with a 5% tariff rate.

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[39] South East Asian Iron and Steel Institute (SEAISI), *Newsletter*, January 16, 2001. http:www.seaisi.org/news-detail.asp?ID=419&y=2001&m=2 (accessed on February 13, 2001)

[40] *Viet Nam News*, October 25, 2000. Findings from interviews at enterprises agree with this statement.

However, other SOEs will require large-scale restructuring. Also, the lives of most companies will be threatened if domestic market is affected by low-priced products from Russia or lasting oversupply. Some managers pessimistically predicted that Russian and Taiwanese companies will offer around $220/ton.

SOEs are seeking production expansion. TISCO and SSC management hold the view that operating expenses can be reduced through enhanced in-house production of billets since domestically produced billets are cheaper than imported ones.[41] On the other hand, management of joint-venture companies believes that EAF construction is unprofitable in view of unstable electricity supplies and high rates. Interviews by JITG indicate that abolishment of the dual price system of electricity would spur incentive among joint-venture companies to install EAFs, with the same electricity rates as the current rates for SOEs made available.

Though somewhat rough, the above analysis could serve as a warning against overly pessimistic or optimistic views. In addition, manufacturers of galvanized sheets and welded pipes, sectors in which even some joint-venture companies are recording deficits, are facing even more difficult conditions. Separate analyses are necessary for these sectors. In short, a general discussion on the merits and demerits of protection and liberalization serves no purpose. Rather, a discussion based on the concrete conditions in the steel industry is necessary.

4. Problems and prospects of protectionist and nurturing policies

4-1 Problems of import prohibition policies

Current industrial policies concerning competition in the steel industry are aimed at nurturing the industry through initiatives of healthy companies, while protecting them from excessive price falls. Their positive effects can be seen in the startup of joint ventures and rationalization at SSC. However, unexpected developments such as expansion by businesses with no long-term possibility also were seen.

The reason for this is attributed not to protectionism itself but rather the form it took --a uniform prohibition of imports. It was adopted presumably because the country had not prepared trade laws. Even in international economic integration, protective measures may be unavoidable against some unfair trade practices or serious damage to domestic industries. However, it is necessary that such measures must specify targets and periods as well as methods.

Toward this end, establishment of trade laws is necessary. Professor Kimura and Professor Ohno analyze this issue in their papers. It should be noted here that it is important to distinguish protective actions designed to nurture an industry from those as a temporary means adopted to protect an industry from a huge damage. It is appropriate for the former to continue over a specific

[41] Interviews at TISCO and SSC.

period while the latter must be discontinued when the threat of great damage has abated.

4-2 Two directions for policy change

Current policies regarding import prohibitions no longer serve definite purposes, lead to overproduction and counter the goals of CEPT. They should be remedied. Such remedies can take two directions.

First, measures to restrict opportunistic entry should be done by forcing strict quality-control systems and controlling entry, the latter now being attempted by the government. All projects to produce long-products require approval from the prime minister as of January 2001.[42] However, such policies can have a limited effect. Though a quality-control system is essential for a sound market, it will take time for the Vietnamese industry to fully adopt and implement the system. Also, while restricting market entry protects existing healthy companies from failing together due to overproduction, it also protects existing low-efficiency companies. In particular, the effect cannot be ignored in the North where TISCO is situated. In addition, according to JITG's interviews, neither VSC-affiliated enterprises nor joint-venture companies have rationalization plans preparing for reductions of tariffs in 2006. And it is easily assumed that small and petty businesses do not either. If entry restrictions are implemented and protection continues, many businesses will lose their incentive to prepare for international competition.

Accordingly, policies to reduce trade barriers are necessary. This is the second direction. Compared to East Asian countries that industrialized in the past, however, Viet Nam is under far greater pressure for liberalization. In addition, the Vietnamese steel industry's foundation in technology is weak. Therefore, the extent of lifting protection and the relevant schedule for the country may be different from full compliance with the CEPT deadline. In such a case, negotiation with AFTA member states will be necessitated.

Even so, a large reduction cannot be avoided and some schedules targeting the year 2006 are necessary. The point is to announce publicly on policies with time frames. Namely, the Sun Set System to announce the extent and timing to reduce protection should be adopted. A vague approach by the government and VSC only encourages enterprises to delay preparation for rationalization plans. Notification to local enterprises on the extent that protection is reduced can change the situations. Opportunistic entry will be controlled without any monitoring, and enterprises will be forced to formulate rationalization plans. Some VSC-affiliated companies may find that a challenge, but sooner restructuring will return greater profits later, with smaller sacrifice.

Under current conditions, a combination of these measures may be realistic. However, progress has been made only in restricting entry, leading negative secondary effects. Prompt action

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[42] *Viet Nam News*, October 25, 2000. SEAISI, *Newsletter*, January 16, 2001.

by the government and VSC for the reduction of trade barriers is expected.

IV. Conclusion of Part 1

As the conclusion of Part 1, we would like to call attention again to the challenges the Vietnamese steel industry is facing.

When asked about the problems in the Vietnamese steel industry, many executives and managers in JITG's interviews cited old equipment and a shortage of funds. It may be true that historical and structural restrictions have made access to technology and funds difficult. However, as analysis of this report shows, these are not the only source of the problems facing the industry. Many rest in industry-related policies and institutions as well as the capabilities of the government and enterprises.

On the other hand, economists from advanced countries are prone to arguing that the flaws in a centrally planned economy and ill effects of trade protectionism cause Viet Nam's problems. In fact, Viet Nam is basically moving toward market economy and participation in international economic integration. A policy that does not regard these will fail. However, it is not true that the farther privatization and liberalization are implemented, the better results are. Viet Nam must strive to carefully achieve a balance between a plan and market system as well as protected and free trade. Minor failure in balance could lead to a failure in coordination.

Future investment plans should take into account these factors. If indeed old equipment and shortage of funds are the major source of the problems, then such problems can be overcome when better technologies and funds become available. If the problems are rooted in vestiges of centralized plans and protective measures, privatization and laissez-faire policy will resolve the problems. However, both suppositions are too simple. Concrete measures should be formulated, taking into account the factors that have determined the progress of the steel industry.

Part 1 analyzed problems mainly in existing steel enterprises and the long-product market. In Part 2, the author shall discuss the master plan for developing the Vietnamese steel industry through measures such as substituting increasing imports of billets and flat products with domestic products.

Part 2 Master Plan for the Vietnamese Steel Industry

I. Investment Plan under International Economic Integration

1. The steel industry in Viet Nam's industrialization strategy

VSC has submitted a master plan centered on investments up to 2010 to the government. The process of revisions continues while the plan still lacks details on many points. The author will analyze its contents, including planned numerical figures submitted in October 2000, supplemented by his own assumptions.

Before discussing the plan, it is helpful to look at the importance of the steel industry's development as part of the nation's overall industrial development.

Economists who study market economy hold diverse opinions about industrial policies. However, opinions about policies in a market economy cannot be directly applied to Viet Nam since SOEs still occupy a considerable share in the country's national economy. And in Viet Nam, overall privatization will not be achieved soon. Toward industry development in the foreseeable future, the government will prepare an overall plan and commit resource distribution. For the present, it is necessary for the study to assume that the government will pursue industrial development policies, while also keeping watching the growth of privatization and initiatives at private companies.

One problem plaguing Vietnam's industrial development is the lack of an overall plan by the government despite its stated commitment to such development. There has been little study of individual industries or related policy-making. This situation, which Professor Ohno has repeatedly pointed out, should be remedied quickly.

Now there are no reasons for the Vietnamese government to give special favors to the steel industry. Presently it has no policy of extending favorable treatment to the capital goods industry. Such treatment is not recommended in the Joint Viet Nam-Japan Research, either.[43] On the other hand, there is no reason to treat the steel industry with indifference. As seen in Part 1, despite encountering problems along the way, Viet Nam has some experience of operation in the steel industry. Its competitiveness is weak but not desperate. And there are reasons to nurture the steel industry from a viewpoint of the effects on the balance of trade. In addition, the master plan for the steel industry reflects an understanding of the industry's realities and is the most comprehensive

[43] Shigeru Ishikawa, Six Years of JVJR and the 7th Five-Year Plan, *Viet Nam-Japan Joint Research Project: Workshop on Economic Development Policy*, Japan International Cooperation Agency and Ministry of Planning and Investment, The Socialist Republic of Viet Nam, Ha Noi, 8-9 December, 2000, p.4

plan of any for capital-intensive industries in Viet Nam, thanks in part to assistance from JICA experts. Viet Nam is urged to continue developing its planning and management capabilities.

Although the steel industry should not be supported at the expense of other industries, it should be supported moderately like other industries.

2. Issues for discussion

The VSC master plan outlines three scenarios based on varying timetables for the construction of integrated steelworks. The scenario with iron-making and steel-making operations of the integrated steelworks scheduled to begin in 2010 is known as the "high case," in 2012 as the "base case" and thereafter as the "low case." Meeting the high case with the 2010 target is extremely difficult from the viewpoint of funding and technology as well as the government's view that does not favor the industry's development as the top priority. Thus the author will focus on the base and low cases in this study.

Tables 7 and 8 show planned construction in the base and low cases. Tables 9 and 10 predict trends in demand, production and imports. Figures 4, 5 and 6 indicate flow of materials in 2005, 2010, and 2015 respectively, according to the base case. Figures 7 and 8 show flow of materials in 2005 and 2010, respectively, according to the low case. The intention in these two scenarios is to partially substitute imports, assuming no change in exports. VSC has no aggressive export strategy other than export to Laos and Cambodia.[44] The scenarios do not specify who will run new factories, while VSC-affiliated enterprises or joint ventures between VSC and foreign companies are assumed.

[44] *Viet Nam News*,October 25, 2000

Table 7. Investment Plan for the Vietnamese Steel Industry: Base Case(2000-2015)

Project	products	capacity (1000t/y)	start year	year of operation in full capacity
1. Modify existing plants	Billet	500	2003	2003
	Long Product	700	2003	2003
2. TISCO (second stage)	Billet	300	2005	2006
	Long Product	250	2006	2006
3. Phu My Steel Plant	Billet	500	2004	2005
	Long Product	300	2005	2006
4. Cold Rolling Mill(CRM)	Cold Rolled Coil	450	2003	2007
5. Billet Center in North	Billet	500	2005	2005
6. Special Steel Plant	Special Steel	100	2008	2012
7. DRI Plant	Direct Reduction Iron	1200	2006	2008
8. Hot Strip Mill	Hot Rolled Coil	1000	2005	2007
9. Thach Khe mine	Iron Ore	10000	2012	2015
10. Integrated Steel works				
HSM	Hot Rolled Coil	3000	2009	2010
CRM	Cold Rolled Coil	1000	2010	2015
BF, BOF, Slab CC	Slab	4500	2012	2015

Source: Edited by Authors from the material of VSC.

Table 8. Investment Plan for the Vietnamese Steel Industry: Low Case(2000-2010)

Project	products	capacity (1000t/y)	start year	year of operation in full capacity
1. Modify existing plants	Billet	500	2003	2003
	Long product	700	2003	2003
2. TISCO (2nd stage)	Billet	300	2005	2006
	Long product	250	2006	2006
3. Phu My Steel plant	Billet	500	2004	2005
	Long product	300	2005	2006
4. Cold Rolling Mill	Colled Rolled Coil	450	2003	2007
5. Hot Strip Mill Based on EAF				
1st Step (slab imported)	Hot Rolled Coil	1000	2006	2007
2nd Step (slab produced)	Slab	1100	2009	2010
6. Preparation for ISW	none till 2010			

Source: Author edited from the material of VSC.

Table 9. Steel Balance Projection (Based on VSC Plan. Base case)
(Unit: 1,000 tons)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Final domestic consumption	2500	2729	2982	3259	3564	3900	4247	4627	5043	5500	6000	6531	7112	7746	8440	9198
Long product	1500	1610	1729	1856	1993	2140	2290	2450	2621	2804	3000	3209	3432	3670	3925	4198
Flat product	1000	1119	1252	1402	1571	1760	1957	2177	2422	2696	3000	3323	3680	4076	4514	5000
Hot rolled product	625	689	760	839	925	1020	1122	1233	1356	1491	1640	1812	2002	2212	2444	2700
Cold rolled product	375	430	492	564	646	740	836	944	1066	1204	1360	1511	1678	1864	2071	2300
Domestic production (plan)																
Long product	1400	1494	1595	1703	1817	1940	2407	2454	2502	2550	2600	2775	2961	3161	3373	3600
Cold rolled product				200	250	250	400	450	450	450	1050	1050	1050	1050	1050	1450
Hot rolled product						600	800	1000	1000	2000	2500	2500	2500	2500	2500	4000
Billet	295	295	295	500	800	1700	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Scrap and other metallic sources for EAF	343	343	343	416	433	650	1550	1750	1950	1950	1950	1950	1950	1950	1950	1950
Crude steel/slab (incl. NISW)													2000	2000	2000	4500
Input to domestic production																
Billet	1540	1624	1734	1851	1976	2109	2616	2667	2719	2772	2826	3016	3219	3435	3666	3913
Yield	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920
Hot rolled product				213	266	266	426	479	479	479	1117	1117	1117	1117	1117	1543
Yield	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
Scrap and other metallic sources	343	343	343	581	930	1977	2093	2093	2093	2093	2093	2093	2093	2093	2093	2093
Yield	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860
Crude steel/slab						638	851	1064	1064	2128	2660	2660	2660	2660	2660	4255
Yield						0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
Gross domestic use																
Long product	1500	1610	1729	1856	1993	2140	2290	2450	2621	2804	3000	3209	3432	3670	3925	4198
Cold rolled product	375	430	492	564	646	740	836	944	1066	1204	1360	1511	1678	1864	2071	2300
Hot rolled product	625	689	760	1051	1191	1286	1547	1712	1835	1970	2757	2929	3119	3329	3561	4243
Billet	1540	1624	1734	1851	1976	2109	2616	2667	2719	2772	2826	3016	3219	3435	3666	3913
Scrap and other metallic sources	343	343	343	581	930	1977	2093	2093	2093	2093	2093	2093	2093	2093	2093	2093
Crude steel/slab	0	0	0	0	0	638	851	1064	1064	2128	2660	2660	2660	2660	2660	4255
Imports																
Long product	100	116	134	154	176	200	-117	-4	119	254	400	434	470	509	552	598
Cold rolled product	375	430	492	364	396	490	436	494	616	754	310	461	628	814	1021	850
Hot rolled product	625	689	760	1051	1191	686	747	712	835	-30	257	429	619	829	1061	243
Billet	1245	1329	1439	1351	1176	409	816	867	919	972	1026	1216	1419	1635	1866	2113
Scrap and other metallic sources	0	0	0	165	498	1327	543	343	143	143	143	143	143	143	143	143
Crude steel/slab	0	0	0	0	0	638	851	1064	1064	2128	2660	2660	660	660	660	-245
Import ratio (%)																
Long product	6.7	7.2	7.7	8.3	8.8	9.3	-5.1	-0.2	4.5	9.0	13.3	13.5	13.7	13.9	14.1	14.2
Cold rolled product	100.0	100.0	100.0	64.5	61.3	66.2	52.1	52.3	57.8	62.6	22.8	30.5	37.4	43.7	49.3	37.0
Hot rolled product	100.0	100.0	100.0	100.0	100.0	53.3	48.3	41.6	45.5	-1.5	9.3	14.6	19.8	24.9	29.8	5.7
Billet	80.8	81.8	83.0	73.0	59.5	19.4	31.2	32.5	33.8	35.1	36.3	40.3	44.1	47.6	50.9	54.0
Scrap and other metallic sources	0.0	0.0	0.0	28.4	53.5	67.1	25.9	16.4	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Crude steel/slab							100.0	100.0	100.0	100.0	100.0	100.0	24.8	24.8	24.8	-5.7
GDP growth (%)	5-6	7.5	7.5	7.5	7.5	7.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Industrial production growth (%)	9-10	8-9	8-9	8-9	8-9	8-9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Steel consumption (%)	5.1	9.2	9.2	9.3	9.4	9.4	8.9	8.9	9.0	9.0	9.1	8.9	8.9	8.9	9.0	9.0

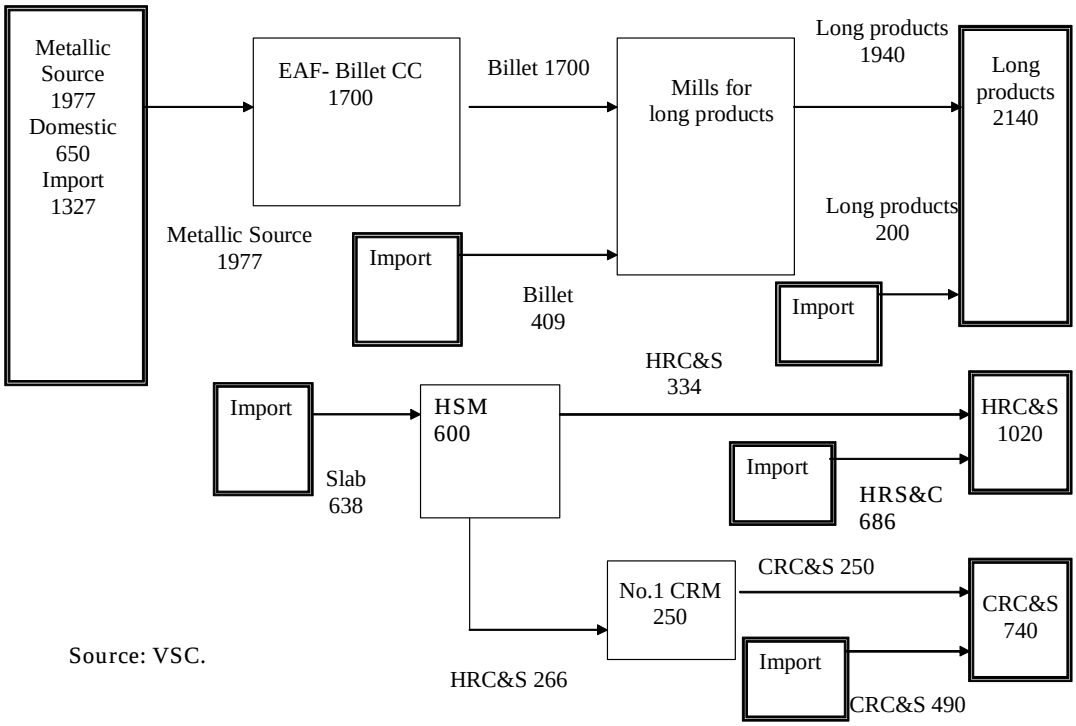
Source: Composed by Nobuyoshi Tanaka, Kenichi Ohno and the Author.

Table 10. Steel Balance Projection (Based on VSC Plan. Low case)
(Unit: 1,000 tons)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Final domestic consumption	2500	2729	2982	3259	3564	3900	4247	4627	5043	5500	6000
Long product	1500	1610	1729	1856	1993	2140	2290	2450	2621	2804	3000
Flat product	1000	1119	1252	1402	1571	1760	1957	2177	2422	2696	3000
Hot rolled product	625	689	760	839	925	1020	1122	1233	1356	1491	1640
Cold rolled product	375	430	492	564	646	740	836	944	1066	1204	1360
Domestic production (plan)											
Long product	1400	1494	1595	1703	1817	1940	2407	2454	2502	2550	2600
Cold rolled product				200	250	250	400	450	450	450	450
Hot rolled product							800	1000	1000	1000	1000
Billet	295	295	295	500	800	1200	1300	1300	1300	1300	1300
Scrap and other metallic sources for EAF	343	343	343	416	433	650	750	750	750	750	750
Crude steel/slab (incl. NISW)										1000	1100
Input to domestic production											
Billet	1540	1624	1734	1851	1976	2109	2616	2667	2719	2772	2826
Yield	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920
Hot rolled product				213	266	266	426	479	479	479	479
Yield	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
Scrap and other metallic sources	343	343	343	581	930	1395	1512	1512	1512	2675	2791
Yield	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860	0.860
Crude steel/slab						0	851	1064	1064	1064	1064
Yield						0.940	0.940	0.940	0.940	0.940	0.940
Gross domestic use											
Long product	1500	1610	1729	1856	1993	2140	2290	2450	2621	2804	3000
Cold rolled product	375	430	492	564	646	740	836	944	1066	1204	1360
Hot rolled product	625	689	760	1051	1191	1286	1547	1712	1835	1970	2119
Billet	1540	1624	1734	1851	1976	2109	2616	2667	2719	2772	2826
Scrap and other metallic sources	343	343	343	581	930	1395	1512	1512	1512	2675	2791
Crude steel/slab	0	0	0	0	0	0	851	1064	1064	1064	1064
Imports											
Long product	100	116	134	154	176	200	-117	-4	119	254	400
Cold rolled product	375	430	492	364	396	490	436	494	616	754	910
Hot rolled product	625	689	760	1051	1191	1286	747	712	835	970	1119
Billet	1245	1329	1439	1351	1176	909	1316	1367	1419	1472	1526
Scrap and other metallic sources	0	0	0	165	498	745	762	762	762	1925	2041
Crude steel/slab	0	0	0	0	0	0	851	1064	1064	64	-36
Import ratio (%)											
Long product	6.7	7.2	7.7	8.3	8.8	9.3	-5.1	-0.2	4.5	9.0	13.3
Cold rolled product	100.0	100.0	100.0	64.5	61.3	66.2	52.1	52.3	57.8	62.6	66.9
Hot rolled product	100.0	100.0	100.0	100.0	100.0	100.0	48.3	41.6	45.5	49.2	52.8
Billet	80.8	81.8	83.0	73.0	59.5	43.1	50.3	51.3	52.2	53.1	54.0
Scrap and other metallic sources	0.0	0.0	0.0	28.4	53.5	53.4	50.4	50.4	50.4	72.0	73.1
Crude steel/slab							100.0	100.0	100.0	6.0	-3.4
GDP growth (%)	5-6	7.5	7.5	7.5	7.5	7.5	6.5	6.5	6.5	6.5	6.5
Industrial production growth (%)	9-10	8-9	8-9	8-9	8-9	8-9	9.0	9.0	9.0	9.0	9.0
Steel consumption (%)	5.1	9.2	9.2	9.3	9.4	9.4	8.9	8.9	9.0	9.0	9.1

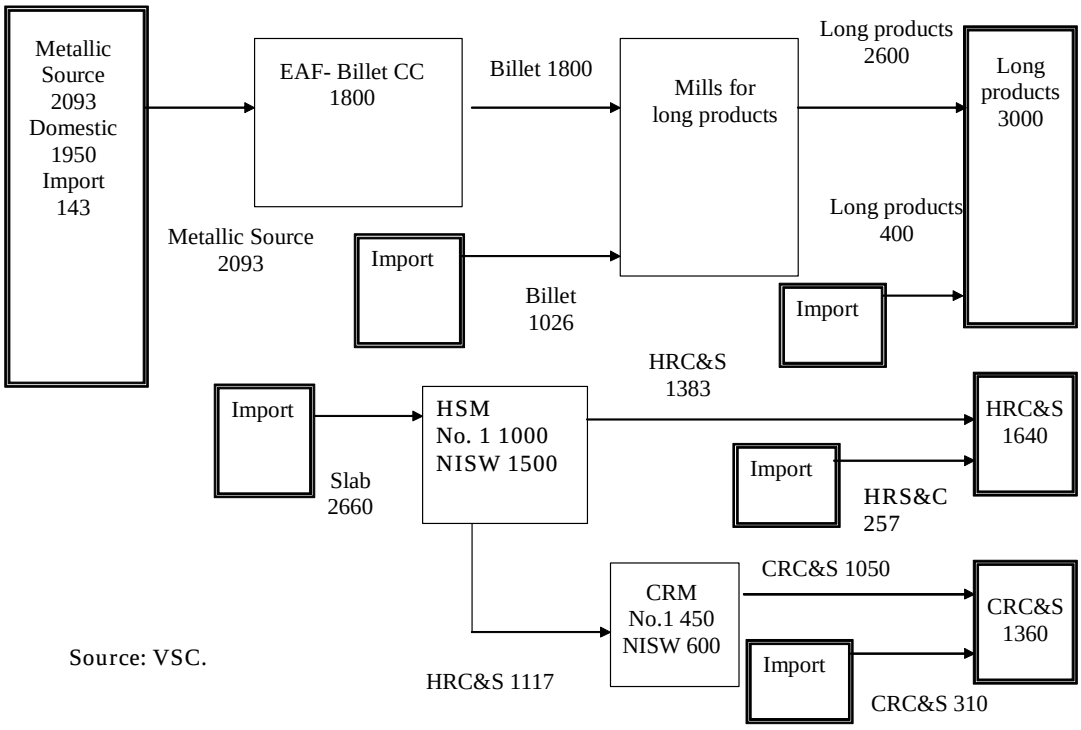
Source: Composed by Nobuyoshi Tanaka, Kenichi Ohno and the Author.

Figure 4. Material Flow of the Vietnamese Steel Industry in 2005 Based on the VSC Master Plan (Base Case) (1000t)



Source: VSC.

Figure 5. Material Flow of the Vietnamese Steel Industry in 2010 Based on the VSC Master Plan (Base Case) (1000t)



Source: VSC.

Figure 6. Material Flow of the Vietnamese Steel Industry in 2015 Based on the VSC Master Plan (Base Case) (1000t)

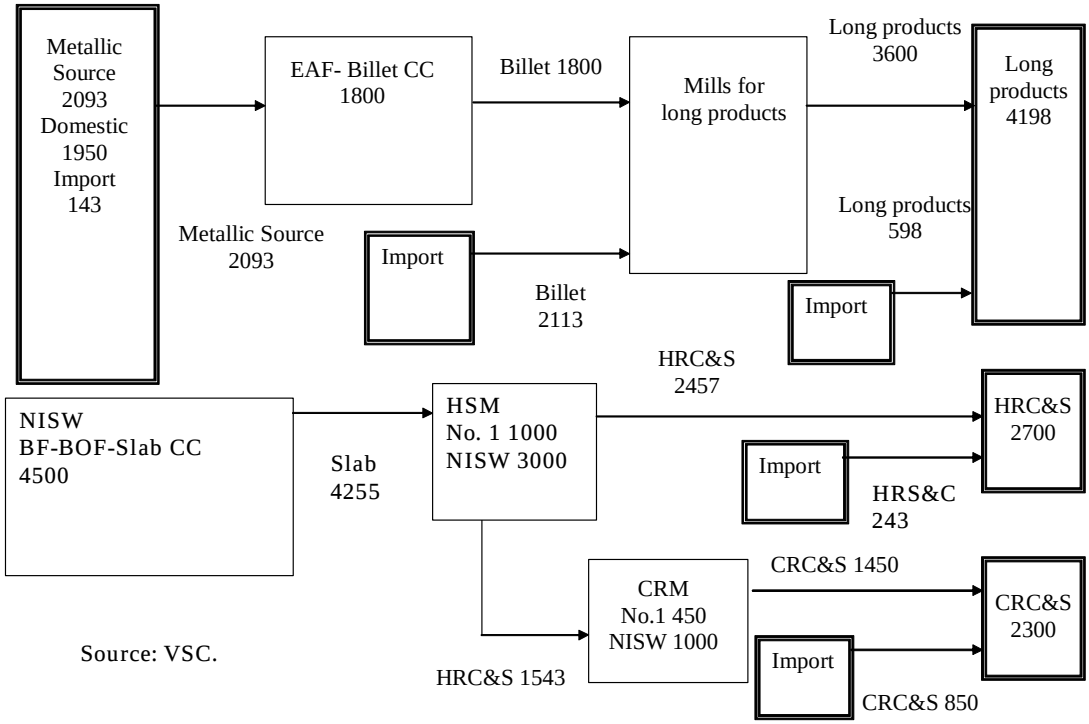


Figure 7. Material Flow of the Vietnamese Steel Industry in 2005 Based on the VSC Master Plan (Low Case) (1000t)

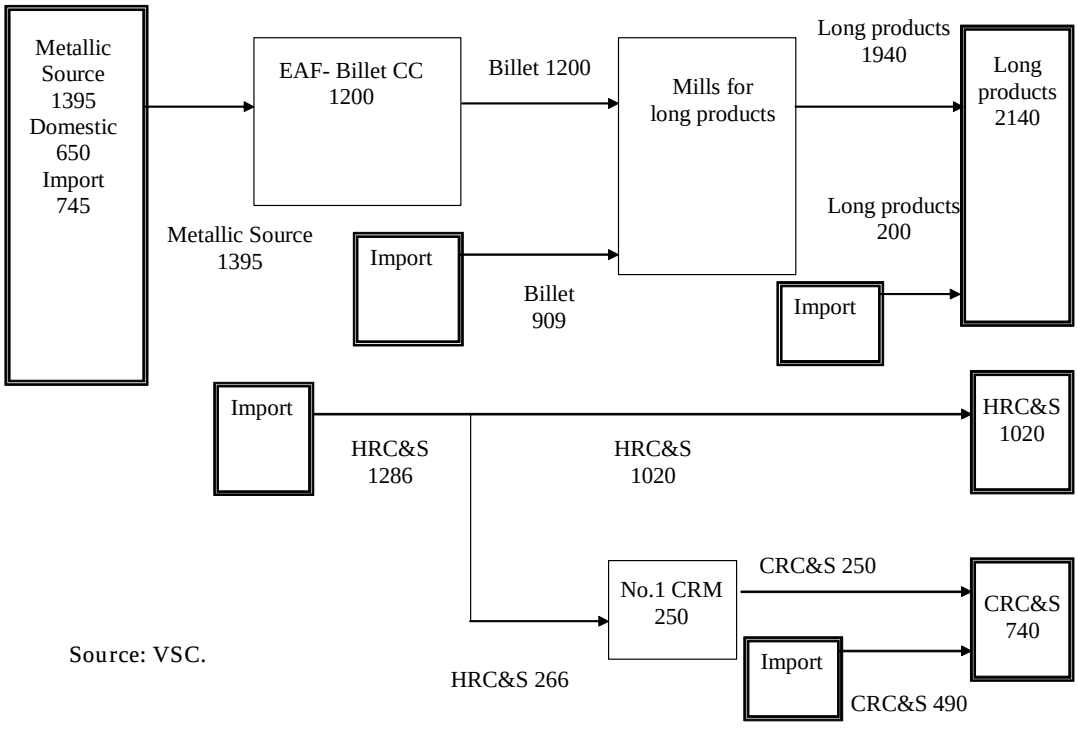
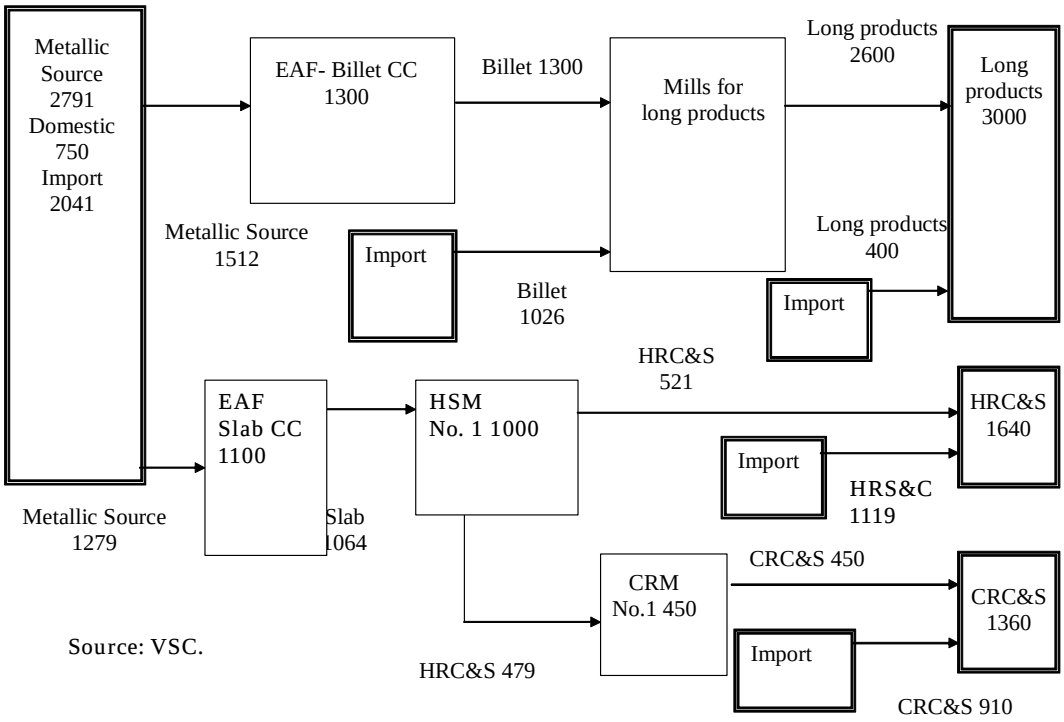


Figure 8. Material Flow of the Vietnamese Steel Industry in 2010 Based on the VSC Master Plan (Low Case) (1000t)



Source: VSC.

The JITG held talks on investment projects with Vietnamese members, VSC managers, JICA experts, an F/S team on cold rolling and researchers at National Economics University (NEU) and Polytechnic University. The following four issues have been discussed at these meetings:

The foremost issue is the schedule for construction of an integrated steelworks. The view of some Vietnamese members is that it should be according to the high or base case, while some Vietnamese members and most of Japanese members believe that the low case is suitable.

The second issue is utilization of mineral resources in Viet Nam. Vietnamese members believe that the Thach Khe mine should be developed to utilize its iron ore. Japanese members believe that the use of the iron ore should be limited to supplementary use. However, both sides agree that a thorough study of the mine is necessary.

The third issue concerns the amount of capital investment for TISCO. There are various views among the Vietnamese members. The Japanese view is that investment should be kept to a minimum.

The fourth issue concerns policies on trade and competition. There is a consensus among all members that the country should take steps toward trade liberalization under international economic integration. However, both sides have not exchanged views on specific policies.

3. Analytical viewpoints

The author does not have the capacity to comment on all of these matters. In this section, he will comment mainly on technology policies. For financial issues and trade policies, please refer to papers by Professors Ohno and Kimura. The author analyzes technology policies from the following aspects.[45]

The Vietnamese steel industry will face three major problems in construction of facilities.

First, there are the constraints arising from relationships with other countries. Those constraints make acquiring managerial resources such as funding, technology and raw materials difficult. Since the abandonment of colonialism and the end of the Cold War, it has become much easier to overcome political barriers to gain access to managerial resources around the world. However, the situation remains unfavorable to developing countries, where the economies give rise to struggles in fund-raising for projects, particularly large ones. The lower the industrial development level, the more difficult the situations are. Multinational companies or international financial institutions may impose conditions that are unfavorable to developing countries. Adversely they may offer plants and equipment at lower prices or decrease interest rates depending on the economic trend in a developed country.

Second, there are historical constraints. The current systems and policies have been influenced by past problems such as the American-Vietnamese War and the failures of a centrally planned economy. A process industry such as the steel industry trends to suffer serious hysteresis as a result of past investment strategies, location selection or product selection.

Third, the country must improve national and local institutional capabilities to acquire funding, technology and raw materials, and convert them into consistent production processes. In steel industry, production processes must enjoy economies of scale. It is critical to ensure a smooth flow of processes, including the selection of technology, location and configuration of equipment, from mine to the product market. To ensure such flow, enterprises need not only plants and equipment but also operating techniques, management skills and marketing methodologies. Technology does not work without human factors.

Changing the first and second conditions described above is not easy. However, institutional capability can change if the government, enterprises and society take the appropriate measures. The

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[45] Refer to Anthony P. D'Costa, *The Global Restructuring of the Steel Industry: Innovations, Institution, and Industrial Change*, London and New York, Routledge, 1999. And refer to the following review article for the author's opinion to this book. *Ajia Keizai (Asian Economy)*, Institute of Developing Economies, Japan External Trade Organization, June 2000 (Japanese).

author has already discussed problems in the domestic systems and policies in part 1. Understanding these problems is necessary to carry out reforms. In short, they are important for the development of the steel industry to acquire managerial resources and convert them into consistent production processes, with an understanding of those structural and historical constraints.

In the following chapters, the author will make comments on the contents of the plan focusing on important items, providing general discussion along with discussion on the other countries' experience.

II. Discussion on Master Plan

1. Strategy for partial import substitution

1-1 Risks of overestimating demand

Viet Nam is pursuing a policy of import substitution to nurture the steel industry. It is realistic for the steel industry. After World War II, only South Korea saw a quick, rapid expansion in steel exports, and at the same time growth of the domestic market supported the steel demand.[46] Although exports from Brazil also expanded in the 1980s, it was the result of excess capacity triggered by the country's economic downturn. Namely, brisk exports from Brazil were not necessarily an indication of a success in industrialization.[47]

As growth of the steel industry depends on smooth expansion of the sales to domestic market, success in investment plans depends on accurate forecasts of domestic demand. It is particularly important to avoid overcapacity. Not a few steel projects in developed and developing countries have failed for that reason. In the most severe cases, construction of an integrated steelworks was discontinued before completion, purchased equipment was not used but stored in a warehouse, or manufacturers were forced to sell semi-finished products with low added value.

Sicartsa II, a SOE in Mexico that began operation in 1988, is an example.[48] Employing a direct reduction process, Sicartsa II had a plan to produce high-quality thick plates for large-diameter pipes. However, due to the government's financial straits and decreased demand stemming from a drop in oil

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[46] Toshio Watanabe, Kaihatsu Keizai Gaku: Keizai Gaku to Gendai Ajia (*Economics and Contemporary Asia)*, Nihon Hyoron-sha, 1996, p.206, (Japanese).

[47] Sin Hasegawa, Seifu Kei Tekko Kigyo no Keiei Kiki to Yusyutsu Siko (Financial Crisis and Export Incentives of the Public Steel companies in Brazil), *The Keizai Gaku (Annual Report of the Economic Society)*, Vol. 56, No. 2, The Economic Society, Tohoku University, September 1994 (Japanese).

[48] Tetsuro Nakaoka, Nihon Tekko Gyo no Tai Mexico Gijyutsu Kyoryoku to Sonogo (1) (2) (Three Big Projects in Mexico by the Japanese Steel Industry), *Keizaigaku Zasshi (Journal of Economics)*, Vol. 92, No.1, 2, The Economic Society of Osaka City University, May and July 1991 (Japanese).

prices, construction of a thick-plate plant was halted. Sicartsa II instead sold slabs while its plant operating rate in 1989 was only 24.5%. Sicartsa II was eventually privatized, becoming Ispat Mexicana.

Forecasting inherently contains uncertainty. To construct plants in the steel industry for the domestic market, it is preferable to seek partial rather than full import substitution, partly to protect the industry from fluctuations in demand. Also, it is preferable to import unprofitable low-grade products, the reasons for which are explored later.

1-2 Scenarios for import substitution in the master plan

The inclusion of a strategy for partial import substitution in the master plan is a realistic approach. However, several problems are seen in forecasts for supply and demand.

First, the current overproduction of long products is overlooked in both of the base and low cases. The master plan calls for an increase in production capacity of long products by 550,000 tons during the period from 2001 to 2006. This would push the total production capacity of VSC and foreign-affiliated companies to 2,720,000 tons, while long-product demand in 2006 is forecast at 2,090,000 tons. With the addition of production capacity at SOEs in other industries, private companies and the home industry, it becomes clear that excessive production will continue. The government and VSC are requested to review competition policies for the long-product market, pointed out in Part 1, and to adjust planned construction of long-product rolling mills accordingly.

For products other than long products, the scale of import substitution varies widely. According to the base case, Viet Nam will produce 63.0% of cold rolled sheets, 46.0% of billets, 94.3% of hot coils and all slabs for domestic consumption in 2015. In the low case, the figures are 33.1% of cold rolled sheets, 46.0% of billets, 47.2% of hot coils and all slabs in 2010. In the base case, an economic downturn would force a severe production adjustment or exports in hot coils, while massive imports of billets would continue. No risk of overproduction of flat products is seen in the low case.

2. Establishment of sound management entity

2-1 Sound management required

Clearly, the construction of an integrated steelworks is the costliest project in the master plan. One of the most important issues in this project is securing funding for construction. Professor Ohno has addressed this in his scenarios for the low and base cases, which include recommendations on how much to borrow and when as well as steps to cushion the industry from external shocks. The author covers here only one topic. That is the management entity that is to raise the funds and handle investments.

Although VSC has not clearly stated the amount of funds it will be able to raise itself, VSC managers and some Vietnamese researchers stated that VSC would be unable to build an integrated steelworks alone. And they called on the government to draw up a national project to realize the construction of steelworks.

Generally speaking, it is possible to build steelworks as a national project. However, the author is concerned about the view held by some experts that the project should be implemented for the benefit of the national economy even when it is not profitable as a business.

It would be appropriate for the government to build infrastructure such as ports, roads and an industrial water supply, as far as such infrastructure is prepared not exclusively for steelworks. However, construction of steelworks is another challenge.

To stress this point, the author cites cases in South Korea, Brazil and India. Each nation established SOEs in the steel industry, though their performance varied widely.[49]

Brazil's Acominas and India's Vizag, integrated steelworks constructed in the 1970s and 1980s, saw costs skyrocket due to construction delays and failure to obtain low-interest funding, which made the financial conditions at the SOE difficult. In Brazil, equipment was up to the world's standard but interest payments and depreciation sent production costs soaring to levels above those in Japan and West Germany. Table 11 shows cost breakdown. Brazil and India, meanwhile, kept steel prices low to nurture their domestic industries. Furthermore, these low-priced steel products helped support other state-owned sectors in India and foreign-affiliated automobile makers in Brazil. However, the steel enterprises had suffered losses. In Brazil, the ratio of net profit to net sales at the state-owned holding company Siderbras had been in the red every year from 1979 to 1985, and in 1987 the total debt exceeded $17 billion. The government bore the burden of funding for additional expansion or investment in renewal and replacement. In South Korea, meanwhile, the state-owned Pohang Iron and Steel Company (POSCO) maintained price competitiveness and profitability though price regulations had executed based on the anti-monopoly policies. And industries using steel were supported by the supply of low steel price.

[49] D'Costa, *op. cit.*, Chapter 5. Shin Hasegawa, *op. cit.*, Hasegawa, Burajiru Tekko Gyo no Seisan Kozo (Production Structure of the Steel Industry in Brazil), *Latin America Ronshu (Review of Latin America)*, Latin America Seikei Gakkai, 1994 (Japanese).

Table 11. Cost Structure in the Steel Industry (a), Brazil and Selected Industrialized Countries, June 1985 (US$ per ton)

Country	Total cost	Labour costs	Coal	Iron	Energy	Ferro alloy and fluxes	Depreciation	Miscellaneous	Subtotal	Financial expenses
Brazil (b)	431	76	67	17	13	17	44	37	271	160
West Germany	339	81	73	50	34	21	18	50	327	12
Japan	370	68	60	52	43	22	31	66	342	28
United States	507	132	59	85	76	22	30	88	492	15

(a) At 90 per cent capacity utilization.
(b) SIDEBRAS.
Source: Bernhard Fisher, Peter Nunnenkamp et al., *Capital-- Intensive Industries in Newly Industrializing Countries* , Mohr, 1988, p.203. ASP (Associc,a~o das Sideru'rgicas Privadas), Encontro do Presidente Jose' Sarney com Siderurgia. Brasilia. 1986.

POSCO serves as a good model for integrated steelworks in Viet Nam. Even with government support for construction, such steelworks should pursue sound independent management to compete in market economy. Otherwise, the burden on the people will become greater. Viet Nam's commitment to integration with international economy is stronger than that of South Korea and Brazil in the past, and its various industries must survive in global competition.

2-2 Management entity in the master plan

Who would own and manage integrated steelworks and other new facilities is not clear in the master plan. VSC assumes that either a SOE or a joint venture between VSC and foreign capital would be responsible for management. The author acknowledges the possibility of management fully by a SOE. However, he recommends participation by foreign capital to realize sound management. This would offer a source of funding as well as dispatches of engineers and managers, which would help the Vietnamese to learn technology and management know-how.

3. Selection of construction sites and hardware

3-1 Principles in selecting sites and technologies

Development of the steel industry and integrated steelworks requires an organized and systematic introduction of technologies to realize mass production. Mass production does not rely only on plant capacity but on a smooth flow in massive goods and services, from mining of raw ore to transportation, procurement to pretreatment, manufacturing, distribution and consumption.

At first the author discusses the selection of hardware and construction sites. The core hardware in a steel industry is steelworks. But one cannot overlook the importance of geography, where the plants are located as well as their location relative to the sources of raw materials and consumption areas.

First, the latest proven technologies should be employed at facilities. The use of old technologies would hurt competitiveness unless there are exceptional advantages in other areas such as raw materials and labor costs. This point must become evident to VSC managers in reviewing the history of TISCO, which had closed small basic oxygen furnaces and open-hearth furnaces. On the other, it is undesirable to use technologies that are under development or those for which no standards have been established even though they are advanced technologies. In the past,

transfers of proven technologies to newly industrialized areas and developing countries have been smooth and successful because of set standards and improvements achieved in industrialized countries.

One example is the transfer of technology from Kawasaki Steel Corporation to CST, a Brazilian company that started operations in 1983.[50] Kawasaki Steel transferred several proven technologies with which it was familiar such as those for blast furnaces, basic oxygen furnaces, blooming and slabbing mills. On the other, unproved technologies are not transferred usually. For example, CST did not install continuous casting machines until the 1990s. Baoshan Steelworks in China, which began operating first blast furnaces in 1985 with technologies transferred from Nippon Steel Corporation, did not adopt continuous casting machines in the first phase of construction but did in the second phase.[51] Continuous casting technology is now proven, but was not proven at the start of these two projects in the 1970s, and caused some accidents such as breakouts.

Adoption of recently developed technology would require troubleshooting and setting of standards during the operation phase, in essence turning the new steelworks in Viet Nam into a laboratory for testing. It would invite a great risk. The best approach is a fast-second approach; that is to quickly adopt recently proven technologies rather than technologies that are obsolete or under development.[52]

As for concrete recommendations, Viet Nam is urged to employ blast furnaces and basic oxygen furnaces for large-scale production of totaling 3 million tons per steelworks that center on flat products, while for production of 1 million ton or less per steelworks, EAF mill is recommended. It should be emphasized, however, currently EAF-related technologies are undergoing innovation, particularly in the areas of casting and rolling in hot coil manufacturing, and of new metallic source manufacturing technology to provide a clean materials for EAF. Some technologies have been established while others are not.

The technology for hot coil production by EAF mill is a proven one, though limited to making of

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[50] Nihon Tekko Kyokai Shakai Tekko Kogaku Bukai (Division of Social Engineering of Iron and Steel Industry, The Iron and Steel Institute of Japan), *Tekko no Gijutsu to Syakai Dotai (Steel technology and dynamic state of society)* 1997 (Japanese).

[51] Takashi Sugimoto, *Hozan Seitetsusho no Kenkyu (A Note on the Baoshan Steel)*, Master Thesis, University of Tokyo (Japanese).

[52] D'Costa, *op. cit.* for the fast-second approach. However, it should be noted that D'Costa's was interested in state of the art technology and did not pay much attention to proven technology.

low-grade products. There are proven technologies in direct reduction processes using natural gas, while others utilizing coal are being established. Construction of India's first Romelt plant is in progress. Nucor, first runner of EAF-based flat products, closed its iron carbide plant in Trinidad due to operation problems and is building a Hismelt plant. Experimentation of DIOS (Direct Iron Ore Smelting Reduction Process) was completed at a pilot plant in Japan but construction of practical plant has not started.

It might be useful for the Vietnamese steel industry to adopt the suitable technologies among them as they become established.

Second, the scale and size of equipment should meet the required minimum for efficient operations, indicated in Fig. 3. As VSC learned from TISCO, limited-capacity equipment used at one step in the manufacturing process necessitates small equipment at other steps in the process, limiting the scale of operations.

Third, primary business operations must remain integrated. We mean that each step in the whole process must flow in an organized fashion from procurement of raw materials to manufacturing, distribution, customer purchase and use. The same rule applies to in-house processes at steelworks as well as those between business processes. For example, steelworks that use imported materials should be located near a coast. Plants engaged in iron-making, steel-making and rolling should be located near one another, either as integrated or separate steelworks, while transportation routes between a steelworks and consumption areas should be secured.

Maintaining a balance in the various processes is also important. For example, a shortage in one process in the chain will slow the flow of goods in whole industry, while excess capacity will cause a drop in operating rates.

Fourth, infrastructure is needed. Ports with adequate water depth for vessels are necessary, as are loading and unloading facilities, roads for transporting goods and stable and affordable supplies of water and electricity. The location of ports should be considered especially for integrated steelworks. These infrastructure factors are displayed in Table 12.

Table 12. Condition for New Integrated Steelworks

	Capacity of NISW	
	3 million t/y	6 million t/y
Land Area	300-350ha	550-650ha
Wharf area		
Extension	1000-1200m	2500-3000m
Depth for raw material	17-18m	17-18m
Ship for raw material	150,000-250,000t	150,000-250,000t
Electric power	150MW	300MW
Electric consumption	450kWh/t	450kWh/t
Water supply	120,000m^3/day	240,000m^3/day
Water consumption	14m^3/t	14m^3/t

Source: Nippon Steel Corporation, from Mr. Tanaka.

3-2 Selection of plant sites and technologies in the master plan

The author evaluated the master plan on the principles mentioned above. The following points are noteworthy.

First are the plan's limitations. It adopts a strategy of partial import substitution and does not assume rapid growth in demand. Also, it calls for gradual construction of facilities from the downstream division. They make it difficult to achieve the minimum efficient scale of equipment and consistent business flow.

Second, in spite of the difficulties mentioned above, the plan excels in its planned adoption of equipment that meets world standards and proven technologies. Most facilities satisfy the minimum efficient scale. Assuming normal operations, most mills will enjoy profits of latecomers and be able to offer keep operating costs low while offering products with standard quality.

Third are concerns about the second phase of TISCO's expansion. As previously mentioned, an expansion in equipment for long-products rolling at TISCO could lead to overproduction in the market for long-products. Also, the plan envisions use of technology of the Romelt process that is not yet proven. Moscow Institute of Steel and Alloy in 1995 constructed a prototype plant, and Nippon Steel introduced the technology but it does not use it for commercial production. Romelt-Sail in India reportedly constructed a plant, scheduled to begin operations in July 2001, with an annual capacity of 300,000 tons using the equipment from National Mineral Development.[53] As it is uncertain that the technology will be established soon, introduction of

[53] *Shin Tetsugen (New Metallic Sources)*, NK Techno Service Co., Ltd., 1998, p.48, 74 (Japanese). "NMCD at a

Romelt process is too risky. For TISCO, procuring raw materials and semi-finished products from outside will lead to high transportation costs. TISCO should not increase its capacity over the extent that it steadily produces metallic sources. If the government protects TISCO with unreasonable expansion, it will cause bureaucratic controls on growth of other steelmakers' market shares and fuel widespread inefficiency.

Fourth, production costs of direct reduced iron (DRI), in the base case, vary greatly based on prices of natural gas used as a reducing agent, though DRI plant is a proven technology. A feasibility study by an U.S. company on construction of a Midrex-based DRI plant in the South has revealed that natural gas should be priced at $1.75 per one million BTU for project viability. However, Petro Vietnam states a price of $3 for one million BTU.[54] According to VSC, if no agreement is reached, the project will be postponed until production begins in a new gas field. Currently, the DRI plant's feasibility is in doubt.

Fifth, care should be exercised in choosing the location of No.1 hot strip mill (HSM). It is logical that it be adjacent to No.1 cold rolling mill (CRM), which is recommended to be built in Phu My industrial park. According to a feasibility study for No.1 CRM, the Phu My is the best location for No.1 HSM from the viewpoints of existence of port facilities, transportation of products to consumption areas and availability of infrastructure. There are great advantages in locating the No.1 CRM and No.1 HSM near each other, such as minimizing transportation costs of hot coils for cold rolling, technology exchanges, information exchange, and cost reductions through shared maintenance employees as well as spare stock and inspection equipment.[55] There have been some opinions to construct No.1 HSM as the initial investment in the integrated steelworks. If No.1 HSM starts operation between 2005 and 2006 as targeted in the master plan, this location involves a too large risk. Firstly, construction of the integrated steelworks will be a lengthy process and it is feared that the plan will be forced to change halfway. More specifically, there is a risk that construction of No.1 HSM is delayed. Another risk is that construction of a blast furnace and basic oxygen furnace will be delayed after construction of No.1 HSM is completed. In the latter case, operations of No.1 CRM and No.1 HSM will be done separately and create extreme inefficiencies. Therefore, the author recommend that No.1 HSM be built in Phu My and No.2 HSM should be established as a part of the integrated steelworks.

Sixth, there are options regarding hot coil production process prior to construction of the

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Glance," http://www.nmdc-india.com /introduction.htm. Tapan Chakravorti, "NMDC to install India's first Romelt plant," *The financial Express*, July 7, 1999.
http://www.expressindia.com/fe/daily/1999070 /fec /fec07.html.

[54] *Saigon Times Daily*, November 2, 2000.

[55] *Cold Rolling F/S Report*, IX-2-1, 2.

integrated steelworks. The master plan calls for the integrated steelworks finally to supply flat products. This is an appropriate selection. Meanwhile, VSC sees a need for an early start in manufacturing of flat products. For that reason, both the base and low cases include a plan for hot coil production prior to construction of the integrated steelworks. The base case assumes slab imports while the low case assumes slab manufacturing by an EAF mill. As stated previously, these processes are undergoing innovations in the world's steel industry, which may offer the Vietnamese industry increased options in 2007. Also, construction time for an EAF mill is short for. Then it is not necessary now to make a final decision for equipment configuration for a slab procuring route prior to construction of the integrated steelworks. Instead, we recommend that information for various technologies be collected and analyzed, while domestic resources be studied in details, and make preparation for speedy adoption of proven technologies.

The seventh point is lack of an action plan to overcome fragile infrastructure. The extent of difficulties in constructing an integrated steelworks differs greatly depending on problems of infrastructure. Also, large problems for EAF mills are high electricity costs and a dual price system. As covered in Part 1, foreign-affiliated venture companies engaged in long product rolling cite high electricity costs as a prohibitive factor in EAF installation.[56] Electricity costs in Viet Nam are higher than those in other Southeast Asian countries, according to a survey by the Japanese members of General Commentary Group. Further, electricity prices are expected to climb, which is giving rise to concerns about the future of steelmakers. Steelmakers alone cannot resolve infrastructure problems; discussions with the relevant government agencies and companies concerned are necessary.

4. Technology transfers and technology formation

4-1 Various steps for technology transfer and technology formation

In this section the author discusses technology from the viewpoint of software. One issue is the management of technology transfer process. The Vietnamese steel industry must learn technology of overseas companies, through a contract for technology introduction or requesting investment of a foreign company. Another issue is to improve the technological capabilities. The Vietnamese steel industry need to not only acquire technologies through transfers but to build up technologies within the country. This is generally understood as a five-step process that requires; (1) mastering operation method; (2) development of skills to maintain introduced plants and equipment; (3) development of skills to make repairs and minor improvements, (4) participation in design and planning, and (5)home manufacturing.[57] In these steps, completion of construction

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[56] Interview at a joint venture company.

[57] Takeshi Hayashi, *Gijutsu to Syakai: Nihon no Keiken (Technology and Society: The Experience of Japan)*, University of Tokyo Press, 1986, pp.57-73 (Japanese), Akira Suehiro, *Kyacchi Appu Gata Kogyouka Ron (Catch up*

project for a steelworks, which is hardware, represents not the end but the elementary step of technology transfers.

The problem calling for immediate attention in Viet Nam is mastering the skills to operate and maintenance of introduced equipment. In the steel industry, the degree of embodiment of relevant technology in equipment is higher than that of assembling industry, but lower than that in the other processing industries. Though basic operations at an integrated steelworks are automated, production systems are extremely complicated and many works require human management and operation. Production is typically made complicated by the following factors:[58] 1) A large number of orders and various products manufactured separately; 2) large batch-type units and machines placed in a series; 3) ordered lots that are not always equal in number to manufacturing lots; 4) long lead time for production; 5) production activities that are easily disrupted at each process; 6) a production system that includes technologies in various fields; and 7) continuous operations without a break. Whether machines and units operate according to designed specifications is largely dependent on operation methods, production control and technologies of peripheral industries. Integrated steelworks, in short, require integrated management of processes.

4-2 Technology transfers and technology formation suitable for conditions in Viet Nam

Based on the foregoing circumstances, the author discusses transfer and formation of technology meeting with conditions in Viet Nam.

First, the author discusses the method of introducing technology. More specifically, a method to procure equipment and the scope of technology transfers.

A study of past cases shows that recipient countries tend to acquire equipment from different companies in different countries with the purpose of reducing costs and making loans available from various sources. It is the so-called "Olympic method." However, this method often makes it difficult to achieve integrated management at steelworks and invites operation troubles.

One example is Mexico's Sicartsa II, which acquired its equipment through the "Olympic method." However, since various contractors who had installed their own particular programs for computerized control had supplied the equipment, formulation of control program for the entire steelworks was very difficult. [59] South Korea also followed the Olympic contract method in constructing its Pohang Steelworks from 1970 to 1981. However, the different facilities were not plagued by differing technologies as the

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Model of Industrialization), The University of Nagoya Press, 2000, pp. 234-240(Japanese).

[58] Yoshisuke Inoue, *Seisankeieikanri to Joho Sisutemu (Management and Control Systems for Production Activities and Information Systems of the Japanese Steel Industry),* Dobunkan, 1988, pp. 71-77 (Japanese).

[59] Nakaoka, *op. cit.*

work was contracted mainly with Japanese equipment manufacturers experienced in steelworks construction in Japan. [60]

To lower costs for equipment and foster domestic technology, there are some cases in which the scope of contract is limited to facilities and start-up preparations. However, for developing countries planning an integrated steelworks, it is preferable that contracts cover the entire transfer process from basic planning to stable operations.

When Kawasaki Steel transferred its technology to CST, it also provided management techniques such as production planning and control, quality control, and provided assistance for equipment maintenance, sales and purchase. [61]In the case of Pohang Steelworks, the parties signed contracts for plant sale in the early stage. Actually, a construction director was dispatched to the site for supervision and to provide assurances of performance. The work took on the nature of turnkey system. Training in facility operations was also formally provided in the contract for the 4th stage of construction.[62]

Acquiring proven technologies including management techniques will raise a new steelwork's operating rate. We cannot overemphasize the importance of learning standard technologies.

Given that as the starting point, it is then necessary to develop operation methods that suit Viet Nam's characteristics and conditions. Partial improvements in equipment and facilities are also required. For example, unlike Japanese mills, the rolling plant at Vina Kyoei has a well-hole structure to suit the country's climate. Equipment and operations should also be modified in line with Viet Nam's low wage levels and simpler product variety compared with industrialized countries. When domestic raw materials are used for integrated steelworks, it will require still further modifications.

The Vietnamese steel industry is encouraged to earnestly learn standard technologies while also pursuing technologies and developments suited to its specific needs and characteristics. To this end, discussion based on specific technological and social conditions is required but not according to bureaucratic intervention such as uniformed rate for local contents.

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[60] Mitsubishi Research Institute, *1980 Nendai ni Okeru Nikkan Kokusai Bungyo no Doko ni Kansuru Kesu Sutadi (Case Studies on the International Division of Labor between Japan and South Korea in 1980's)*, National Institute for Research and Advancement, October 1981(Japanese).

[61] Nihon Tekko Kyokai Syakai Tekko Kogaku Bukai (Division of Social Engineering of Iron and Steel Industry, The Iron and Steel Institute of Japan), *op. cit.*

[62] Mitsubishi Research Institute, *op. cit.*

Second, efforts should be focused on developing human resources. Vietnamese managers, engineers and workers are encouraged to commit process of introducing technology and receive training in a country that provides technology. Some Japanese -affiliated companies in developing countries invite group leaders, foremen and engineers to Japan to give them training for a few weeks to up to more than a year. It is important that these skills be learned and brought back to Viet Nam. Proper treatment of trainees is important to encourage their commitment to their companies, using such technology, preventing them from quitting the company. On the other, to promote employees to upper-level jobs where they cannot utilize their skills is not recommended. Employee training programs and proper compensation are issues worth deeper study.

Third, it is important to note that a steelworks is supported not only by steel technologies but also by peripheral technologies. For example, the some 3,000 researchers at Nippon Steel Corporation have various specialties: mechanics (35%), electric engineering (15%), construction (10%), metallurgy (22%), chemistry (12%), physics (5%), and other (1%). In addition, system engineers are working at the affiliated companies.[63] Technologies in those fields must be nurtured within the steel industry and also in the peripheral industries. From an angle of business function, peripheral technologies include maintenance, machine design and manufacture, product development, metallurgy engineering and environmental control. For immediate purpose, technology for maintenance should be secured. Technology-recipient countries often experience a drop in operating rates due to shortages in spare parts or inadequate equipment maintenance and repairs.

> According to a survey by the Japan Plant Association in 1984, about half the plants exported from Japan posted operating rate of 60% or less, 10 to 20 years after delivery, due mainly to shortages of spare parts, and also by poor operations and unstable electricity supplies.[64] One engineer who participated in a cement plant transfer cited poor warehouse management as a reason for the spare parts shortage. Other problems mentioned were failures in the operations, maintenance, order and budget departments to work more closely and a shortage of foreign currency to purchase parts.

Currently in Viet Nam, TISCO and SSC have engineering departments, but their technological level cannot support modern steelworks. The scale and system of domestically manufactured Cevimetal's rolling mills and Da Nang Steel's EAFs are below world standards.

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[63] According to the cold rolling F/S team.

[64] Jiro Takabayashi, Semento Puranto Ni Yoru Gijutsu Iten Jouno Mondaiten Ni Tsuiteno Kosatsu (Cases of the Low Wroking Rate of Exported Plants: The Case of Cement Plants), *Ajia Keizai (Asian Economy)*, Institute of Developing Economies, October and November 1989 (Japanese).

According to an executive of Vina Kyoei , most of the spare parts for rolling mills are secured from overseas since they cannot be procured in Viet Nam. In the medium- and long-term view, efforts are needed to develop and improve peripheral industries and upgrade the engineering industry, while in the short-term view trying to secure spare parts and services from overseas.

5. Procurement of raw materials and semi-finished products

As the master plan shows, individual plants will require various raw materials and semi-finished products depending on their production processes. For example, integrated steelworks use iron ore and coal, EAF mills utilize scrap and hot strip mills require slabs.

A retrospective view of the steel industry reveals that a domestic supply of raw materials is considered less critical after World War II than before that.[65] As is reflected in the growth of Japan's steel industry, the location of the source has become comparatively unimportant; obtaining the highest quality raw material at low prices has been essential..

Aside from market fluctuations, there are no particular constraints in importing iron ore and coal from foreign countries to secure a supply. With regard to contracts with mining companies, lessons can be learned from Japan and South Korea's experiences. As to the supply of iron ore, the major question concerns the use of ore from the Thach Khe mine. At present, all we know about the mine is that its ore contains a high percentage of zinc content and its estimated reserves exceed 500 million tons. It is known that high zinc content causes various operational problems if ore is loaded into a blast furnace in a lump state. However, the author cannot comment in detail since thorough investigations have not yet been carried out. A feasibility study is required before a decision can be made on the use of Thach Khe ore. For now, it is not advised to determine the location or design facilities for steelworks on the assumption Thach Khe's ore will be a main raw material.

Scrap prices fluctuate in the market between $100 and $200 per ton. Supplies can be hard to come by in a boom situation. South Korea is beefing up its self-sufficiency rate in iron scraps and is expected to be completely self-sufficient by around 2010. This will in turn reduce the amount of Korean imports, which totaled 5.57 million tons in 1998.[66] This reduction will be favorable to Viet Nam when it imports scrap. Meanwhile, EAF steelmakers are enjoying a global growth, and demand for scrap is certain to increase in the long term. To secure a stable supply of metallic sources for EAFs, these steel makers should also consider iron production with direct reduction. However, a thorough feasibility study is necessary.

Slab prices fluctuate in the market between $140 and $270 per ton. Securing a supply also

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[65] Etsuo Abe and Yoshitaka Suzuki eds., *Changing Patterns of International Rivalry: Some Lessons from the Steel Industry*, University of Tokyo Press, 1991.

[66] *Tekko Shimbun (Japan Metal Daily)*, October 26, 2000.

becomes difficult in a boom situation. It will be suitable to import low-grade slabs from the former Soviet Union countries or China and high-grade slabs from developed countries or Brazil. Moves by Brazil's CST, which produced 4.393 million tons of slabs in 1999, should be watched. CST plans to begin operations of a hot strip mill with a capacity of 3.2 million tons a year in 2002.[67] With this mill, CST is expected to consume much of its own slab output to manufacture hot coils internally. Meanwhile, Japanese integrated steelmakers have recently been boosting exports of slabs to increase the operating rate of their blast and basic oxygen furnaces. It is possible that some of Japanese makers are willing to sign a long-term contract with Vietnamese enterprises.

6. Product and sales policies

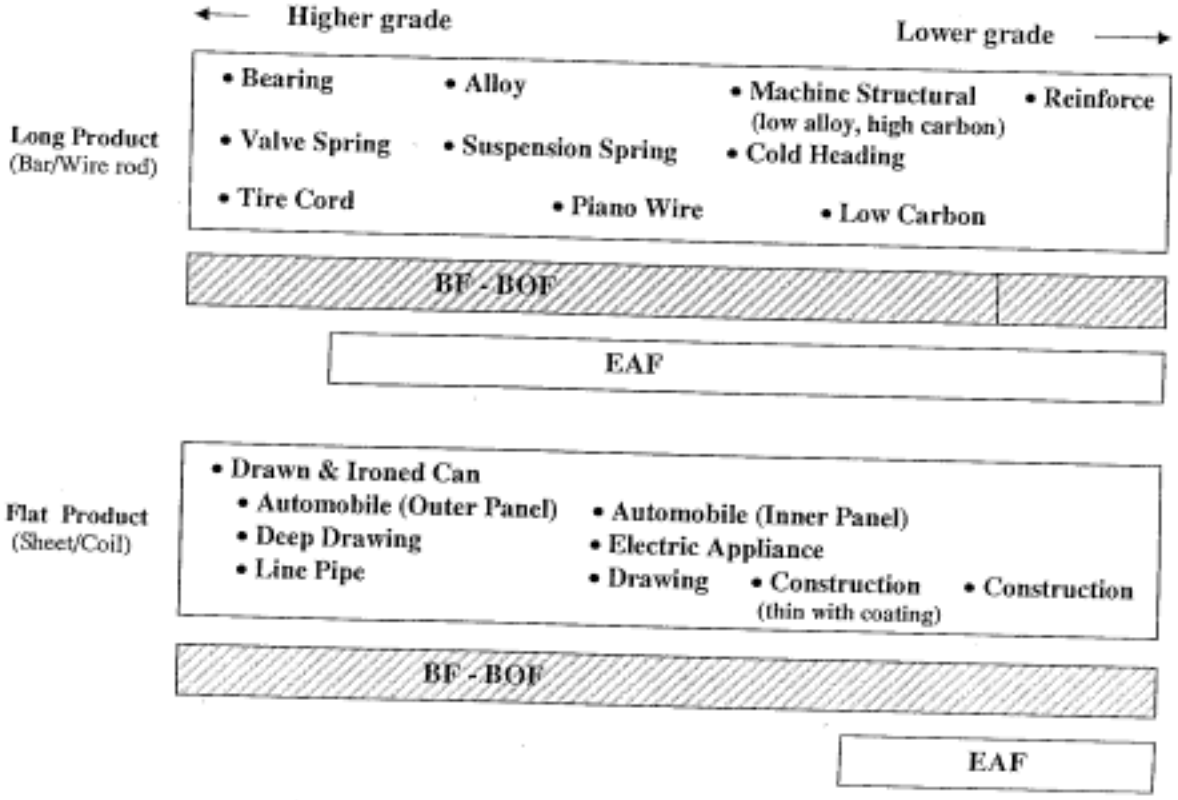
Price competition in the global steel industry is turning fierce for two reasons: 1) Steelmakers in the former Soviet Union countries are exporting massive products at below cost: 2) Oligopoly in developed countries is weakening due to the growth at EAF steelmakers and globalization of business. Such price competition can negatively affect profits that would otherwise be obtained in the market of certain types of steel products.

The Vietnamese steel industry must take this situation into account when seeking to expand production. One measure is to enact trade laws, an issue that is not discussed here. Instead, the author discusses product and sales policies.

First, product mix should be discussed. Figure 9 shows the relationship between grades of steel and production processes. New steelworks should concentrate on the production of high-grade items as far as there is domestic demand. Table 13 shows the relationship between grades, domestic demand and feasibility of domestic production. High-grade steel products yield high profits at the normal operating rate. However, demand for high-grade steel is low in Viet Nam. The opposite is true for low-grade steel products. It is necessary to select an appropriate product mix based on these relationships.

[67] http://www.tubarao. com.br/cst_ingles/index_ingles. html.

Figure 9. Schematic productive capability by steelmaking process



Source: Nippon Steel Corporation (From Mr. Tanaka, JICA Expert).

Table 13. Schematic representation about the feasibility of production of various products in Viet Nam

Grade of products	Example	Volume of Domestic Consumption	Profitability at Standard Operating Rate	Estimated Operating Rate in Viet Nam	Estimated Profit in Viet Nam	Feasibility
Very High Grade	Hot- dip Zn-Fe alloy coated sheet for Automobile	very small	very high	very low	no profit	×
High Grade	Cold rolled coil for electrical equipment	2005 small 2020 larger	high	low→higher	low or high (It depends on the actual operating rate)	2005 × 2010 or 2020 ○
Middle Grade	Cold rolled coil for galvanizing sheet	2005 medium 2010 large	middle	high	high	○
Low Grade	Bar and wire rod for construction	large	low	It depends on the business condition	low or high (It depends on the actual operating rate)	△ or ○
Low Grade(products under the cut-throat competition)	Steel mill products under the competition with imported products made in CIS	large	low	not so high	low or no profit	×

Source: The Author edited.

After conducting market research, JICA's F/S team made recommendations on cold rolled flat products with a view to large demand and higher profits. Cold rolling mills scheduled to start

operations in 2003 will be able to profit from manufacturing cold rolled flat products for the manufacturers of galvanized sheet, furniture for export, and switchboard.[68]

Companies are urged to be cautious about producing low-grade steel such as general-purpose cold rolled flat products, where cutthroat competition is now under way. Although such production is technologically easy in Viet Nam, profits are unlikely. The author recommends, therefore, that domestic demand of these products be satisfied through imports rather than domestic production, a move that will free the government from adopting a protective stance against the flow of low-priced imports. This is better for the Viet Nam's economy.

With the exception of cold rolled flat products, market research for other areas is insufficient. In depth research will be needed for each phase in construction projects to pursue the expansion of production volume and high added value.

Second, sales and service strategies should be discussed. In pursuing a strategy of import substitution, the Vietnamese steel industry needs to be managed with a global perspective to prevent a flood of imports. The country's steel industry has not experienced customer service and demand for high-quality products. However, to meet diversified customer needs and offer the high quality required in products such as cold rolled flat products, the appropriate production method and meticulous manufacturing procedures must be employed. Preventative measures to avoid problems and appropriate problem-solving steps should be drawn up. Mills in a downstream process are good places to learn solutions to problems from the viewpoint of end users. It should be particularly remembered that many of the customers purchasing high added value products are expected to be foreign-affiliated companies. They may expect the quality, delivery and service that are standard in newly industrialized or advanced countries. To provide less than that may encourage them to look for sources outside of Viet Nam. The Vietnamese steel industry should learn from foreign customers' experience in world' standard quality, delivery and services. Customers will be good teachers.

In the shift to the manufacture of higher-quality products, the integrated control of all processes becomes all the more necessary. For example, a customer request for high-quality products should be quickly conveyed to the steelworks, which should maintain highly stable operation. All processes are linked, and it is impossible to produce high-quality products without smooth operations at each step of the process.

7. The importance of a step-by-step approach

7-1 General considerations

A gradual approach in nurturing a steel industry in a developing country is often realistic due

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[68] CRM F/S Report.

to limited access to funds. This is especially true for Viet Nam, which is facing a more severe international financing environment than either Japan or South Korea during their construction of integrated steelworks.

The gradual approach also has merits by enabling a smooth learning of know-how and technology. Much can be learned about customer needs, problem-solving and service by managing a mill in the downstream process in particular. It is important to establish an organized system that allows the Vietnamese industry to learn at each step and then to take that knowledge to the next step.

The risks in the gradual approach in construction of a steelworks are related to risks involved in long lead time for completion of all projects. Construction plans may be changed due to difficulties in raising funds or changes in the political situations, production technologies or market structure. Two measures can help lessen such risks. One is to implement construction of individual projects promptly, which makes them less vulnerable to the effect of changes. The longer the construction period, the more changes occur halfway of constructing each facilities. The other measure is to allow certain flexibility in projects while maintaining their integration. Namely, develop a system in which changes in plans do not adversely affect competitiveness.

7-2 Effective utilization of the two-track approach

Ultimate objective of the master plan is to achieve a stable supply of flat products through construction of an integrated steelworks. Toward that end, the base and low cases offer two-track approaches. It calls for initial construction of a rolling mill for flat products, independently, followed by construction of an integrated steelworks.

From a financial viewpoint, the low case is more realistic than the base case. Ohno paper shows it in detail. The low case is also preferable as it provides sufficient time to learn know-how and skills.

To reduce the risks inherent in a long-term project, two suggestions are offered. One is to build No.1 HSM in Phu My. Stable operations can be secured at Phu My rolling mills, even when the plan for constructing integrated steelworks is changed. The second suggestion is to maintain a flexible stance regarding slab procurement prior to construction of integrated steelworks to take advantage of on-going technological innovation.

For effective accumulation and learning of experiences, there are some suggestions. First, VSC can learn management know-how of foreign companies based on the information from managers that has been dispatched to joint ventures from VSC. Such actions can be taken immediately.

There is an example in non-steel industries with such moves.[69] Japanese automobile producers successfully raised the competitiveness centering on their compact cars in the 1970s and 1980s based on production control, parts procurement system and workers' organization. Some western automobile producers sought to overcome their weakness through technical tie-ups and joint ventures with Japanese automakers to learn Japanese production system.

General Motors (GM), the world's biggest carmaker, and Japan's Toyota jointly established the NUMMI in 1984. However, in the beginning GM did not regard NUMMI's production system. GM team members that were sent to NUMMI thought GM should introduce that system. But their voice was too weak to make GM's executives turn toward them. Those who learned at NUMMI were scattered to different divisions and had no power to reform production system. Rather, reform of the GM system in the 1970s and 1980s centered on advanced technology and increased use of robots. In the end, neither productivity nor product quality improved. In the 1990s, GM finally introduced NUMMI production system to other plants.

Second, the planned project to construct No.1 CRM should be used as a measuring tool in ascertaining the difficulty of future projects. While technology, location and product variety are being determined for No.1 CRM, financing method and planned profitability are still to be determined.[70] When the construction plan for No.1 HSM starts, financing and profitability will be great problems as well. The Japanese members of General Commentary Group holds the view that construction of the No.1 HSM should start after it is confirmed that No.1 CRM can secure a stable cash flow.[71] The Vietnamese government and VSC are urged to consider this view. It is necessary to apply the lessons in No.1 CRM project to the construction of No.1 HSM and other facilities. Without the success of No.1 CRM, later construction of other facilities will not see a success.

Third, a system should be implemented to promote the technology diffusion in Viet Nam. Sharing know-how and technologies acquired by a plant or individuals across the nation will boost the level of technology in the whole steel industry. However, some difficulties are expected when experiences in other developing countries are studied.

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[69] Poul Ingrassia and Joseph B. White, *Comeback: The Fall and Rise of the American Automobile Industry*, Touchstone Books, 1995. Koichi Shimokawa, *Nichibei Jidousha Sangyo Koubou no Yukue (The Battle between the American and Japanese Automobile Industries)*, Jiji Press, 1997 (Japanese).

[70] *CRM F/S Report* and interview at VSC.

[71] Koichiro Fukui, Takao Aiba and Hiroko Hashimoto, Long-term Scenario on Import Substitution/ Capital-intensive Industry Furtherance, *Viet Nam-Japan Joint Research Project: Workshop on Economic Development Policy*, JICA and MPI, The Socialist Republic of Viet Nam, Ha Noi, 8-9 December 2000, p.48.

As an example, it has been found that engineers and technicians in Thailand who acquire know-how and knowledge in domestic training programs or abroad keep it to themselves rather than sharing it. Company B, a Japanese-affiliated automobile parts manufacturer had sent managerial candidates in Thailand to Japan for training each year for 10 years. The company discontinued the practice after too many of the candidates quit after returning home. It is suspected that these candidates used their acquired know-how to advance their own careers rather than raise productivity at the production site or the company. [72]

Situation can be more complicated if multiple companies may manage the newly built plants provided in the master plan. In such a case, cross-company technology exchange is necessary.

As noted previously, employees who received training should be encouraged to commit the expected work. In addition, there should be some system to make them responsible for information sharing. For technology exchanges between companies, VSC or non-profit academic societies may need to take the initiative. Creating a link between the forums for technology diffusion and scientific research also could be beneficial. For example, member companies of the Iron and Steel Institute of Japan are improving the industry's level of technology while maintaining corporate confidentiality. Their research covers a range from basic areas in metallurgy to production control and social development. This example provided may be instructive and useful for the Vietnamese steel industry.

III. Conclusion of Part 2

Construction of a flat product mill and integrated steelworks will greatly change the prospects for the Vietnamese steel industry. The task facing the industry is not limited to construction of plants and equipment. Rather, it is to create a new business sector. Both the Vietnamese government and steel enterprises are encouraged to pursue improvements in technological, managerial and policymaking capabilities while engaged in projects. Toward that goal, this report has offered various basic suggestions.

Among capital-intensive industries and manufacturing industries in Viet Nam, the plan for the steel industry is the most comprehensive and organized. Therefore, the industry's problems and potentials brought to light by the Joint Viet Nam-Japan Research may become useful material for

[72] Suehiro, *op. cit.* p.242.

other industries as well. Industrial development strategies should not be based on abstract propositions but rather detailed studies of the real situation. Concerned organizations and enterprises in Viet Nam are expected to conduct studies of many other industries and to draw up strategies based on their findings.

*In this the paper author refers to the papers written by Prof. Ohno and Prof. Kimura without footnotes. They are included in the Final Report of the Japan-Vietnam Research Project. And they are also published as NEU-JICA Discussion Paper series as follows.

Ohno, Kenichi, Free Trade versus Infant Industry Promotion: The Possibility of Temporary Protection for Latecomer Countries, *NEU-JICA Discussion Paper*, No.3, 2001.

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