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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF INDUSTRY
VIETNAM STEEL CORPORATION
THE SOCIALIST REPUBLIC OF VIETNAM

The Feasibility Study on Steel Flat Product Mills
(Phase I : F/S on Cold Rolling Mill)
IN
The Socialist Republic of Viet Nam

FINAL REPORT

OCTOBER 2000

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Preface

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct the Feasibility Study on Installation of Steel Flat Product Mills (Phase I : F/S on Cold Rolling Mill) in the Socialist Republic of Viet Nam and entrusted the study to the Japan International Cooperation Agency (JICA).

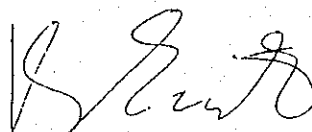
JICA sent a study team headed by Mr. Kiyoshi Kobayashi of Nippon Steel Corporation (NSC) and constituted by members of NSC to Vietnam three times from February to September 2000.

The team held discussions with the officials concerned of the Government of Vietnam and conducted related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I do hope that this report will contribute to the promotion of steel industry in Vietnam and to the enhancement of amity between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Vietnam for their close cooperation throughout the study.

October 2000



Kunihiko Saito

President

Japan International Cooperation Agency

October 2000

Mr. Kunihiko Saito
 President
 Japan International Cooperation Agency - JICA
 Tokyo, Japan

Dear Mr. Saito ;

Letter of Transmittal

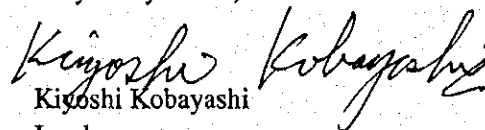
We are pleased to submit herewith the Final Report of "The Feasibility Study on Steel Flat Product Mills (Phase I : F/S on Cold Rolling Mill) IN The Socialist Republic of Viet Nam". This report describes the results of the study made with the Vietnamese government authorities concerned and Viet Nam Steel Corporation with regard to the feasibility of the construction of the first cold rolling mill in Viet Nam.

In this report an appropriate product mix based on the demand projection for cold rolled steel sheets up to the year 2010 is proposed. For the said product mix an appropriate processes and specifications of major equipment are also proposed. In addition, the effects of the construction of the cold rolling mill on Viet Nam are analyzed and examined from financial, economical and environmental viewpoints.

As a conclusion, it is considered that the construction of the new cold rolling mill is both beneficial and feasible for Viet Nam. Firstly, the project appears profitable as an investment. However, as the fund raising considered requires improvement, a pertinent proposal is made in this report. Secondly, the economic analysis shows the project is most effective in reducing foreign currency payment and significantly contributes to regional and industrial development. The survey results also show that the harmful effects of wastes such as gas and water emissions from the mill can be minimized by the introduction of appropriate equipment and facilities. For these reasons, we hope that the construction of the new cold rolling mill will be realized with further investigation given to the contents of this report.

In closing, we wish to express our deep appreciation to those concerned at JICA, the Ministry of Foreign Affairs and the Ministry of International Trade and Industry for their courtesy and support. We also wish to thank most sincerely the Ministry of Industry, the Ministry of Planning and Investment, the Ministry of Science, Technology and Environment and Viet Nam Steel Corporation for the cooperation and assistance provided for the implementation of the survey.

Very Truly Yours,


 Kiyoshi Kobayashi
 Leader

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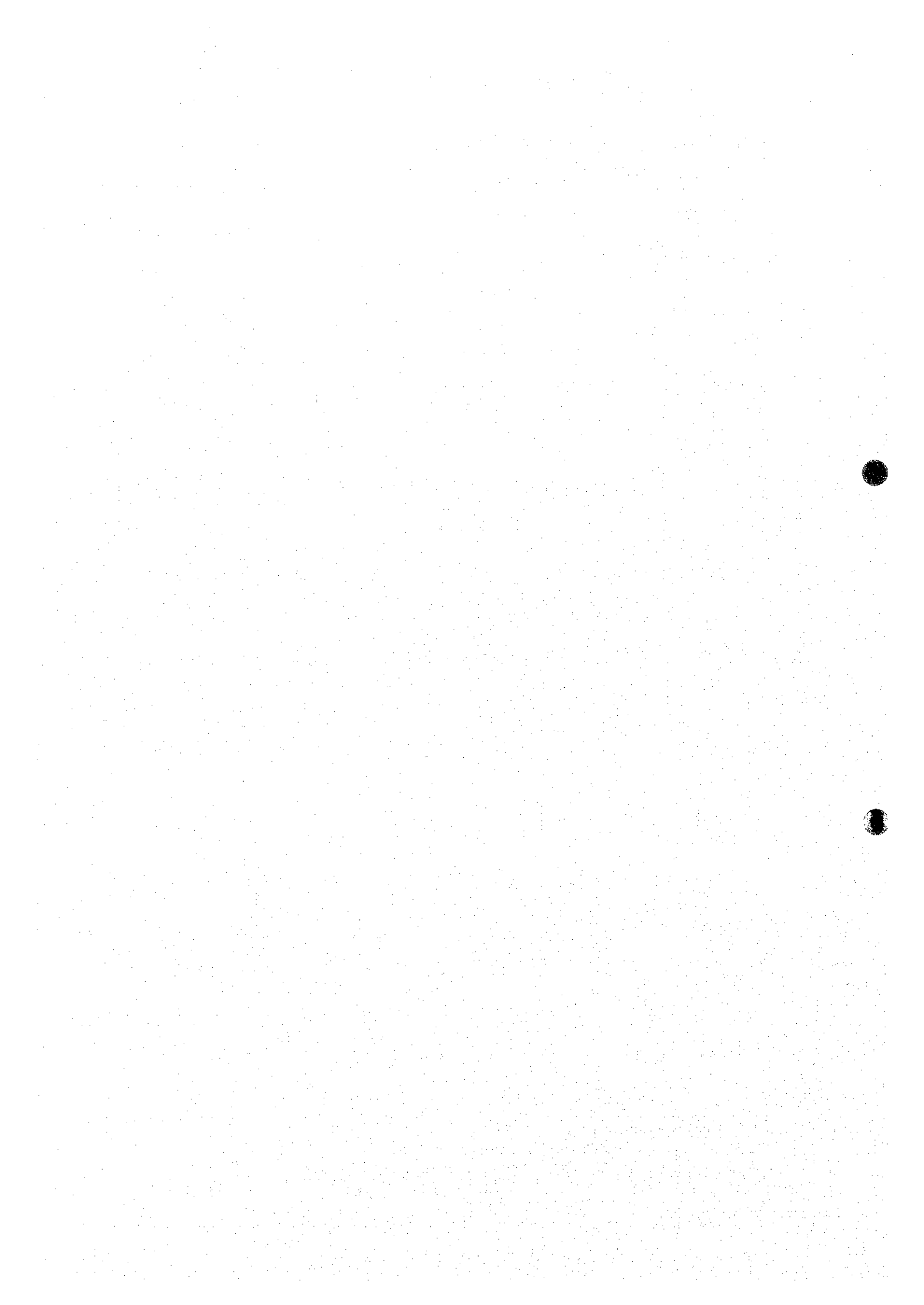
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List of Abbreviations

AC :	Alternating Current
ACSR :	Aluminum Conductor Steel Reinforced
ADB :	Asian Development Bank
AFTA :	ASEAN Free Trade Area
AGC :	Automatic Gauge Control
ARP :	Acid Regeneration Plant
ASC :	Apparent Steel Consumption
ASEAN :	Association of South East Asian Nations
ASTM :	American Society for Testing and Materials
BAF :	Batch Annealing Furnace
BG :	Back Ground
BOD :	Biochemical Oxygen Demand
BR :	Bridle Roll
B/S :	Balance Sheet
BUR :	Back-up Roll
CaCO ₃ :	Calcium Carbonate
CC :	Cold Rolled Coil for Conventional Use
CCU :	Coil Cooling Unit
C/F :	Cash Flow
CGL :	Continuous Galvanizing Line
CH :	Cold Rolled Coil for High Class Use
CIS :	Commonwealth of Independent States
Cl ₂ :	Chlorine Gas
CM :	Cold Mill
CO :	Carbon Monoxide
COD :	Chemical Oxygen Demand
CQ :	Commercial Quality
CR :	Crane Rail Height
CRC :	Cold Rolled Coil
CRM :	Cold Rolling Mill
CRS :	Cold Rolled Steel Sheet
CS :	Crane Rail Span

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dB(A) :	Decibel A-scale
DC :	Down Coiler
DDC :	Direct Digital Controller
DDT :	Direct Discharge on Truck
DDQ :	Deep Drawing Quality
DOSTE :	Department of Science, Technology and Environment
DQ :	Drawing quality
DS :	Disconnecting Switch
DWT :	Dead weight tonnage
E :	East
EAF :	Electric Arc Furnace
ECL :	Electrolytic cleaning line
EER :	Electrical Equipment Room
EIA :	Environment Impact Assessment
EIRR :	Economic Internal Rate of Return
EH :	Eaves Height
ENE :	East-North East
E/R :	Electrical Room
ESE :	East-South East
FeCl₂ :	Ferric Chloride
Fe₂O₃ :	Ferric Oxide
FIRR :	Financial Internal Rate of Return
FH :	Full Hard
FL :	Floor Level
FM :	Finishing Mill
GCB :	Gas Circuit Breaker
GDP :	Gross Domestic Product
GI :	Galvanized Iron
GIS :	Galvanized Iron Substrate
GISW :	Gas Insulated Switchgear
GH :	Full Hard Grade of GIS
GL :	Ground Level
GS :	Annealed Grade of GIS
GSO :	General Statistical Office

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GTO :	Gate Turn off Thyristor
H₂S :	hydrogen Sulfide
H₂SO₄ :	Sulfuric Acid
HCl :	Hydrochloric Acid
HCM :	Ho Chi Minh
HCY :	Hot Coil Yard
HNO₃ :	Nitric acid
HPCL :	Heavy Plate Cutting Line
hr :	Hour
hrs :	Hours
HSHL :	Hot Shear Line
HSM :	Hot Strip Mill
HSPM :	Hot Skinpass Mill
IGBT :	Insulated Gate Bipolar Transistor
IISI :	International Iron and Steel Institute
IM :	Induction Motor
IMF :	International Monetary Fund
IMR :	Intermediate Roll
IRR :	Internal Rate of Return
JIS :	Japanese Industrial Standard
JV :	Joint Venture
LOA :	Length Overall of Ship
LPG :	Liquid Propane Gas
L-TR :	Left Tension Reel
MCCB :	Molded Case Circuit Breaker
MOI :	Ministry of Industry
MOSTE :	Ministry of Science, Technology and Environment
MPI :	Ministry of Planning and Investment
NESDB :	National Economic and Social Development Board (Thailand)
N :	North
NE :	North East
NNE :	North-North East
NNW :	North-North West
NOF :	Nonoxidization Furnace

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NOx :	Nitrogen Oxide
NW :	North West
O ₃ :	Ozone
OHC :	Overhead Crane
PCM :	Pre-coated Metal
pH :	Potential of Hydrogen
PIW :	Pounds per Inch Width
PL :	Pickling Line
P/L :	Profit & Loss statement
PLC :	Programmable Logic Controller
P/O :	Pickled and Oiled Sheet
POR :	Pay Off Reel
PP :	Power Plant
PPPL :	Push Pull Pickling Line
PR :	Pinch Roll
RCL :	Re-coiling Line
RCM :	Reversing Cold Mill
RF :	Reheating Furnace
RH :	Ridge Height
RM :	Roughing Mill
R-TR :	Right Tension Reel
S :	South
SE :	South East
SEAISI :	South East Asia Iron and Steel Institute
SGC :	Semi Gantry Crane
SPM :	Skin-pass Mill
SPT :	Standard Penetration Test
SSE :	South-South East
SSW :	South-South West
STB :	Atmospheric Stability
SO ₂ :	Sulfur Oxide
SV :	Supervising
SW :	South West
TCM :	Tandem Cold Mill

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T/H : Tons per Hour
TR : Tension Reel
TRF : Transformer
VCB : Vacuum Circuit Breaker
VSC : Viet Nam Steel Corporation
W : West
WNW : West-North West
WR : Work Roll
WSW : West-South West
WV : Wind Velocity
WWD : Weather Working Day

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Summary

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JICA Study Team made both the site surveys in Viet Nam and the necessary work in Japan and obtained the following conclusions with regard to "The Feasibility Study on Steel Flat Product Mills (Phase I: F/S on Cold Rolling Mill) IN The Socialist Republic of Viet Nam"

1. The investigation both on the macro-economic performance and on the market of flat products in Viet Nam and neighboring countries. According to the investigation the demand for cold rolled steel sheets has been predicted to be around 500,000 tons per year in 2005 and around 1,000,000 tons per year in 2010.
2. The study on the product mix and the production capacity appropriate for the planned cold rolling mill was made based on the result of the above market survey. As a result of this, the cold the production of galvanized iron substrates (both annealed and non-annealed) and cold rolled steel sheets for high class use and the production capacity of 205,000 tons (product basis) per year are recommended.
3. The most appropriate production processes for the planned cold rolling mill was studied. The push-pull type pickling line, the combination-type reversing cold rolling mill, the electrolytic cleaning line, the box annealing furnace and the recoiling line have been recommended as the major production processes. The major specifications of the said process equipment have been also given. In addition, the study on the specifications of electricity, instrumentation and process computer and civil and building was made together with the conceptual design of infrastructure. The manning plan for the planned cold rolling mill was also studied, and the required number of employees is expected to be 400 including both the staff engineers and operators and maintenance persons.
4. The construction schedule for the planned cold rolling mill was studied. The period of 24 months is required from the commencement of civil work to the commercial run.
5. The construction cost has been estimated to be around 126 million USD. However, there exists a possibility of reduction in equipment cost depending on the demand and supply conditions of equipment suppliers. In addition to the construction cost the working capital summing up to 2 million USD is to be prepared for the procurement of hot coils and consumable such as lubrications and packing materials and for the manning expense required at the initial stage of commercial operation.
6. The feasibility study on the construction of new cold rolling mill was made. The internal rate of return is expected to be 10.3 % (after tax) for the base conditions, and accordingly this project is considered to be feasible. However, it has been revealed that the free cash flow in normal operation is short every year over 10 years from the start-up of the cold rolling mill. As countermeasures to this cash flow problem the following two items have been recommended ;
 - 1) Introduction of equity capital of more than 10 million USD
 - 2) Extension of the period of repayment from 10 years to 12 years

In addition, the import duty of 5 % on the cold rolled steel sheets has been recommended to secure the profitability.

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7. The economic analysis was made to estimate this project from a viewpoint of national and/or social economic influence. It has been concluded that this project has a large value of investment even from a viewpoint of national economy due to the following four positive effects.
 - 1) Saving of foreign exchange summing up to 170 million USD
 - 2) Creation of new employment up to 1000 persons
 - 3) Promotion of industrial development
 - 4) Promotion of regional development
8. The fund raising for the planned new cold rolling mill was investigated. The fund raising in Viet Nam and the buyer's credit have been referred to as the possible fund raising methods. However, the condition of foreign loan is expected to be strict compared to that of domestic loan, and accordingly the fund raising in Viet Nam has been recommended.
9. The environmental standard in Viet Nam was investigated, and the environmental impact of the construction of new cold rolling mill was estimated. It has been revealed that there would be no problems or issues with regard to air and water and the noise standard would be satisfied simply by removing the fan of the acid regeneration plant from the boundary.
10. Technical evaluation of sites for the construction of new cold rolling mill was made. Three industrial zones, AMATA, NHON TRACH and PHU MY were surveyed. Considering both the advantages of port facility, transportation of hot coils and room of expansion and the appropriateness for the heavy industry, PHU MY Industrial Zone has been recommended as the site for the new cold rolling mill.
11. The preliminary study on the construction of hot rolling mill, which is planned after the start-up of the cold rolling mill, was made. With regard to the site, PHU MY Industrial Zone has been recommended with the port facility, the distance to the cold rolling mill and the availability of utility taken into consideration. Hot coils for the cold rolling mill, those for general use and heavy plates are to be produced with the annual production amount of 800,000 to 1,000,000 tons recommended for the first stage. The coil box type roughing mill and the conventional type tandem mill have been recommended as the production processes.

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Chapter I Background of the Feasibility Study on Steel Flat Product Mills (Phase I : F/S on Cold Rolling Mill) in The Socialist Republic of Viet Nam

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1. Background of the Study

Viet Nam, which has been carrying out a program of economic reforms named "Doi Moi", has been aggressively introducing a market economy. Although Asia's economic crisis in 1997 and 1998 did not have great direct impact on Viet Nam, the nation had to revise somewhat downward the estimated rate of the economic growth. In addition, Viet Nam had to revamp the nation's large industry development promoting plans. For example, it was decided to delay the conducting of a detailed study pertaining to developing a master plan for steelmaking including the construction of integrated steelworks, which was carried out by the Japan International Cooperation Agency from June 1996 to March 1998.

Having no facilities to produce steel sheets, Viet Nam now entirely depends on imported supplies thereof. Imports of steel sheets in 1998 exceeded 700,000 tons. Though the rate of Vietnam's economic growth has slowed down, it is considered that the demand for steel sheets increases as the steel-consuming industries develop, accordingly, an establishment of a framework for domestic supply of steel sheets requires urgent attention.

While retaining its master plan as a long-range program, the Vietnamese government formulated a short-to-medium range industry development promoting program to create a small-to-medium framework to produce steel sheets in quantities sufficient to satisfy the nation's current economic and industrial needs. To be more specific, the essence of the program is to construct hot and cold rolling mills with annual production capacities of 600,000 and 250,000 tons respectively. The Vietnamese government has requested a continued technical support from Japan. Accordingly, the Japan International Cooperation Agency dispatched its preliminary investigation team towards the end of November 1999 to conclude an agreement on details of the study, based on which the detailed study described below was carried out.

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2. Purpose of the Study

The Study was made for the six purposes summarized below.

- (1) To predict the future market (in 2010) for cold rolled steel sheets by investigating the present state of the market and predicting the growth of the nation's economy and industrial sectors associated with cold rolled steel sheets, and then to determine the optimum product mix and production capacity of the cold rolling mill to be planned.
- (2) To design a cold rolling mill plant with the product mix and production capacity described above, including a schematic design of infrastructure and to carry out a feasibility study to determine the economic viability of the new cold rolling mill.
- (3) To conduct a technical evaluation on the possible candidate sites for the new cold rolling mill and to select the most appropriate one.
- (4) To investigate environmental standards and regulations, gather relevant data pertinent to the selected site, perform an environmental simulation, and give advice on environmental countermeasures.
- (5) To give advice on the construction of the hot rolling mill which gives a direct impact on the cold rolling mill.
- (6) To transfer knowledge on cold rolling technology and cold rolled products and techniques for performing feasibility studies to the parties concerned in Viet Nam through activities mentioned above.

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3. Schedule of the Study

The Study, which started with the first site survey following the domestic preparatory work done in Japan in February 2000, was carried out as shown in Fig. I-3-1.

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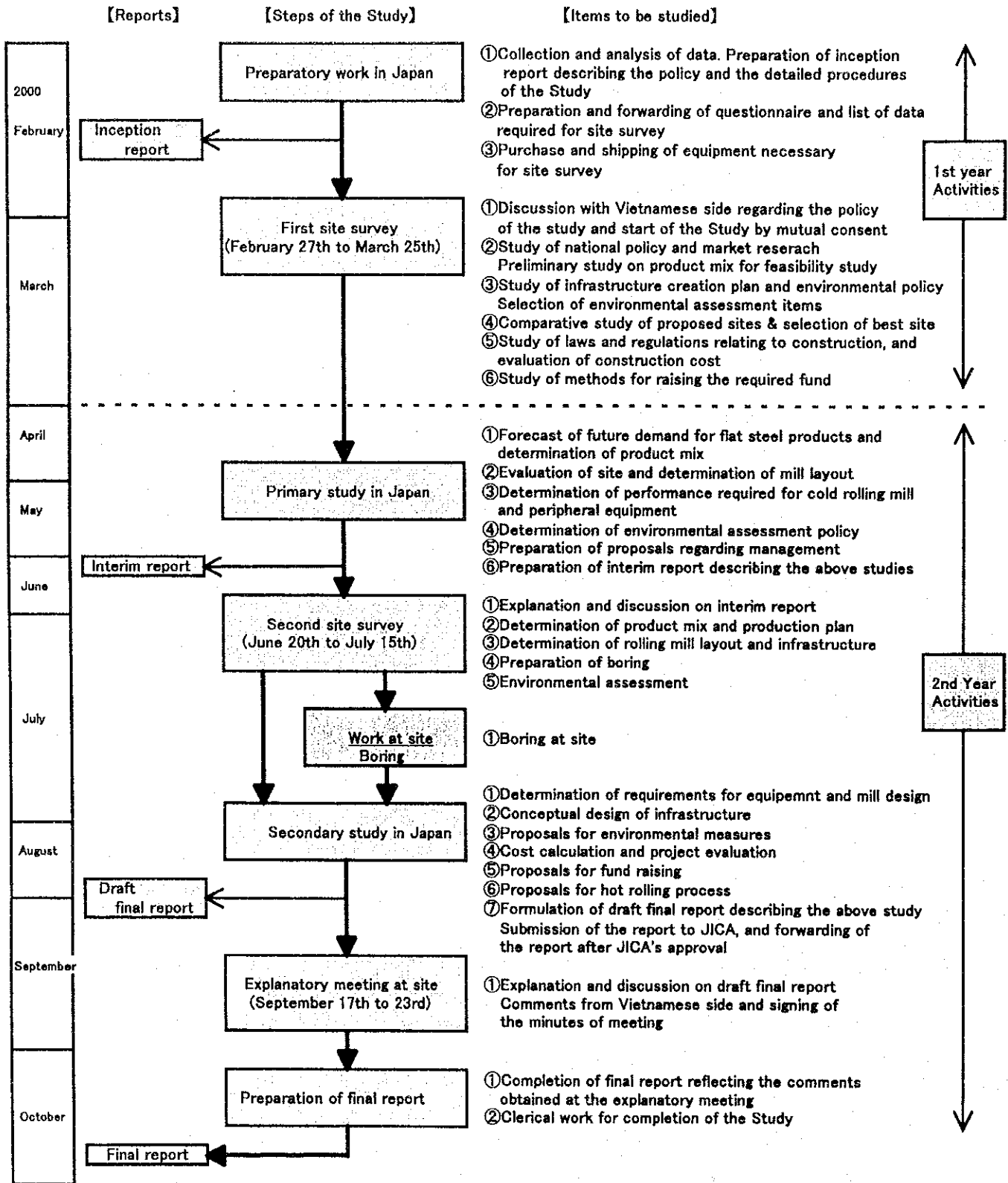


Fig. I-3-1 Flow of Feasibility Study

Chapter II Present Situation of Economy in Viet Nam and Projection of Its Growth

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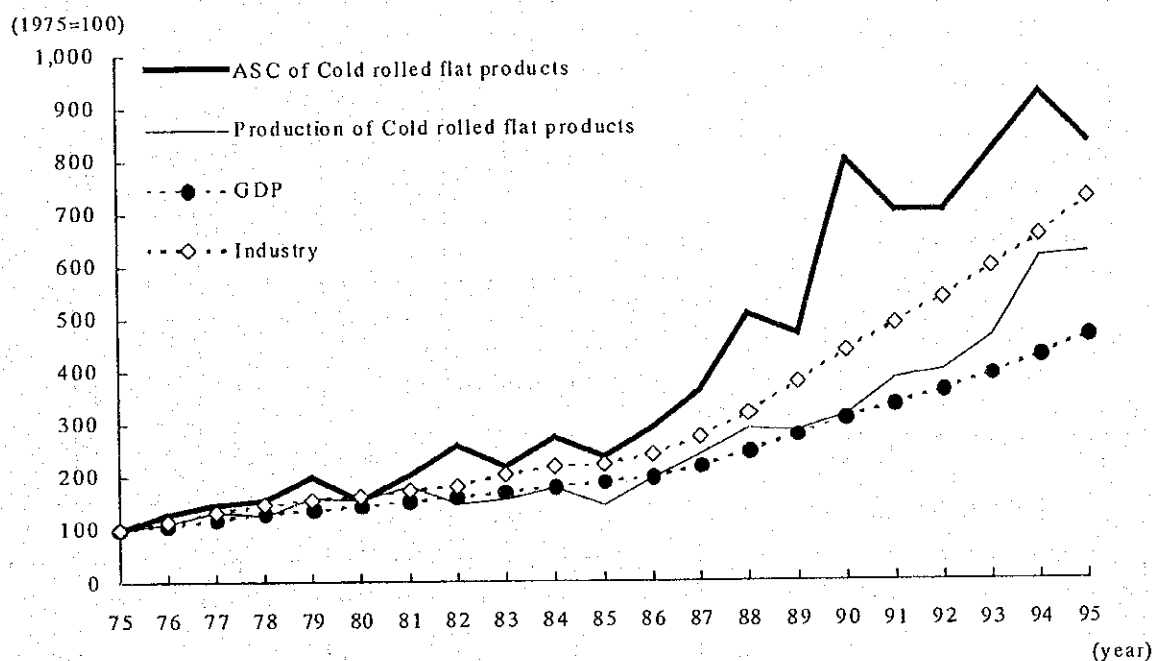


1. Outline and Projection of Macro-Economic Performance

1.1 Economic Growth and Demand for Cold Rolled Flat Products

Generally speaking, the demand for cold rolled flat products increases as the economy of a country, especially the industry sector, grows. A correlation can be thought to be here between both. Fig. II-1-1 shows the trends of GDP and the demand for cold rolled flat products in Thailand. A trend of the demand for cold rolled flat products exceeding the growth of the industry sector is clearly seen there.

In forecasting the demand for cold rolled flat products, the perspective of economic growth of the country in question is of prime importance, and so we considered as follows.



Source: IISI, NESDB

Fig. II-1-1 Supply and Demand of Cold Rolled Flat Products and Real GDP in Thailand

1.2 Outline of Macro-Economic Performance in Viet Nam

Firstly, let us look at the current status of Viet Nam's economy. Table II-1-1 shows major economic indicators in Viet Nam. Viet Nam's economy has been hovering at low rates of growth since the Asian economic crisis of 1997. Nominal GDP of 1999 is expected to be 399,942 billion dong, with real GDP growing at 4.8% or one percent point less than that of the previous year. The ratio of gross domestic investment in GDP fell short of 20%, a level considered necessary for sustainable growth of the economy. The ratio of gross domestic savings in GDP maintained 20% plus for the three consecutive years. The inflation rate is expected to remain as low as 0.1% and the current account balance entered

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the black as a result of an increase in exports and lower import levels.

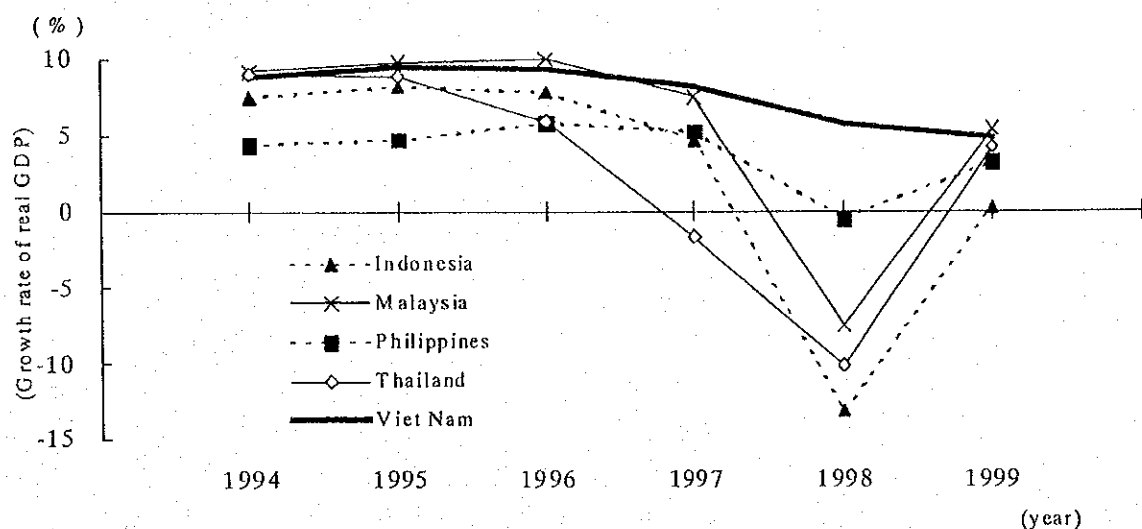
Table II-1-1 Major Economic Indicators in Viet Nam

		1995	1996	1997	1998	1999	2000
1	Growth rate of GDP (% p.a.)	9.5	9.4	8.2	5.8	4.8	5.5
2	GDP at constant 1994 prices (Billion dong)	195,567	213,833	231,264	244,596	256,269	
	Agriculture, forestry, fisheries	51,319	53,577	55,895	57,866	60,892	
	Industry and construction	58,550	67,016	75,474	81,764	88,047	
	Services	85,698	93,240	99,895	104,966	107,330	
3	GDP at current prices (Billion dong)	228,892	272,036	313,623	361,016	399,942	
	Agriculture, forestry, fisheries	62,219	75,514	80,826	93,072	101,723	
	Industry and construction	65,820	80,876	100,595	117,299	137,959	
	Services	100,853	115,646	132,202	150,645	160,260	
4	Gross domestic investment / GDP (%)	27.1	28.1	28.3	25.5	19.7	20.8
5	Gross domestic savings / GDP (%)	16.1	17.8	21.8	21.1	22.0	21.6
6	Inflation rate (% p.a.)	12.7	4.5	3.6	9.2	0.1	6.0
7	Growth rate of merchandise exports (% p.a.)	28.2	41.0	26.5	1.0	22.3	10.0
8	Growth rate of merchandise imports (% p.a.)	43.8	38.9	0.8	-2.1	1.2	16.0
9	Current account balance / GDP (%)	-11.0	-10.3	-6.5	-4.4	2.3	0.8
10	Exchange Rate (dong / US dollars)	11,037	11,032	11,683	13,297	13,932	

Source: 1 MPI
2-3 GSO
4-10 ADB

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Fig. II-1-2 presents the trends of real GDP in ASEAN countries. Table II-1-2 shows nominal GDP of ASEAN countries in 1996 (in billions of U.S. dollars). Fig. II-1-2 tells us that Viet Nam's economic growth fell temporarily due to the influence of the Asian economic crisis, but the impact of the recession was much smaller than that experienced by other ASEAN countries because of the relatively small scale of Viet Nam's economy as shown in Table II-1-2, which in turn suggests that the economy has a fair chance of growth in the future.



Source: Indonesia - Thailand IMF
Viet Nam MPI

Fig. II-1-2 Growth Rate of Real GDP in ASEAN Countries

Table II-1-2 Nominal GDP in ASEAN Countries (1996)

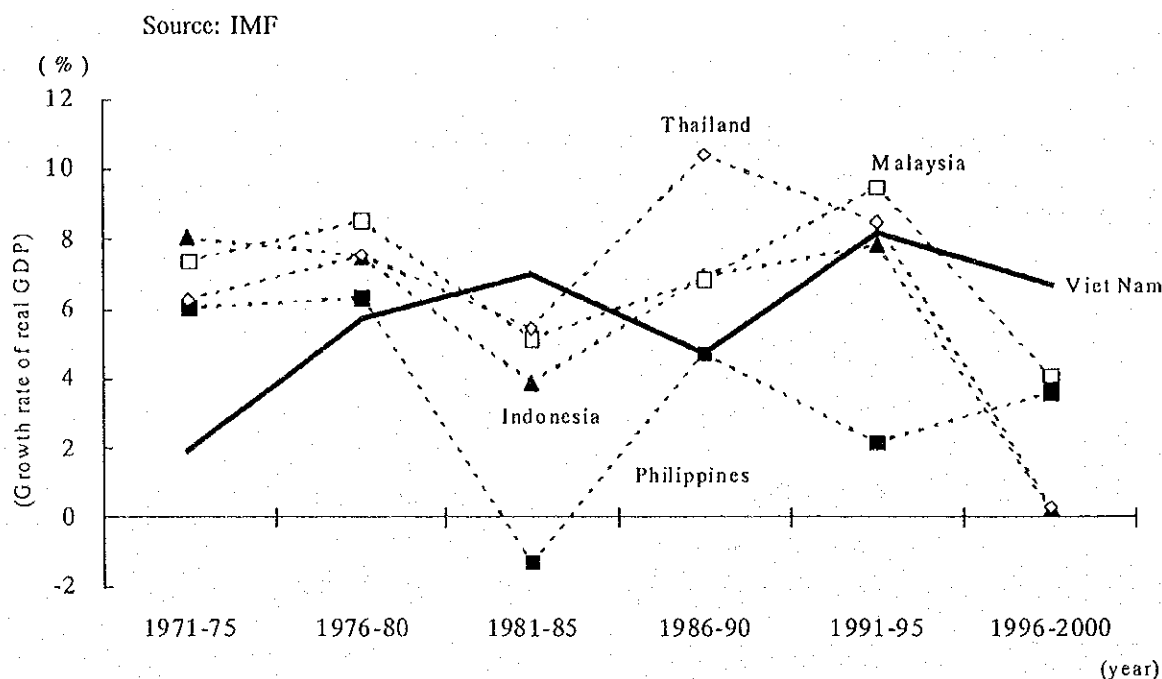
(Unit : Billion US dollar)

Indonesia	Malaysia	Philippines	Thailand	Viet Nam
227	101	83	182	25

Source: IMF

Fig. II-1-3 shows the long-term changes of real GDP growth for the past 30 years in five year average figures. Viet Nam's GDP shows an average rate of growth of 6.7% per annum for the period from 1996 to 2000, and is expected to average 5.7% for the entire period.

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For 1995-2000 in Viet Nam MPI

Fig. II-1-3 Long-term Change of Real GDP Growth Rate

Table II-1-3 presents average growth rates of real GDP by sector in Viet Nam for the period from 1996 to 2000. Whereas the country has been striving to achieve a growth of 9-10% per annum in its 8th Five Year Plan (1996 to 2000), actual results remained far behind the target, especially in the industry and service sectors, resulting in the total growth rate of 6.7%.

Table II-1-3 Average Growth Rate of Real GDP in Viet Nam (1996-2000)

(Unit : % p.a.)

	Average growth rate of real GDP in 1996-2000	
	8 th five year plan	estimate
Agriculture	4.5 - 5	4.3
Industry	14 - 15	10.4
Services etc.	12 - 13	5.4
Total	9 - 10	6.7

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II-1-4

1.3 Projection of Macro-Economic Performance

Table II-1-4 shows growth rates of real GDP by sector. The forecast of GDP growth is based on the result of interviews with MPI because the 9th Five Year Plan (2001 to 2005) was just about to be established at the time of survey, and the growth is expected to reach 6.7% in 2005 and 6.6% in 2010.

When observed by sector, the growth of the industry sector is estimated to be 9.5% for 2005, and 8.0% for 2010.

Table II-1-4 Growth Rate of Real GDP by Sector

(Unit : % in 1994 prices)

	(actual)					(forecast)			
	1995	1996	1997	1998	1999	2000	2003	2005	2010
Agriculture	5	4.4	4.3	3.5	5.2	4.0	3.3	3.0	3.0
Industry	14.0	14.1	13.1	10.5	9.3	8.9	9.3	9.5	8.0
Services etc.	11.0	10.0	7.1	4.9	2.3	3.7	5.8	7.0	7.0
Total	9.5	9.4	8.2	5.8	4.8	5.5	6.6	6.7	6.6

Source: MPI

Table II-1-5 presents a forecast of real GDP. This has been tabulated based on the real GDP of Table II-1-1 multiplied by the forecast rates of growth by sector of Table II-1-4.

Table II-1-5 Forecast of Real GDP

(Unit : Billion dong at constant 1994 prices)

	1999	2000	2003	2005	2010
Agriculture	60,892	63,297	70,022	73,938	85,314
Industry	88,047	95,839	125,290	149,276	218,735
Services etc.	107,330	111,248	131,943	149,512	209,020
Total	256,269	270,384	327,255	372,726	513,069

In the following sections, we shall be reviewing the prospects of the real GDP of Table II-1-5 more in detail.

Fig. II-1-4 shows the ratio of contribution of each sector to changes in the real GDP growth rate. As observed in the economic growth patterns through 2010, the growth of the industry sector occupying 34% of the entire GDP of 1999 would be contributing approximately 50% of the GDP growth.

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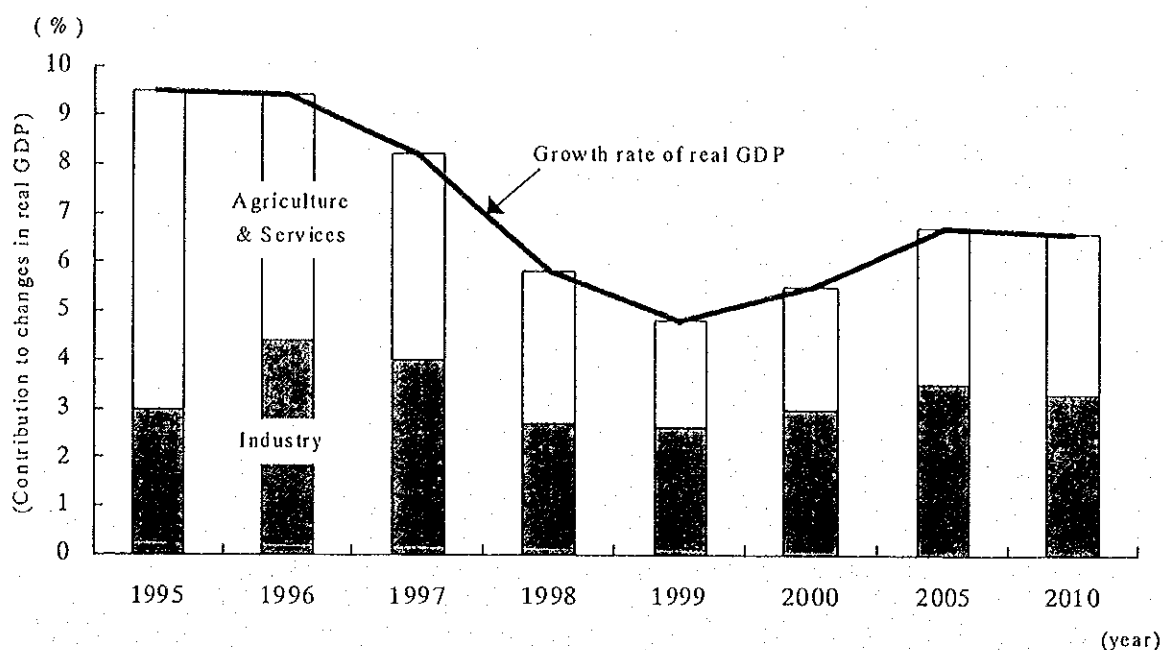


Fig. II-1-4 Contribution to Changes in Real GDP

Now, Fig. II-1-5 presents the trends of composition of GDP by sector. The ratio of the industry sector which showed 20% plus in 1985 is expected to reach and cross the 40% level in 25 years by 2010.

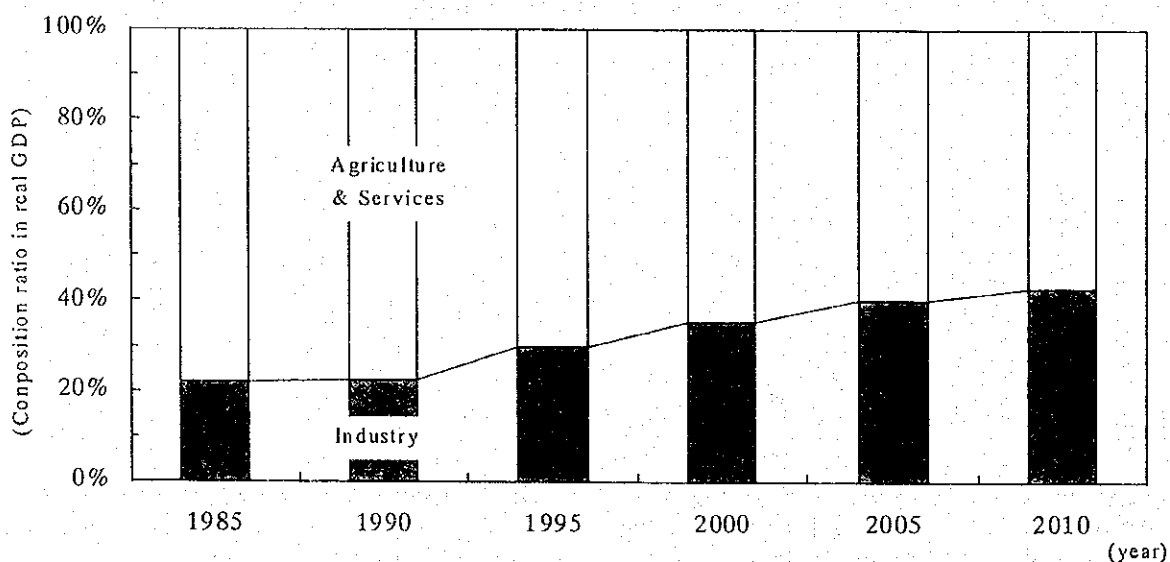
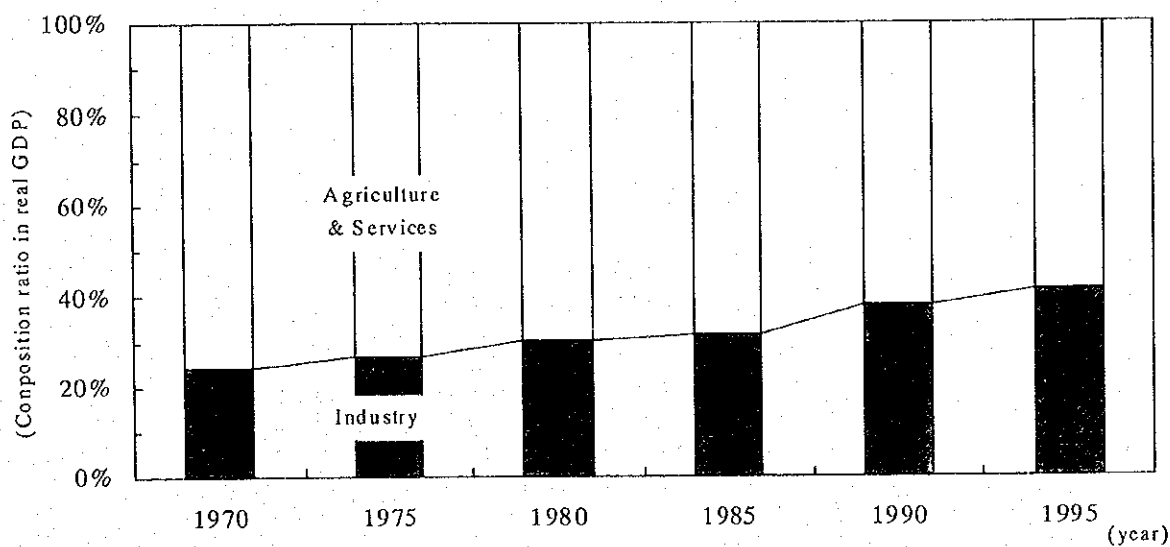


Fig. II-1-5 GDP Composition Ratio by Sector in Viet Nam

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The above analysis indicates that Viet Nam's economic growth in the coming ten years will be primarily driven by the growth of the industry sector.

On the other hand, Fig. II-1-6 shows the composition of GDP by sector of Thailand. The ratio of the industry sector in GDP was just 20% plus in the 1970's, but will be crossing the 40% level in 25 years due to the advancement of industrialization. This fact suggests that the forecast of Viet Nam's economy above mentioned is practical, reasonable and realizable.



Source: NESDB

Fig. II-1-6 GDP Composition Ratio by Sector in Thailand

Table II-1-6 shows a forecast of nominal GDP per capita in Viet Nam. For the purpose of its comparison to nominal GDP per capita (in U.S. dollars) of ASEAN countries of which a long-term chronological data are available, the real GDP of Table II-1-5 was deflated by GDP deflators to calculate nominal GDP, which was then converted to U.S. dollars using a Dong/U.S. dollar exchange rate. GDP per capita (in U.S. dollars) has been calculated by dividing the number so obtained by the population.

Assuming the growth of GDP deflator returning to 4.9% annually on average for the period from 2000 to 2010 back from the deviated trend of the period from 1995 to 1999, the nominal annual average GDP growth rate will be as high as 11.8%. Further, if we assume that the exchange rate of Viet Nam dong against U.S. dollars depreciates at an annual rate of 1.5% for the period from 2000 to 2010 and the population increases during the same period at an annual average rate of 1.6%, then nominal GDP per capita (in U.S. dollars) of 1999 of 374 U.S. dollars will increase to approximately 600 U.S. dollars in 2005, and 900 U.S. dollars by 2010.

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Table II-1-6 Forecast of Nominal GDP per Capita in Viet Nam

		1999	2000	2005	2010
GDP at constant 1994 prices (a)	Billion dong	256,269	270,384	372,726	513,069
GDP deflator (b)	1994=100	156.1	166.2	215.4	264.7
GDP at current prices (c) = (a) × (b)	Billion dong	399,942	449,469	803,022	1,357,878
Exchange Rate (d)	dong / US dollars	13,840	14,050	15,148	16,332
Population (e)	Million peoples	77.3	79.4	84.8	92.3
GDP per capita (f) = (c) / (d) / (e)	US dollars	374	400	600	900

Table II-1-7 shows the nominal GDP per capita in ASEAN countries.

Table II-1-7 Nominal GDP per Capita in ASEAN Countries

(Unit : US dollars)

	1976	1977	1982	1987	1999
Indonesia	327	387	643	465	729
Philippines	380	430	731	578	975
Thailand	374	421	755	943	1,994

Source: IMF

Fig. II-1-7 compares the forecast of the nominal GDP per capita of Viet Nam of Table II-1-6 to the records of other ASEAN countries of Table II-1-7. The forecast of nominal GDP per capita of Viet Nam can be considered reasonable when compared to the actual results shown by other ASEAN countries.

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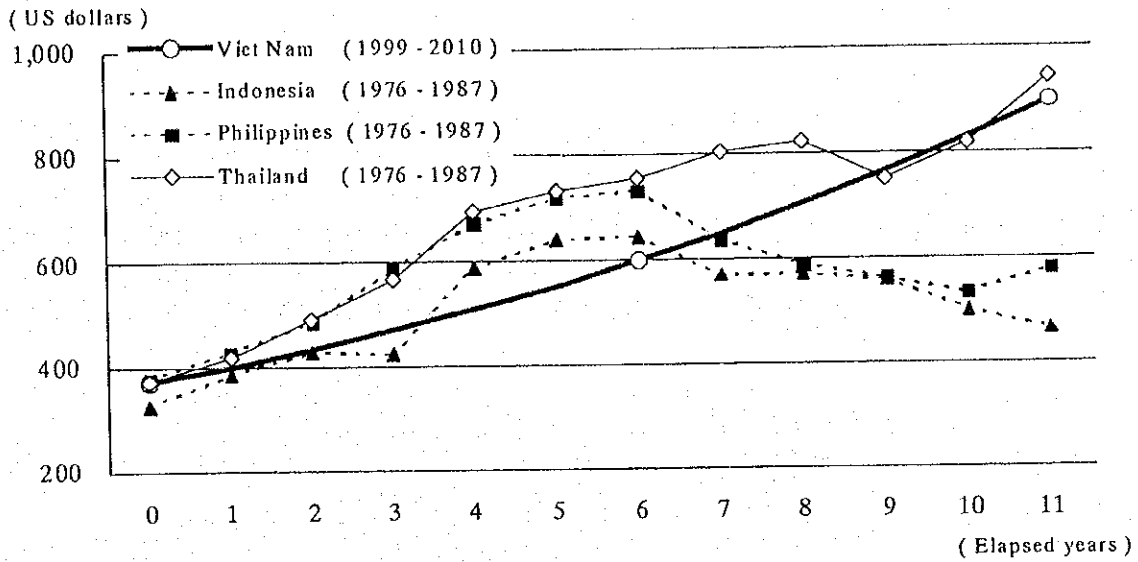


Fig. II-1-7 Nominal GDP per Capita in ASEAN Countries

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2. Outline and Projection of Each Industrial Sector

2.1 General

Cold rolled flat products are used not only by a construction sector, but also by manufacturing sectors as well. We have examined the status of manufacturers of GI sheets as major users of cold rolled flat products and other industries with future potential growth including the manufacturing industries of motorbikes, automobiles and home appliances in Viet Nam. Whereas our survey was conducted by interviewing the users and government authorities, it would certainly be more desirable if the public statistics of steel and related products were to be improved to allow us in conducting forecasting work on a continuous basis.

Table II-2-1 List of Organizations for Interview Survey

Category	Company name
GI manufacturer	Southern Steel Sheet (SSSC)
GI manufacturer	Posvina
Galvanized pipe manufacturer	Vingal Industries
Steel processing company	Vinanic
Steel processing company	Saigon Steel Service & Processing
Steel trading company	Hanoi Metals
Steel trading company	HCM City Metals
Motorbike manufacturer	Honda Vietnam
Motorbike manufacturer	Yamaha Motor Vietnam
Motorbike manufacturer	Suzuki Vietnam
Motorbike parts manufacturer	Vietnam Steel Products
Automobile manufacturer	Toyota Motor Vietnam
Home appliance manufacturer	Sanyo Home Appliances Vietnam
Home appliance manufacturer	Toshiba Vietnam Consumer Products
Ministry	MOI
Ministry	MPI
Agency	GSO

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2.2 GI Manufacturers

Table II-2-2 shows the production of GI sheets based on an interview survey. There are 21 GI sheet manufacturers in Viet Nam with an aggregated annual production capacity of 332 thousand tons in total. In 1999, but the actual production was 120 thousand tons. Most of the manufacturers are small-scale private enterprises with an annual production capacity of 10,000 tons or thereabouts and are processing sheet by sheet. SSSC and Posvina are joint venture enterprises of a reasonable size having an annual production capacity of 50,000 tons or thereabouts and are processing coil by coil. The products manufactured domestically are primarily used by the construction sector.

Table II-2-2 Production of GI Sheets

(Unit : 1,000 tons)

	(actual)					(forecast)				
	1995	1996	1997	1998	1999	2000	2003	2004	2005	2010
GI sheets	61	80	90	100	120	140	210	230	250	500

Source: GI manufacturers, VSC

Fig. II-2-1 shows ASC per capita of GI sheets in ASEAN countries. The x-axis shows a forecast of GDP per capita of Viet Nam quoted from the forecast for Viet Nam of Table II-1-5 and actual figures of ASEAN countries of Table II-1-6. Whereas the ASC of GI sheets in Viet Nam in 1999 was approximately 2.5 kg, it is expected to grow further along with the growth of GDP per capita.

ASC per capita of GI sheets of Philippines and Thailand turned out to be 3 kg and 5 kg in average when GDP per capita of both countries were in U.S. dollars at 600 and 900 respectively. If we assume Viet Nam will be developing to those levels of GDP per capita by 2005 and 2010, the ASC of GI sheets calculated in a reverse direction from the ASC per capita is estimated to be 250 thousand tons by 2005, and 500 thousand tons by 2010. These results give reasonable supports for the estimate of the production shown in Table II-2-2.

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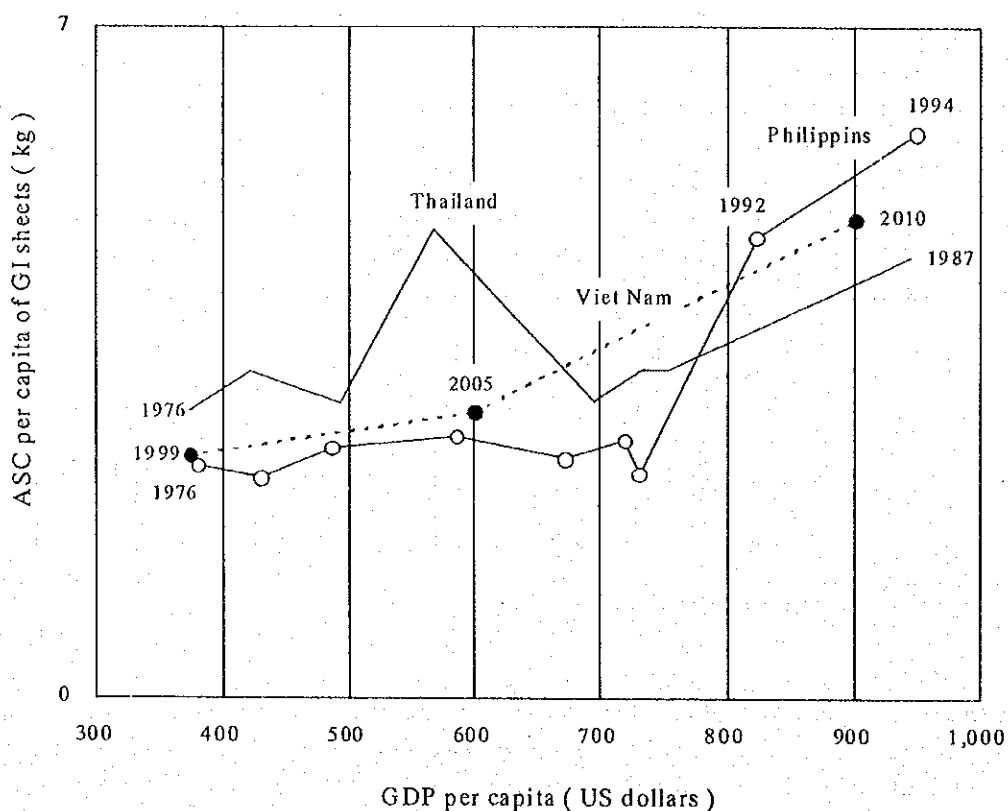


Fig. II-2-1 ASC per Capita of GI Sheets in ASEAN Countries

2.3 Motorbike Industry

Table II-2-3 presents the number of motorbikes assembled in Viet Nam. There are five foreign capital motorbike manufacturing companies, and 42 local companies, which altogether produced 437 thousand pieces in 1999.

Table II-2-3 Assembly of Motorbikes

(Unit : 1,000 pieces)

	(actual)					(forecast)				
	1995	1996	1997	1998	1999	2000	2003	2004	2005	2010
Motorbikes	55	40	97	376	437	450	500	550	600	900

Source: MPI, MOI, etc

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Fig. II-2-2 shows the diffusion rate of motorbikes in ASEAN countries. GDP per capita on the x-axis is based on the forecast by Viet Nam of Table II-1-5 and the actual figures of ASEAN countries of Table II-1-6.

The number of motorbikes in use per thousand persons in Viet Nam in 1996 was estimated as 45. Compared to other countries on the basis of GDP per capita, the ratio of motorbikes in use in Viet Nam is at a higher level than those of other ASEAN countries as a result of active inflow of second-handed motorbikes from neighboring countries. If the ratio is translated into the ratio of motorbikes per household, it is one for every six households on average or a mere 16.7% diffusion in terms of households. It is, therefore, fair to expect that the number of motorbikes to increase as GDP per capita grows.

If we assume, on the basis of the number of assembled motorbikes of Table II-2-3, that 10% thereof would be replacement demand and the rest being new demand, the number of motorbikes in use will be 114 per thousand persons by 2010, or one motorbike per 2 to 3 households. A ratio of 6.9% as annual increase of motorbikes in use is slightly smaller than the average of other ASEAN countries of 7.3% per annum, and is considered reasonable.

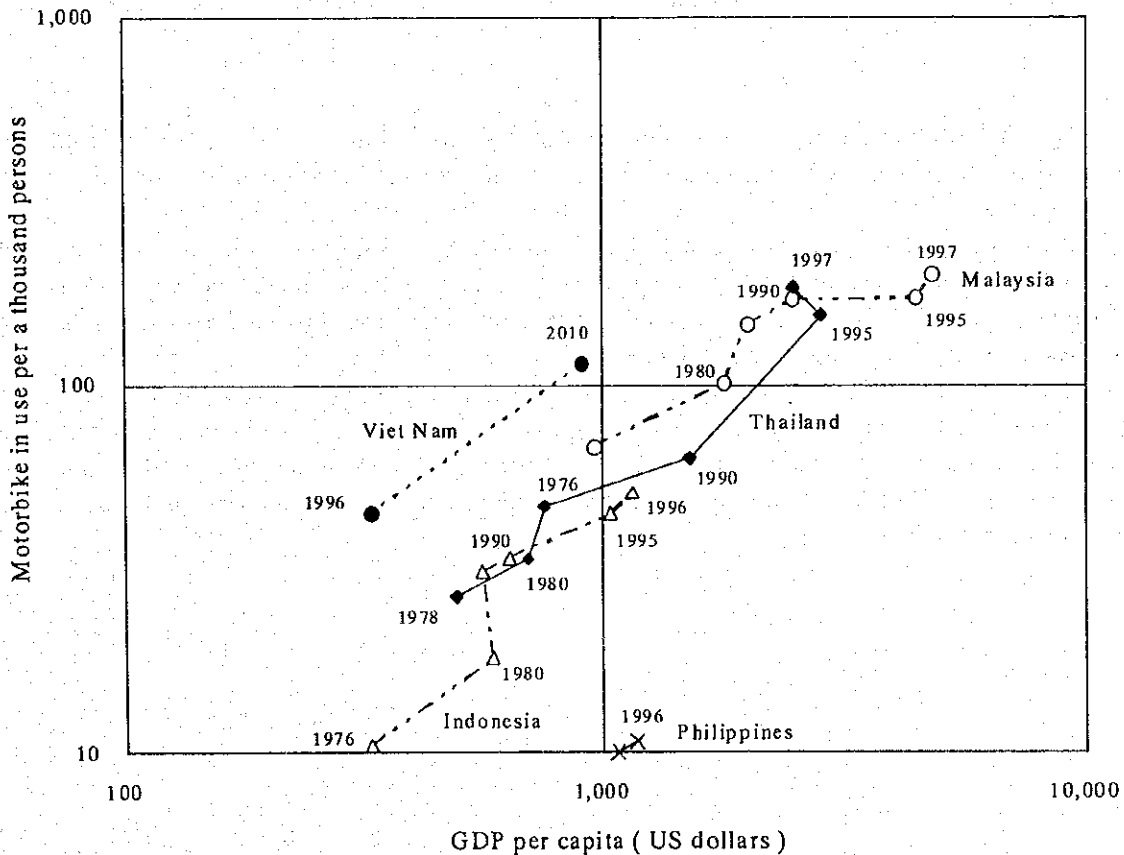


Fig. II-2-2 Diffusion Rate of Motorbike in ASEAN Countries

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2.4 Automobile Industry

Table II-2-4 shows the number of automobiles assembled in Viet Nam. There are 11 joint ventures operating in Viet Nam with an aggregate production capacity of 15 to 20 thousand pieces per year, but the actual number of automobiles assembled was less than 10,000 in 1999.

Table II-2-4 Assembly of Automobiles

(Unit : 1,000 pieces)

	(actual)					(forecast)				
	1995	1996	1997	1998	1999	2000	2003	2004	2005	2010
Passenger cars	0.0	5.1	6.8	2.7	4.4	5.5	7.0	10.0	11.0	18.0
Commercial vehicles	0.0	5.7	8.1	3.2	4.1	6.5	8.0	10.0	13.0	12.0
Total	0.0	10.8	14.9	5.9	8.5	12.0	15.0	20.0	24.0	30.0

Source: MPI, MOI, etc

Fig. II-2-3 shows the diffusion rate of automobiles in ASEAN countries. GDP per capita indicated against x-axis is the forecast by Viet Nam of Table II-1-5 and actual figures of ASEAN countries quoted from Table II-1-6.

The number of automobiles in use per 1,000 persons in Viet Nam was estimated as 2 in 1996. Comparing the number of automobiles in use by ASEAN countries relative to GDP per capita, Viet Nam is far behind other ASEAN countries. As GDP per capita increases through 2010, the number of automobiles in use in Viet Nam will surely increase.

On the basis of the number of automobiles assembled indicated in Table II-2-4, if we assume 10% of the said number is the replacement demand, and the rest is the new demand, the number of automobiles in use will increase to 7 per thousand persons by 2010. The ratio of increase of the number of automobiles in use of 7.8% is just slightly below the average rate of 8.1% in Indonesia and Thailand and which is considered quite reasonable.

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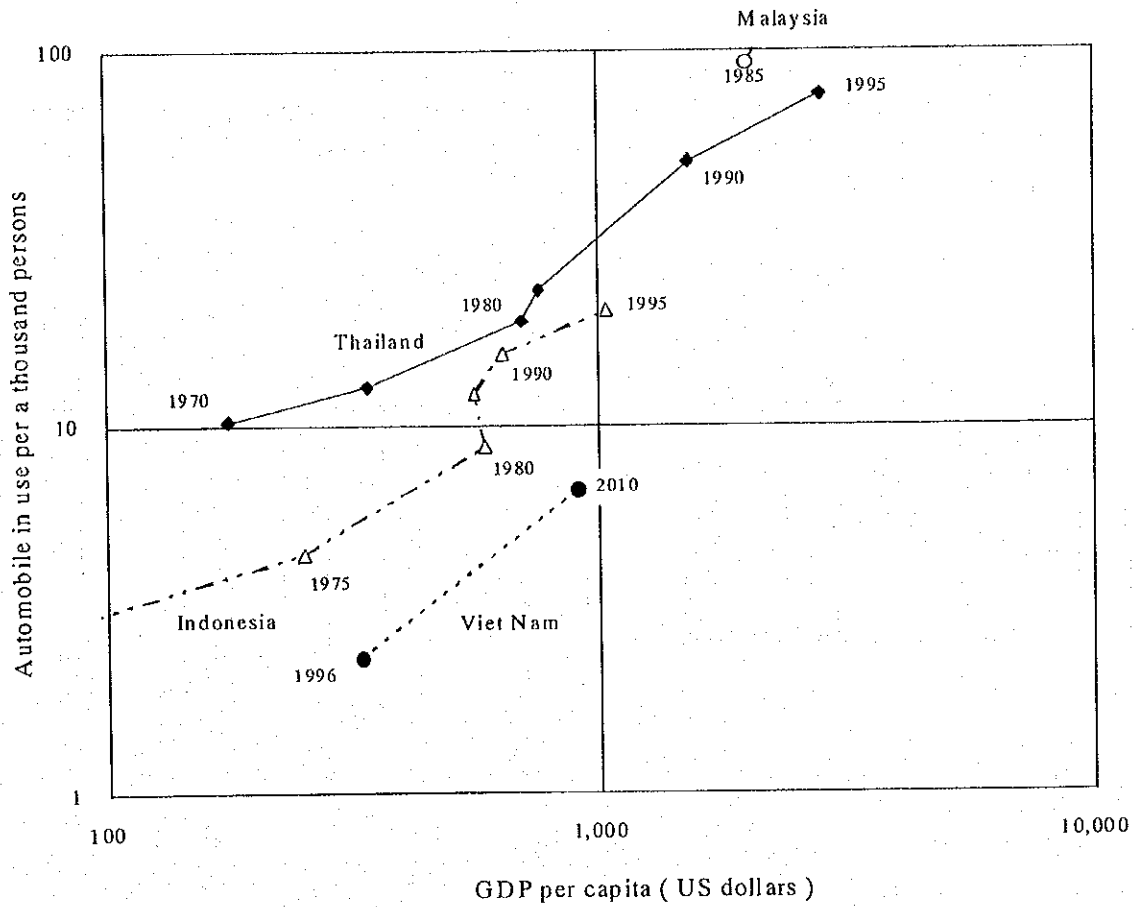


Fig. II-2-3 Diffusion Rate of Automobile in ASEAN Countries

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2.5 Home Appliance Industry

Table II-2-5 shows the number of home appliances assembled in Viet Nam. There are several foreign capital home appliance manufacturers operating in Viet Nam. Approximately six manufacturers assemble air conditioners, refrigerators or washing machines, and their products are both domestically distributed and exported to foreign countries.

Table II-2-5 Assembly of Home Appliances

(Unit : 1,000 pieces)

	(actual)					(forecast)				
	1995	1996	1997	1998	1999	2000	2003	2004	2005	2010
Air-conditioners				7	32	80	100	120	140	200
Refrigerators			33	110	130	195	231	260	300	450
Washing machines				20	200	250	300	350	400	600

Source: Home appliance manufacturers

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