Japan International Cooperation Agency

No.

Ministry of Industry

The Socialist Republic of Viet Nam

Final Report – Summary on

the Master Plan Study for

Industrial Pollution Prevention in Viet Nam

(Wastewater)

September 2000

International Center for Environmental Technology Transfer
Mitsubishi Chemical Engineering Corporation

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Map


CHINA
Nanning
Hanoi
Haiphong
LAOS
Gulf
Of
Tonkin
Vientiane
Survey regions
Hue
Da Nang
VIETNAM
Nakhon Ratchasima
CAMBODIA
Nha Trang
Phnom Penh
Ho Chi Minh City

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Abbreviation List

Organizations

ADB	Asian Development Bank
APEC	Asian Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
CECE	Center for Environmental and Chemical Engineering
CECO	Chemical Engineering Corporation
CECS	Center of Environmental Protection and Chemical Safety
CEETIA	Center for Environmental Engineering of Towns and Industrial Areas
CIDA	Canada International Development Agency
DOI	Department of Industry
DOSTE	Department of Science, Technology and Environment
DTPQ	Department of Technology and Product Quality
ENCO	Environmental Committee
EU	European Union
EPC	Environmental Protection Center
FIRI	Food Industries Research Institute
GEF	Global Environmental Facilities
GOV	Government of Viet Nam
IMF	International Monetary Fund
INEST	Institute of National Science and Technology
ISO	International Organization for Standardization
JBIC	Japan Bank of International Cooperation
JICA	Japan International Cooperation Agency
MOC	Ministry of Commerce
MOD	Ministry of Defence
MOF	Ministry of Finance
MOH	Ministry of Health
MOI	Ministry of Industry
MOSTE	Ministry of Science, Technology and Environment
MPI	Ministry of Planning and Investment
NEA	National Environmental Agency
OPEC	Organization of Petroleum Exporting Countries
SBV	State Bank of Vietnam
SIDA	Swedish International Development Authority
UNCRD	United Nations Centre for Regional Development
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
USA	United States of America
VCEP	Vietnam Canada Environmental Programme
VICB	Vietnam Industrial and Commercial Bank
VIDB	Vietnam Industry and Development Bank
VINABECO	Vietnam National Alcohol-Beer and Beverage Corporation
VINACHEM	Vietnam National Chemical Corporation
VINACOAL	Vietnam National Coal Corporation
VINAMILK	Vietnam National Milk Company
VINAPIMEX	Vietnam National Paper Corporation
VINATEX	Vietnam National Textile-Garment Corporation
VOCARIMEX	Vegetable Oil-Cosmetics-Aromas Company of Viet Nam
WB	World Bank
WHO	World Health Organization
WTO	World Trade Organization

Materials

ABS	Alkylbenzen Sulfonate
ABS	Acrylonitrile Butadiene Styrene copolymer
AOX	Adsorbable Organic bound Halogen
AP	Alkaline Pulp
BKP	Bleached Kraft Pulp
CGP	Chemi-Ground Pulp
CVC	Chief of Cotton
DIP	De-Inking Pulp
DDT	Dichloro-Diphenyl-Trichloro-ethane
DMDS	Dimethyl Disulfide
IC	Integrated Circuit
KP	Kraft Pulp
LAS	Linear Alkylbenzen Sulfonate
LPG	Liquefied Petroleum Gas
LSI	Large Scale Integrated circuit
MLSS	Mixed Liquor Suspended Solid
MM	Methyl Mercaptan
MS	Methyl Sulfide
MSG	Monosodium Glutamate
OCC	Old Corrugating Container
PCB	Polychlorinated Biphenyl

POY	Pre Oriented Yarn
PTY	Processing Textured Yarn
PVA	Polyvinyl Alcohol
PVC	Polyvinylchloride
SCP	Semi-Chemical Pulp
T/C	Mixture of Polyester and Cotton
TSPP	Sodium Pyrophosphate
UV	Ultra Violet
WP	Waste Paper

Special Terms

BOD	Biochemical Oxygen Demand
BOT	Build Operate Transfer
CCM	Computer Color Match
CCS	Computer Color Search
CIP	Cleaning in Place
COD	Chemical Oxygen Demand
CP	Cleaner Production
DF	Diffusion Factor
DTF	Official Discount Rate
E/S	Evaporation/Steam (ratio)
EFC	Effluent Chlorine Free
EIA	Environmental Impact Assessment
EOP	End of Pipe
EPZ	Export Processing Zone
FDI	Foreign Direct Investment
FOB	Free on Board
GAP	Green Aid Plan
GC	General Corporation
GDP	Gross Domestic Product
GMP	Good Manufacturing Practice
GNP	Gross National Product
HACCP	Hazard Analysis Critical Control Point
IQF	Individually Quick Freezing
IZ	Industrial Zone
JV	Joint Venture
KD	Knockdown
KN	Kappa Number
L/A	Loan Agreement

M/M	Minutes of Meeting
NIP	Nipper Pressure
OA	Office Automation
ODA	Official Development Assisteance
OJT	On the Job Training
ORP	Oxidation Reduction Potential
OWF	On the Weight of Fiber
PPP	Polluter Pays Principle
PR	Public Relations
PVD	Physical Vapor Deposition
QR	Quick Recommendations
RO	Reverse Osmosis
S/W	Scope of Work
SME	Small and Medium size Enterprise
SOE	State Owned Enterprise
SP	Solidification Point
SS	Suspended Solids
TCVN	Tieu Chuan Viet Nam (Vietnamese standard)
TOC	Total Organic Carbon
TPM	Total Productive Maintenance
TQC	Total Quality Control
TQM	Total Quality Management
TSL	Two Step Loan
TSS	Total Suspended Solids
ThOD	Theoretical Oxygen Demand
UHT	Ultra High Temperature
VA	Value Analysis
VAT	Value Added Tax
VCEP	Vietnam Canada Environmental Project
VSS	Volatile Suspended Solids

Units

g	Gram
ha	Hectare
kCal	Kilo Calorie
kg	Kilo gram
km	Kilo meter
kW	Kilo Watt
kWh	Kilo Watt Hour

l	Liter
m	Meter
m^2	Square meter
m^3	Cubic meter
mg/l	Milli-gram per liter
Mpa	Mega Pascal
MPN	Most Probable Number
mS/cm	Milli Siemens per centi-meter
NTU	Nephelometric Turbidity Unit
ppm	Part per million
rpm	Revolutions per minute
t	Ton
US$	United State Dollars
VND	Vietnamese Dong
µS/cm	Micro Siemens per centi-meter

Chapter 1

Background and Aim of the Study

Chapter 1. Background and Aim of the Study

1.1 Background of the Study

Since 1976 when Viet Nam was consolidated, Viet Nam has industrialized as a socialist planned economy with an emphasis on heavy industry. Following the introduction of the *doi moi* (renewal) policy in 1986, the country has been stepping up its drive toward industrialization by following the principles of a market economy.

Even though the growth rate receded to –3.3% in 1989, a remarkable growth rate of 17.1% was observed in 1992. Industries in Viet Nam have maintained a 10 % or higher growth rate from 1991 to 1999. Thus, if industry continues to grow at this present rate without adopting pollution prevention treatments, the pollution issue will become a very serious problem in Viet Nam.

The Vietnamese government has therefore been making every effort to formulate and implement various environmental policies by, for example, instigating and enforcing an Environmental Protection Law in 1994. It has also been a beneficiary of a number of cooperative programs offered by foreign and international organizations in areas such as monitoring. The first large-scale environmental inspection was conducted throughout the country starting in June, and running through November 1997. According to the results of the investigation, a majority of the factories that had been operating before the Environmental Protection Law was formulated, were found not to be in compliance with the Law, had no wastewater treatment equipment, and were discharging untreated, or close to untreated, wastewater.

The investigation results revealed clearly that the pollution prevention conditions in each factory were insufficient, and that covered Vietnam Governmental bodies, in terms of both regulations and enterprise support, needs to cooperatively support environmental preservation policies cooperatively.

On the other hand, in the past, the Vietnam Government has received a lot of cooperation from international organizations, but this cooperation has been concentrated mostly within the Ministry of Science, Technology, and Environment

(MOSTE). Therefore, the approach taken by the Ministry of Industry (MOI), the Ministry which is required to support and promote industrial pollution measures taken by private enterprises toward environmental issues, is lagging the establishment of environmental prevention systems.

In response to the request by MOI, in August 1998, the first environmental impact assessment was carried out by the Japan International Cooperation Agency (JICA). In December of the year, the MOI requested the Japanese Government to conduct "the Study for an Environmental Pollution Prevention Plan for Industrial Wastewater Along the Cau River". Moreover, in March of 1999, during the second Environmental Impact Assessment, after receiving a comment from the Japanese side that MOI ought to have its own strategies for industrial pollution prevention, MOI expressed a desire to receive cooperation for making wider, more comprehensive strategies.

From these results, the Japanese Government dispatched a preliminary team to Vietnam from JICA in August 1999. An Agreement was reached in response to the request in the form of ”the Master Plan Study for Industrial Pollution Prevention (Waste water)”, and on August 11 the parties concerned signed the Scope of Work (S/W) for conducting this Study.

1.2 Objectives of the Study

The aim of this survey is to review regulations, and to create a general Master Plan on the administrative side, which will provide a framework for introducing enterprise guidance policies.

1.3 Study Schedule

The study was conducted based on the operation of the following programs:

The first local survey in Vietnam was conducted for about one week from the 27th of October to the 3rd of November 1999. The content of the survey included an investigation of industrial, environmental and financial policies in Vietnam.

The second local survey in Vietnam was conducted for 37 days from the 16th of November to the 22nd of December 1999. The survey included additional examinations of development plans, social and economic conditions, industrial

structure and industrial pollution control policy in Vietnam; a survey of subject factories; water quality analysis; and simple proposals for improvement.

The third local survey was conducted from the 20th of February to the 20th of March 2000. This survey consisted of detailed proposals of improvement including necessary equipment estimates to enterprises selected, and an analysis of water quality. In addition, it also included the first joint seminar with the MOI in Ho Chi Minh City in which policy, as well as proposed countermeasures for the five industries, were publicly disclosed.

The fourth local survey was conducted over 10 days from June 1 to June 10, 2000. The survey included four workshops and discussions on a policy proposal outline with the Vietnam side.

The fifth local survey took place over 13 days from July 23 to August 4, 2000. In addition to an explanation and discussion on the draft of the Final Report, a Draft Final Report Seminar was held in collaboration with MOI concerning the content of proposed countermeasures.

1.4 Industrial Sectors Studied

The Scope of Work called for five different industries to be studied: textile and garment, chemicals, pulp and paper, food processing, and metalwork. According to the results of the Study, a plan will be formulated for industrial pollution prevention (waste water) in each of these five industries; these plans will be developed to cover the entire manufacturing industry, with the aim of decreasing the level of industrial pollution in Viet Nam.

Chapter 2

Present Industrialzation and Industrial Pollution Prevention Policy

Chapter 2 Present Industrialization and Industrial Pollution Prevention Policy

2.1 Present Industry in Viet Nam

2.1.1 Remarkable Industrial Progress in Viet Nam

Since renovation in 1986, Viet Nam has been carrying out the most important reforms in it's modern history, which are called *doi moi*. The contents of these reforms include ① a shift from a centrally planned economy to a market economy under the State's management, ② development and diversification of international economic relations, and ③ reform of the State Administration. After renovation began, industry in Viet Nam showed remarkable progress and the industrial growth rate rose continuously more than 10% from 1991 to 1999. The economy in Viet Nam suffered through a regional economic crisis in late 1990's, the industrial growth rate will be expected to drop below 10% in 2000, but it is estimated it will still show a stable growth rate compared with other ASEAN countries.

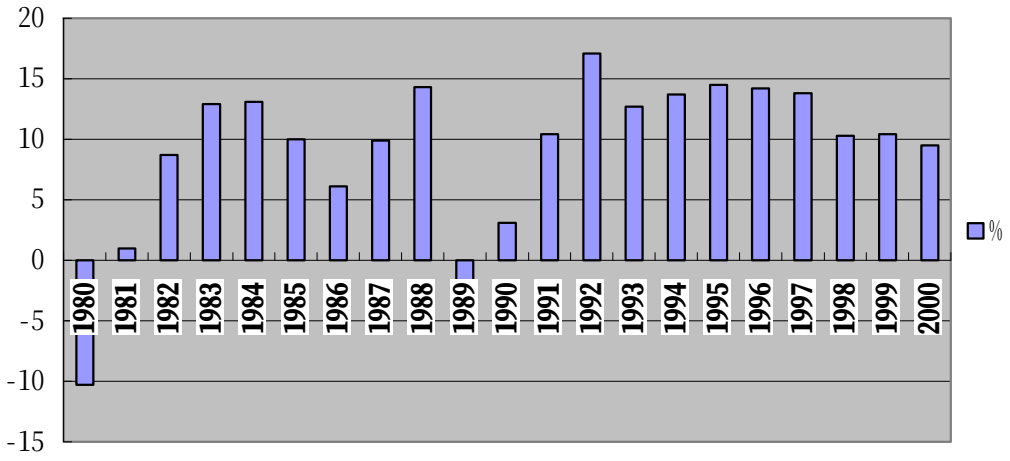

Figure 2.1 Industrial Growth Rate

Source: "Socio-economic Statistical Data of 61 Provinces and Cities" p.75

1999 figures are from the Annual Report by MOI

2000 figures are forecasted from "Viet Nam Socio-Economy the Period 1996-1998" p.50

The ratio of industry and construction in GDP became larger than that of agriculture, forestry and fishing in 1994. The ratio in 1999 reached 34.5% of GDP and is still foreseen to increase. The industrial sector is now the most important one for growth in Viet Nam.

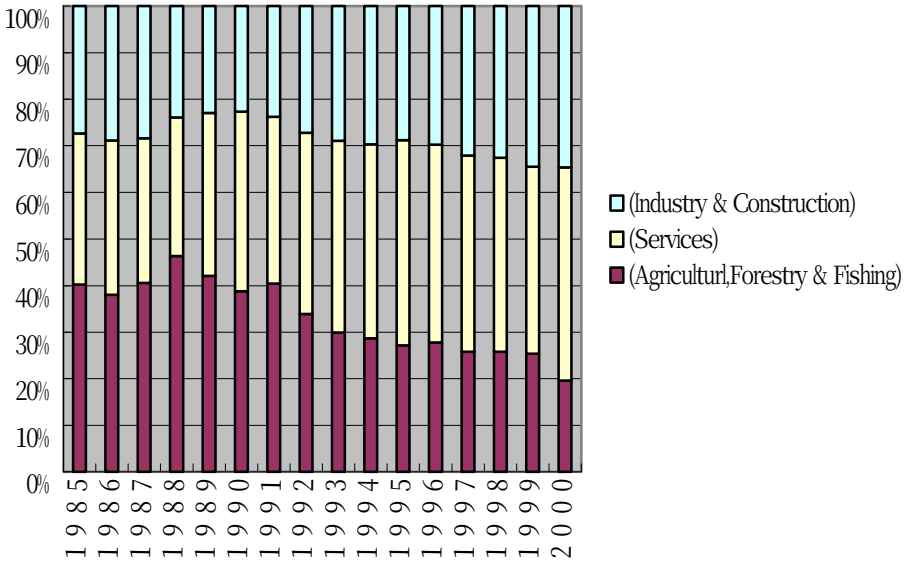

Figure 2.2 Industrialization in Viet Nam

2.1.2 Forecast of Industrial Production in Viet Nam

From 1997 to 2000 many industrial products are estimated to increase several times, like steel and steel products (3.06 times), paper (2.06 times), caustic soda (6.00 times), vegetable oil (1.67 times), and fabrics (3.57 times). Production of these items are expected to increase more through 2010, and production of some products, like caustic soda, are foreseen to expand by 20 times or more. After the petrochemical industry begins operations, new chemical products like polyvinyl chloride, methanol, synthetic fibers, and polyethylene are expected to emerge.

This forecast, made by MOI, shows that industrialization in Viet Nam will continue at a high growth rate.

2.1.3 The Increasing Environmental Load

The industrial growth rate is increasing rapidly in Vietnam, and growth in the future is expected to be at the same high rate. However, the environmental load has been increasing at the same rate as industrial growth.

For example, using the case of the paper and pulp industry, it is easy to make an environmental load comparison with Japan. The COD ratio to the production amount in Vietnam has reached about 82 times that of the Japanese figure, and the absolute values of COD are almost the same in Japan and Vietnam. The paper and pulp industry's expected production improvement in the future will lead the environmental load volume in Vietnam to reach or surpass the Japanese condition even though their

production amount is not as large as in Japan. In the Japanese case, the value of the COD load was 2.2 million tons without environmental measures in 1970, and the promotion of pollution prevention measures brought both an increase in the production amount and a 91 % decrease in the total environmental load.

2.1.4 Problem Points of Existing Industrial Policy

(1) Low Profitability Due to Geographic Decentralization of Small Scaled Enterprises

At present, industrial production in Vietnam is expanding rapidly. However, when production per factory is compared to international standards, it is revealed that the figure remains behind previous, smaller standards.

Because all industries possess distinct and special qualities, just because an industry's the production scale is small does not mean that it will work at a disadvantage. For cases like the textile industry, where the bigger the production scale is the higher the costs of labor and textile machinery become, if labor and machinery are increased greatly, after expansion, the cost per unit produced will not decrease. Therefore, international competitiveness will not clearly become stronger. The textile industry is referred to as a “labor-intensive industry”.

On the other hand, for cases of the chemical and paper and pulp industries even if production capacity is increased greatly, the cost for various kinds of machinery will not increase proportionately to the increase in production capacity. It is another way to say, basically, costs for the reactors, furnaces, tanks, etc are proportionate to the production capacity to the 0.6 power, so the costs will not increase greatly. (0.6 power rule)

This type of industry is called an “equipment intensive industry,” and also has the characteristic that the number of laborers, in most cases, will not increase much if the production ability increases.

In this situation, concentration and integration of enterprises are effective for the reduction of cost for both equipment and labor.

Profits made by small scale and geographically dispersed factories will be low because facility, equipment and labor costs are relatively expensive in equipment intensive industries. This situation puts small sized and dispersed factories at a disadvantage because it is hard for them to implement pollution prevention investment.

On the other hand, it is expected that small and medium-size enterprises in industries such as food processing, furniture, and sundries that have favorable conditions, for example they have a secure supply of raw material, or some kind of

local quality that differentiates them from their competition, will grow rapidly in the future.

(2) Increasing Costs Due to Outdated Production Processes

There are many factories that are still using outdated production methods. In the pulp industry, the Kraft Pulp (KP) method is now the main method used for producing pulp. This method utilizes caustic soda (NaOH) and sulfate soda (Na_2S), and these chemicals and energy from wastewater are recollected and are called black liquor. In Viet Nam this method is being adopted at a low rate. Among the 21 enterprises subject to the Study, only 2 enterprises are following the Kraft Pulp method and executing the implementation of black liquor collection equipment, accumulation and burning of waste liquor, recovery of energy, and at the same time, recollecting caustic and sulfate soda. Good quality pulp can be produced using the KP method. Waste water is utilized as a source of energy, and there is little consumption of chemicals in this method due to recollection.

There are some companies that are producing caustic soda according to the diaphragm process, however, the ion exchange membrane method is more profitable, both in terms of general energy costs and quality.

In the dyeing process, continuous dyeing equipment has an advantage, but in Viet Nam there is very little continuous dyeing equipment in use. In addition, for these type of dyeing machines, concerning the ratio of liquid dye to cloth, it is possible to reduce the ratio of the liquid dye, therefore both cost and the pollution load can be validly decreased. For small-scale dyeing factories with high production capacity, continuous dyeing machines, because the operation rate will lower drastically, from here forth the general execution of scale increases and the introduction of new equipment are necessary.

It is necessary for companies to have profits in order for factories to invest in the environment. Because there may be big differences in cost, as well as quality, depending on the production method used, there is a limit to cost reduction and profit increases that can be gained if improvement in product yield is sought only through production management improvement. In cases like these, in order to advance pollution prevention, it will be necessary, at any rate, to adopt policies for changing the production method.

(3) Disadvantageous Factory Locations

The most suitable place to locate enterprises changes over time. Enterprise location is a very important factor for social stability, especially for promoting

industries in poverty areas. The following are some examples of problems that should be solved in the long term in order to increase enterprise profits and make investment for pollution prevention easier.

Among the paper factories surveyed, some have changed raw materials to imported pulp from domestic wood or bamboo. For mass-produced products like pulp, the portion of transportation costs is large and competitiveness can change just by factory re-location. So, those factories located inland, far from seaports, must consider changing their location and re-locating near seaports. Most inland factories are now using imported material and the use of imported material in the industry is forecasted to increase in the future.

It is profitable to consider generally, locating each industry depending on their respective, special characteristics. Concerning remote areas, for industries that are not really related and can't obtain merits through reduced transportation costs and scale increases (traditional handicrafts, arts and crafts, industries using regional products and the tourism industry, which makes use of special natural conditions) a plan for luring these industries to remote areas is thought to be adequate.

Oppositely, in fixed industries like the petrochemical industry, massive sized facilities, integration, including related industries, and a location where low cost transportation is possible are required.

(4) Insufficient Production and Environmental Management

In all 5 industries surveyed it is necessary to improve the level of management. It is obvious there is a need to record wastewater statistics for environmental prevention, but on top of that, it is also necessary to raise competitiveness so companies can afford to invest in the environment.

2.2 Current Situation of Water Pollution in Vietnam

2.2.1 Annual Change in Water Quality

Fig 2.3 shows annual changes in BOD and COD at Lien Mac of the Red River. The water quality worsened after 1997.

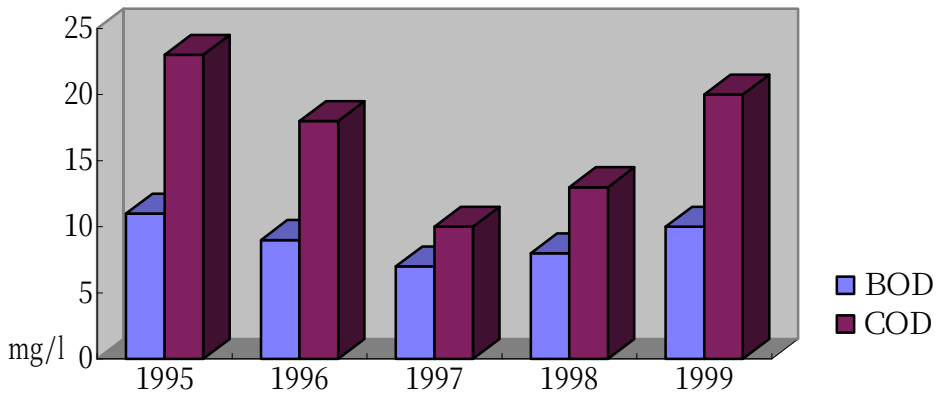

Figure2.3 Water Quality at Lien Mac in Red River (HANOI)

Source: National Environment OAM Program

Fig 2.4 shows the changes in DO and COD in the River Tuy Loan in 1995 , 1996 and 1997.

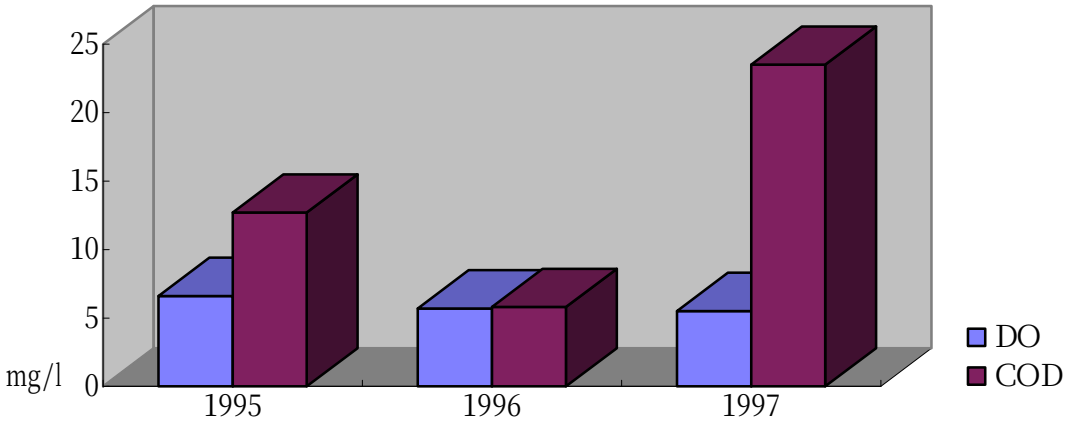

Figure 2.4 Water Quality in Tuy Loan River in Danang

Source: National Environment OAM Program

The concentration level of Dissolved Oxygen reveals the degree of pollution in wastewater. If the DO concentration is low, that means there is more organic matter in wastewater and that it is more polluted. The DO value has been getting worse year by year since 1995. On the other hand, the COD value improved around 1996, however, after that, it again became dramatically worse.

In regard to river water quality in the Southern region, a significant volume of industrial wastewater, as well as household wastewater, from the more than 10 million inhabitants in the area is discharged into the Saigon-Don Nai River water system, causing serious environmental problems. Figure 2.5 shows the annual change of water quality in terms of DO concentration from 1995 to 1999, and organic matter process pollution can be observed.

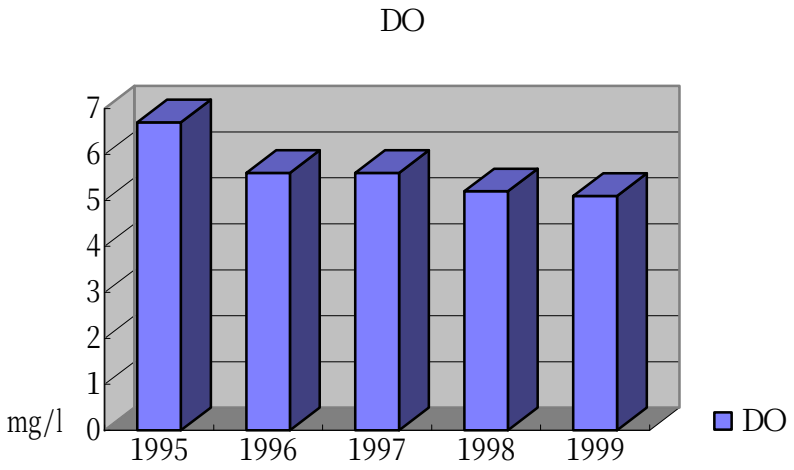

Figure 2.5 DO Concentration in the Sai Gon River (Ho Chi Minh)

Source: National Environment OAM Program

2.2.2 Pollution Distribution

In order to grasp the quality and actual conditions of water, the Study Team selected main rivers located in the Northern, Central, and Southern regions in Viet Nam. Water quality was measured from December 1999 to January, 2000. Sampling and water quality analysis was done by CECO (Chemical Engineering Corporation), an analyzing institution in Hanoi.

The To Lich river and the Kim Nguu river are typical urban canals in the Northern area, and the BOD and the COD value in the river water is 115-378 mg/l and 160-535 mg/l respectively. These figures reveal that serious organic pollution has been occurring due to domestic and industrial wastewater being discharged without treatment. In addition to this, values of metal concentrations, such as lead, Mn, and Cu, are also high. The lead value especially, 0.125mg/l at a sampling point in the To Lich river, and 0.855mg/l at a sampling point in the Kim Nguu river, are way beyond the value of the water quality standard A (for drinking), 0.05mg/l, and water quality

standard B (for ordinary use), 0.1mg/l.

These rivers are used as canals in urban regions, and should be differentiated from other rivers, such as the Red river, for their degree of pollution. These rivers have small flow rates, narrow river widths, and small natural purification systems because of a low rate of circulation. Thus, infrastructure countermeasures, such as sewerage systems, should be implemented as soon as possible.

The Nhue River has only a little pollution even though river water is muddied.

Han river water was measured as a representative river that runs through the Central region, and DO values at all sampling points are 6mg/l or more, which satisfies standard A, which is 6mg/l or more. Both BOD and COD values are4.8-6.4 mg/l, and 6.5-9.2 mg/l respectively, and pollution related to the living environment is not so serious at the moment. Items that are harmful to human health, such as heavy metals, also show low concentration values, and it can be concluded that there is minor effect to river water by industrial wastewater. However, these measurements were conducted during the rainy season in the Da Nang region, and it can be assumed that water quality will worsen during the dry season.

Water quality in the Sai Gon River from the point where it merges with the Don Nai River, and on downstream, is getting worse. Underneath the Dan Xay Bridge, BOD and COD concentration values were 29mg/l and 40.8 mg/l respectively, and exceed the standard B value, BOD 25mg/l, and COD, 35mg/l. The reasons for this are attributed to the discharge of domestic and industrial wastewater from densely populated and industrial areas along the river, which cause down stream values to worsen.

The Thi Vai River water quality has worsened due to the influence of industrial wastewater coming from the MyXuana and Go Dau industrial zones.

The ThiVai River has a serious pollution condition caused by industrial wastewater, and the situation is expected to worsen because of increasing industrial activity and the construction of more factories. Therefore, countermeasures for industrial pollution sources, such as introducing wastewater treatment facilities in factories, should be promoted.

2.2.3 Pollution Sources

There are two types of wastewater that cause pollution, industrial wastewater and domestic wastewater. Table 2.1 shows each industry's pollution load in the main industrial zone in Vietnam.

Table2.1 Water Pollution Sources in Industrial Zones by Industry (Organic Pollution)

(1) Industrial Water Pollution Sources in HANOI (1996～1998)

No	Industrial Zone	Industries	number of employees	pollutants		volume of waste water (m^3/day)
				SS (kg/day)	BOD (kg/day)	
1	Thuong Dinh Industrial Zone	Machine	6171	2084.85	-	4,907
		Construction Material	640	490.17	1.59	54.16
		Textile, Shoes	5772	727.60	1588.57	1,015.00
		Foodstuffs, Tobacco	7655	1304.4	263.36	22,114
		Others	491	259.42	1.72	95
		Total	20729	4866.44	1855.24	28,185.16
2	Hai Ba Trung District Area	Machine	560	673.88	-	296.9
		Construction Material	1714	4890.12	19.497	3,816.7
		Textile garment	14217	3142.78	6542.13	18,243.30
		Office supplies	-	-	-	750.00
		Total	16491	8706.78	6561.627	23,106.9
3	Van Dien Area	Machine	884	1513.00	511.58	329.00
		Construction Material	324	2166.00	7.67	100.00
		Others	1040	371.63	0.48	1003.40
		Total	2248	4050.63	519.73	1432.40
4	Chem Area	Machine	930	617	-	135
		Construction Material	1334	110.17	-	727
		Others	844	47.67	96.92	785
		Total	3108	774.84	96.92	1647
5	Sai Dong Area	Machine	2638	71.33	-	2355
		Construction Material	750	1300.00	4.60	100.00
		Others	2307	591.49	480.00	76.20
		Total	5695	1962.82	484.60	2531.20
G-Total			48,271	20,361.51	9,518.17	56,902.66

Source: National Environment Agency (NEA)

(2) Industrial Water Pollution Sources in PHU THO

No	Industries	Number of employees	pollutants		volume of waste water (m^3/day)
			SS (kg/day)	BOD5 (kg/day)	
1	Machine	600.00	454.50	17.58	93.50
2	Construction Material	805.00	77,906.67	261.40	1,298.00
3	Chemical	2,304.00	4,936.00	2,210.00	43,882.00
4	Textile, Paper manufacturing	7,716.00	6,170.00	7,180.00	76,518.30
5	Foodstuffs	1,157.00	1,873.00	680.30	1,068.00
	Total	12,582.00	91,340.17	10,349.28	122,859.80

Source: NEA

(3) Industrial Water Pollution Sources in NAM DINH

No	Industries	Number of employees	pollutants		volume of waste water (m^3/day)
			SS (kg/day)	BOD5 (kg/day)	
1	Machine	1,200	1,878	-	72
2	Foodstuffs	1,242	966.5	1,857.12	3,989
3	Textile	24,152	1,476.99	630.64	17,614.08
4	others	973	37.5	28	117.17
	Total	27,567	4,358.99	2,515.76	21,792.25

Source: NEA

(4) Industrial Water Pollution Sources in BAC NINH

No	Industries	Number of employees	pollutants		volume of waste water (m^3/day)
			SS (kg/day)	BOD5 (kg/day)	
1	Glass Factory	-	82.37	0.58	600
2	Glass Factory in Dap Cau	-	1.04	599.2	800
	Total	-	83.41	599.78	1,400

Source: NEA

The total BOD discharge amount of these four industrial zones per day is 23 tons. This value was compared with the various industries surveyed to determine if the surveyed results were adequate or not in terms of order. The COD discharge amount coming from the 21 paper and pulp enterprises surveyed this time, which operate 240 days per year, reaches 760 tons per day, and even if BOD is half that of COD, 16.5 times the total discharge amount of the four industrial zones is allowable.

In the same way, the total amount of discharged BOD coming from the 21 enterprises surveyed this time in the food processing industry is 11.7 tons per day, and

51 % of the total discharged amount of the four industrial zones is allowable. As far as order goes, in the case of food processing, the numerical value is matches that of the Vietnam side.

As for the case of paper and pulp, because the amount contributed to the total discharge amount of COD in a few factories is extremely large, it is thought that the total BOD discharge amount shown in the materials received from the Vietnam side is adequate.

In addition, supposing that the total pollutant load coming from households is 50 grams per day per person, the Hanoi area, with a population of 3,000,000, will produce 150 tons per day. This value matches a figure that is 15.8 times that of the 9.5 tons per day of the total BOD discharge amount of the 5 industrial zones in the Hanoi area. Regarding total BOD and COD household pollution, because sewer systems are not in place, the overwhelming majority of this pollution is made up of waste.

2.3 Current Status of Industrial Pollution Prevention

2.3.1 Basic Framework of Policies on Industrial Pollution

(1) Environmental Protection Law

Vietnamese environmental policies are based on the Environmental Protection Law that was enacted in December 1993. This Law was approved and enacted at the fourth meeting of the ninth session of the Diet held on December 27, 1993 in accordance with the Constitution of the Socialist Republic of Vietnam, as established in 1992. It was enforced as a Law on January 10, 1994.

The Environmental Protection Law forms the basis of environmental protection measures in Vietnam. The Law defines the “Environment” as “natural resources and environmental ingredients,” and covers problems related to overall environmental conservation. It consists of seven chapters and 55 articles.

The basic philosophy and objectives concerning environmental protection underlying this Law are:

① To conserve and improve the environment;
② To protect the foundations of ecosystems;
③ To prevent environmental destruction; and
④ To carry out appropriate development of natural resources and conserve resources.

The items to which the Environmental Protection Law apply are broad and include air, water, and soil, and extend to living creatures, ecosystems, and the protection of biodiversity of living creatures. The Law aims to implement active measures for protecting the global environment, as well as industrial pollution control

measures.

Organizations that are responsible for implementing environmental policies, the requirements of establishing national and municipal environmental management systems, and the responsibilities of relevant organizations are identified in the Law. The Law also specifies the environmental assessment system, environmental monitoring, penal provisions, and compensation for damages.

(2) Organization and system

1) The organization and duties of MOSTE, the Ministry which manages and coordinates the governmental administration with respect to environmental protection, are shown below.

MOSTE is responsible for the following items:

① Planning a national strategy and policies on environmental protection, and submitting it to the government

② Making annual and long-term plans concerning environmental contamination and prevention of environmental pollution and accidents, and implementing the plans after receiving government approval

③ Setting up and managing an overall environmental monitoring system

④ Monitoring and analyzing environmental conditions nationwide, and submitting periodic reports to the government and Diet

⑤ Evaluating and examining reports on implementation of environmental impact assessments related to development projects

⑥ Surveying and applying the results of scientific and technical studies to environmental protection, introducing and revising environmental standards, and managing training provided for the environmental administration

⑦ Instructing and supervising branches, regions, and organizations related to the enforcement of the Environmental Protection Law

⑧ Seeking the government's approval for participating in international organizations and international conventions on environmental protection, and implementing appropriate international actions

2) Duties that fall within the jurisdiction of the NEA, which is under the umbrella of MOSTE and plays a key role in the nation-wide environmental administration, are specified as follows.

① Examining and submitting policies, measures, and legal documents on environmental conservation

② Monitoring compliance issues with the Environmental Protection Law
③ Preparing and implementing national plans and action plans related to environmental management
④ Examining environmental impact assessment reports
⑤ Monitoring and evaluating environmental protection, and installing and managing forecasting systems
⑥ Preventing environmental pollution
⑦ Dealing with problems related to environmental accidents and incidents
⑧ Implementing international cooperation
⑨ Providing instruction for environmental officers at related branches and municipal organizations
⑩ Planning and implementing training courses
⑪ Implementing studies on environmental management
⑫ Collecting information and documents on environmental issues

In addition, the role of ministries and agencies involved in environmental preservation sets policies and strategies , as well as for every organization involved in environmental preservation, following national strategies and policies. In addition to work on management of environmental preservation plans and pollution complaints, Ministries and agencies also cooperate for carrying out inspections on Environmental Impact Assessment reports that go together with enterprise activities like development and production. Also, they regulate surveys and appraisals of environmental conditions, and carry out research on environmental technology and its applications together with MOSTE.

3) The role of local governments, who are under the guidance of the central government, for promoting environmental preservation countermeasures is regulated in Government Ordinance (Decree No. 175/CP) Article 6 which lays out the duties and responsibilities of provincial governments and centrally-administrated cities. The outline of the Ordinance is as shown below:

① It is possible for concerned administrative organizations to publicly disclose ordinances and notifications related to environmental preservation.
② Direct and supervise compliance with environmental standards at the national and local level.
③ Inspect Environmental Impact Assessment reports
④ It is possible to pick up certificates that certify environmental standards from the Enterprise Agency.

⑤ Carry out regulations with the national government for surveys and handling of breaches of the Law.

⑥ Solve problems concerning the environment such as strife, complaints and petitions, and send them on to other organizations.

Moreover, for provincial governments and centrally-administrated cities, assist in ensuring that the environmental management of the people's committee works on science, technology and environment related administration matters.

2.3.2 Regulations for Industrial Pollution

(1) Environmental Pollutant Standards

MOSTE promulgated the Vietnamese Environmental Standards (VS) in 1995.

The said VS includes emission standards for environmental pollutants, general environmental standards regarding air quality, effluent standards, environmental quality standards regarding water quality, soil quality and the soil-residue-prone pesticide allowable limit, and regulations such as maximum allowable noise levels on roads, as well as in the general environment.

As for water quality, the following 4 standards are in effect.

①Water quality standard of surface water (TCVN 5942-1995) for 31 items and 2 types

②Water quality standard of coastal water (TCVN 5943-1995) for 26 items and 3 types

③Water quality standard of underground water (TCVN 5944-1995) for 22 items

④ Effluent standard of industrial waste water (TCVN 5945-1995) for 33 items and 3 types

For the wastewater standards themselves, if standards have not been established for some new types of substances discharged, like several different new organochlorine compounds, the standards for selected polluted materials is adequate. However, a problem exists in that there is imbalance between wastewater and environmental standards. Environmental standards, as opposed to the wastewater standards, are too lenient in some areas.

(2) Environmental Monitoring

For conserving and maintaining the environment, it is essential to grasp the present situation of environmental quality adequately using some appropriate methods and standards. For this reason, Chapter 4, Article 37, Clause 4 of the Law provides for environmental monitoring.

NEA has been responsible for nation-wide monitoring activities, and the Environment Monitoring Center has been responsible for the monitoring and measuring of environmental quality. In 1994, they conducted a fixed-point measurement at 72 stations for air quality, at 109 stations for water quality, at 200 stations for acid rain, at 29 stations for radiation and at 52 stations for noise pollution.

Environmental monitoring was conducted, and some points were noticed where pollutant concentration values are exceeding the environmental standards. However, analysis on the reasons why the values were exceeding the environmental standards, and countermeasures for them have not been implemented. Following this, there are many points where the environmental standards are continuing to be widely exceeded.

Besides the monitoring and measuring of the general environment, the Department of Science Technology & Environment (DOSTE) checks the condition of polluted effluent periodically at pollutant generating sources, like factories. In addition, factories also measure emission gases, effluent, etc. and report the results to DOSTE at regular intervals. However, most of the factories are not able to carry out analysis by themselves. There are a few analyzing institutes that can be contracted to make analysis, however, small and medium-size enterprises do not usually request analysis because of the additional cost burden.

In order to improve the environmental situation, it is insufficient to use data taken only once a year by DOSTE as a basis.

(3) Environmental Impact Assessment : EIA

In the case the environmental impact caused by business activities of enterprises of a certain scale or larger is considered significant, the offending enterprise is required to conduct an advance evaluation with regard to environmental impact, prepare an EIA report (Environmental Impact Assessment) and submit it to the authorities concerned (MOSTE, etc.). This is done to prevent disruption to the environment and environmental pollution which may be caused by the implementation of business based development plans. The business activities for which an EIA report is required are as follows: (the business categories and scale are provided in the detailed rules of the Government Decree.)

①Businesses and urban development / measures for population control in association with regional development supported by national policies

②Projects for the economy, science, health, society, culture, security and self defense

③Investment, support and aid in Vietnam by overseas and international institutions

The following 3 items are prescribed to be included in the scope of coverage of the

EIA report; 1) An evaluation on the current conditions of the environment, i.e. air quality and water quality at the project site; 2) An evaluation of the environmental impact caused by the project; and 3) Measures to solve the environmental problems they are faced with at present. The EIA report is reviewed by MOSTE in the case of large-scale businesses, and is reviewed by provincial or municipal branches of DOSTE in the case of local, small-scale businesses.

(4) Environmental Protection Promotion Organizations

MOSTE is responsible for specialized inspections on environmental protection conditions. So, they carry out inspections concerning environmental protection at the Ministry, local government and people's committee levels, as well as check on how and what kind of measures for environmental protection have been implemented by enterprises and individuals.

2.3.3 Tackling Pollution Control

(1) Industrial Pollution Investigation

According to the results of the 1997 survey by MOSTE, 3,311 factories were determined to be causing serious environmental pollution. Of these 785 factories, 23.7% were State-owned enterprises, and 2,526 (76.3%) were private industries. 2,722 of these factories are located in residential areas and 585 are located outside of residential areas.

The main pollution source sectors were determined to be as follows:

1. Food Industry	1,217 factories (36.8%)
2. Chemical Industry	457 factories (13.8%)
3. Construction Materials Industry	432 factories (12.3%)

The main reasons why these factories are causing serious environmental pollution are as follows:

① Use of old technologies, machines and equipment.
② Lack of treatment methods and methods for reducing waste.
③ Lack of capacity to invest in waste treatment systems and to upgrade technology.
④ Unaware of the concept of environmental protection.
⑤ Unsuitable spatial distribution(especially private industry)
⑥ Management standards and capacity are low

This investigation provided opportunities to gain experience in environmental

protection management at all levels, partly contributed to the effectiveness of the Environmental Protection Law, improved environmental consciousness and was supported and well assessed by the people involved. Bringing into play the good results of the large scale investigation, MOSTE has continuously performed periodic investigations of the factories and built up a country wide list of factories that are violating the Environmental Protection Law since the investigation was carried out. However, penalties are lenient, industries do not have high-level technology and cannot afford financing, and there is a lack of a governmental support system for weak enterprises. These problems must be addressed. Not many of the enterprises are conducting pollution countermeasures, even though many enterprises have made plans for implementing such measures.

MOSTE classifies these factories and determines solutions for them accordingly.

The report on the current status of the environment is complete. Since 1998, in addition to the annual report on the current state of the environment prepared by MOSTE for submission to the National Assembly, the Ministry has been giving legal authority and has been supplying appropriate financial measures to ministries and industries to allow them to prepare their reports on the current state of the environment. These reports can be used as a basis for the management of environmental protection in ministries and industries.

In 1998, most of the seriously polluting factories prepared reports on the current status of the environment. In 1999-2000, it is anticipated that this activity will be applied to some industries that are causing a serious impact on the environment. However, remarkable improvement has not yet been observed.

Pollution control all over the country has been performed regularly. Many measures and projects on pollution prevention and treatment for key areas and basins in the country have been proposed.

However, environmental protection in Vietnam has not met the requirements that their level of socio-economic development requires. One of the major reasons for this concerns the requirements of the Government Management Structures and Organization (from the central to the provincial level).

As environmental protection is not considered as a separate, national economic industry, it does not receive independent and necessary investment. Although the government considers it a priority to invest in environmental protection, the priority for and consideration given to environmental investment has been scattered and unremarkable in comparison with the demands.

At the local level, State administrative organizations for the environment are overloaded and unable to undertake increased duties due to a lack of human resources, finances and capability.

The government has considered many projects on strengthening the organization of State management on the environment at all levels.

2.4 Financial Support to Enterprises

2.4.1 International Cooperation and Financial Support

(1) International Cooperation and Vietnamese Executing Agencies

For international cooperation in environmental programs, the executing agencies of Vietnam are generally MPI, MOSTE and NEA, and cooperation has basically been focused on the construction of infrastructure and capacity building for environmental improvement through industrial pollution prevention. Little has been seen of foreign cooperation efforts to directly improve pollution prevention at polluting factories.

(2) Financial Support for Enterprises

In order to promote and support industrial pollution prevention measures for enterprises, financial support and a favorable tax system should be used as incentives for obtaining compliance with following standards can be used. In addition to these, supportive policies to each enterprise such as installing pollution prevention equipment adding to provide low interest rate and favorable conditions loans.

However, Vietnam Government has difficulty to supply budget to spare for financial measures including financial support for pollution prevention to enterprises and even favorable tax system.

Theses are caused by Vietnamese financial difficulties basically. Besides this, in case they accept foreign supports, main support is used for equipping infrastructures of preventing discharge pollutants such building a sewerage system so far, and not many foreign supports have been provided for installing industrial pollution prevention equipment.

When international cooperation come up to this area, it is very important to adjust to supporting Vietnamese Government policies such as privatization, financial reformation, and state own enterprises reformation for promoting economical efficiency.

2.4.2 Financial Measures for Supporting Enterprises

(1) Domestic Financial Situation and Financial and Monetary Actions

Judging from recent Vietnamese financial and monetary statistics, the government seems to be facing a shortage of domestic budget for favorable tax system or financial support system for enterprises to conduct industrial pollution prevention measures in a short term.

Thus, it is realistic to accept experts dispatch or installation of cooperative

pollution prevention equipment sectional from technical cooperation, grants or soft loans from financial support through financial institutions, (this support should be packaged with technical support), from foreign countries as for a short term while maintaining basic financial reformation policies.

(2) Domestic Financial Institutions

Current Vietnamese financial institutions are as follows. The main institutions are state owned commercial banks, however, it is difficult for them to provide loans because of defective collateral system for mainly private industries.

a. State owned commercial banks

It is said that 82 % of assets of whole financial institutions is accounted by state owned commercial banks.

b. Joint stock banks

There are 51 of joint stock banks, stockholders are state owned enterprises (SOEs) and private enterprises, and the all assets are estimated to be equal to about 10 % of whole financial institutions assets. Most of them are established in from 1991 to 1993.

c. Blanch offices of foreign banks and private joint banks

Most of foreign bank blanches are dealing with only foreign exchange and bank businesses relating to trading. There are 23 banks in total, and it is said that their assets are equal to 8 % of whole financial institutions assets.

(3) SOEs reformation and financial reformation

a. SOEs reformation

There are about 5,800 SOEs, and a total of their production amount occupies about 30 % of GDP, their investment shares about 20% of the total domestic investment amount, and their balance shares about 50% of a total domestic financial institution loans. Also, the number of their employees is about 15 % of whole employment except in agriculture.

b. Financial reformation

A financial reformation is closely related to the SOEs reformation. As stated above, about 50 % of a total bank loans flow into SOEs, and also they borrow 70 % of a total mid-term loans. There are still some problems remain, such as bank correspondence for loans, a supervision of banks as it ought to be etc..

c. Encouragement for private sectors

A number of private enterprise has been grown rapidly in five years. Although

a ratio of their production amount to the total industrial production is very little, their existence has a high evaluation in a creation of working opportunities point of view.

Small and medium-size enterprises have difficulties to get loans because of underdeveloped finance system and a defect collateral system. The following problems are remained.

- Private mid and small enterprises are asked to show security when they get loans against SOEs do not have to show.
- Unclear debt amount belong to collateral from outside, and exchange process is also unclear.
- Banks generally do not authorize that private enterprises use land right as a collateral, and this cause difficulty of getting loans.
- Because financial organizations do not have sufficient loan examining ability, favoritism loans are sometimes observed.
- Inspection following international standards is not done to financial organizations, and this causes bad debt.

2.4.3 Supporting Economical Reformation Loans (Singing on September 1999, ¥20 billion)

Japan provided loans, 20 billion yen, for the purpose of supporting Vietnamese economical reformation on September 1999. Promoting private enterprises, SOEs reformation, and financial reformation are emphasized as main conditions of this loan.

Chapter 3

Problem Analysis

Chapter 3 Problem Analysis

3.1 Insufficient Grasp of the Causes of Environmental Pollution (Industrial, Household and Agricultural)

3.1.1 Insufficient Grasp of Pollution

It can be said that rivers in industrial zones in Vietnam are polluted by industrial wastewater. However, concentration values of BOD and COD in rivers in cities are effected greatly by household wastewater. It is assumed that toxic substances, such as heavy metals, are discharged from industry. However, there are items that cause pollution besides industrial processes, such as batteries in scrapped cars, which can cause lead poisoning.

Pollution prevention measures are promoted and implemented without grasping the reason for causes of pollution, even though each polluted substance has different sources. Even though enterprises belong to the same industry there are big differences, in some cases in this Study as much as a 40,000 times difference, between their respective, polluting effects on the environment.

For adopting the most efficient countermeasures, it is necessary to get a grasp on the industry wide enterprise pollution effect on the environment. In order to do so, it is necessary to grasp the total amount of wastewater, and the pollutant concentrations and total amount of key pollutant substances in each large scale factory.

3.1.2 Lack of Production and Environmental Management in Enterprises

Principal production data relating to profits, such as unit consumption of raw materials and utilities, and production transformation rates, are not calculated in many enterprises. As a matter of course, the amount of pollutants discharged in wastewater are not measured at most enterprises.

It is impossible to estimate effects of countermeasures without having an idea on how much improvement can be realized if countermeasures are implemented by an enterprise, and at which enterprise countermeasures should be implemented.

3.1.3 Lack of Sufficient Knowledge on Wastewater Measurement and Difficulty in Requesting Analysis from External Organizations

In small and medium-sized enterprises, no wastewater treatment systems have been installed and there are no analysis technicians. Because of this, it is difficult for many enterprises to take measurements autonomously, even if they

want to. There are some private technical consultants that do pollution measurement, but these outside technical consultants were rarely observed conducting measurements in small and medium-size enterprises by the Study Team.

3.2 Insufficient Support Measures from the Administration to the Enterprises

The Study Team found that there are some places where pollutant concentrations exceed the environmental standards by 10 times for both household and toxic waste. However, even though the situation is extreme, the government has not taken any aggressive action for implementing countermeasures and identifying pollution sources. If a hazardous pollution situation is found in the environment, the government has no way to grasp which enterprises are using toxic substances. It is necessary for them to start making lists that show which enterprises utilize which toxic substances. There are many enterprises that did not execute countermeasures before the nation wide environmental inspections were implemented.

There are many reasons why enterprises do not execute pollution prevention countermeasures, and one of the main reasons is that MOI, the administration in charge of pollution prevention in industries, concentrates it's administrative activities actually on SOEs.

Environmental Impact Assessment (EIA) is an efficient measure for new enterprises, however, it is not sufficient for existing enterprises. After all, besides the penalty system, there have been few of sufficient countermeasures taken by the Administration for enterprises that violate wastewater regulations.

In addition to these, even if heavy metals are used for plating or other purposes, enterprises are not legally bound to report the use of such substances to the Administration. So, when toxic substance pollution occurs, enterprises that are causing the pollution can't be located. Measures must start with a listing up of factories that use toxic substances. Also, because environmental standards and wastewater standards have partial inconsistency, when concentration values exceed the environmental standards, pollution will increase greatly**.**

3.3 Delay in Implementation of Enterprise Countermeasures for Pollution Prevention

Implementation of countermeasures for pollution prevention in enterprises is extremely overdue, and only less than 10% of the enterprises surveyed are

satisfying wastewater standards.

The direct causes of this situation are as follows:

A. Enterprises have no waste water treatment facilities. B. Enterprises have waste water treatment facilities, but have insufficient operational know how. C. Adoption of Cleaner Production technologies has been delayed. D. Maintenance of equipment is not performed adequately.

The factors that are responsible for the direct causes of the delay in implementation are nearly common, and are as follows:

① Enterprise profitability is low and they can not bear the cost burden of countermeasure implementation. ② Enterprises do not have the technical capability to solve problems and the number of experts who can perform technical guidance, as well as provide information, are scarce. ③ Penalties are lenient. ④ There are few support measures in the fields of finance and taxation to assist enterprises in compensating for low profitability for investment in pollution prevention.

Enterprises have low profit structures, 60% of the enterprises subject to the Study were revealed to have profits less than the amount of interest paid on financing. Also, in terms of the ratio of profits to returns, 60 % of the enterprises earning low profits have less than a 1 % ratio, and they can not finance investment in pollution prevention. The factors causing low profitability are as follows:

- The level of production management is low, and the ratio of effective utilization of materials and fuels is also low. This causes a decrease in profitability.
- Equipment intensive industries have small production capability.
- Outdated production methods are adopted.
- The location of factories is sometimes not suitable.
- Transportation system is inefficient and this causes higher transportation costs.

These problems are summarized in Figure 3.1 and 3.2.

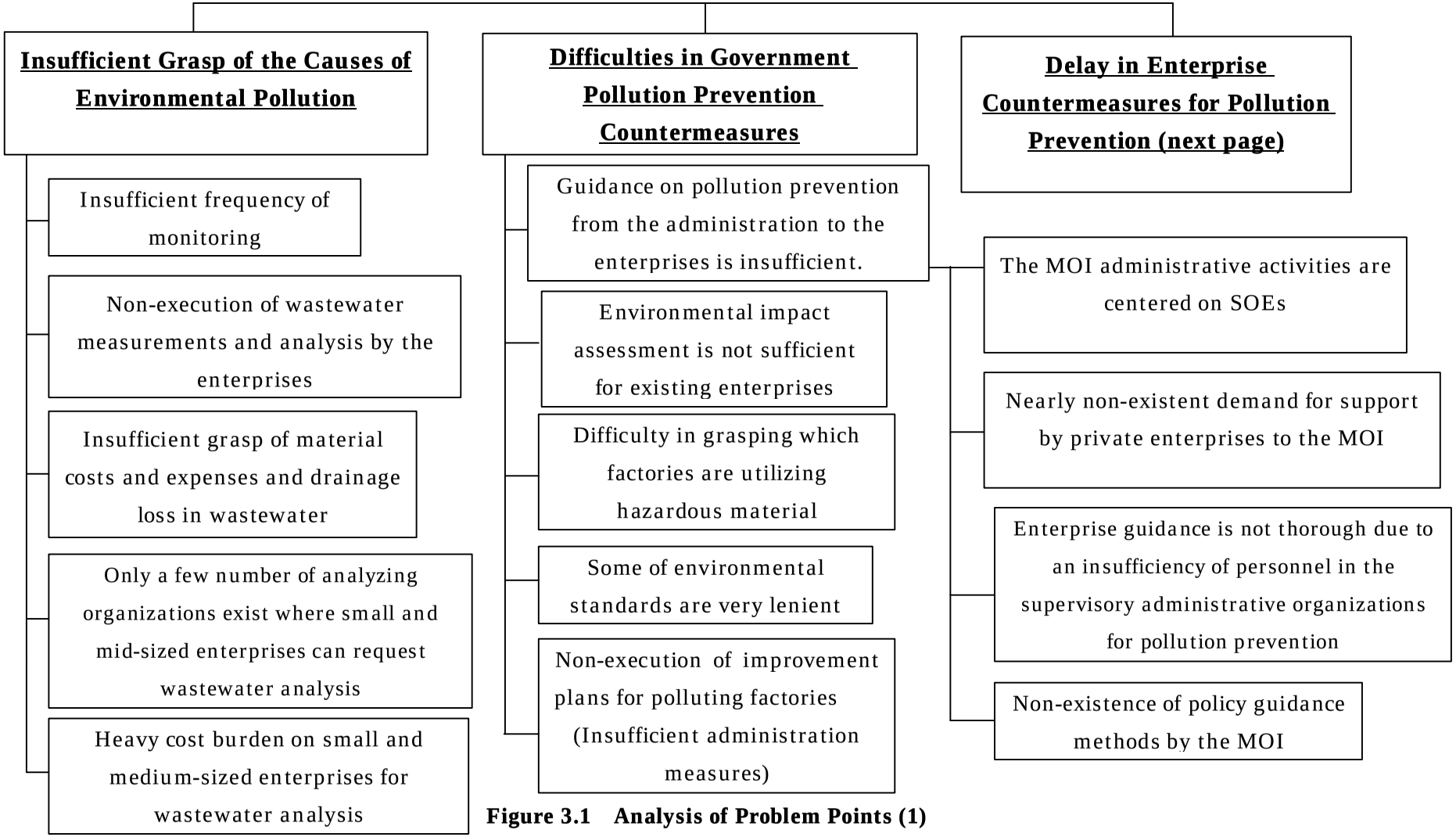

Figure 3.1 Analysis of Problem Points (1)

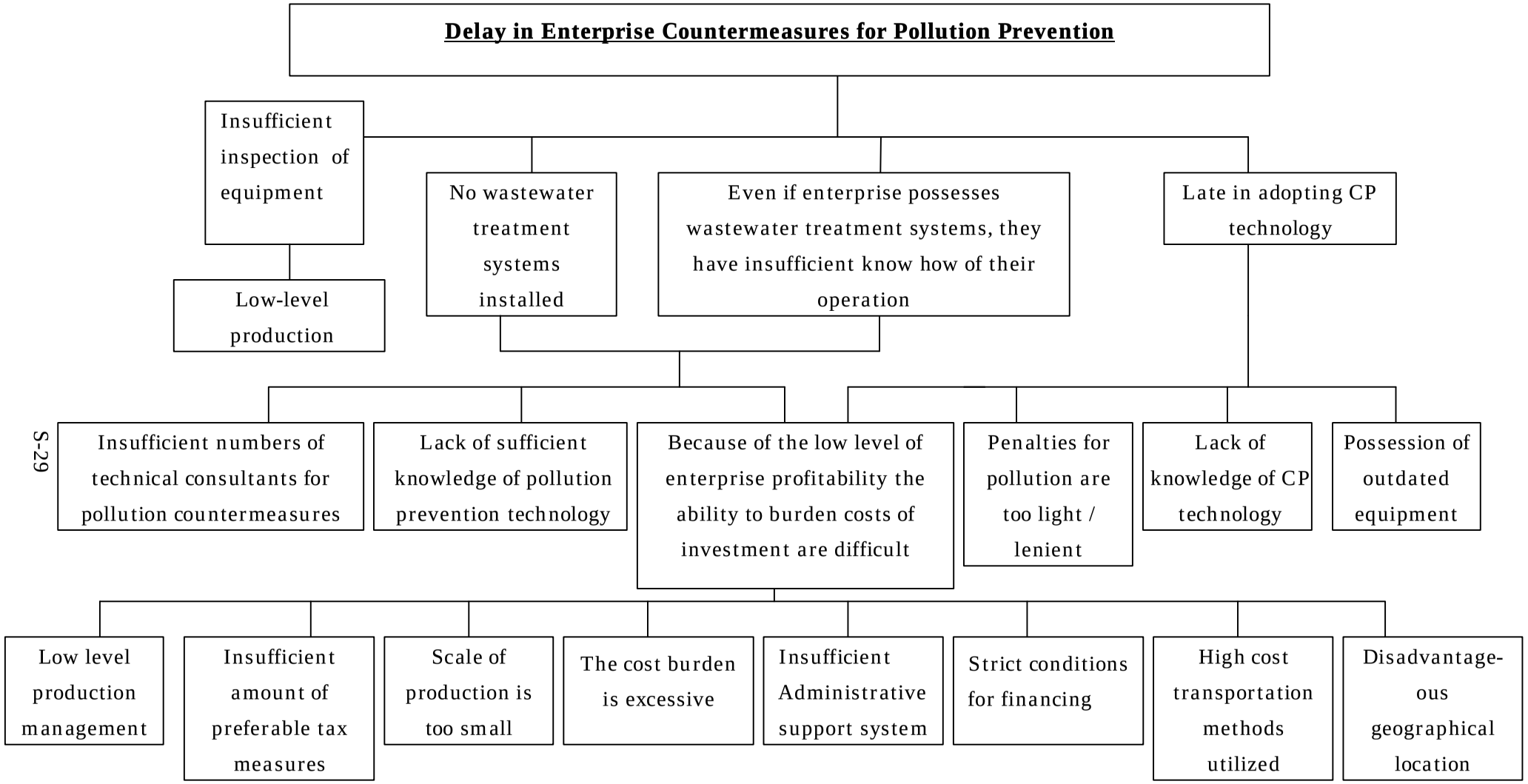

Figure 3.2 Analysis of Problem Points (2)

Chapter 4

Countermeasures and Their Anticipated Effects

Chapter 4 Countermeasures and Their Effects

4.1 Strengthening the grasp on the causes of environmental pollution

For grasping the causes of environmental pollution, the following measures are required:

① Strengthening the monitoring system of public waterways and especially, of waste water from enterprises which presently needs to be monitored more strictly.

② Preparing the surrounding environment for supporting monitoring, including the development of analyzing organizations, the training of analyzers and assurance of monitoring accuracy.

As for ①, there are two methods possible for implementation; one is that the government directly enforces it, and the other way is for the government to encourage enterprises to implement autonomous measures while checking the data provided by the enterprises indirectly. The merit of this method is that encourages enterprises to sample and take data autonomously. Enhanced productivity effects due to improved in-house management can be expected, and therefore, this will lead to the establishment of an autonomous management system.

As for ②, there are two methods possible for implementation; one is the utilization of a method that places emphasis on the use of special analyzing organizations, and the other is a measure that focuses on the training of expert analyzing technicians in enterprises. Both these measures have merits and demerits as shown in the comparative chart. It would be appropriate to first train external experts in order to support small and medium-size enterprises and solve the problem of the lack of analyzing ability, and then afterwards, train in-house analyzers.

4.2 Strengthening Pollution Prevention Measures

As an alternative of the current pollutant concentration regulations, the Total Emission Control method may be adopted, which concentrates on regulating the total emission of pollutants. In this method, autonomous enterprise monitoring management and a grasping of total pollutant discharge by pollution prevention managers are required. It is more effective to reduce pollutant loads rather than the concentration regulations that are currently used because of limited capital and human resources.

In addition, a registration system of enterprises using hazardous material and government sponsored human resource training are considered to be other

potential policy measures.

4.3 Motivating enterprises to implement pollution prevention measures

In order to urge the enterprises to invest in pollution prevention, there are two measures that can be taken in a broad sense; one is to impose stricter penalties and the other is to provide support in order to lessen their burden.

In the case that an enterprise has the required technological capability and can obtain financing, just imposing a stricter penalty on the enterprise for not satisfying the regulatory standard is sufficient enough.

However, if enterprises cannot come up with funds to pay the penalty, the enterprise may be forced to shut down operations due to the heavy penalty. This causes an increased burden on social costs, such as an increase in the number of unemployed.

As support measures priority, Cleaner Production technologies that do not place a heavy financial burden on enterprises and large investment are easy to implement, and high effectiveness is expected. It is very important to determine which measure is the most effective for the actual cause of pollution.

As for the lack of capability to cope with technological problems: ① in-house training of human resources, ② technological instruction by experts such as consultants,③information exchange among enterprises and ④ promotion of ISO 9000 will be appropriate measures.

As for capital procurement, long-term loans and a TSL system which includes experts guidance using international support are very effective, and moreover, a reinforced, complementary credit system is urged to be adopted only for enterprises which do not have reliable credit.

As for financial instruments, loan system especially for small and medium-size private enterprises is efficient so that measures for improving the loan system and supporting privatizing reformation should have high priority.

Other measures are an official commencement system, promotion of cooperation between governmental administrative organizations, reward system for employee initiated improvements.

4.4 General Observation on Industrial Pollution Prevention Policies

A system that respects enterprise independence including self-help measurement of pollutants, grasping material balance and unit consumption for

improvement should be established. This type of system is also desirable because it can be expected to reduce administration costs and production costs by improving productivity. Figure 4.1 shows this system.

On the other hand, when enterprises, such as small and medium-size enterprises, have little ability to conduct pollutant measurements, the administration office itself has to take action, such as implementing monitoring or controlling and instructing enterprises on complying with wastewater standards. Figure 4.2 shows a system for this case.

Administration offices should provide instruction on methods, which improve the usage of raw materials and byproducts at the production process and prevents them from being to be discharged in wastewater or solid wastes (this method is the so called “Cleaner Production”) of enterprises, even if an enterprise is small or mid sized.

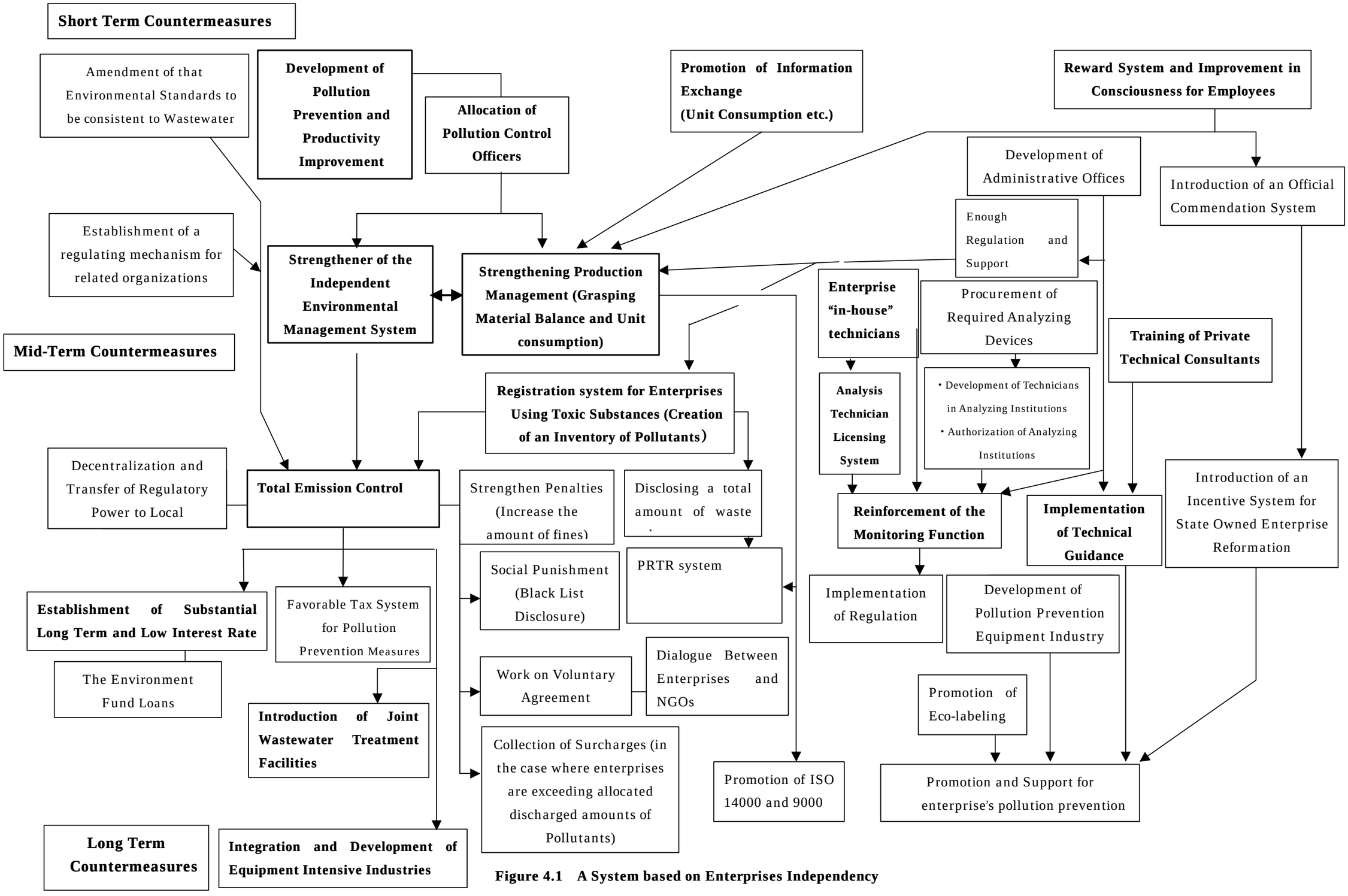

Figure 4.1 A System based on Enterprises Independency

Short Term Countermeasures

Amendment of Environmental Standards to be Consistent to Wastewater Standards

Development of Pollution Prevention

Allocation of Pollution Control Officers

Promotion of Information Exchange (End of Pipe method etc.)

Reward System and Improvement in Consciousness of Employees

Development of Administrative Offices

Introduction of an Official Commendation System

Establishment of a Regulating Mechanism for Related Organizations

Enough Regulation and Support

Reporting regularly and Supervision of emission

Enterprise "In-house" Technicians

Procurement of Analyzing Devices

Training of Private Technical consultants

Mid-Term Countermeasures

Registration System for Enterprises Using Toxic Substances (Creation of an Inventory of Pollutants)

Analysis Technician Licensing System

• Development of Technicians in Analyzing Institutions
• Authorization of Analyzing Institutions

Decentralization and Transfer of Regulatory Power to Local

Concentration Control

Strengthen of Penalties (Larger fines)

Implementation of Regulations

Reinforce the Monitoring Function

Implementation of Technical Guidance

Introduction of an Incentive System for State Owned Enterprise Reformation

Establishment of Substantial Long Term and Low Interest Rate Loans

Preferential Tax System for Pollution Prevention Measures

Social Punishment (Black List Disclosure)

Development of Pollution Prevention Equipment Industry

Environment Fund Loans

Work on Voluntary Agreement

Promotion of Eco-labeling

Introduction of Joint Wastewater Treatment Facilities

Collection of Surcharges (in the case where enterprises are exceeding allocated discharged amounts of Pollutants)

Promotion of ISO 14000 series

Promotion of and Support to Enterprise's Pollution Prevention

Long Term Countermeasures

Integration and Development of Equipment Intensive Industries

Figure 4.2 A System that Depending on Administrative Supervision

Chapter 5

Master Plan Proposal

Chapter 5 Master Plan Proposal

In this chapter, a Master Plan Proposal and an action plan for pollution prevention will be presented.

5.1 Establishment of basic policies and objectives concerning measures for industrial pollution

5.1.1 Concept of sustainable development

In Vietnam, domestic industries have been developing remarkably recently and are expected to continue. New petrochemical products are also expected to emerge because the Petrochemical Industry Development Plan has been promoted and it is predicted that the environmental load will increase due to the maturing of industry.

The main countermeasure taken currently against would-be environmental load is the relocation of the pollutant source factories to the suburbs.

However, because more industrial facilities will relocate to the same site, the generated volume of pollutants in the region will increase, and the advantages gained by the relocation of factories will gradually decrease.

Therefore, considering that industries cause large environmental loads, industrial pollution will become more serious.

A basic policy should be set for promoting industrial development, and at the same time, continuing to improve the quality of the environment in Vietnam.

5.1.2 Specific objectives

Compliance with environmental standards should be set as a concrete target for now, and compliance with wastewater standards should be set as the ultimate, final target. For setting specific objectives, we should consider separately human health related items and items that are related to the living environment. Human health related items include heavy metals, such as mercury and chromium, as well as substances that may directly damage human health, such as organochlorine compounds. These pollutants are coming from industrial wastewater, it is necessary to get a grasp of the factories that discharge these pollutants, and then implement measures in them.

Items related to living environment are rarely harmful to human health.

Because industrial, agricultural and fishery use wastewater affects living environmental items, improvement needs to be made with in all of these sources comprehensively, or no effects on the environment will be observed. The necessity of further review of the adoption of land use regulations, or total emission control regulation will probably rise in the future.

5.1.3 Prerequisites for the Master Plan

(1) Urgent Sufficient Environmental Pollution Improvement

For policy execution, the most polluted items need to be given the highest priority for implementation.

(2) Effects of Speed

Because a measure can effectively improve the environment directly, and also can be carried out very speedily, measures should be implemented as soon as possible with concern for the term “cost effective,” the cost should be considered to include costs that occur during the time of countermeasure implementation.

(3) Difficulty of Achievement

Even if the implementation of a measure is considered to be urgent and little time is required to actually see positive results, the measure is of no use if it is not practical and cannot actually be implemented.

Therefore, if the possibility for implementation is higher, a measure should be given higher priority.

(4) Previous Results

Countermeasures that have already been implemented more than once by the Vietnam government should be given higher priority because they have existing knowledge on the measures and understand that the measures support their policies.

(5) Evaluation

The Survey Team evaluates countermeasures by taking the previously stated factors into consideration, and studies priority for implementation.(See Table 5.2)

5.2 Proposals for the Master Plan

5.2.1 Industrial Pollution Prevention Priorities

(1) Environmental Regulation Scheme

Introduction of pollutant load control method, which focuses on strengthening the monitoring system and minimizing subject especially polluted water areas, is highly recommended for improving regulations. Because there are some limitations for utilizing manpower and financing, grasping accurate pollution conditions and focusing measures on factories that are causing serious pollution will be more effective. There are two ways to strengthen the monitoring system, one is an indirect method that respects enterprise self-management ability, the other method stresses that the administration itself conducts monitoring. Even though there are two methods, the promotion of both production and environmental improvements based on a system that respects an enterprise's self-management ability is appropriate. A system, which includes the allocation of a manager for dealing with pollution prevention, calculating the total emission of pollutants, autonomous measurement, and self-management for productivity will be established by promoting the acquisition of ISO 14000 and 9000 series certification.

(2) Industry Support System

The Study team set the development of environmental pollution control managers, technological guidance, and the promotion of information exchange should be given high priority. Following these measures a long-term low interest rate system and installation of common wastewater facilities, should be given priority. After these, importance should be placed on enlarging environmental engineering courses in universities. In addition, priority should be given to constructing a cooperative structure for inter-governmental administration that requires no additional cost burden and is easy to implement.

The following should be given priority in the order they occur: the training of environmental engineers and environment technology consultants, a preferential tax system, the integration of equipment intensive industries, promotion of acquisition of ISO series certification, development of the pollution prevention equipment industry, and an incentive system for employees.

A commendation system could also be given high priority, even though this measure does not have a direct effect on improving the environment if it doesn't require any costs and is easy to implement.

5.2.2 Details of the Master Plan

Table 5.1 shows the details of the proposals.

TABLE 5.1 Proposed Measures against Industrial Pollution

1.Environmental Regulation Side	Current Situation	Problems	Proposal Content	Consideration
Amemdment of Environmental Standards	Pollutants have been itemized.	There is little conformity with waste water standards. Compared to wastewater standards, environmental standards are not so severe.	It is estimated that a pollution level of approximately one tenth of the waste water standard should be appropriate for Environmental standard. As for the BOD values, the objective of the first stage should be 10ppm, which will not make the human body uncomfortable, and at the second stage it should be targeted at 5ppm, which will not damage the development of fish and shellfish.	
Determination of the Subject Water Areas and Pollutants for the Total Emission Control Method	Only the concentration levels of the pollutants, and not the quantity, has been under regulation.	Production management is not being carried out, nor is the concentration and volume of waste water measured.	Select a polluted river with toxic materials that are harmful to humans and is beyond the environmental standards. Then calculate the total amount of waste discharged from the factories along the river. Then, allocate the total amount of waste that each factory is allowed to discharge. With regard to COD, after the selection of an influential river, follow the same procedure as above.	Examine the total emission control method as a long term measure, and after the measurement is completely done, examine a system of trading emission allotment
Strengthening of Environmental Monitoring	The frequency of monitoring is less than once a year.	The results of infrequent monitoring may not reflect the actuality because seasonal and circadian fluctuation of pollutant amount is big.	To increase the frequency and the number of points for measurement in the polluted river for materials that are exceeding environmental standards.	
Introduction of a Qualified Analyzing Technician System	The value of BOD can vary among measuring organizations by as much as ten times.	The kind of bacteria has not been standardized for measuring BOD.	To license those who pass MOSTE skills and technical qualifications. As the number of qualified experts increases, qualified experts will be obligated to measure data for official use. Qualification will be awarded to those who complete the course by the designated authorities with a considerably good mark.	
Introduction of a Qualified Pollution Control Officer System	There are no employees qualified to supervise the amount of pollutants discharged from the enterprises.	Absence of responsible employees for environmental management within the enterprises makes it difficult to accurately grasp environmental pollution.	To obligate enterprises with over 300 employees, which is estimated to cover about 90% of the total amount of polluted substances, to allocate experts responsible for grasping and managing polluted materials and development of countermeasures. At the same time,the experts are recommended to play a part in guidance for improvement in productivity.	
Strengthening the Penalties for Pollution Violations	Penalties costs less than implementing countermeasures.	The level of the regulation standard is set higher than the operating level of pervading firms. In the circumstance that some firms implement the measures and others do not, the former have disadvantages over the latter in competitiveness.	To set more realistic environmental standards which the enterprises can comply with, such as the introduction of the total emission control method, and at the same time to strengthen the penalties that do not cause unfairness among the enterprises in terms of competitiveness.	
Public Disclosure and Promotion of Participation	Enterprises are not obligated to disclose information to the public.	It is difficult to grasp the current situation of environmental pollution because the monitoring system has not been established.	An annual announcement of the type, concentration levels and volume of the pollutants discharged from the firms, promotes the local residents participation as supervisors, so that the enterprises feel pressure to make efforts to reduce the pollutants.	If possible, agreement between residents and enterprises should be made.
Registration of Firms Handling Toxic Materials	There is no registration system.	It is unknown which firms handle toxic materials.	Submission of a report on the volume of consumed heavy metals that includes total quantity. This will serve as a measure against pollution in advance.	

2.Enterprises Assistance Side	Current Situation	Problems	Proposal Content	Consideration
A. Human Resource Development				
Environmental Analyzing Experts	No system for the development of experts exists.	There are few training opportunities for analyzing technology on the job. Data varies among analyzing organizations who adjust independently type of the bacteria used for experiments.	It is necessary to develop approximately 600 experts under the assumption that one-day measurements will be made in 10% of 630,000 total enterprises twice a year. There is a need to develop approximately 100 experts a year for 5 years.	To make use of existent analytical organizations, such as CECO or CETTIA as training facilities.
Pollution Control Officer	No system for the development of officers exists.	No appropriate training organizations for environmental managers in enterprises.	Approximately 3000 enterprises will be selected if the target is enterprises with approximately 300 employees. Assuming that training of environmental management together with improvement in productivity takes about a month and it is held three times a year, then it will take 10 years to train the PCO needed.	To make use of the research institutes belonging to MOI by the command of Industrial Energy and Environmental Office.
Environmental Technology Consultant	No system for development of consultants exists.	Lack of consultants who have the ability to consult on technology for measures, cost of facilities or cost burden.	Less than 100 consultants are needed for conducting consulting services at 3000 enterprises a year, assuming that consulting services are to be conducted at three enterprises a month. It is necessary to develop approximately 20 consultants, together with PCO, a year.	The same as above
B. Technical Guidance	No system to meet the demand of technical guidance from the enterprises exists.	Existence of many non-functioning facilities because of a lack of operating skills even if facilities have already been established.	To assemble human resources who are capable of guidance in the research institutes under MOI in cooperation with senior experts from overseas. Approximately 120 experts need to be developed under the assumption of conducting guidance at 50 enterprises a year, for the target of 6000 enterprises. Under the assumption that it takes 5 years to complete the training of the experts needed, then 24 experts need to be developed a year.	To train guidance experts of guidance through the use of a technical cooperation system under the command of Industrial Energy and Environmental Office of MOI.
C. Assistance for Investment in Pollution Prevention				
Long-term low interest rate financing system	No official system of financing for the enterprises.	Lack of financial organizations to implement financing mainly to the enterprises. Difficulty to provide assets as security.	To promote the establishment of a security system and request funds,such as TSL, from foreign donors.	Under the command of Industrial Energy and Environmental Office within MOI, request the cooperation of influential foreign donors and promote the establishment of a security system regarding domestic land use.
A Preferential Tax Treatment System	No preferential tax treatment system exists exclusively for pollution	Tendency not to invest in End Of Pipe due to the increases in cost that leads to tight management situation.	To promote the introduction of a preferential tax treatment system, such as land tax, in cooperation with MOF.	
Official Commendation System	No official commendation system exclusively for environmental management exists.		To commend enterprises or machine makers who make achievements regarding pollution prevention countermeasures or pollution prevention equipment.	Possible to stimulate the enterprises to promote countermeasures effectively due to the small amount of cost needed for implementation.
D. Introduction of Joint Waste Water Treatment Facilities in Industrial Zones	No industrial zones with joint waste water treatment facilities.		To get industrial associations and influential enterprises to summarize the specifications of treatment facilities and to promote the system under the MOI support structure.	Different specifications of joint waste water treatment facilities are adopted according to treatment capabilities, or the kinds of polluted materials.
E. Promotion of Information Exchange	Little chance for exchanging information on technology within the industry.	A wide variety in the original unit of consumption in the manufacturing of the same kind of products and no improvement in consumption of raw materials.	MOI creates opportunities for information exchange with regards to the original unit of consumption and technology for environmental conservation until each industry reaches a point where they voluntarily exchange information.	

3. Other Activities	Current Situation	Problems	Proposal Content	Consideration
A. Integration of Equipment Intensive Industries	Equipment intensive industries are of small scale and scattered to various area	That the industries are of small scale and consequently are less competitive is one of factors that makes it difficult to implement environmental measures.	To promote the non-equipment intensive industries in regions and to guide industries through the provision of a preferential taxation to the factories above a certain level of scale with regard to equipment intensive industries.	It is necessary to locate industry in regions from the viewpoint of ensuring employment
B. Promotion of ISO 14000 and 9000	Few enterprises possess ISO standard.	It is difficult to acquire ISO certification without thorough production management, and there is a possibility of being shut out of international market in the future without ISO.	To develop pollution control manager and productivity improvement manager and to hold seminars on information on technology often. For the Environmental Office to consider the establishment of a training center concerning the environment and productivity in cooperation with foreign donors.	Most effective to pursue for measures for environment and improvement in productivity, that is, for cleaner production that enables to grasp .
C. Development of the pollution prevention equipment industry	Only a small number of inexpensive, easy to operate, high performance pollution prevention equipment.	Difficult to manufacture machines effectively due to little accumulation of technology in the equipment industry.	To apply the preferential tax treatment system, not only to the industry that is the direct user of equipment, but also to the pollution prevention equipment industry.	
D. Improvement of environmental engineering courses at universities	No courses specialized in environmental engineering.	Lack of skilled engineers who have the capability of evaluating every process of production and technicians with sufficient knowledge who can aim for the integration of pollution prevention and improvement in productivity.	To improve environmental engineering courses in which environment and production are integrated.	
E. Establishment of an incentive system in the state owned enterprises	No reward system for good achievement.	Existence of inactive supervisors who have detailed knowledge on the production site and have the ability to propose improvements. Because their activities do not affect their pay level, which is disadvantageous to the enterprise.	To introduce a system in which a certain portion of profits are allocated to those who propose the scheme or implement it in the case that the proposal results in an improvement in productivity.	
F. Promoteion of interministerial cooperation	No alliance among administrative agencies with regards to regulation and assistance.	Even if assistance measures and realistic regulation approach are made, but they might be inconsistent without interministerial coordination.	To create opportunities for exchanging information among administrative agencies on regulation and assistance measures.	

5.3 Specific measures to be taken by the government

For regulations, policies that can reduce the cost burden of measures, pollution prevention measures that focus on the Total Emission Control method, and a method that is effective for environmental improvement within a short period of time, should be given higher priority. For guidance, improved management technology, mainly concentrating on production and production quality, should be given the highest priority. These measures can be implemented even if an enterprise lacks adequate financial resources and profits. Moreover, enterprises can work out adequate strategies, such as the introduction or refurbishment of appropriate equipment, by grasping the material balance of production processes clearly through the use of these activities. It is hoped that a system, which includes measures such as promoting the development of pollution prevention managers, conducting technical guidance in enterprises, and one that will encourage employees in the future to voluntarily take action for improving productivity, is carried out.

Secondly, technology guidance and information exchange will be the keys for this system. As a concrete example, a Quality Improvement Technology Center (QITC) should be set up, and an organization that can provide technical guidance to enterprises, and engineers who have experience working overseas in the area of technology, should be utilized.

5.3.1 Environmental Regulation Scheme

(1) Enactment, reform and abolition of regulations

The role of MOSTE

Wastewater standards are appropriate, however, environmental standards are lenient compared to the standards in other countries. Therefore, in the case wastewater is discharged into rivers the dilution rate should be increased by 10 times, and the environmental standard value should be revised and targeted to be set at 1/10 of the value of the figure that is currently used. BOD and COD values, which already excessively exceed 1/10 of the wastewater standard values, should be temporarily set at a target value of 1/5 of the current standard, and then later, through revision and reform, appropriate environmental standards need to be established. Because new pollutants will be generated according to the conditions of industrial development, MOSTE should add pollutant standards for these new items, step by step, as needed. For instance, there are no standards for organochlorine compounds such as tetrachloroethylen and trichloroethylene that

are already being utilized as cleaners.

(2) Setting Target reduction amounts for selected pollutants in the main water system

If wastewater is harmful to human health, or whether or not restrictions should be made against utilizing water for industrial or agriculture use, is dependent on the existence of environmental standards in public water areas where industrial wastewater is discharged. For this reason, considering the reality that most of the enterprises have technical difficulties and lack financial resources to implement measures, controlling the volume of emissions to a point which satisfies environmental standards should be set as a temporary target.

・The Role of MOSTE

① First of all, BOD and COD concentration values of household wastewater need to be set objectively. Then, a water system where the environmental standards are being exceeded, and also where it is necessary to control the amount of discharged pollutants, should be selected. Regarding items harmful to human health, lead and cyanide are considered to be the most dangerous pollutants at present.

② Secondly, the amount of selected pollutants that must be reduced in the water system needs to be estimated.

・The Role of MOI, the Ministry that is Responsible for Overseeing Enterprise Production

① Investigate factories in subjective water areas, and estimate the yearly total discharge of selected pollutants. In order to make this estimation, pollution prevention managers in enterprises need to be instructed on how to prepare unit consumption charts and material balance sheets. If actual measurement data exists, verify the data and calculate it as accurately as possible.

② Allocate the amount of pollutant that must be reduced by each factory.

③ Implement enterprise support measures such as technological support in order to make the reduction of the amount of allocated pollutants for each factory possible. Allow each factory to transfer the allocated amount to other factories, and if needed, the MOI should act as an intermediary or assist in the adjustment process.

(3) Reinforce the monitoring system

・ The role of MOSTE

Substantiate the office that conducts environmental measurements and

motivate the people in charge of measurement in the office, or in the enterprise, to improve their skills by providing training and awarding certifications.

(4) Training Pollution Prevention Managers

・The role of MOI

It is crucial to assign managers who have the ability to calculate the discharged amount of pollutants, and plan for the education and training of people among existing employees in enterprises of a certain scale.

At the same time, it would be desirable if a system is planned where this manager improves productivity using material balance sheets and unit consumption charts.

(5) Additional penalties for polluting enterprises

・The role of MOSTE

MOSTE should change the values of the standards temporarily to more realistic figures, and at the same time, demand that enterprises comply with these new standards.

For this reason, if additional, harsher penalties are implemented, it will help strengthen compliance with standards by enterprises.

(6) Participation of local residents

・The role of local governments and MOSTE

To make it easier for local residents to get information on the environment, the participation of local residents in environmental preservation should be supported. MOSTE and local governments should promote and guide enterprises in signing Voluntary Agreements in order to prevent pollution problems and to solve troubles between residents and enterprises.

(7) A registration system for enterprises that use toxic substances

・The role of MOSTE and MOI

In order to prevent pollution that might occur in the future, it is necessary for MOI to introduce a registration system where the name of the enterprises and their consumption amount of heavy metals is reported to MOI at fixed intervals. The system should include a measure that calls for MOI to submit a list of enterprises using heavy metals to MOSTE, so that MOSTE can use the report for monitoring purposes.

5.3.2 Enterprise Support Measures

Enterprise support measures should be generally carried out by MOI, the ministry in charge of enterprise production management.

(1) Human Resource Training

① Training of productivity and quality improvement technicians.

・The role of MOI

The establishment of a pollution prevention manager is necessary for managing pollution prevention related to the discharge of pollutants. In small and medium-size enterprises, it is realistic to put pollution prevention managers in charge of productivity and quality improvement. Thus MOI should promote not only environmental technology, but also the use of Cleaner Production methods that can improve the profit rate of enterprise by reducing costs and improving production quality, and should also take into consideration the enterprises production.

② Support the training of quality improvement consultants

・The role of MOI

Utilization of national university courses and establishment of a technical training center for consultant training should be implemented.

(2) Technical instruction

The role of MOI

A system should be developed by MOI where technical instruction can be given directly at the factory site. For the time being, a public organization that has the necessary technology should provide guidance, and when private consultants are trained and qualified in the future, the public system should be downsized so that the enterprises can fully utilize private schemes.

Through a joint effort of donor countries, a system should be created at a low cost that employs retired technicians that used to work overseas, or the owners of small and medium scale enterprises, these personnel should be sent to Vietnam as instructors.

(3) Support for enterprises investing in pollution prevention.

① Create a financing system at a long-term low interest rate

・The role of MOF and MPI

At present, a financing system with long-term low interest rates, especially designed for investment in the environment, is in place in some limited

municipalities, including HCM City, but in general such financing is not available. Furthermore, because the collateral system is inefficient for private companies, it is really hard for them to borrow equipment capital, as well as operating capital, from banks. For this reason, the Vietnamese government has indicated their intention toward establishing an "Environment Fund" only for use in environmental improvements. The possibility of introducing a two-step-loan (TSL) system with international cooperation should be reviewed and discussed.

Also, a supplementary credit system, provided by MOF, that makes up for shortages in security should be introduced because the current system, where land titles are used for security, is not functioning well for small and medium-size private enterprises.

② Reduction and exemption from taxes

・The role of MOI and MOF

There is little preferential treatment for investment in pollution prevention at present.

As for investing in pollution prevention, take into account that investment for pollution prevention is more difficult than other usual investments where a return in profits can be expected, therefore preferential treatment for the land tax, etc. should be introduced by MOI and MOF.

③ Award system

・The role of MOI

Enterprises (both manufacturers and suppliers of the pollution prevention equipment), individuals and groups, which have contributed to pollution prevention should be awarded for their efforts as an incentive measure. This system hardly requires any governmental funding, therefore it is extremely efficient in terms of cost.

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④ Foreign and domestic financial support

Current, basic economical reformation policies should be maintained, experts should be dispatched, joint pollution prevention equipment needs to be implemented by sectors and financial support needs to be provided by financial organizations (i.e.a TSL scheme which requires the acceptance of financial and environmental experts) through foreign support for technology, no interest loans and soft loans.

5.3.3 Other Activities for Industrial Pollution Prevention

(1) Centralization and integration of industries

・The role of MOI

As for equipment-intensive industries, the production output per factory should be expanded to an international level to save production costs for the purpose of raising the international competitiveness of these industries and to give them the financial strength they need to be able to invest in the environment. In order to support this proposal, centralization and integration of equipment-intensive industries should be promoted. If surplus human resources become available through centralization and integration, measures for allocating such human resources to new industries should be started in parallel.

As for the small production amount industry that has high cost burden for wastewater treatment equipment, there are two methods: Method A, where wastewater processing equipment is owned jointly in order to decrease the cost load, and method B, where a specified, strong enterprises is chosen for development, and where other factories can place production orders, is an effective method.

(2) Creation of common treatment facilities in industrial zones for small and medium scale enterprises

・The role of MOI and Department of Industries (DOI)

MOI and DOI should promote the establishment of a common treatment facility for the dyeing or plating industry under the possibility of existing industrial complexes.

(3) Development of the pollution prevention equipment industry

・The roles of MOI and MOF

Development of cost effective, high performance pollution prevention equipment by private companies should be supported by MOI and MOF through low interest rate financing and tax preferences, as well as a commitment to purchase the initial domestic demand amount of the equipment should be made by the government. Also in order to promote investment from foreign capital to pollution prevention industry, add them to the list of tax preferences.

(4) Promoting ISO9000 series Quality Management, and ISO 14000 series Environmental Management

・The roles of MOI and MOSTE

The promotion and introduction of ISO 14000 in factories needs to be carried out. ISO 9000, which deals with quality management, should be encouraged at the same time in Vietnam because increased profits due to production quality improvement can be expected. Also develop domestic judging and registration organizations, as well as consultants.

(5) Guidance on establishing technology exchange organizations by industries

・The role of MOI

Because there are large differences in unit consumption of raw materials between enterprises, a place for exchanging technological information within the industry should be established.

(6) Promote the expansion of environmental engineering courses at higher education institutions

・The roles of MOI and MOE

In order to develop high-level technicians, courses on environmental improvement and productivity improvement need to be expanded.

(7) Establish incentive systems at state owned enterprises

・The role of MOI

For state owned enterprise employees, an incentive system should be established where, if costs decrease and profits increase because of autonomous employee activities where they use their own ideas, a certain portion of the profit will be returned to the employees who implemented the activities as an incentive to promote autonomous activities for increasing profits.

(8) Work in closer mutual cooperation between responsible administrative offices

Construct a cooperative structure between inter-governmental administrative offices in order to implement countermeasures, and create support systems for enterprises.

5.4 Specific measures to be taken by other organizations, Especially Enterprises

(1) Improve Environmental and Production Management

Increasing the effective utilization rate of raw materials, or the amount of materials, leads to a decrease in the volume of wastewater and pollutant concentrations in wastes. Also, for the time being, it conserves the required raw material amount and reduces production costs.

Therefore, enterprises should put efforts into improving the effective utilization rate of raw materials at all times. In order to do so, operation records, such as how much raw materials were received, the transformation rate of raw materials, and the amount of material loss in wastewater, should be recorded and a material balance sheet should be made.

(2) Acquisition of ISO 14000/9000

Acquisition of ISO 14000 and 9000 shouldn't be carried out strictly by the book, but should be implemented as a means to make substantial improvements.

(3) Autonomous daily improvement activities by employees

Employees who work on a production line know what kind of and how much unnecessary work exists in the line. Thus, employees should be encouraged to grasp their company's level of unit consumption of raw materials and utilities, and to compare them to domestic or international levels. In addition, they should be encouraged to take part in autonomous activities aimed at improving enterprise conditions.

Maintaining a healthy cycle, such as implementing improvement activities, leads to improved profits, and if employees are allowed to share in the profits which resulted from the improvement activities, it will promote more active improvement activities and will ultimately provide more profits to the enterprise.

(4) Grasping new technology trends

Attention needs to be paid at all times to the trends of new technologies in the same business category. Efforts should be made to introduce technologies that have smaller environmental loads.

(5) Academic circles and universities

For enhancing technical standards and management systems of factories, places where persons concerned can exchange information autonomously in and

among industries (technical committee of industrial society, etc.) should be provided.

(6) Monitoring Institute

This Institute needs to make efforts that will enable low cost and accurate measuring, as well as improve measuring techniques.

(7) Consulting Institute

An institute should be established where appropriate technology, including appropriate Cleaner Production technology, can be provided depending on the operating conditions and scale of factories.

(8) Pollution prevention equipment industry

The development of further advanced equipment is expected. Moreover, the industry should consider introducing an “eco-labeling system” that would be used as a measure to persuade consumers to purchase superior, “environmentally-friendly” equipment.

5.5 Action plan and Organization Implementing Plans

Table 5.2 shows action plan charts. Policies to be arranged by the implementing organizations are shown in Table 5.3.

Table 5.2 Countermeasures for industrial pollution prevention

- - - survey ——→preparation ⇒implementation

		short term (1-2 years)		mid term (3-5 years)			long term (6-10 years)				
	administration	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1.regulations amendment of environmental standards	NEA	——	——⇒adjust ratio between emmission standards and environmental standards								
decide on a water area and target polluted substances	NEA,MOI	- - -	- - - - ——	⇒NEA:①monitoring rivers, ②detect polluted substances, ③ make a decision on the total amount of emmision MOI: allotment of emmision to each factories - - - - - -——→		⇒amendment of allotment		⇒amendment of allotment		⇒amendment of allotment	
strengthen monitoring	NEA	- - -	- - - - ——	⇒monitoring for necessary information of total emmission amount							
institute an "environmental monitoring"system	NEA	- - -	- - - - ——	⇒set up environmental monitoring			⇒amendment of environmental monitor system				
institute an "environmental manager"system	MOI	- - -	——→⇒set up environmental managers in factories which were alloted polluted substances				⇒amendment of environmental manager system expand manager system to ordinary factories				
penalize enterprises for violations	NEA	- - -	———→	⇒announcement of Black List, impose fine							
information exchange and participation of inhabitants	NEA	- - -	- - - - ——	⇒announcement of total emmission and allotment to each factories							
registration of enterprises using harmful material	NEA,MOI	- - -	- - - - ——	⇒registering factories which emmit heavy metals or harmful substances							
2.support to enterprises A. training of human resources											
manager for environmental monitor	NEA	- - -	- - - - ——	⇒acquisition of ability for environmental monitoring							
manager for environmental prevention , productivity and quality	MOI	———	—→⇒acquisition of ability for unit comsumption and material balance sheet								
consultants for environmental technology	MOI	- - -	- - - - ——	⇒training environmental consultants			⇒training environmental consultants (upper class)				
B. technical guidance	MOI	- - -	- - - - ——	⇒environmental prevention , productivity and quality							
C. support for investment in pollution prevention											
long term and low interest loans	MOF,MPI	- - -	- - - - ——	——→⇒supply finance							
tax reductions	MOF,MPI	- - -	- - - - ——	——→⇒implementation of tax reduction							
commendation	MOI	———	—→⇒select enterprises which achieved environmental prevention								
D. carry out joint treatment in industrial zones	MOI	- - -	- - - - ——	——→⇒construction of joint treatment facilities							
E. organize and promote information exchange	MOI	——→	⇒guide industries to exchange unit comsumption , productivity and quality								
3. other necessary activities A. concentration of equipment intensive industry	MOI	- - -	- - - - —	——— selection of factories	——— making plan of re—structuring	———→	⇒enlarge the scale and centralization				
B. promotion of ISO 14000 and 9000	MOI	- - -	- - - - ——	——→⇒promotion to large scale factories			⇒promotion to middle and small scale factories				
C. foster the pollution prevention machine industry	MOI	- - -	- - - - ——	——→⇒supply finance and tax reduction							
D. set up environmental courses in universities	MOE	- - -	- - - - ——	⇒set courses of environmental prevention , productivity and quality			⇒enlarge courses of environmental prevention etc.				
E. set up an incentive payment system in SOE's	MOI	- - -	- - - - ——	⇒implementation of incentive payment			⇒amendment of incentive payment to more effective way				
F. strengthen relations between governmental administration	All	——→	⇒exchange information and joint implementation of environmental preservation and production improvement								

Table 5.3 Industrial Pollution Prevention Measures in each Administration

	Basic Policy	Countermeasures	Proposals	Remarks
MOI	Support and guidance of implementing countermeasures for enterprises			
	(1) Development of enterprise environment and development of production managers	Development of pollution prevention managers	Approximately 3000 enterprises will be selected if the target is enterprises with approximately more than 300 employees. Assuming that training of environmental management together with improvement in productivity takes about a month and it is held three times a year, then it will take 10 years to train the pollution prevention managers needed.	The research institutes belonging to MOI are eligible to implement the measure by the command of Industrial Energy and Environmental Office.
	(2) Technology guidance (dispatching instructors to enterprises)	Development of instructors for Cleaner Production and End of Pipe technologies	Human resources who are capable of guidance should be assembled in the research institutes under MOI in cooperation with senior experts from overseas. Approximately 120 experts need to be developed under the assumption of conducting guidance at 50 enterprises a year, for the target of 6000 enterprises. Under the assumption that it takes 5 years to complete the training of the experts needed, then 24 experts need to be developed a year.	The research institutes belonging to MOI are eligible to implement the measure by the command of Industrial Energy and Environmental Office.
		Development of private consultants	Approximately 3000 enterprises will be selected if the target is enterprises with approximately more than 300 employees. Assuming that training of environmental management together with improvement in productivity takes about a month and it is held three times a year, then it will take 10 years to train the pollution prevention managers needed.	The research institutes belonging to MOI are eligible to implement the measure by the command of Industrial Energy and Environmental Office.
	(3) Ensuring necessary funds	Ensuring the loan amount	Necessary fund for industry circles should be requested to the related administration to be ensured.	
	(4) Reducing investment burden for enterprises and development enterprise financial condition	Preferential Tax Treatment System	Preferable tax treatment should be requested to the related administration for industrial pollution prevention.	
		Introduction of joint treatment facilities	Establishment of joint treetment facilities should be supported.	
		Development of pollution prevention equipment industry	The preferential investment treatment system should be applied to the pollution prevention equipment industry.	Application of eco-label system for excellent pollution prevention equipment is one of good promotion method that doesn't require costs.
		Integration of equipment intensive industry	While non-equipment intensive industry should be promoted in local, equipment intensive industry should offered a preferential treatment only for a certain scale factories that newly established or renovated.	
	(5) Countermeasures relating to supports	Promotion of information exchange	MOI should provide common meeting ground until enterprise autonomous exchanging information system for unit consumption and environmental technologies is established.	
		Introduction of incentive system for SOEs	A system should be introduced, in which a certain parcentage of profits is repaid to those who contributed to actual productivity improvement	
		Promotion of ISO 14000 and 9000 series	Pollution prevention manager and productivity improvement manager should be developed, and seminars for technological information actively should be held for the purpose of establishing a system that able to grasp material balance and pursue the improvement of environmental measure and productivity.	
	(6) Allocation of the total emission control allotment to enterprises and promote and adjust trading emission allotment when the total emission control method is introduced.	Allocaiton of the total emission control allotment to enterprises and promote and adjust trading emission allotment	The total discharge amount to be reduced from each of factories should be alloted .	The total discharge amount of pollutants from factories located along the designated water area should be estimaed by MOSTE
	(7) Grasp of enterprises using toxic substances	Registration of enterprises utilizing toxic substances	Factories should be obligated to report the amount of hazardous materials to be consumed so that MOI can prepare the measures for will-be expansion of hazardous materials consumption.	The list of total toxic substances amount should be submitted to MOSTE

MOSTE	Mainly implementing regulations			
	（1） Establishment, reform and abolition of Wastewater and Environmental Standards	Revision of Environmental Standards	Environmental standard should be amended to be approximately one tenth of the wastewater standard. For example, the standard for BOD should be changed to 10ppm for the time being, which will not make the human body uncomfortable, and in the future it should be targeted at 5ppm, which will not damage the development of fish and shellfish.	
	（2） Execution of control such as monitoring system, and impose penalties	Reinforcement of the monitoring system	The frequency and the number of points for measurement in the polluted river of materials that are exceeding environmental standards should be increased.	
	（3） Necessary Related Policies for executing regulations	Development of analyzing technician for environment	Skill and technical qualifications should be introduced. As the number of qualified experts increases, only qualified experts will be obligated to measure data for official use.	
		Determination of the total emission amount of pollutants (in the case of implementing the total emission control)	As for COD and toxic materials that is beyond the environmental standards, the permissible amount of toxic materials and COD discharged from the factories along the polluted river should be set.	Refer MOI-(7)
MPI	Promotion of foreign aid relating to pollution prevention and create investment plans	Funding planning	Necessary fund raising plan should be made for pollution prevention measures.	
		Promotion of international cooperation	Financial and technological cooperation should be promoted.	
MOF	Fund supply and credit complement for pollution prevention investment supplying, and execution of a preferential tax treatment system	Execution of a preferential tax treatment system for supporting pollution prevention measures	Tax reduction system such as for the land tax should be introduced with consultation with MOI.	
		Funds for pollution prevention investment	Long term low interest loans for pollution prevention measures should be provided to banks.	
		Improvement and development a credit complement system	Collateral system should be improved in Vietnam.	
MOE	Diversification of environmental courses in university	Diversification of environmental courses in university	Environmental engineering courses should be expanded in universities through integrating couses of environment and production.	

5.6 An Estimation of Mid and Long-term Demand for Investment in Industrial Pollution Prevention Countermeasures

An estimation of mid and long term demand for investment is shown in Table 5.4.

Table 5.4 An Estimation of Mid and Long-term Demand by Sub-sectors Subject to the Survey for Investment in Industrial Pollution Prevention Countermeasures

(million VND)

Sub-sector	Survey	# of Enterprises	CP		EOP		Total	CP/EOP	CP/EOP
			# of enterprises	Amount	# of enterprises	Amount		Neither are required	Both are required
Textile	Detailed Survey	5	4	6,000	5	32,000	38,000	0	4
	Simple Survey	14		8,000	8	45,000	53,000	6	0
	Total	19	4	14,000	13	77,000	91,000	6	4
Chemical	Detailed Survey	4	4	32,000	4	15,000	47,000	0	4
	Simple Survey	17	0	0	12	27,000	27,000	5	0
	Total	21	4	32,000	16	42,000	74,000	5	4
Paper and Pulp	Detailed Survey	5	5	81,000	5	11,000	92,000	0	5
	Simple Survey	16	16	209,000	16	59,000	268,000	0	16
	Total	21	21	290,000	21	70,000	360,000	0	21
Food Processing	Detailed Survey	5	5	15,000	5	25,000	40,000	0	5
	Simple Survey	16	0	0	14	61,000	61,000	2	0
	Total	21	5	15,000	19	86,000	101,000	2	5
Metals	Detailed Survey	4	0	0	4	21,000	21,000	0	0
	Simple Survey	18	0	0	8	71,000	71,000	10	0
	Total	22	0	0	12	92,000	92,000	10	0
Total	Detailed Survey	23	18	134,000	23	104,000	238,000	0	18
	Simple Survey	81	16	217,000	58	263,000	480,000	23	16
	Total	104	34	351,000	81	367,000	718,000	23	34

Premise Exchange Rate: 100 JP\ = 12,000 VND

1 US$ = 14,000

Chapter 6

Summary of Case Studyies for Enterprises

Chapter 6 Summary of Case Studies for Enterprises

6.1 Objectives of the Enterprise Study

During the second and third field survey, the Study Team conducted factory studies of selected enterprises in five industrial sub-sectors. The objectives of the enterprise study were as follows:

1. To grasp the present state of the industrial sub-sectors, based on which the Master Plan is to be worked out
2. To work out improvement countermeasures based on the analysis of the present state
3. To make simple recommendations that do not require a large financial investment for the enterprises studied
4. To propose plans for improvement by means of Cleaner Production technology and End of Pipe technology, including an estimation of the investment cost required for implementation of improvement measures for enterprises that are judged to have improvement potential
5. To prepare basic data on financial demand for implementing industrial pollution prevention countermeasures in Viet Nam

6.2 Enterprise Study Procedures

The enterprise studies were conducted in two phases: Phase Ⅰ was a simplified study of 104 enterprises, and Phase Ⅱ was a detailed study of 23 enterprises.

6.3 Summary of the Study Results

The following are the current problematic issues that are common to each industrial sub-sector:

Approximately 93 % of the factories discharging industrial wastewater among the enterprises studied are not presently satisfying the wastewater regulation standard. The causes that create this problem are analyzed as follows:

(1) Imperfect Functioning of the Existing Wastewater Treatment Systems

Nearly 60 % of the wastewater treatment systems that have already been installed are not functioning properly. Figure 6.1 shows the relation between

factors causing this problem.

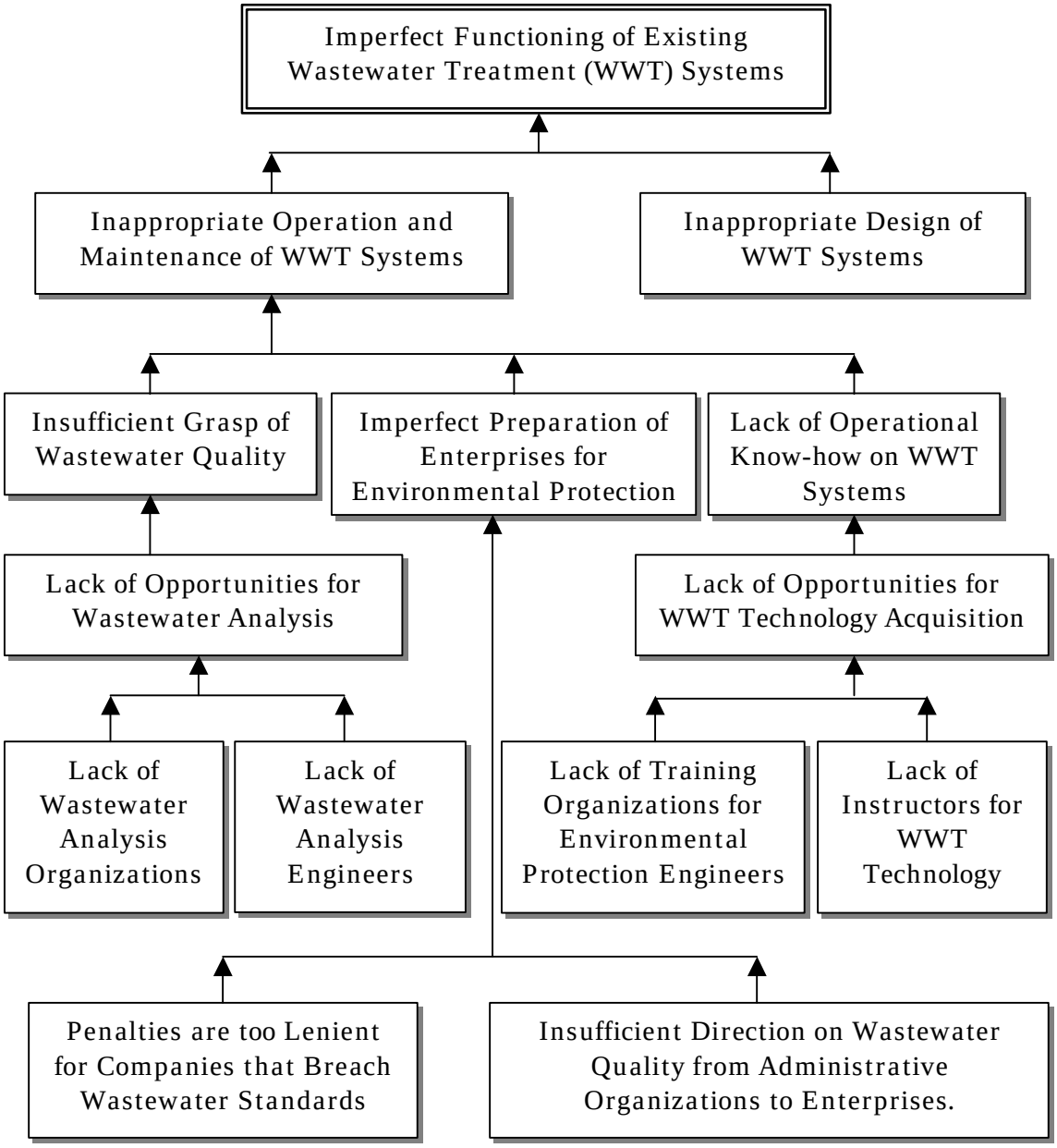

Figure 6.1 Causes of the Imperfect Functioning of Existing Wastewater Treatment Systems

The following issues should be solved in order to make existing wastewater treatment systems function properly:

1. Preparation of educational and training organizations that provide enterprises with opportunities for acquiring operational know-how on wastewater treatment systems
2. Preparation of organizations that can provide enterprises with water

analysis services necessary to grasp wastewater quality

3. Direction from administrative organizations to promote enterprise preparation for environmental conservation

(2) Discharge of Valuable Materials into Wastewater

Valuable materials are discharged in process wastewater as pollutants. Figure 6.2 shows the relation between factors causing this problem.

In order to solve this problem, it is necessary to start by grasping the present state of production losses as the first step for applying Cleaner Production technology, which is the main subject of this Study. One of the important tasks of the administrative organization is to establish organizations to direct enterprises in production management that emphasizes the importance of grasping the current state of production activities, including the environmental impact caused by wastewater.

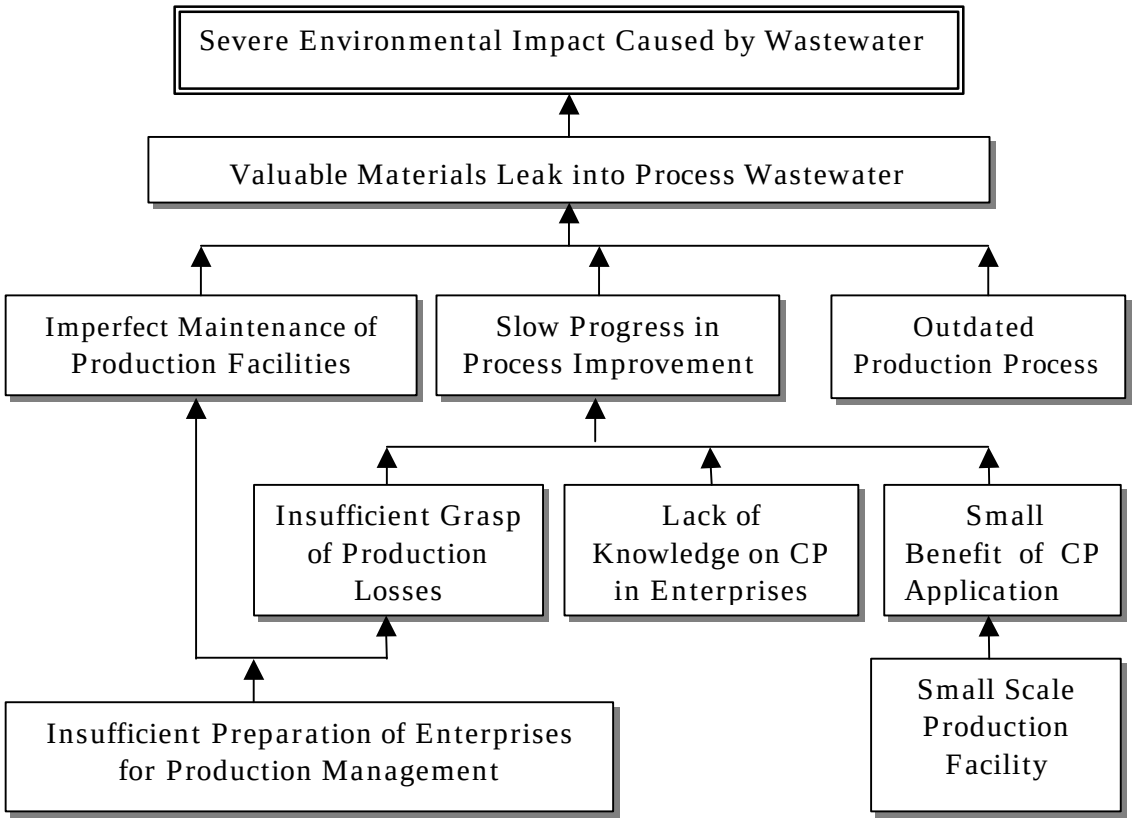

Figure 6.2 Relation of Factors Causing Valuable Material Discharge into Process Wastewater

(3) Slow Progress in Wastewater Treatment Systems

In 73 % of the enterprises that are discharging industrial wastewater, wastewater does not satisfy the regulation standards because wastewater treatment systems have not yet been installed. Figure 6.3 shows the relation between factors causing the slow progress in wastewater treatment system installation.

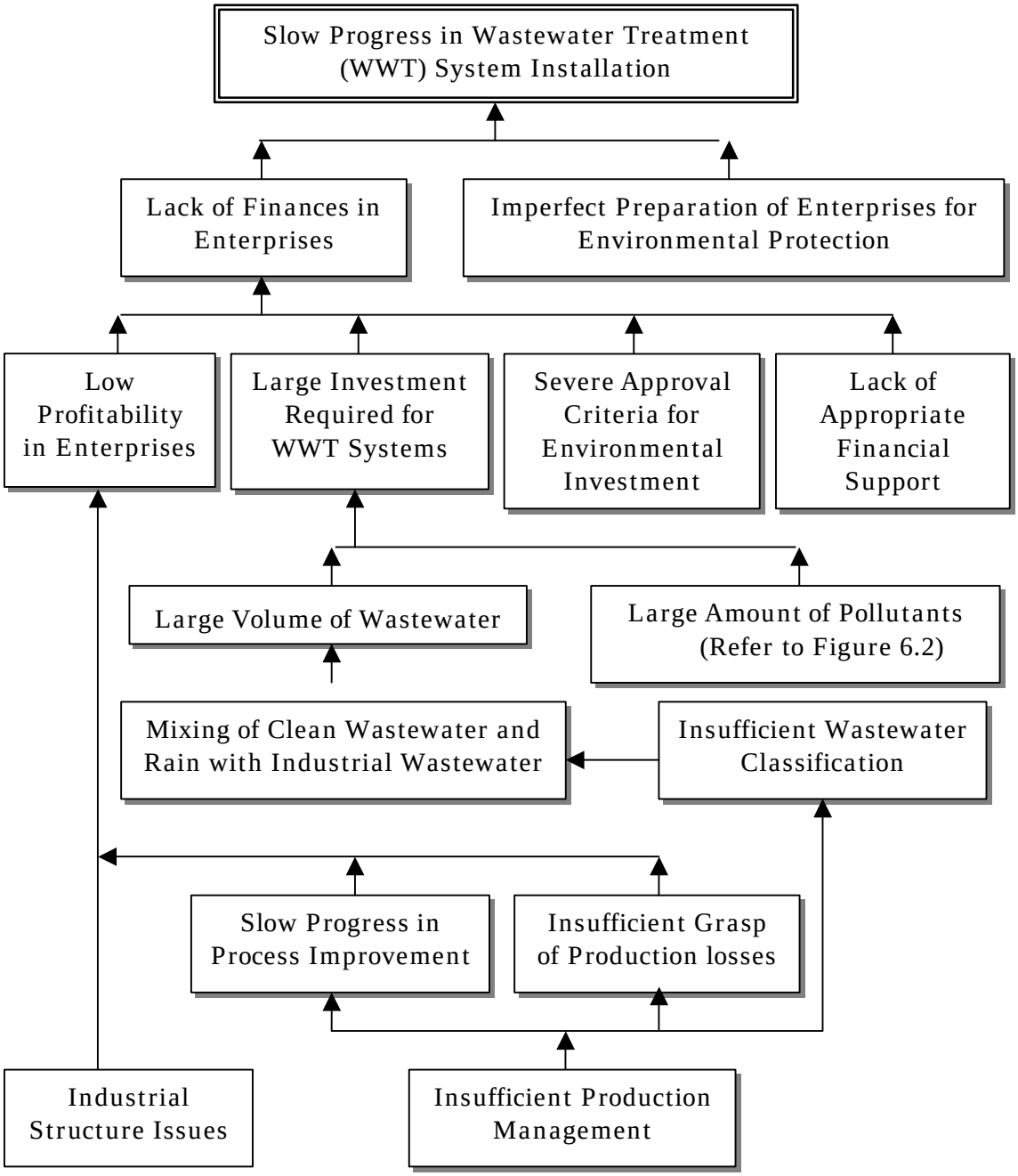

Figure 6.3 Causes for Slow Progress in Wastewater Treatment System Installation

In general, enterprises cannot afford to invest in wastewater treatment system installation. Besides, it is not desirable for them to introduce wastewater treatment systems under current conditions, because the cost required to install a wastewater treatment system is relatively high due to the following:

1. A large scale system is required to treat a large volume of wastewater, and in most enterprises, wastewater is not currently classified and is mixed with clean water and rain.
2. A considerable investment is required to install a system to treat wastewater that contains a large amount of contaminants, because valuable materials are mixed in with wastewater as mentioned in the previous paragraph.

One urgent issue that requires action is a reduction in wastewater pollution impact by promoting the enforcement of production management. This measure does not require a large investment.

(4) Industrial Sector Structure Issue

Process intensive industries in Viet Nam, such as the chemical and paper and pulp industries, are faced with the adverse structural condition of having many small factories dispersed geographically throughout Viet Nam. Figure 6.4 shows the relation between the factors causing this problem.

On a long-term basis, in order to improve the competitiveness of process intensive industries, the infrastructure for logistics, and transfer of raw materials and utilities needs to be improved.

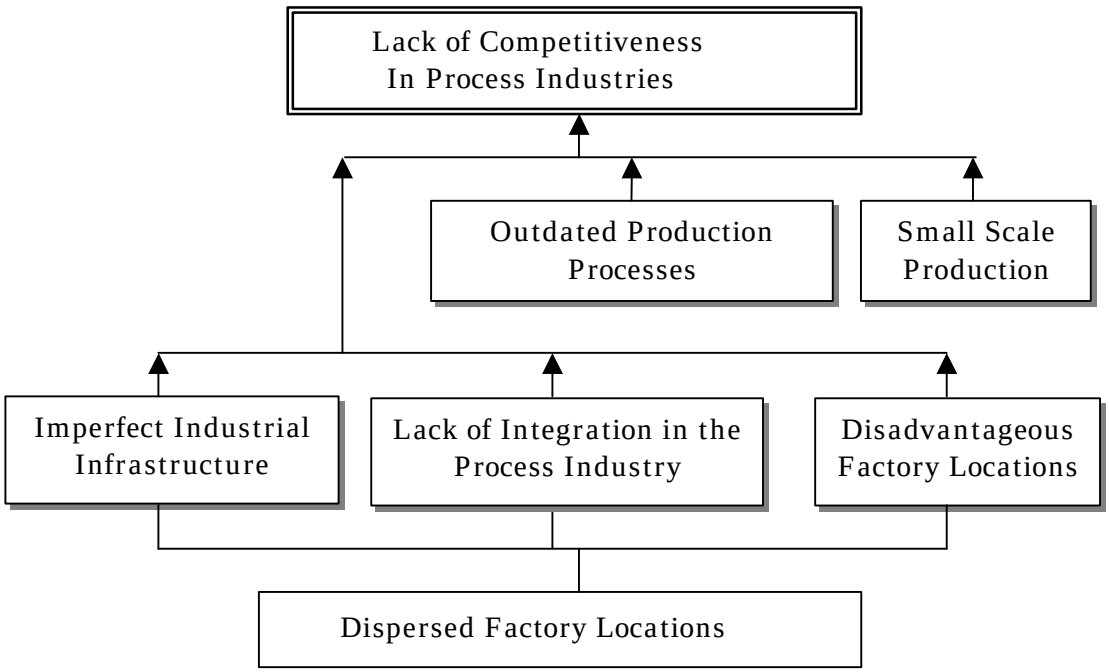

Figure 6.4 Factors Related to Industrial Sector Structure

Chapter 7

Countermeasures for Wastewater Pollution in the Textile & Garment Sub-sector

Chapter 7 Countermeasures for Wastewater Pollution in the Textile & Garment Sub-sector

7.1 Present State of Wastewater and Productivity in the Textile and Garment Sub-sector

7.1.1 Enterprises Surveyed in This Study

The Textile Team surveyed nineteen State-owned enterprises in a simple survey and also, surveyed 5 of these enterprises again more thoroughly in a detailed survey. The following Table 7.1 shows the scope of the survey: (T-01*~T-05* are the enterprises that were surveyed in detail.)

Table 7.1 Enterprises Surveyed

No	Name of Enterprise	Number of Employees	Turnover Million VND	Consumption of Industrial Water ton/day	Kinds of Processes
1	T-01*	3500	495,000	3,600	SP., WV., DY., SW.
2	T-02*	480	38,931	500	KN.,DY., SW.
3	T-03*	400	20,204	40	WV., DY., SW
4	T-04*	7500	378,000	7,000	SP., WV., DY., SW.
5	T-05*	1700	113,204	1,600	SP., WV., KN., DY.
6	T-06	2800	2,863	70	SW.
7	T-07	2000	76,195	600	SP., WV., DY., SW.
8	T-08	200	78,881	250	SW.
9	T-09	1200	75,722	730	SP., WV., DY., SW.
10	T-10	595	14,555	200	SP., CP., DY.
11	T-11	5000	208,000	0	SW.
12	T-12	1500	99,500	1,500	WV., DY., SW.
13	T-13	3700	440,000	4,800	SP., WV., DY., SW.
14	T-14	70	14,000	310	DY.
15	T-15	850	75,246	200	SP., WV., DY.
16	T-16	3000	225,000	4,800	SP., WV., DY., SW.
17	T-17	1300	40,000	60	SP., WV., SW.
18	T-18	1700	140,000	250	WV., DY., SW.
19	T-19	1800	160,000	300	SP., WV., KN., DY., SW.

(Remark) : SP.= Spinning, WV.= Weaving, KN.= Knitting, CP.= Carpet, DY.= Dyeing, SW.= Sewing

7.1.2 Industrial Wastewater in the Textile & Garment Sub-sector

(1) Wastewater Quality

Table 7.2 shows the quality of wastewater in the textile & garment sub-sector

that was analyzed in the second field survey.

Table 7.2 Wastewater Quality in the Textile & Garment Sub-sector

	Unit	Spinning & Weaving	Dyeing & Finishing	Garment Factories	Vietnam Standard
Temperature	℃	24.7	35.3	30.3	
pH		7.3	8.93	7.5	5.5～9
Elec. Conductivity	μS/cm	290	370	270	
Turbidity	NTU	2.8	13.5	10.8	
Oil content	mg/l	0.04	0.02	0.02	1 or 10
BOD	mg/l	16.5	522	40.7	50
COD	mg/l	21.5	665	55	100
DO	mg/l	2.4	4.2	1.7	
SS	mg/l	5.8	17.3	12.1	100
Total Nitrogen	mg/l	19.1	9.2	7.9	60
Residual Chlorine	mg/l	Trace	Trace	13.5	
SO_4	mg/l	97.6	91.2	63.4	
Cyanogen	mg/l	0.02	Trace	0.02	0.1

(2) Dyeing Factory Wastewater

Table 7.3 shows wastewater quality of the dyeing factories surveyed in the Study.

1. Most of the factories are over the allowable limit for most parameters measured.
2. The average wastewater volume per factory is about 2,000m^3/day.
3. Only 4 factories are equipped with a wastewater treatment facility. The other factories are discharging their wastewater without any treatment.

Table 7.3 Dyeing Factory Wastewater

	PH	BOD mg/l	COD mg/l	SS mg/l	Water m^3/day	W.W.T System
T-01	11.36	384	844	60	3,600	No
T-02	7.71	578.6	1133.1	33.7	500	No
T-03	10.12	222	325	62	40	No
T-04	11	47	260	10	7,000	No
T-05	9.53	135	360	19	1,600	No
T-07	10.5	132	158	74	600	Yes
T-09	7.9	40	41	15	730	No
T-12	11.3	784	957	19	1,500	No
T-13	10.0	77	269	45	4,800	No
T-14	10	308	2353	40	310	Yes
T-15	3.2	2	52	6	200	Yes
T-16	10.5	14	341	12	4,800	No
T-18	9.9	85	433	25	250	U. Cnst

T-19	9.76	273	920	18	300	Yes
Vietnam Standards	**5～9**	**100**	**400**	**200**		

＊WWT…… Waste Water Treatment System

(3) Garment Factory Wastewater

Table 7.4 shows the wastewater quality of garment factories surveyed in the Study.

Wastewater treatment facilities in use are generally, just small sedimentation tanks.

Table 7.4 Garment Factory Wastewater

	pH	BOD mg/l	COD mg/l	SS mg/l	Water m^3/day	W.W.T System
T-06	7.8	33	52	11	70	No
T-08	6.1	79	88	40	250	No
T-11	—	—	—	—	0	No

(4) Future Subjects for Consideration

1. It is necessary that pollution prevention efforts be concentrated on the dyeing factories because they emit highly concentrated pollutants and a large volume of wastewater.
2. It is necessary to install wastewater treatment facilities for the effective prevention of industrial pollution. The function of the few existing wastewater treatment facilities is not adequate because there are some design problems, such as with the treatment methods selected and the volume of the treating tank, so it is necessary that these be improved.
3. Existing wastewater treatment facilities do not work sufficiently and the quality of their wastewater cannot clear environmental standards in Vietnam. It is also necessary to transfer wastewater treatment technology in addition to improving facilities.

7.1.3 Productivity in the Textile & Garment Sub-sector

Table 7.5 shows the comparison of labor productivity between a large Japanese factory and a medium-sized factory in Vietnam.

Table 7.5 Comparison of Labor Productivity between Japan and Vietnam

	Spinning Process		Dyeing Process	
	Japan	Vietnam	Japan	Vietnam
Capacity	80,000 sp	23,000 sp	$55{,}000 \times 10^3$ m/year	$15{,}000 \times 10^3$ m/year
Employees	260	530	300	460
Productivity per Employee	308 sp	43 sp	183×10^3 m/year	33×10^3 m/year

There is more than a 5 time difference in labor productivity between Japan and Vietnam, both in the Spinning Process and in the Dyeing Process. However, this data may not be suitable for comparison because there is a trend to ignore labor productivity in Vietnam due to the very low cost of labor there.

7.2 Causal Analysis in the Textile & Garment Sub-sector

7.2.1 Present State of Production Technology in the Textile & Garment Sub-sector

Making assumptions based only on the enterprises surveyed, the results of the findings leave the Study Team with no choice but to admit that the production technology used in the Vietnam Textile and Garment Industry is at a low level. However, there are some enterprises that are preparing to improve their technology to produce products for export, and there are some considerably high level joint-venture enterprises, financed with indirect foreign capital (not investigated directly by the Study Team) that seem to have a high level of technology.

From a “Cleaner Production” point of view, the survey this time should have focused on the dyeing process where wastewater is discharged. However, the purpose of this Study is to report on the current state of the enterprises, including the spinning and weaving processes, concentrating on areas where costs can be reduced and added product value can be increased.

(1) Spinning Process

The machines that are equipped in Vietnam spinning factories are mainly old ones made in China or European countries. The factories in the Hanoi and Danang areas, especially, lag behind in modernization.

The main problems in the spinning process of the factories surveyed are as follows:

1. The functions of the draft parts in old machinery are no good, and because of

unevenness, this condition leads to poor yarn quality.

2. On the old equipment, cans and roving bobbins that contain semi-finished products from the spinning process, are too small. This causes low productivity because it requires many changing operations. The main problem with mistakes caused in changing semi-finished products is the decreased yarn quality.
3. In the winding process, there is a splicing system that can produce knot-free yarn. Most spinning factories lag behind in the introduction of this modern technology.
4. In the winding process, clearer-type electric yarn is the global standard, but most spinning factories lag behind in the introduction of this modern technology.

(2) Weaving Process

The main problems in the weaving processes of the factories surveyed are as follows:

1. Old shuttle looms account for about 80 % of the weaving machines. The Hanoi and Danang areas, especially, lag behind in modernization.
2. Among the old shuttle looms in use, many machines still utilize a manual-type shuttle change. This manual, shuttle change-type loom is not only low in productivity, but also has quality problems. Owing to machine stoppage at each shuttle change, fabric unevenness occurs because of variation in warp tension, especially in thin fabric weaving.
3. In the factories there are many old shuttle looms with narrow widths, so the number of export products are limited because they are low value-added items.

(3) Dyeing Process

The main problems in the dyeing processes of the factories surveyed are as follows:

1. The dyeing industry in Vietnam is generally made up of minor enterprises, so continuous dyeing machines which have high productivity are only slightly utilized and batch type machines are the main machines used for fabric dyeing. Only one factory has introduced a continuous dyeing machine. Some factories have introduced partial, continuous dyeing machines which

continuously treat the scouring and bleaching process for towels.

2. Liquid flow type machines are mainly used for the batch process. However, most of the liquid flow-type machines were made 10 years ago and even relatively new machines use old technology. A considerable amount of wince- type and jigger-type machines are in use.
3. The batch-type dyeing machines that are commonly used are based on this technology, as well as old machines, so the liquid ratio of the machines is pretty high. (for example the liquid ratio = 1:10～1:12 for polyester)
4. The factories use standard dyestuff and chemicals, so they are not trying to improve the dyeing process through the use of new dyeing methods.
5. Most of the factories surveyed utilize well-water. Only a few factories have installed water treatment systems. However, these systems are very simple systems and the treatment is imperfect. Therefore, process water quality is very low at most of the factories and it may have an effect upon the quality of products.
6. Most of finishing machines in use are very old and inefficient, therefore it seems that the functions that can be added are somewhat restricted.
7. Several factories have adopted CCM systems. However, at most of the factories, color matching is carried out manually. This computer system is expensive, therefore it is difficult to introduce it into small-sized enterprises. However, from now on it will be necessary to introduce CCM in most factories to improve color matching.
8. Preparation of dyestuff and chemicals are carried out manually at the Color Kitchen. However, as a matter of cause, operation manuals are deficient and handling and storage of chemicals is very confused. Therefore, this increases the likelihood of operation error or contamination to take place.
9. Laboratory facilities are insufficient and the inside of the laboratories are in disorder. It seems that there are some obstructions for making recipes and checking color.
10. In Vietnam, it will be difficult for automation to become widespread because labor cost is very inexpensive. However, from the point of view of improving product quality and increasing productivity, automation of dyeing machines should be considered. In the case new dying machines are procured, automated machines should be adopted.
11. Energy conservation is insufficient at most of the factories surveyed. Only a few factories reuse warmed cooling water. Some factories do not even

recover steam condensation. Most of the factories do not recover heat energy from wastewater or exhaust gas from their dryers.

12. Some apparel manufacturing factories wash apparel using cleaning, softening and stone washing processes. Facilities in these factories consist of horizontal washers, centrifugal separators and dryers. Some facilities are very old and not in good condition.

7.2.2 Present State of Production Management Technology in the Textile & Garment Sub-sector

The present condition of production management in the factories surveyed is at a very low level, and many factories are not under normal controls. Factories whose export rate is low are not aware of quality issues. These factories are far away from being competitive internationally.

The main problems involving management technology in the factories surveyed are as follows;

1. Quality control is hardly carried out at all in the factories surveyed. There is little concern for quality control from the top management on down to the shop-floor workers. Most of the factories don't prepare standard manuals. Some factories have already received ISO9002 certification and other factories have begun the certification program. It seems that many other factories want to obtain the certification in the near future.
2. The factories surveyed generally lack cost awareness. They do not even grasp the concept of unit consumption for each product, which is a basic principle of cost management.
3. Equipment management ability is low and the maintenance of old machines is especially bad. The lack of a maintenance function results not only in a decrease of production capacity, but also has a bad influence on product quality, corrupts unit consumption, decreases equipment life and causes big damage to the factory.
4. Things are not kept in good order and the insides of factories are also, very dirty. The "5S movement" is carried out in some parts of Vietnam, but almost all factories show no concern for this matter.
5. Many of the factories are suffering from an insufficiency of engineers. The development of engineers is indispensable to help solve technical and management problems.
6. It is very important that management makes efforts elevate workers' skill

level and morale.

7.2.3 Relation Between the Problems and the Causes

Figure 7.1 shows a diagram of the relation between existing problems and their causes in the textile and garment sub-sector.

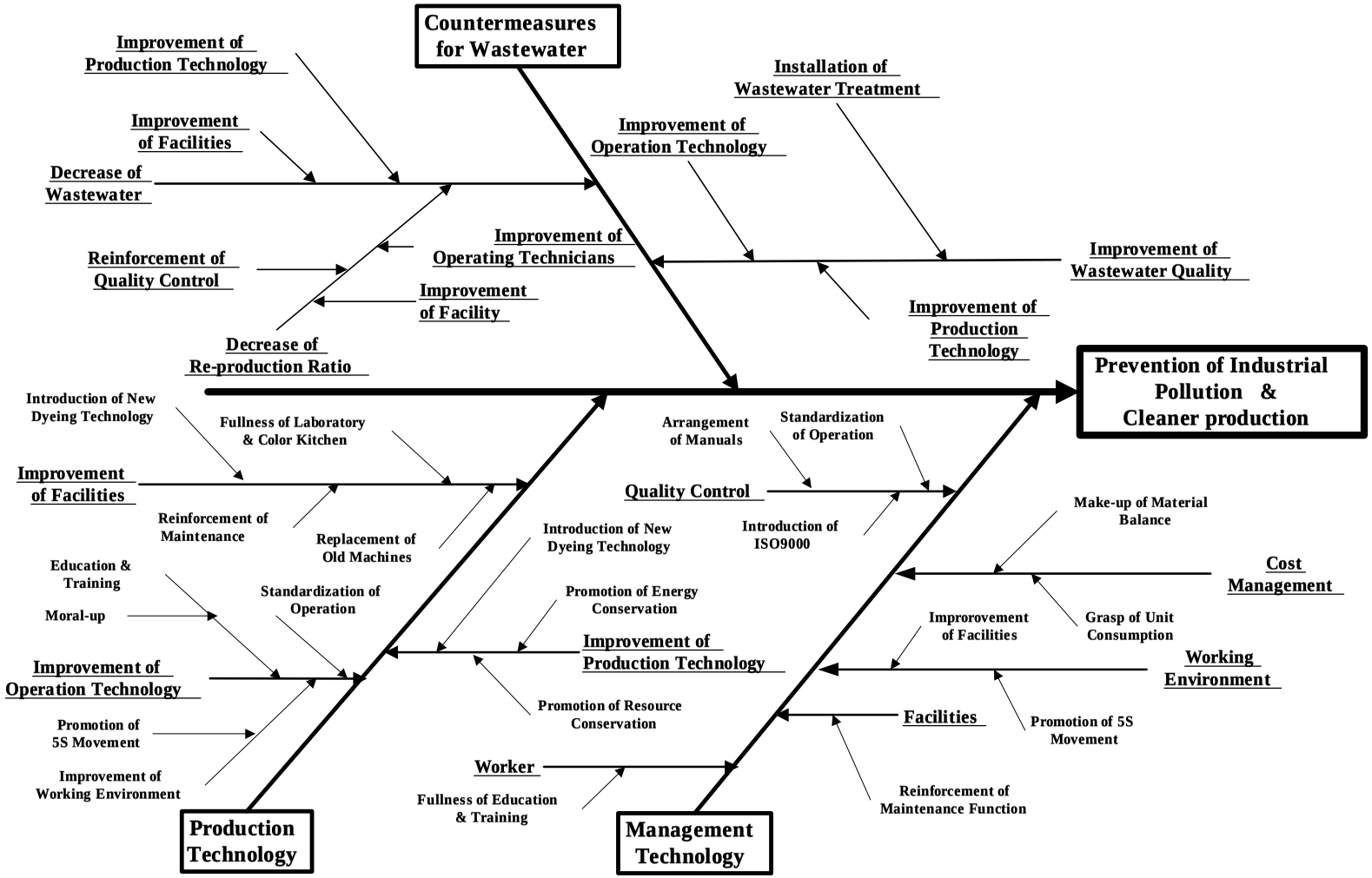

Figure 7.1 Causal Relation of Prevention of Industrial Pollution Problems & Cleaner Production

7.3 Countermeasures for Technical Improvement and Evaluation in the Textile & Garment Sub-sector

7.3.1 Existing Problems in the Textile & Garment Sub-sector

The following problems currently exist in the Textile & Garment Sub-sector:.

1. Superannuated equipment
2. Outdated production technology
3. Insufficient countermeasures for energy conservation
4. A lack of quality control
5. A lack of cost management
6. An imperfect maintenance system
7. Insufficient organization and a lack of concern for keeping factories clean
8. A lack of educational and training opportunities for employees
9. A lack of wastewater treatment systems

7.3.2 Countermeasures for Improvement by Promoting Cleaner Production Technology in the Textile & Garment Sub-sector

(1) Spinning & Weaving Processes

Recommended countermeasures for improvement of the factories surveyed are as follows:

1. In order to improve the draft parts of machines in the drawing and roving process, it is necessary to replace the existing old-type machines with modernized machines. For the spinning process, it is better to re-design only the draft parts rather than to replace whole machines. With this improvement, the quality of yarn evenness will be improved and it will be possible to produce a high value-added product.
2. It is necessary to replace machines with one's that have large packaging systems for the drawing and roving processes. It is expected that quality and productivity will be greatly improved by taking this measure.
3. It is advantageous to attach a manual splicing system to existing winding machines for knot free products.

   For introducing the electric yarn clearer into the winding process, it would be advantageous to improve existing mechanical-type winding machines.
4. There are many problems with quality and low operating rates of old shuttle looms. Therefore, these looms should be modernized by gradually installing modern, advanced looms, like rapier looms or air jet looms. It is important

to choose a model which can cope with the requirements of the market, and it is also important to select an appropriate fabric width when considering machine specifications.

(2) Dyeing process

Recommended countermeasures for improvement of the factories surveyed are as follows:

1. It will be advantageous to refurbish superannuated dyeing machines (mainly Wince-type) or inefficient machines (mainly Jigger-type) and change them over to low liquid ratio-type machines as long as they have no functional problems. Also, a general increase in low liquid ratio-type machines should be facilitated. (for example: liquid ratio = 1:6 for polyester) Accordingly, the quantity of discharged wastewater and chemicals will decrease. Furthermore, it will be possible to improve productivity and to produce high value-added products.
2. As much as possible, it is recommended that enterprises introduce the following new dyeing technology:
   a. The utilization of an alkali proof-type dyestuff for polyester to reduce the consumption of water, steam and chemicals by omitting reduction washing.
   b. Introduction of a one-bath dyeing method for the polyester and cotton mixture to reduce the consumption of water, steam and chemicals through process reduction.
   c. The utilization of multi-functional dyestuff for cotton dyeing to reduce the volume of dyestuff discharged into wastewater through improvement of the dyestuff mixing ratio.
3. It is urged that the following countermeasure for the laboratory and the Color Kitchen be adopted:
   a. Laboratory facilities need to be completed in order to improve test dyeing, recipe preparation and to rationalize product inspection, which will decrease the reprocessing ratio.
   b. CCM (Computer Color Matching System) should be introduced in the factories in which it has not yet been introduced in order to improve the color matching method.
   c. Color Kitchen facilities should be prepared in order to improve the accuracy of scaling, prevent contamination, and to improve the working environment. It is important also to put things in order and clean up the

insides of facilities.

4. The following countermeasures are urged to be adopted for better energy conservation:
   a. Recover steam condensation where it is currently not being recovered.
   b. Recycle cooling water from the heat exchanger and use it as process water.
   c. Recover waste heat of high temperature wastewater coming from dyeing machines through heat exchange between waste and process water.

(3) Management System

The following countermeasures are urged to be adopted to reinforce management systems:

1. The first step for realizing this countermeasure is for top management to recognize that quality control is essential. After that, it is necessary to reinforce the quality control system, make and observe standard manuals and educate employees on quality control. Introduction of the ISO 9000 series should be utilized as a method for reinforcement of the quality control system.
2. In order to perform thorough cost management, it is necessary to make up detailed material balance sheets, grasp unit consumption and manage this kind of data. These measures will result in the elimination of wastefullness and reduce costs.
3. Reinforcement of the maintenance system for facilities is necessary to maximize the performance of the facilities, maintain and secure productivity levels and product quality.
4. The "5S movement" should be promoted to help organize and clean the inside of factories. As a result, waste-fullness will be eliminated, a consciousness for maintaining cleanliness will be instilled in workers and these measures will become a leading force for securing quality improvement. Productivity will also increase and a gain in customer's trust will follow. In order to implement these measures, the strong leadership of top management is inevitable and the introduction of "small group activities" is desirable.

7.3.3 Countermeasures for Improvement by End of Pipe Technology in the Textile & Garment Sub-sector

The following countermeasures are necessary for improving End of Pipe

technology in the factories surveyed:

1. Most of the dyeing machines in use are batch-type. Therefore, the wastewater quality changes drastically depending on the production schedule. It is first necessary to install wastewater tanks (equalization tank) to equalize water quality before wastewater treatment. The capacity of equalization tanks should be designed to hold more than 1/2 of the wastewater discharged per day.
2. Most dyeing factories do not recover heat energy from wastewater. Therefore high temperature wastewater is discharged, as it is, out side of factories. High temperature effluent like this must be cooled because, not only does it have a bad influence on the ecosystem, but it also decreases the efficiency of biological wastewater treatment. The best way to lower the temperature of wastewater is through heat recovery using a heat exchanger or by recovering steam condensation in the dyeing process. The next best way to cool high temperature wastewater is to install a trickling cooling tower after the equalization tank.
3. In order to improve the effect of wastewater treatment, pH adjustment inside the aeration tank is very important. Activated sludge treatment becomes most effective with a pH factor of around 6 or 8. If pH strays out of this range, the treatment ability of the bacteria decreases. Therefore, it is necessary to install a neutralization tank that can adjust pH right before the biological treatment tank. For biological treatment, it is very important to breed bacteria that is suitable for the wastewater from each dyeing factory. These bacteria should be raised among other microorganisms that are suitable for the climate of Vietnam.
4. As for dyeing factory wastewater treatment methods, a combination of the activated sludge process and coagulating separation is generally adopted. However, both methods discharge large quantities of sludge during normal operations. So, it is necessary to install a sludge dehydrating system for the effective treatment of this surplus sludge.

7.4 Conclusion and Recommendations for Industrial Pollution Prevention in the Textile & Garment Sub-sector

7.4.1 Recommendations for Prevention of Industrial Pollution in the Textile & Garment Sub-sector

Countermeasures proposed by the Study Team to prevent industrial pollution in the Textile & Garment Sub-sector are shown in Table 7.6 and Table 7.7.

Table 7.6 Recommended Countermeasures for Industrial Pollution Prevention (Short-Term Countermeasures)

No	Items	Merits
1	Improvement of spinning & weaving machines	Increase productivity & improve quality of products
2	Recovery of steam condensation	Save energy
3	Recycling of cooling water	Save energy
4	Heat recovery from wastewater	Save energy
		Lower the temperature of wastewater
5	Reinforce laboratory facilities	Improve test dyeing & recipe preparation
		Rationalize product inspection
6	Reinforce color kitchen facilities	Improve the accuracy of scaling
		Prevent contamination
		Improve the working environment
7	Reinforce quality control systems	Prevent variation in quality
		Reduce production costs
		Guarantee quality to customers
8	Make up material balance charts and grasp unit consumption	Eliminate waste-fullness
		Recognition of items to be improved by management
		Reduce production costs
9	Reinforce the maintenance system	Maintain full performance of the facilities
		Maintain and secure productivity levels Maintain quality of products
10	Promote the “5S Movement”	Eliminate waste-fullness
		Instill a consciousness for maintaining cleanliness in workers
		Ensure quality improvement
		Increase productivity
		Gain customer's trust

Table 7.7 Recommended Countermeasures for Industrial Pollution Prevention (Long & Mid-Term Countermeasures)

No	Items	Merits & Demerit
1	Introduce low liquid ratio-type dyeing machines	(Merits) ・Decrease the quantity of discharged wastewater and chemicals ・ Improve productivity and produce high value-added products
		(Demerits) ・Expensive (In some cases, not economical)
2	Introduce new dyeing technologies	(Merits) ・Reduce consumption of water, steam and chemicals ・Reduce the volume of dyestuff discharged into wastewater.
		(Demerits) ・Need to develop or introduce the new technology
3	Introduce CCM	(Merits) ・Improve the color matching method
		(Demerits) ・Expensive
4	Install wastewater treatment systems	(Merits) ・Decrease industrial pollutants
		(Demerits) ・Expensive

7.4.2 Measures Requested of Administrative Organizations

The Study Team proposes that the following measures should be taken by the administrative organizations to execute the "Proposals for Industrial Pollution Prevention" outlined in the above paragraph 7.4.1:

1. The administrative organizations should have a positive mind frame for making investments in countermeasures for industrial pollution, and clarify and promote their position by hammering out policies that favor investment, such as tax reductions, low interest rate financing or subsidization of investments in countermeasures, for industrial pollution.
2. The following measures are necessary on the side of the administration to support an elevation of the technology level at enterprises, or for the entire industry.
   a. Collect technical information from overseas and furnish it to enterprises
   b. Develop and dispatch talented engineers to help develop technology
   c. Develop basic technology at the request of enterprises
   d. Develop technology under the leadership of the administration

3. The administration is urged to organize a system for promoting management techniques such as ISO 9000 series certification acquisition, enlightening employees on management techniques and popularizing factory management systems like TQM, TPM or 5S.
4. The administration needs to study the possibility of setting up a model enterprise or a model factory that utilizes Cleaner Production technology, energy conservation technology and technology for reducing industrial pollution. The administration should help finance and subsidize this project and open it to the public. It will offer the public the chance to see and hear about the actual conditions, the merits or usefulness of these technologies in relation to other enterprises, and it will result in the popularization and promote the introduction of these technologies.

7.4.3 Investment Demand for Industrial Pollution Prevention Countermeasures in the Textile & Garment Sub-sector

The demand for investment is shown in Table 7.8.

Table 7.8 Investment Demand for Countermeasures for Pollution Prevention

	Cleaner Production	Wastewater Treatment
Factories in the detailed survey	5,600,000,000 VND	31,940,000,000 VND
Factories in the simple survey	8,000,000,000 VND	45,487,000,000 VND
Total	13,600,000,000 VND	77,427,000,000 VND

Note: Investment for Cleaner Production is only for energy saving.

Chapter 8

Countermeasures for Wastewater Pollution in the Chemical Sub-sector

Chapter 8 Countermeasures for Wastewater Pollution in the Chemical Sub-sector

8.1 Current Status of Industrial Wastewater and Productivity in the Chemical Sub-sector

8.1.1 Selection of Enterprises for the Survey

(1) Simplified Survey

21 enterprises out of the 53 enterprises in the chemical sub-sector in Vietnam were selected by MOI to be surveyed. The enterprises selected were all state-owned enterprises, except for one joint venture between MOI and two local government -owned enterprises. The enterprises surveyed are classified into inorganic basic chemicals(4), fertilizer(4), rubber and tires(4), detergents(4), battery and dry cells(3), pesticide(1) and inorganic gas products(1).

Ten of the enterprises selected are located in the Hanoi and surrounding area, nine in the HCMC and surrounding area, and two in the Da Nang region.

(2) Detailed Survey

Four enterprises were selected from among the enterprises in the simplified survey for the detailed survey, two fertilizer, one battery and dry cell, and one pesticide enterprise.

8.1.2 Industrial Wastewater Discharged from the Chemical Sub-sector

(1) Types of Industrial Waste Water

There are many types of industrial waste water discharged from chemical factories depending on the products, raw materials, additives and the processes utilized. In general, production plants for inorganic chemicals discharge acidic or alkaline waste water, or water containing inorganic salt as a solid substance. Battery production plants discharge acidic waste water and water contaminated with heavy metals. The production plants for organic chemical products, such as rubber products, detergents and insecticides, discharge waste water showing relatively high COD or BOD values, and in some cases water that contains high SS, outside the factory.

(2) Quality and Volume of Industrial Waste Water

The results of analysis of the industrial waste water samples collected at the final discharge point of each factory are shown in Table 8.1. The volume of industrial wastewater is shown as well.

(3) Waste Water Treatment System

There are various kinds, scales and functions of waste water treatment systems and these depend on the kind of waste water itself. However, waste water treatment systems in the chemical sub-sector in Viet Nam mainly have adopted primary level treatment, such as primitive neutralization and sedimentation utilizing natural precipitation. Among the 21 chemical enterprises surveyed, there are two enterprises that have adopted a secondary waste water treatment system, such as activated sludge treatment.

Table 8.1 Wastewater Quality of Enterprises Surveyed

Enterprise Number	Quantity (m^3/day)	Quality Parameter (mg/l)			
		COD	BOD	SS	Oil
C01	180,000	26.4	15.8	114	0.2
C02*1	0	18	14	36	0.2
C03*2	30	120	48	4	0.19
C04*3	9,600	96	54	310	0.37
	2,880	74.6	29	270	0.42
C05	1,500	142	52	1,122	0.35
C06	200	220	78	61	0.2
C07	6,000	120	27	39	1.6
C08*4	40	520	350	56	1.2
C09	210	49	16	17	0.05
C10	830	124	76	56	0.15
C11	360	316	144	255	0.9
C12	Batch	320	193	59	0.19
C13*5	0	1,040	367	36	0.07
C14	700	19	11	5	0.16
C15	1,000	64	24	18	0.28
C16	816	23.2	9	45	0.13
C17	42	340	118	3,336	0.17
C18	500	1,120	560	1,000	0.23
C19*1	0	14.4	10	26	0.12
C20*5	0	40	19	81	0.25
C21	250	32	18	3	0.1
TCVN5945-1995		100	50	100	10

(Data : Analyzed by the Chemical Engineering Corporation)

*1 Waste water pool, no discharge to outside (only a reference)

*2 Waste water from battery production

*3 Two kinds of waste water from different products

*4 Household waste water

*5 Recycling water

(4) Waste Water Management

Almost all the enterprises surveyed have not implemented periodical analysis of their industrial waste water for all the necessary pollution items required to be monitored to improve productivity and avoid environmental impact. Periodical testing of pH is implemented in several enterprises on a daily basis. Not all, but some enterprises surveyed have submitted the results of their EIA for evaluating their environmental impact, but the frequency of such reviews should be increased more in the future. Many cases were observed where the sedimentation tank was filled with sediment because of inadequate management.

According to the results of the sample analysis in this survey, much of the industrial waste water from the enterprises surveyed does not satisfy the national environmental code, TCVN 5945. Furthermore, there is no equipment for monitoring and alerting the factory on the quality of industrial waste water, except in one activated sludge treatment system installed in a subsidiary company.

(5) Problems Related to Current Condition of Wastewater Treatment

According to the results of factory investigation, the following problems can be observed relating to the current condition of wastewater treatment.

a. Discharging high load wastewater because of insufficient management of production equipment

b. A large amount of discharged wastewater due to the outdated production method.

c. Insufficient management of wastewater treatment facilities and moreover, decrease of treatment capacity because discharge wastewater all together.

d. Inappropriate maintenance and remodeling of wastewater treatment facilities.

e. Appropriate treatment is not done for material specific that requires to have a treatment

(6) Improvement for Waste Water Management

< Improvement in the Production Process >

① Reduction of Pollutants Through Maintenance and Modification of the

Production Facilities

②Reduction in the Amount of Wastewater by Improvement of the Production System

③ Separation and Classification of Discharged Wastewater from Production Facilities

< Improvement of the Waste Water Treatment Facilities >

①Improvement of Treatment Capacity Through Maintenance and Modification of the Wastewater Treatment Facilities

② Reduction of Pollutants Through Appropriate Operation Controls for Wastewater Treatment Facilities

③Reduction of Pollutants by Changing the Procedure for Wastewater Treatment

8.1.3 Productivity in the Chemical Sub-sector

The reasons why high load burden wastewater is discharged from factories are insufficient maintenance management for production equipment and leave bad conditioned equipment as it is. For example, a large volume of lubricant oil leakage occurs and oil flows to ditches because of poor maintenance, however, a large oil separation equipment is installed instead of taking fundamental measures. This condition involves cost burden for renovating outdated equipment, and leading constant river water pollution as long as losses such as cost burden for buying lubricant oil, investment and maintenance costs for improving wastewater treatment equipment capacity, cost for collecting waste oil.

There are many factories operated without basic awareness of production management.

8.2 Analysis of the Factors Influencing the Current Status of the Chemical Sub-sector

8.2.1 Current Status of Production Technology in the Chemical Sub-sector

In general, the facilities utilized by the state-owned enterprises belonging to the chemical sub-sector in Viet Nam were installed mainly after the 1960s. These older facilities were built by domestic construction companies and also imported from the former Soviet Union, China, Taiwan and Korea. The current status of production technology for the 21 enterprises surveyed this time are summarized in the next section and examples of production technology for chemicals currently

being introduced in the chemical sub-sector in Viet Nam are shown in the following diagrams. As a whole, the technology used for producing chemicals is rather outdated and average, but depending on the chemical product and on recent licensing by foreign companies, some kinds of advanced technology for chemical production have been built into some facilities.

Productivity problems in the chemical sub-sector in Viet Nam are as follows:

1) Processing technology is outdated and stale. Also, there are many cases where productivity is relatively low because the scale of production is small and costs are rather expensive.
2) Many enterprises still use processes and equipment installed initially when the enterprises were established, and they have not made any technological improvements in order to modernize.
3) Even if enterprises have a sufficient number of chemical industrial engineers, investigation and development of environmental pollution prevention controls are not being undertaken sufficiently.
4) There is no system for gathering and exchanging technological information among enterprises within the same industry. With only this kind of effort being made it is kind of difficult to make a firm basis for technology innovation. Thus, in order to solve these problems, it is crucial to determine what causes the problems, and also to evaluate the problems. More over, solutions, manpower, information, technology and financial resources are needed in order to form and implement countermeasures.
5) Not only for the processing technology, it is difficult to create a base of innovation in technology because there is only a few system for technology reformation such as information gathering, and technological information exchange system.

8.2.2 Current States of Production Management Technology in the Chemical Sub-sector

(1) General Production Management

1) The management technologies stated above are not used efficiently or implemented consciously in this sector. Many enterprises are using production management only for meeting their targeted production targets nowadays.
2) In addition, production equipment in use is equipped with few measuring devices which are essential for obtaining necessary data. As stated before, there

are only a few cases where automated equipment is used for taking measurements, keeping records, and controlling systems. It can be said that production management information is not being provided, and analysis is not being done using statistical methods successfully.

3) There are few observed cases where technological examination based on accumulated data is being used in order to improve production management. Generally, in chemical factories, data should be used for changing the production situation and improving efficiency over the long term, and as the basis for continuous technical and management improvement for productivity.

4) Environmental and safety equipment, which is necessary for production management, is unsatisfactory at this moment. It is very important for chemical factories to find out the primary factors for change in order to solve problems.

From this viewpoint, it is crucial to introduce practical and efficient production management in order to have the power required to win in enterprise or industrial competition against other countries.

(2) Quality Control

Almost all enterprises belonging to the chemical sub-sector place their management priorities on cost reduction and quality control to comply with the competition in the domestic market, which includes imported chemical products. Although realistic and practical quality control systems in the chemical sub-sector in Viet Nam should be a big issue for all chemical enterprises in the near future, all enterprises realize the importance of the issue. However, examination of their actual operating systems reveals that they need to put more effort and thought into it. For example, in a powder detergent and pesticide-packing unit, the products are made uneven because they are packed by hand. Moreover, because quality analysis is not conducted on their products, raw materials, and additives regularly, it can be said that practical management for improving the production quality level is low.

The objectives of such real quality control systems should be to establish an improvement in productivity and to provide the best possible product for clients or consumers. In this sense, the current quality control condition of the enterprises surveyed does not reach this level except in a few enterprises.

(3) Standardization

Three enterprises among the twenty-one enterprises surveyed have already been certified with ISO 9002, and six other enterprises are expected to obtain ISO 9000 certificates within the year 2000. In addition, two other enterprises are preparing for application for ISO 9000. Furthermore, two of three enterprises certified with ISO 9002 are working on applying for ISO 14000 and hope to obtain it within the year 2000. Two other enterprises have also started to work for ISO 14000 certification.

There are a great many state-owned enterprises in the chemical sub-sector that have a high level of consciousness for standardization of their management. Such current conditions for standardization will help lead to big improvements and the development of the chemical industry in the future. Promoting standardization in the chemical sub-sector is expected to raise awareness for productivity problems, and to improve product management.

(4) Productivity Improvement

Many enterprises surveyed seemingly place their top priority on maintaining clean factories at all times in spite of having old facilities and buildings. Their consideration and activities for factory maintenance are evaluated as a base of improvement for their productivity.

However, production management for realistic improvement seems to be a big issue for the chemical sub-sector in Viet Nam, because the current conditions of maintenance of production equipment and the operating conditions of production seem not to be appropriate for optimum production, with the exception of a few enterprises. This situation is considered to be a basic, common problem throughout the chemical sub-sector.

In order to attain high productivity and maintain optimum production, while at the same time considering productivity improvement and environmental conservation, more precise and attentive production management will need to be taken up by all chemical enterprises in the future.

Joint venture enterprises have been performing activities for big productivity improvement such as Small Group Activity, Proposal System for Improvement (KAIZEN Activity), Total Productive Management or Maintenance and 5S Activity.

8.2.3 Problems and their Causes

The correlation between problems and causes is shown in Figure 8.1

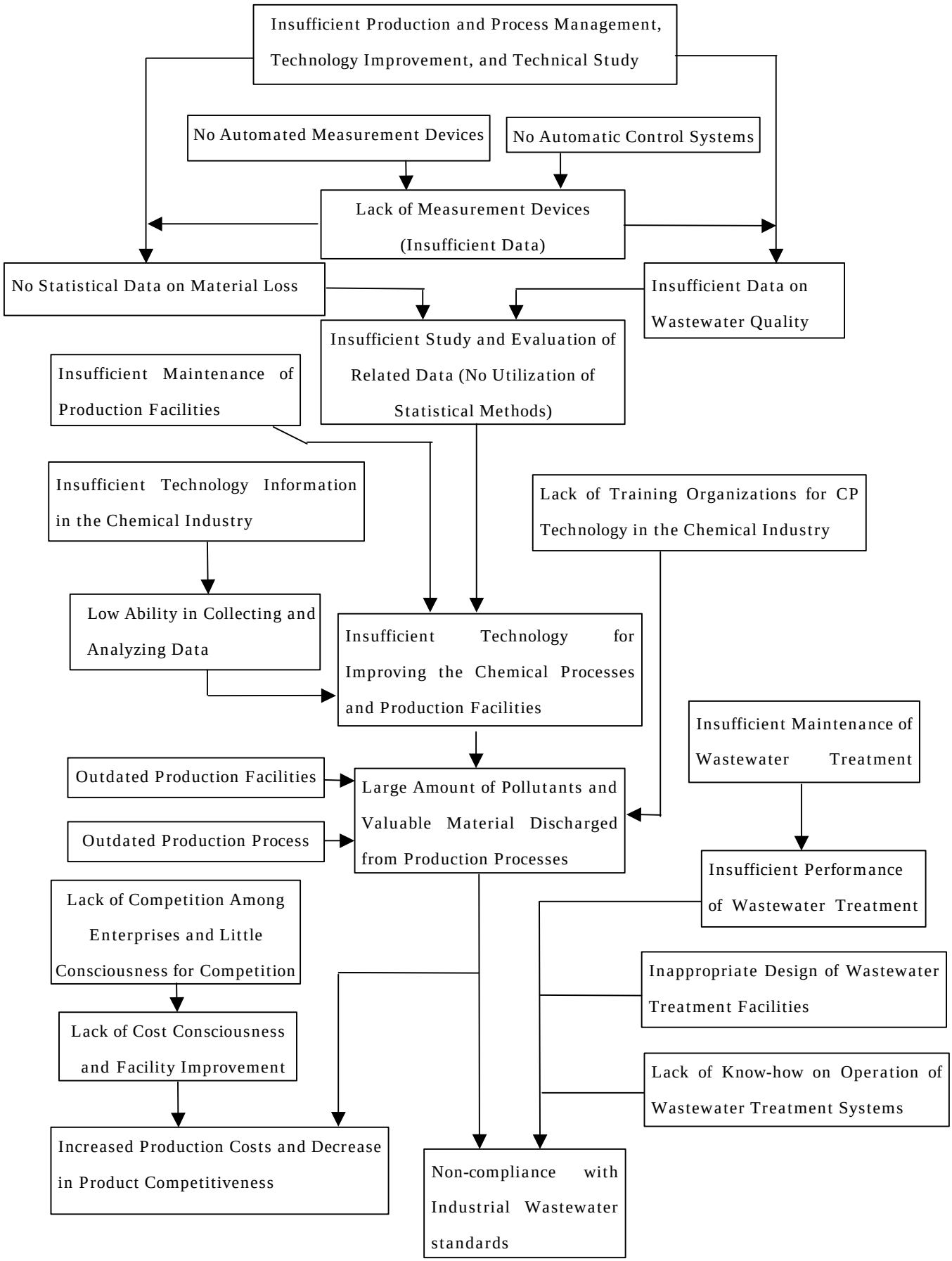

Figure 8.1 Problems and Causes

8.3 Technological Countermeasures for Industrial Pollution Prevention in the Chemical Sub-Sector and Evaluation of Their Expected Effects

8.3.1 Problems related to the status of technology in the Chemical Sub-Sector

1) Low productivity from production equipment that has become superannuated.
2) Relatively high costs which are related to small scale production systems. It is difficult to gain merits of scale, which are characteristic of the chemical industry, because the scale of production capacity and facilities are relatively small in the chemical sub-sector in Viet Nam.
3) Because of aging equipment and a lack of adequate repair work being done on them, production losses occur and emissions to the environment are increased.
4) A shortage of automated measuring equipment and automatic control devices which are essential for production management.
5) Inefficient installation of treatment equipment, which is directly related to emissions to the environment. Management, operation and maintenance of equipment are also not executed precisely. These factors are not being performed efficiently for environmental protection.
6) A lack of information on, and opportunities for, training that is needed for improving production technology.
7) The rational concept of integrating correlation between related enterprises is not performed to improve productivity because of the dispersed locations of each chemical enterprise. None of these enterprises share or exchange their raw materials, additives, energies, intermediate products, final products and by-products.
8) Labor costs will rise because automated processes for handling raw materials and products were introduced recently and are not universal throughout the industry.
9) There are many cases where enterprises are able to cope with cost increases resulting from a lack of necessary infrastructure in the relatively large scale chemical sub-sector. For instance, because there is no stock point near one factory they have to purchase and import their chemical raw materials in 30 liter cans from Germany at an expensive price. Also, there are many cases where transportation costs and time are increased due to a lack of optimum means of transportation and a transportation network, such as a rapid railway, highway, and wide, paved roads for large sized lorry cars and lorry trains.

10) The high price of electricity pushes up costs for chemical production. For example, caustic soda production utilizes electrolysis which consumes much electricity. This is a phenomenon caused by the lack of infrastructure.
These conditions make the chemical sub-sector not perform as well as it should.

8.3.2 Countermeasures that will propel the introduction of Cleaner Production technology in the Chemical Sub-sector

1) Create and implement countermeasures to prevent leakage. Detect and ascertain reasons why losses, such as leakage, or spillage of raw materials and products from chemical equipment is occurring.
As the starting point for this measure, small group activities which require the participation of all employees, such as a 5S movement, or a proposal system for making improvement, should be enforced.
2) Conduct and implement an economic examination, along with a technological examination, on investment effects.
3) Make efforts to collect information on Cleaner Production in chemical industries in advanced countries. This information is very useful and valuable because, when the equipment production ability is increased for expanding production, it is normal to promote the use of Cleaner Production in the production process itself.
4) Establish necessary institutes for training and facilities to obtain and exchange technological information because promoting Cleaner Production technology is considered to be a very important step.

8.3.3 Promote the Introduction of End of Pipe Technological Countermeasures in the Chemical Sub-sector

1) In order to develop better equipment management and to find out the optimal conditions for wastewater treatment equipment, conduct operating management and equipment maintenance management regularly and continuously. It is especially necessary to control the pH value of wastewater as a starting point.
2) It is very important to understand and comprehend the effects of processing equipment. The appropriateness of present operation management concerning levels of wastewater and processing equipment capacity needs to be

reconsidered and countermeasures need to be taken according to the results of this investigation and re-assessment. Depending on the level of toxic substances in wastewater, implement countermeasures to minimize the wastewater load as the first step and then take appropriate measures, such as activated sludge treatment afterwards.

3) Exchange useful information regularly within the same industry on improving and reforming End of Pipe technology.
4) Use the inter-net, or other information sources to get ahold of trends in End of Pipe technology in advanced countries, and consider introducing that technology into processing equipment of your own company.
5) In particular, promote the efficient use of energy by recycling wastewater and collecting heat, and try to reduce processing costs.

8.3.4 Countermeasures for Chemical Sub-sector improvement for the future.

According to the current status of the chemical sub-sector, the following steps for further development of competitiveness in the chemical industry in Viet Nam will be imperative in the near future:

1) Integrate correlated factories by type of chemical industry, as well as by production capacity levels, for the purpose of reducing costs and pollution per unit of production.
2) Implement mass production for the production of basic organic chemicals and increase productivity of abundant domestic raw materials such as petroleum and coal. This will enable the industry to reduce production costs and make good use of domestic resources.
3) Increase the additive value of the chemical industry by producing many kinds of chemical derivatives from basic chemicals and reduce transportation costs by installing large scale-type stock facilities that are connected to the chemical derivatives.
4) Build up the infrastructure, such as the transportation system, for providing low cost and an abundant supply of chemicals for industrial raw materials for other industrial sectors. We expect this measure to have a multiplier effect on improvement among all industries in Viet Nam.
5) Develop and produce the necessary chemicals which will satisfy quality, amount and performance requirements in the future for other industrial sectors through increased domestic R&D. An increase in the overall level of

the chemical industry, as well as an increase in international competitiveness, is expected with this change.

6) Accelerate capacity building, reinforce the R&D function and technology transfer in the industrial chemical field. To do so it is crucial that experts, managers, engineers, and technicians all increase their performance level in order to manage this new, improved chemical industry.

There is an urgent necessity for establishing a strategy for mid and long term plans for the chemical industry in Viet Nam at the governmental level. This kind of strategy will bring increased international competitiveness to the chemical industry in Viet Nam in the long term.

8.4 Conclusion and Recommendations for Industrial Pollution Prevention in the Chemical Sub-sector

8.4.1 Conclusion for Industrial Pollution Prevention in the Chemical Sub-sector

1) It is difficult to reduce the pollution load from wastewater if production capacity is continuously increased because this also leads to increased industrial pollution in the chemical industry.
2) It is crucial to take countermeasures and thoroughly reform production systems that are discharging environmental loads in order to prevent industrial pollution. At the same time, industrial competitiveness should be strengthened and production capacity increased. It is necessary to introduce Cleaner Production technology, such as energy and resource conservation technology, and activities for production improvement related to Cleaner Production, are needed.
3) Environmental pollution prevention technology in the chemical industry is already well established in advanced countries. It is important to introduce suitable technology in the appropriate places in the Viet Nam chemical industry.
4) It is very important to establish training facilities in order to improve the effect of introducing these technologies and also to spread technology throughout the industry. In addition, the performance level of managers, engineers, and technicians needs to be raised as soon as possible.
5) It is important that future plans be made and action taken for the development of strategic and comprehensive administrative plans, pollution prevention

plans, and industrial improvement, not only by SOEs, but also by private, foreign capital, and joint ventures as well.

8.4.2 Conclusions for Industrial Pollution Prevention in the Chemical Sub-sector

<General countermeasures>

(1) Short-term countermeasures :

① Introduce production management system technology.

② Introduce small group activities for improving production capacity and the working environment.

(2) Mid-term countermeasures :

① Introduce Cleaner Production technology mainly related to saving resources and energy conservation.

② Introduce and install End of Pipe technology for minimizing the wastewater pollution load and choose the appropriate area to do so, based on the effects and results of other proposals stated above.

③ Establish training centers for training and introducing technology. Also, create an administrative organization for supervising the centers to help spread these technologies.

(3) Long-term countermeasures :

① Strengthen research and develop a division whose function is to improve technology, as well as to internally develop in-house technology.

② Promote production modernization and refurbishment of equipment, along with an increase in production equipment capacity, by industry type.

③ Encourage the strengthening of industrial competitiveness by reorganizing enterprises into classified industries. Also, take action for concrete countermeasures in order to strengthen the competitiveness of all enterprises.

<Countermeasures for the production process>

(1) Short-term countermeasures :

① Implement periodical daily or hourly observations of the production facility and equipment and take action to make problems clear, as well as take countermeasures to solve problems.

② Precisely grasp operating conditions in order to determine fluctuations in

production, equipment conditions, and production losses. Also, make records of operation data to determine changes in production conditions in the long term. Pick up problems for detailed discussion for future improvements.

③ Reduce the loss of raw materials, additives and utilities caused by inappropriate maintenance and decrease the frequency of facility troubles through continuous maintenance of production facilities.

④ Introduce activities for increased employee participation, like the 5S Activity. Keep the factory clean at all times, so that problems can be found easily and environmental and safety accidents can be prevented in advance.

(2) Mid-term countermeasures :

① Take technical countermeasures for bottlenecks in processes. Implement plans for simultaneous improvement of productivity and environmental impact, taking into consideration efficient investment to combat the causes of pollution.

② Promote the establishment of production management technicians and put them in charge of technology improvement.

③ Establish a productivity improvement technology research center.

< Improvements for Waste Water Treatment Facilities >

(1) Short-term countermeasures:

① Change the present concept of waste water treatment facilities. Wastewater treatment facilities should be considered as being as important as production facilities for generating better productivity. Implement periodical daily or hourly observation of the waste water treatment facilities and equipment and take action for making problems clear. Also, take appropriate countermeasures.

② Precisely grasp the operating conditions of waste water treatment facilities by recording operation data and analysis data. Know and find the important points for maintaining and improving the capability of facilities. If it is possible, take action for improvement of operation procedures and for making small modifications of the facility itself.

③ Check the supply condition of neutralization chemicals and additives for waste

water treatment and also, remove precipitate or accumulation in the treatment facility in order to maintain the performance of waste water treatment.

④ In the case operating conditions of production plants change, or there is a change in waste water quality, review the procedures for treatment, quickly determine the treatment condition that should be implemented and verify actual and preferable treatment conditions and the performance of the facility.

⑤ Build capacity and increase the performance ability of engineers, operators and analysts through education and training.

(2) Mid-term countermeasures :

① Maintain treatment equipment quality by reconsidering processing methods and conditions when wastewater quality changes.

② Establish a maintenance technology education center for operations in each sector.

8.4.3 Measures that should be taken by the Administration

<Measures that should be taken by the Administration>

1) Set a clear vision for the future of the chemical industry.
2) Make clear the position and role of the chemical industry among all industries in Viet Nam.
3) Work out a program which helps to promote the chemical industry from an international point of view.
4) The plan for promoting the chemical industry should include measures for strengthening the international competitiveness of the industry.

<Measures that should be guided by the Administration>

1) Promote enterprise improvement, for example, by establishing a technology committee for exchanging information between enterprises in the same area of the chemical industry, by conducting inspections mutually, or through the implementation of a joint research project.
2) Instruct and set goals for productivity improvement for enterprises in the same industry using the top runner method.
3) Establish a Chemical Industry Association, whose members will include most of the main enterprises, for enlarging the industry and making strategic

connections. The Association should have the functions of collecting and exchanging information, creating industry wide scenarios for industry improvement, providing environment and it should also make safety guidelines and serve as liaison office to the Administration.

4) Collect and analyze information dealing with international standards for the chemical industry. Instruct enterprises and assist in industry reorganization using a data base made of the collected information.
5) All administrative functions should be controlled by one ministry. For example, MOI should control measures related to the chemical industry, such as a subsidy and taxation system, it should also, legislate laws for promoting energy saving, create managing organizations for pollution prevention and promote the improvement of industrial structures.

These countermeasures should be undertaken, not only by SOEs under MOI, but also by private, foreign capital and joint venture enterprises.

8.4.4 Budget needed for countermeasures for industrial pollution prevention in the Chemical Sub-sector

In general, especially from the view of Cleaner Production and environmental pollution prevention, a large budget is needed in the chemical sub-sector in order to improve the industry and strengthen industrial competitiveness. This is because the chemical industry is considered by many to be responsible for environmental pollution issues. The following should be considered to be included in long-term, mid-term and short-term budgets for conducting countermeasures:

1) Modernize production systems.
2) Increase and condense production scales.
3) Improve technology and production efficiency.

The Survey Team estimates that about 74,700 million VND is needed for the budget for countermeasures for production improvement and environmental pollution. The details of the budgets needed for countermeasures vary widely from investment for improving processes to direct investment for environmental pollution prevention. They also include measures for the working environment. In addition, each industry's situation also varies widely, from industries that don't require any further investment to an industry that needs a maximum of 18,800 million VND. About 3,600 million VND was estimated to be the average

investment required for an enterprise in the chemical sub-sector.

A certain degree of short term investment is needed in the chemical sub-sector in Viet Nam. However, on the other hand, there are many countermeasures that exist for improving productivity that do not require any investment.

The following examples: ① 5S movement,② Kaizen proposal activities ③ and TQC activities are recommended. Conducting small group activities like these bring about results in production efficiency and reduce costs.

These activities produce very effective results especially in the following cases:

1) Countermeasures that decrease production losses, such as resource and energy saving, and are related closely to the everyday operations of the production unit.
2) Countermeasures that solve small problems and help maintain steady production for equipment management.

The key for making these activities successful is to ensure that all the employees in the enterprise take positive roles, depending on each employee's position, and to develop activities continuously using close teamwork. By introducing these small activities, it is expected that not only will cost competitiveness improve, but also that production technology will improve and know-how will be disseminated throughout the entire enterprise.

8.4.5 Example of a Feasibility Study Result on Investment for Cleaner Production

Investment for a recovery and reuse system for lost apatite in a superphosphate fertilizer production factory will be recovered because the amount of raw material apatite purchased will decrease. This system also will contribute to reducing pollutants to the air and wastewater. Recovery time of the investment is estimated to be less than 1 year, or at most, a few years only.

8.4.6 Demand on Investment of Industrial Pollution Prevention Measures in the Chemical Sub-Sector

Necessary funds in industrial pollution prevention countermeasures for subjected enterprises in this survey can be estimated about 7.4 billion VND as shown in Table 8.2.

Table8.2 Investment Demand for Industrial Pollution Prevention Measures

(Unit:million VND)

Sub-Sector	Investigation	enter-prises	CP		EOP		Total	Neither CP nor EOP are unnecessary	Both CP and EOP are necessary
			enter-prise	Amount	enter-prise	Amount			
Chemical	Detailed Survey	4	4	32,000	4	15,000	47,000	0	4
	Simplified Survey	17	0	0	12	27,000	27,000	5	0
	Total	21	4	32,000	16	42,000	74,000	5	4

Source：Statistical Yearbook-1998;General statistical Office

Vietnam Socio-Economy:the period 1996-1998 and Forecast for the year 2000

Chapter 9

Countermeasures for Wastewater Pollution in the Paper and Pulp Sub-sector

Chapter 9 Countermeasures for Wastewater Pollution in the Paper & Pulp Sub-sector

9.1 Present State of Wastewater and Productivity in the Paper & Pulp Sub-sector

9.1.1 Enterprises Surveyed

Enterprise case studies were carried out on 21 enterprises, namely 12 in the area around Hanoi and 9 in the Ho Chi Minh City area.

Five enterprises were selected for a detailed study based on production capacity, the kind of pulp produced, and the state of waste liquor recovery. These enterprises include two SOEs, one provincial SOE and two private enterprises.

9.1.2 Production and COD Discharge in the Paper & Pulp Sub-sector

Paper and paperboard production in Viet Nam showed rapid growth at an annual average of 22.6 % from 1990 to 1996. Table 9.1 shows the total COD effluent of the 21 mills surveyed in this Study compared with that of all of Japan.

Table 9.1 COD Effluent in Viet Nam Compared to that in Japan

	Production t/year	COD discharged t/year	Rate %
Japan 1970	12,973,240	2,200,000	17.0
Japan 1989	26,808,792	200,000	0.75
Ratio : 1989/1970	2.07	0.91	4.4
Vietnam 21 Mills 1999	212,343	183,229	86.3
Ratio : Vietnam 1999 / Japan 1989	0.0079	0.916	11,500

The total production of the 21 mills surveyed is 212,000 t/year. This figure is only 7 % of Japanese production, but COD in Viet Nam is nearly equal to the total COD discharged in Japan in 1989.

9.1.3 Industrial Wastewater in the Paper and Pulp sub-sector

(1) Wastewater Quality

Table 9.2 shows the wastewater quality of the 21 enterprises surveyed in this Study.

1) COD

Only two mills out of the 21 surveyed are achieving the regulation standard for

COD of 100 mg/l or less for their industrial wastewater. One of them, in fact, is in a very critical situation as the amount of water they are consuming is 549 times higher than that of their paper production.

Table 9.2 Wastewater Quality of the Enterprises Surveyed

No.	Product t/year	F.Water km³/year	Rate m³/t	pH -	E.Cond. μS/cm	BOD mg/l	COD mg/l	DO mg/l	VSS mg/l	TSS mg/l	Phenol mg/l
1	3,802	950	250	9.95	1,220	319	5,320	7.72	100	289	0.280
2	3,800	668	176	7.17	394	166	430	3.01	115	229	0.052
3	1,667	1,200	720	6.93	243	273	420	2.43	23	66	0.047
4	60,000	17,000	283	9.63	2,020	861	9,340	3.33	240	773	0.340
5	7,285	1,800	247	9.12	1,050	281	525	7.14	90	158	0.161
6	483	244	505	7.53	1,180	826	2,893	0.97	69	83	0.000
7	60,619	4,449	73	6.53	179	141	360	3.88	67	105	0.000
8	23,823	10,237	430	6.49	3,140	196	669	2.50	160	215	0.119
9	4,660	1,650	354	7.67	221	32	128	4.76	8	100	0.002
10	1,238	420	339	6.40	5	72	392	4.35	432	500	0.013
11	4,275	864	202	7.66	141	63	259			350	0.000
12	2,000	40	20	10.17	1,740	910	2,230	4.11	84	250	0.025
13	2,000	60	30	7.75	1,300	10	61	1.52	7	13	0.000
14	8,827	396	45	7.62	494	460	1,200	3.21	361	407	0.002
15	1,194	655	549	9.11	254	57	71	8.02	356	424	0.022
16	3,310	840	254	7.22	276	121	345	2.85	26	127	0.003
17	1,750	159	91	7.78	1,990	89	922	0.49	14	98	0.047
18	1,000	23	23	7.73	4,784		5,120		120	149	0.320
19	15,000	301	20	8.91	1,460		2,680	4.30		257	0.028
20	1,800	90	50	7.94	2,717		8,320	4.68		204	0.268
21	4,000	576	144	7.11	210		8,990	0.36		1,190	0.024
Mean	10,121	2,517	229			287	2,413	3.66	134	285	0.08

2) SS

Five mills, corresponding to about one-fourth of the 21 surveyed, are complying with the discharge standard of 100 mg/l for SS. Three of them, however, are using a large volume of water, 720, 505 and 354 times that of their paper production, respectively. Therefore, only two mills, or about one-tenth, are substantially clearing the restricted value of 100 mg/l.

3) Mercury and Chromium

It should be noted that wastewater from some factories contains Mercury and Chromium. It is believed that Mercury and Chromium come from the materials

caustic soda.

4) Phenol and Chloroform

It should be noted that chloroform, as well as phenol, is generated from the pulping process and the bleaching process, both which utilize chlorine.

(2) Excessive Use of Water and Fiber Loss

There are five mills which have a high VSS out of TSS. VSS is considered to mainly consist of recyclable, good quality, fine fiber. Therefore, it is highly possible for these mills to recover their invested funds through cost reductions, for instance by installing a concrete settler with a low construction cost. It should be taken into consideration that the average water consumption of the 21 mills is 229 times that of paper production because of a comparatively low water cost of 148-2,000 VND/m^3.

(3) Existing Wastewater Treatment Systems

Only four mills, among the 21 studied, have wastewater treatment systems in addition to simple settling ponds. Other mills release the entire amount of their wastewater into simply dug settling ponds and the settled fiber, etc. can be recovered at best for use in low grade paper. However, many mills, after the de-hydrating and drying processes, have this settled fiber carried out of the factory by a transportation agent for use as brick making fuel.

(4) Problematic Items in the Current Treatment System

In Viet Nam, only the bamboo price is lower than the international level, and chemicals prices are almost equal to that of the international level. As for fuel, coal prices seem somewhat lower than the international level, but in consideration of its calorific value and the cost for ash treatment, there is no real substantial difference. Heavy oil is at the international price level and electricity is twice as high as international prices. For working out improvement measures, it needs to be kept in mind that fine fiber flowing into rivers is a very expensive substance.

Furthermore, an extremely high amount of water consumption, despite the low price of water, will lead to the use of much more electric power and chemicals. The temperature of paper-making materials becomes nearly the same as the temperature of the water, and then the water content in the wet sheet at the press outlet increases, which causes the use of extra, rather expensive, fuel as mentioned

above. Incidentally, it should be noted that the energy cost at each of Japan's major paper making companies is several per cent of the total cost, while Vietnam's energy cost is comparatively high, around 20 % of the total cost, although the bamboo price is low.

9.2 Causal Analysis of the Present State and Problematic Issues in the Paper & Pulp Sub-sector

9.2.1 Present State of Production Technology in the Paper & Pulp Sub-sector

(1) Pulping Process

Pulping equipment is largely classified into four types: Chemi-ground Pulp (CGP) by Cold Soda Method, Alkaline Pulp (AP) Method, Kraft Pulp (KP) by Sulfite Method, and Recycled Paper from Waste Paper (WP).

Technological issues in the pulping process are summarized below.

1. It is now required that sodium hydroxide be added in excess of the usual amount, because the chip size is larger than a pack of cigarettes. Due to an excessive addition of chemicals, not only small chips, but even optimal sized chips are overly dissolved. Consequently, the content of dissolved material becomes high, and the yield decreases causing the wastewater quality to worsen.
2. Cold water washing is the usual practice in Viet Nam, and this method requires a large amount of water and bleaching material, as the washing efficiency is not high enough.
3. Most of the factories in Vietnam use Janson Screens with 3ϕ plate holes, which makes it impossible to remove small particles.

(2) Paper Machines

Generally, paper machines in Vietnam consist of wire cylinder and Yankee dryer-types. Technological issues concerning the paper machines are summarized below.

1. The poor maintenance of the "Doctor," which is used to remove the scum in the dry cylinders, and a preference for an angle of nearly 45° in many mills, causes frequent paper cuts between the dryer and the reel in some mills.
2. In one mill, defects in the cylinder wire were found and every time the cylinder rotated big holes were made.
3. The wet paper, after going through the de-hydration process, contains much water because of the low temperature, 25 ℃, of the material feed to the

paper machine and because of the low "Nipper" Pressure (NIP) exerted due to the small diameter of the press roll.

4. Generally in most factories in Viet Nam, wastewater is collected to a final sedimentation pit. The screening and cleaning of the dirt apparatus, after already having separated the fiber clusters and vinyl scrap, mixes together unbleached and bleached pulp, including the colored pulp. Therefore, this mix can only be used as raw material for the lowest quality cardboard.
5. A large amount of floating particles and foam are found on the surface of the Cylinder Wire vat.
6. There are factories where sulfur powder is combusted and a Sulfur Dioxide (SO_2) gas is blown into a dryer hood.

(3) Measuring Instruments

As for measuring instruments, only pressure gauges for steam are mounted on the cooking digester and the dryer in the paper process, although some of them appear unreliable.

9.2.2 The Present State of and Problems Concerning Production Management Technology in the Pulp and Paper sub-sector

Six (6) of the companies surveyed have some kind of management scheme, but the others do not use flow sheets, records or management schemes. There is also a lack of managerial leaders and this makes it difficult for employees to increase their own self-management ability.

9.3 Countermeasures for Technology Improvement in the Paper and Pulp Sub-sector

9.3.1 Countermeasures by Promoting Cleaner Production Technologies

Generally speaking, the KP (Kraft Pulp) method, including the black liquor recovery system which burns organic materials like lignin etc., and the recovery of chemicals, are the most effective methods for reducing water pollution. However, these systems are very expensive, especially for small capacity plants like those in Viet Nam factories. Therefore, Cleaner Production Technology, which can be adopted easily with only a small investment, is recommended.

In Viet Nam now, only a small amount of bamboo and planted eucalyptus are available, and inland mountains are bare all the way up to their summits. Even

twigs and bushes are used as household fuel and brick burning fuel.

Average consumption and production of Pulp and Paper in Viet Nam during 1990-1996 showed explosive increases of 25.6 % and 22.6 %, respectively. In the case of such rapid growth in consumption, chips have to be imported at international prices and therefore, a switch over to the KP method needs to be primarily planned in order to improve the quality and yield, and to save energy. However, introduction of the latest, advanced equipment, which mainly consists of imported machinery, seems to be difficult under the present situation of excess imports.

On the other hand, low cement prices and labor costs enable the construction of buildings and structures at 1/10 the cost of that in Japan. Machinery can also be procured at nearly 1/10 the cost if manufactured in country. Accordingly, when implementing a production increase plan, CP could be tentatively planned in an attempt not to increase, or even to decrease, environmental impact despite increased production. Furthermore, reduction of the COD load, to some extent, is thought to be possible without adding additional facilities, but by making more economical use of expensive chemicals and high calorific dissolved organic constituents which are at present discharged in wastewater.

(1) Promotion of "Seven (7) S"

In order to ensure safety, strict enforcement of the "Three (3) S's," namely SEIRI (=putting things in order), SEITON (=arranging things in the right order) and SEISO (keeping things clean) are essential. In Japan, since the latter half of the 1940's, safety campaigns have been conducted in all companies and today many companies are promoting the movement as a "Five (5) S's" campaign by adding, in general, two (2) S's, i.e. SEIKETSU (=cleanliness) and SHITSUKE (=discipline). By further adding two (2) more "S's", i.e. "Save Energy" and "Save Material", the promotion of a "Seven (7) S's" campaign is required for today's Viet Nam.

(2) Cleaner Production in the Pulping Process

(a) Adjustment of the Chip Size

In order to solve the problem of large chip size, an adjustment of the shape and length of the "chipper blade" is necessary. In some cases, expansion of the "chipper" is necessary. As a result of the reduction in "knot," it is expected that the amount of bleaching material used will be greatly reduced.

(b) Regulation of Chemical Liquid Circulation

In order to improve chemical circulation in the cold soda method, it is recommended that vinyl pipes be installed for spraying chemical liquid around. Through this countermeasure it is expected that "knot" will diminish and the electricity used in the succeeding grinding process will be greatly reduced.

(c) Re-use of Boiled Steam and of the Effluent (discharged liquor)

The old method, which efficiently uses gas and steam, has been effectively applied in both the SP method and the KP method.

Savings of several % of steam and a saving in chemical costs of over 20 % is possible by using simple devices and pipelines. Moreover, due to the above measures, the concentration of the cooking liquor becomes high and it is possible to achieve a drastic reduction of steam for enrichment in the case of recycling of black liquor.

(d) Discharged Liquor Recycling

The cold soda method is applied in the pulping process of bamboo pulp and in the CGP. However, the effluent is not being recycled. Through re-use of the effluent, it is possible to re-use caustic soda and to establish an economical recycling system by increasing the concentration of the effluent made into concentrated black liquor.

(e) Improvement of Washing Efficiency

"The higher the temperature, the better the washing efficiency." This statement is correct because the particles which have adhered to the fiber, and the chemicals and organic material used during the pulping process, will wash away more easily when the temperature is higher.

Considering the multi-stage washing system, if the amount of water used is reduced, there will be no drainage loss of fine fibers, dissolving chemicals can be recycled, the amount of bleaching material will be reduced, and the impurities in the effluent waste water will be reduced.

(f) Simplified Combustion System of Chemicals and Caustification Equipment

In Viet Nam, because the cost of coal is low, it is better to establish a simplified chemical recycling combustion system with the aim of recycling the high cost caustic soda. By transforming sodium carbonate into caustic soda through the use

of simplified caustification equipment, a part of the caustic soda consumption can be reduced. Moreover, if a heat transfer apparatus is installed in the heating furnace in order to generate steam in the exhaust gas, it will be possible to generate more than the necessary steam required for the evaporator. This will also provide the steam necessary for bleaching in the production of AP.

(g) Improvement of Paper Recycling Equipment

In Japan, a 10% increase in the consumption of waste paper has reduced energy consumption by 26.8 %. After the second oil crisis, large-scale investments were made, due to which very significant energy efficiency was established by reducing electricity costs by 1/30 to 1/50 of initial costs through the substitution of mechanical pulp with De-inked Pulp (DIP).

The rate of waste paper use in Viet Nam (waste paper consumption/pulp and waste paper consumption) is 38.43 %, which is the lowest in Asia, a continent known throughout the world for its high waste paper consumption. Because timber resources are also limited, it is necessary to promote an increase in the waste paper consumption rate. It is possible to produce high quality DIP with low cost equipment, provided that the alien particles can, to some extent, be sorted out and separated.

It is recommended that the following measures be implemented in Viet Nam:

a) Preconditions
    1. Classify waste paper based on type for cargo collection;
    2. Manually remove incompatible material and particularly large foreign particles and vinyl cords.
b) Introduce the “Tower System” for medium concentration (8-12%) pulp
c) Use of coarse screens for the removal of ink, adhesives and other alien material before they break apart.
d) Introduction of a kneading system.
e) Introduction of a “Flotator” which can clean away minute adhesives of less than 5μ.
f) Installation of a cleaner for removing heavy and light foreign particles.
g) Installation of equipment for washing and cleaning away filler and adhesives.

(h) Dirt Screening Improvement

In order to improve the Janson Screen efficiency, it is recommended that a slit

type plate of 0.45 S be adopted. If this measure is introduced, it is expected that adhesives and small particles will be caught, and not only will the quality improve, but also paper cutting will be reduced.

(3) Cleaner Production of the Paper Machine

(a) Cleaning System Improvement

In order to improve the cleaning system, it is recommended that water hoses and air hoses be installed in the wet and dry parts respectively, at an appropriate interval. It is also recommended that water pressure be set higher than 2 kg/cm^2 at a minimum, but preferably at 3 kg/cm^2, just like it is in the shower-type system.

(b) Recycling of White Water from each Paper Machine

It is recommended that recycling equipment be installed for good quality fiber at every technological process. If this is carried out, the amount of recycled fine fiber will increase without having to revert to the previous processes, and the amount of SS in the effluent will greatly diminish.

(c) Warm Shower Washing

It is recommended that warm water be used for the shower in the washing process.

With an increase of temperature the viscosity of the pulp slurry is reduced, water dehydration gets better, and it is possible to reduce the moisture of the paper after pressing.

(d) Steam Humidification for Damp Paper

It is recommended that a simple steam box be installed before the press roller in order to reduce the moisture in the damp paper at the exit of the press through steam humidification. The steam consumption at the dryer can thus be reduced several times.

(e) Countermeasures for Foam at the Cylinder Wire Vat

In order to prevent foam and floating material from collecting at the cylinder wire vat, it is recommended that a shower be installed. In addition, it is necessary to maintain the pressure and angle of the shower water.

(f) Doctor

The angle of the “Doctor” is 40°, but there are many cases where it has a larger

angle and it is necessary to change the angle to approximately 30°.

(g) Paper Machine Draw Regulation Apparatus

It is recommended that an adjustment apparatus be installed in paper machines that do not have draw regulations, because the loss caused by paper cutting and paper tear is great.

(h) Sulfur Dioxide Absorber

The burning of sulfur powder should be stopped from the aspect that it is harmful to human health and for environmental protection. It is recommended that a simple absorption tower be installed for making SO_2 water which could be added to the pulp slurry raw material.

9.3.2 Countermeasures for End of Pipe Technology in the Paper & Pulp Sub-sector

The paper & pulp sub-sector in Viet Nam has a high potential for reducing environmental impact through the promotion of Cleaner Production (CP) technology. The investment demand for pollution prevention can be reduced by adopting End-of-Pipe technology after reducing environmental impact through the implementation of CP measures.

The following wastewater treatment technology should be improved in the sub-sector:

1. Replacement of excavated sedimentation ponds with tanks made of concrete;
2. Introduction of appropriate wastewater treatment systems that use biological treatment methods.

9.4 Conclusion and Recommendations for Industrial Pollution Prevention in the Paper & Pulp Sub-sector

9.4.1 Recommendations for the Paper & Pulp Sub-sector

The following countermeasures need to be taken in the sub-sector:

(1) Short Term Countermeasures

1. Promotion of 7S Movement ;
2. Adjustment of the Chip Size;
3. Countermeasures for Foam at the Cylinder Wire Vat; and
4. Utilization of Low Mercury Caustic Soda.

(2) Mid-Term Countermeasures

1. Improvement of Dirt Screening;
2. White Liquor Recycling;
3. Warm Water Shower Washing;
4. Steam Humidification of Damp Paper;
5. Improvement of Paper Recycling Equipment; and
6. Wastewater Treatment by Biological Methods.

(3) Long-Term Countermeasures

1. Regulation of Chemical Liquid Circulation;
2. Reuse of Cooking Liquid and Steam;
3. Recycling of Discharged Liquid;
4. Improvement of Washing Efficiency;
5. Combustion and Caustification Equipment;
6. Improvement of Paper Recycling Equipment.

9.4.2 Measures Requested of Administrative Organizations

It is necessary, and also inevitable, to have the positive involvement and back up of the responsible administrative organizations for IPP in Viet Nam to lead the execution of the countermeasures in paragraph 9.4.1. The Study Team proposes that the following countermeasures be taken by the related administrative organizations:

(1) Support an Elevation in the Technology Level

The paper & pulp sub-sector could be the most promising sub-sector among the five targeted in this Study for achieving effective implementation of Cleaner Production technology to prevent industrial pollution. The technology standard in individual enterprises at present, however, is not high enough to implement Cleaner Production technology independently.

It is recommended that MOI promote enterprise guidance and training for enterprise employees through the development of human resources in the institutes under its direction, so that these institutes can direct enterprises on Cleaner Production and End of Pipe technology.

(2) Promotion of Voluntary Improvement Activities in SOEs

In order to promote the implementation of industrial pollution countermeasures in enterprises, the administrative organizations should work out

and implement, on a mid-term basis, measures that promote voluntary improvement activities. This should be done utilizing a partial return system of profits system for employees that utilizes "Improvement Proposals" and focuses on Cleaner Production implementation.

(3) Incentive Measures

In order to resolve the situation that most enterprises are not able to invest in environmental protection, the administrative organizations should work out measures that encourage investment, such as tax reductions, low interest financing or subsidization of investments as countermeasures for industrial pollution.

(4) Industrial Structure Improvement

The pulp and paper industry is a typical, equipment intensive industry. At present, the enterprises in the pulp and paper sub-sector in Viet Nam are generally small in size and lack competitiveness.

Considering that in the future the Pulp and Paper industry in Viet Nam will be more dependent on imported waste paper for raw materials, it is proposed that the administrative organizations work out a long term measure for locating a new, large-scale paper factory near a sea-port by integrating several small factories currently dispersed throughout local provinces.

(5) The Incidental Terms of Government Permission for Expansion

Since effluent pollution caused by Viet Nam paper and paperboard mills is enormously high at present, abatement of the present pollution load is needed for the enterprises who wish to obtain grants for increasing production, especially for those whose pollution rate is exceeding regulation values by a great extent.

In the case that an enterprise makes an application for a production capacity expansion by n times, an incidental condition that the environmental impact be decreased to about 1/n or $1/n^2$ should be imposed on the approval. Through this measure, the environmental pollution per unit production can be reduced to $1/n^2$ or $1/n^3$.

9.4.3 Investment Demand for Industrial Pollution Prevention Countermeasures in the Paper & Pulp Sub-sector

The total demand for investment for industrial pollution prevention is estimated at approximately 360 billion VND, as is shown in Table 9.3.

Table 9.3 Investment Demand for Industrial Pollution Prevention Countermeasures in the Paper & Pulp Sub-sector

Unit: million VND

Type of Study	No. of Companies	Cleaner Production		End of Pipe		Total
		No.	Amount	No.	Amount	
Detailed study	5	5	81,000	5	11,000	92,000
Simplified study	16	16	209,000	16	59,000	268,000
Total	21	21	290,000	21	70,000	360,000

Chapter 10

Countermeasures for Wastewater Pollution in the Food Processing Sub-sector

Chapter 10 Countermeasures for Wastewater Pollution in the Food Processing Sub-sector

10.1 Present State of Wastewater and Productivity in the Food Processing Sub-sector

10.1.1 Enterprises Visited

As a part of the case studies for the Master Plan Study, the Study Team visited 21 enterprises in Ha Noi, Ho Chi Minh City, Da Nang and surrounding areas during the second field survey. Five out of these 21 enterprises were visited again during the third field survey for a further, detailed study.

Except for one joint venture, the enterprises visited were all State-owned. The main products of the enterprises visited cover a wide range of products and include dairy products, beer, liquor, soft drinks, sugar, glucose syrup and confectioneries, spices and seasoning, processed seafood, vegetable oil, instant noodles and cigarettes.

The enterprises visited were analyzed based on turnover in 1998, and the total number of employees as shown in Table 10.1.

Table 10.1 Turnover and Number of Employees of the Enterprises Visited

Number of Employees	Turnover (billion VND)				
	＜10	10-100	100-1,000	1,000＜	Uncertain
＜200	SOE 2	SOE 1			
200-500		SOE 2	SOE 2		SOE 2
500-1,000		SOE 2	SOE 1		JV 1
1,000＜			SOE 3	SOE 2	SOE 1
Uncertain					SOE 2

10.1.2 Industrial Wastewater in the Targeted Enterprises

(1) Sources of Wastewater

Wastewater from the food processing industry sub-sector is classified into the following four categories:

Category 1: Wash water that is generated intermittently through washing vessels, piping, machine parts and/or the floor after batch production;

Category 2: Wash water that is generated continuously in seafood processing lines from product and equipment washing, from instant noodles

production lines during equipment washing, or in beverage packaging units when drums or bottles for beer, liquor or soft drinks are washed.

Category 3: Process wastewater that is generated from processes;

Category 4: Cooling wastewater that is continuously discharged at high temperatures.

(2) Current Status of Industrial Wastewater Treatment

Few enterprises have installed effective wastewater treatment systems in the sub-sector. Wastewater from most factories is discharged in canals, or in the surrounding environment, without treatment. Enterprises in the sub-sector are now surveying adequate wastewater treatment systems. Most of the projects for wastewater treatment in the sub-sector, however, are neither finalized, nor being implemented, due to a shortage of financial resources.

The main pollutants found in wastewater from food processing factories are organic. Organic pollutants can generally be treated by biological systems, which in order to operate the system effectively, require a definite employee training period and sufficient operational know-how.

Technology transfer of wastewater treatment system operations will be a big issue in Viet Nam, although wastewater treatment systems could be designed and constructed by certain organizations in Viet Nam.

(3) Environmental Impact Caused by Industrial Wastewater from the Sub-sector

The environmental impact of wastewater from the enterprises visited in this Study was estimated based on an analysis of the wastewater.

Table 10.2 shows the absolute amount of all contaminants, calculated by multiplying the amount of wastewater by its respective, pollutant concentrations in all the enterprises visited. The amount of wastewater discharged was estimated according to the water balance reported by factory representatives because no flow meters were provided for measurement. Figures shown in Table 10.2 include domestic wastewater, which is discharged together with industrial wastewater in most enterprises. The wastewater from the sub-sector is characterized by high organic pollutant content.

The lowest row shows figures calculated by multiplying the total amount of wastewater, 35,767 m^3/day, by the respective national standard, TCVN 5945. Absolute COD and BOD discharged from the sub-sector as a whole are 5 and 6 times higher respectively, than the standard.

.**Table 10.2 Contaminants Discharged from Enterprises Visited**

Enterprise Number	Quantity (m^3/day)	Pollutant Discharged (kg/day)			
		COD	BOD	SS	Oil
F01	740	2,171	1,755	575	0.85
F02	1,080	688	541	81	0.40
F03	1,139	754	443	164	0.28
F04	2,400	864	540	310	48.00
F05	290	69	32	17	0.05
F06	600	353	275	154	5.07
F07	260	2,840	1,940	319	0.14
F08	240	434	321	99	0.10
F09	300	167	127	99	0.11
F10	810	74	50	86	0.54
F11	400	1,292	943	319	1.86
F12					
F13	4,000	1,621	978	2,649	0.63
F14	20,000	226	140	440	2.40
F15	450	135	82	95	0.10
F16	250	93	56	141	0.06
F17	345	121	76	30	0.07
F18	850	4,349	2,900	2,822	0.41
F19	1,008	549	345	103	0.14
F20	300	82	47	44	0.06
F21	305	178	118	237	0.07
Total	35,767	16,744	11,509	8,668	61.34
TCVN 5945		3,577	1,788	3,577	357.6

10.2 Causal Analysis for the Current State of the Food Processing Sub-sector

10.2.1 Current Status and Problematic Issues Concerning Production Technology in the Food Processing Sub-sector

Most enterprises are faced with the following problematic issues concerning production technology:

1. Outdated production facilities;
2. Small scale production by batch-wise operations;
3. Outdated production processes;
4. Incomplete countermeasures for resource conservation, such as steam condensate or cooling wastewater recovery;
5. Leakage of liquid from glands on pumps and valves is left as is due to an insufficient facility maintenance scheme;
6. Easy and unrestricted utilization of large amounts of water, including

pumping up of a large amount of groundwater;

7. Lack of engineers and skilled laborers;
8. Manual packaging processes;
9. Facilities that are non-conforming to the GMP standard, e.g.
   (1) Inefficient floor drainage of washing wastewater in the production area due to leveled or uneven structures;
   (2) Lack of measures to prevent the product or equipment from being contaminated with foreign matter

10.2.2 Current Status and Problematic Issues of Production Management Technology in the Food Processing Sub-sector

(1) Quality Control

The level of production control in companies doing business with foreign countries is relatively high. For example, companies producing processed seafood are making every effort to meet the severe requirements raised by foreign buyers which are based on GMP or HACCP standards.

In general, however, there is room for improvement in most companies in the sub-sector for production control that adheres to GMP for food processing factories.

(2) Standardization

One factory visited in the Study already obtained ISO-9002 certification in November, 1999. Likewise, similar projects for obtaining ISO-9002 certification are being undertaken in some other companies. As a matter of course, it is understood that standard manuals are prepared and revised as needed in those companies that intend to get ISO-9002 certification.

(3) Productivity Improvement

It was observed that a “5S Movement” had been introduced in one of the factories visited. However, positive measures for productivity improvement, like the “5S Movement”, are not being practiced commonly in Viet Nam. In most companies, productivity data is gathered only for reporting purposes. Very rarely are production losses calculated and analyzed in a short management cycle, e.g. daily, in order to study and establish countermeasures for reducing losses.

(4) Waste Reduction

Most factories the Study Team visited are making efforts to reduce waste.

One remaining task for factories in the Food Processing sub-sector is to minimize leakage from processes in order to reduce the amount of wastewater generated by floor, equipment and machine parts washing.

(5) Problematic Issues of Production Management in the Food Processing Sub-sector

Common problematic issues in production management found in most enterprises in the food processing sub-sector are summarized as follows:

1. Lack of basic data to control unit consumption;
2. Lack of positive action to reduce production losses.

10.2.3 Problematic Issues of Wastewater Treatment in the Food Processing Sub-sector

The food processing sub-sector has the following problems concerning wastewater treatment:

1. No treatments adopted;
2. No wastewater quality analysis;
3. No separation of dirty wastewater, clean wastewater, or rainwater;
4. Lack of information on the latest wastewater treatment technologies;
5. Insufficient operational know-how of wastewater treatment systems, especially for biological treatment.

10.2.4 Summary of Causal Analysis of the Current State

The food processing sub-sector has the following problematic issues that are the same as the common issues described in Chapter 6:

1. Imperfect infrastructure for industrial pollution prevention such as;
   (a) Lack of education and training organizations for environmental pollution prevention engineers; and
   (b) Lack of wastewater quality analyzing organizations and engineers.

   The administrative organizations responsible for industrial pollution prevention are urged to give enterprises direction for environmental protection and to promote effective measures.

2. Small-scale factories are dispersed throughout the country;

   Imperfect industrial infrastructure, such as logistics and/or an efficient transportation system for raw materials and utilities, is causing low

profitability in enterprises, which consequently restricts investment for improvement and modernization due to a chronic lack of financing.

3. Low level of production management in most enterprises

In most enterprises, due to the insufficient analysis of production processes, production losses and problematic issues in production processes are not sufficiently grasped. In addition, it needs to be pointed out that the wastewater amount is large in most factories because cheap industrial water is easily consumed and dirty wastewater is mixed with clean wastewater and rainwater due to the lack of a philosophy for classifying wastewater for recovery and re-use. One of the reasons why the progress of the installation of wastewater treatment systems in the sub-sector is slow, as well as in other sub-sectors, is that a large investment is required due to the large volume of wastewater that must be treated.

10.3 Countermeasures for Technology Improvement in the Food Processing Sub-sector

10.3.1 Countermeasures for Promoting Cleaner Production Technology

In order to cope with the fundamental problem of small scale production in most enterprises in the sub-sector, it is urged that new factories of sufficient scale be created by integrating several enterprises together in the same business. Such drastic countermeasures, however, would have trouble being accepted under current circumstances and should be discussed on a different level of industrial promotion policy in Viet Nam. Therefore, countermeasures should be adopted in this section only on the basis that they improve the existing enterprises.

(1) Process and Facility Improvement

Examples of production process or facility improvements are listed as follows:

1. Recovery and reuse of cooling wastewater;

In general, cooling wastewater is clean and can be reused. Recovering cooling wastewater is an effective way to decrease the total amount of wastewater and to reduce the cost required for the installation of wastewater treatment systems. Therefore, before enterprises study the installation of a wastewater treatment system, it is recommended that they study the possibility of separating dirty and

clean wastewater and also investigate the possibility of reusing cooling wastewater;

2. Recovery and re-use of steam condensate;
3. Recovery of distiller bottom components in liquor producing factories as fuel or animal feed;
4. Process change from acidic hydrolysis to enzymatic hydrolysis in the starch saccharification process;
5. Floor drainage improvement by sloping floors with a slight gradient in the production area;
6. Sealing up windows to prevent possible invasion of foreign matter into the production area.

(2) Production Management Improvement

1. Introduction of the concept of unit consumption and a reduction of production losses: More concretely,
   (a) confirm what losses are compared to theoretical or standard unit consumption;
   (b) compare the unit consumption of main materials regularly (e.g. monthly, weekly or for every batch);
   (c) work out ways to minimize losses;
2. Initiate improvement activities that require the participation of all employees, like the "5S Movement".

The "5S Movement" in item No. 2 was widely practiced in Japan, and proved effective in improving morale and productivity. By executing the "5S Movement" improvements in space utilization, workers' morale, access to materials and goods, the work environment, the impression left on clients, accident prevention, and in the personal well-being of employees, are expected.

In order to enable the enterprises to smoothly implement the countermeasures related to management activities, such as the items mentioned above, it is urged that public or private institutions be established and function to provide necessary advice to the enterprises.

10.3.2 Countermeasures Utilizing End of Pipe Technology

It is impossible to reduce the environmental impact caused by industrial wastewater only by improving production technologies. In order to satisfy the wastewater regulation standards, the introduction of wastewater treatment

systems is essential. On a mid-term basis, wastewater treatment systems should be installed in every enterprise incorporating the following factors:

1. Introduction of biological treatment systems;
2. Appropriate sizing of oil separators with sufficient retention times in the oil refining factories;
3. Preparation of wastewater analysis devices at the same time wastewater treatment facilities are introduced; and
4. Training of personnel in charge of wastewater treatment and analysis.

10.4 Conclusions and Recommendations for Industrial Pollution Prevention in the Food Processing Sub-sector

10.4.1 Recommendations for Enterprises in the Food Processing Sub-sector

Summarizing the discussion in the previous section, the following are proposed countermeasures urged to be taken by the enterprises in the sub-sector:

(1) Short Term Countermeasures

A reinforcement of management technology, starting starts with the recognition of the present status of production management and the adoption of countermeasures which do not require a big investment, is recommended on a short term basis:

1. Promote production loss reduction activities by setting up a project team;
2. Promote a productivity improvement movement that incorporates the participation of all employees;
3. Separate dirty wastewater and clean wastewater;
4. Get a better, more accurate grasp of water balance and the volume and quality of wastewater;
5. Begin training engineers on wastewater quality analysis and wastewater treatment methods.

(2) Mid and Long-Term Countermeasures

It is recommended that the following countermeasures which require investment be promoted on a mid and long term basis.

1. Recovery and reuse of cooling wastewater;
2. Recovery and reuse of steam condensate;
3. Installation of wastewater treatment systems;

It is recommended that wastewater treatment experts be invited to test the operations of wastewater treatment systems in order to establish optimal operating conditions;

4. Improvement of floor drainage by sloping floors in the production area;
5. Prevention of possible invasion of foreign matter into the production area by sealing up windows.

10.4.2 Measures to be Taken by Administrative Organizations

In order to promote the implementation of industrial pollution prevention countermeasures in individual enterprises, MOI, as the key administrative organization, is urged to take the following core measures:

(1) Draw up a Policy for Industrial Pollution Prevention (Wastewater)

Under existing circumstances it is impossible, and may prevent the sound development of the economy, to force enterprises in Viet Nam to comply with the wastewater quality standard, TCVN5945, without delay. It is recommended that MOI set up a phased attainment plan for TCVN5945 and direct and administer enterprises based on it.

(2) Guidelines for Industrial Pollution Prevention

It is important to promote both Cleaner Production technologies and End of Pipe technologies in order to prevent industrial pollution. It is recommended that MOI direct enterprises by working out guidelines for Cleaner Production and End of Pipe technologies. The guidelines are to be composed of the following:

1. Grasping the present state of production and wastewater;
2. Production process improvement;
3. Recovery of valuable material;
4. Separation of dirty wastewater, clean wastewater and rainwater;
5. Recovery and reuse of cooling wastewater and steam condensate;
6. Installation of wastewater treatment systems;
7. Operation and maintenance of wastewater treatment systems.

It is recommended that items 1 through 5 mentioned above, which do not require a large investment, be promoted as short term targets. It is recommended that the installation of wastewater treatment systems be aimed for by most enterprises on a mid-term basis.

(3) Incentive Measures

In order to resolve the fact that most enterprises are unable to invest in environmental countermeasures due to financial difficulties, it is recommended that a system where enterprises can be provided with long-term, low interest loans or tax preferences, as mentioned in Chapter 5, be enforced.

(4) Infrastructural Provisions for Industrial Pollution Prevention

It is recommended that MOI put the Industrial Energy and Environment Office in charge of setting up the infrastructure necessary for enterprises to take countermeasures for industrial pollution prevention. This office should work to set up:

1. Agencies to provide training services for production management;
2. Agencies to provide services for wastewater quality analysis or wastewater diagnosis.
3. Agencies to provide training services for wastewater treatment;
4. Agencies to provide services for technology transfer concerning wastewater treatment

10.4.3 Investment Demand for Industrial Pollution Prevention in the Food Processing Sub-sector

The sum of the funds required by the targeted enterprises in the food processing sub-sector in this Study for industrial pollution prevention is estimated to be over 100 billion VND, as shown in Table 10.3.

Table 10.3 Investment Demand for Industrial Pollution Prevention (Food Processing Sub-sector)

Unit: million VND

Type of Study	No. of Companies	Cleaner Production		End of Pipe		Total
		No.	Amount	No.	Amount	
Detailed study	5	5	15,000	5	25,000	40,000
Simplified study	16	0	0	14	61.000	61,000
Total	21	5	15,000	19	86,000	101,000

Chapter 11

Countermeasures for Wastewater Pollution in the Metal Works Sub-sector

Chapter 11 Countermeasures for Wastewater Pollution in the Metal Works Sub-sector

11.1 Present Condition of Industrial Wastewater and Productivity in the Metal Works Sub-sector

11.1.1 Enterprises Studied

The characteristics of the 22 companies visited in the Study are summarized in Table 11.1. The table shows the following facts:

Table 11.1 Companies Visited

No.	Ownership	Main Products	Establishment	Employees	Waste Water Volume m^3/day	Plating
M-01	SOE	Spare Parts for the Textile Industry	1986	140	40	Yes
M-02	PC	Plating Parts	1999	70	20	Yes
M-03	SOE	Tractors	1960	700	700	Yes
M-04	SOE	Bolts and Nuts	1963	413	200	Yes
M-05	SOE	Hand Held Tools	1960	630	260	Yes
M-06	SOE	Machine Tools	1958	150	200	No
M-07	SOE	Pressure Vessels	1962	230	20	No
M-08	SOE	Fans	1967	400	20	No
M-09	SOE	Cutting Tools	1968	450	15	Yes
M-10	JV	Transformers	1994	263	-	No
M-11	SOE	Engines	1980	1400	680	Yes
M-12	SOE	Spare Parts for Engines	1968	700	400	Yes
M-13	SOE	Spare Parts for the Coal Industry	1930	480	20	No
M-14	SOE	Pumps	1960	850	-	No
M-15	SOE	Grindstones	1966	407	24	No
M-16	SOE	Chemical Equipment	1976	350	-	No
M-17	SOE	Transformers and Motors	1977	500	20	No
M-18	JV	Diesel Engines	1969	500	-	No
M-19	SOE	Wires and Cables	1972	145	20	No
M-20	JV	Automobiles	1995	140	160	No
M-21	SOE	Medals and Badges for Police	1981	120	3	Yes
M-22	PC	Small Plated Parts	1983	10	10	Yes

SOE: State Owned Enterprise / JV: Joint Venture / PC: Private Company

1. Among the 22 companies surveyed, 18 companies are state-owned, two companies are joint ventures and two companies are from the private sector.
2. There are two private plating companies and the others are mechanical equipment and parts manufacturing companies.
3. Most of the companies have less than 500 employees and discharge waste

water less than 50m3/day. The private plating companies especially, are small

companies which have less than 20 employees.

4. 10 companies have plating shops and the remaining 12 companies do not have plating shops.

Among the 22 companies surveyed, four companies, M-01~04, were selected for a detailed study based on the possibility for improvement etc.

11.1.2 Industrial Waste Water Discharged from the Metal Works Sub-sector

Table 11.2 & 11.3 show the waste water analysis results from wastewater that was sampled during the second field survey. Table 11.2 shows the results of companies with plating processes. Table 11.3 shows the results of companies without plating processes. These tables indicate the following:

1. Plating processes are discharging harmful material, (CN, Cr^{+6}, heavy metals etc.) more than the TCVN standard allows.
2. Some of the companies without plating processes have problems with pH and Oil which are caused by the acid washing and machine washing processes.
3. In some cases BOD, COD, SS and Oil exceed the standards. It is assumed that this is a result of the mixture of living waste and waste from the machining process.
4. A water treatment unit is required for waste water discharged from plating processes.
5. For Oil and pH, neutralization and oil separation in a storage tank are required.

11.1.3 Summary of Present Conditions of Waste Water and Productivity in the Metal Works Sub-sector

The present conditions of wastewater and productivity focusing on the plating processes, are as follows:

1. There are no plating companies which do not have a water treatment unit in Japan. However, in Viet Nam, the plating companies have to start waste water treatment from now.
2. There is no numerical data on plating productivity in Viet Nam, but the operating load and productivity of some of the private plating companies

are similar to Japanese plating companies. On the other hand, the operating

Table 11.2 Water Analysis Result (factory with plating process)

Company No.	Water Volume m^3/day	pH	Oil Content mg/l	BOD mg/l	COD mg/l	SS mg/l	CN Mg/l	Cu mg/l	Fe mg/l	Zn mg/l	Cr^{+6} (T.Cr) mg/l	Ni mg/l
M-01	40	2.6~10.8	0~2	1~8	4~29		0.01~0.03	0.05~0.66	0.23~1.28	0.09~0.35	0.09~0.63	0.27~4.38
M-02	20	4.4~9.0	8~15	3~6	39~165		0.17~3.29	0.38~2.33		0.86~2.55	0.03~0.81	0.25~2.84
M-03	350	7.1~8.0	0.2~0.4	13~18	48~88		0	0.27~0.68		0.93~2.64	0.05~2.07	0.01~0.42
M-04	200	2.1~10.4	0~0.2	15~34	90~192		0.01~0.43		0.1~10.2	0.91~2.7	0.01~0.08	0.01~0.08
M-05	260	5.8~8.1	0	5~7	28~135	18~312	0.05~0.59	0.27~2.27	0.01~2.45	0.05~0.41	(0.4~2.6)	2.3~12.5
M-09	15	6.7~7.0	0.1~0/9	12~127	51~184	17~79	0.06~0.09	0.19~1.27	1~1.52			
M-11	680	7.4~9.3	0.4~1.6	82~125	113~174	12~75	0	0.16~0.45	0.4~3.2	0.4~0.7		
M-12	350	4.1~7.1	0~2.2	59~102	98~223	24~102	0~0.01	0.24~1.24	1.1~6.3	0.7~1.0		
M-21	3	1.6~3.4	0~0.2	1~9	5~46		0	0.02~6.65	0.2~4.2	0.03~0.41	0.01~0.61	0.03~0.30
M-22	10	3.0	0	72	126	180	0.32	2.76			0.095	
TCVN 5945		5.5~9	1 or 10	50	100	100	0.1	1	5	2	0.1 (1)	1

Table 11.3 Water Analysis Result (factory without plating process)

Company No.	Water Volume m^3/day	pH	Oil Content mg/l	BOD mg/l	COD mg/l	SS mg/l	CN Mg/l	Cu mg/l	Fe mg/l	Zn mg/l	Cr^{+6} (T.Cr) mg/l	Ni mg/l
M-06	200	6.8~7.6	0~0.05	5~138	7~181	46~126	0.05~0.29	0~0.03	0.6~9.4	0.09~0.81		
M-13	20	8.5~12.2	0~41	26~72	55~92	5~4900	0		0.8~19.6	0.17~3.55		
M-15	24	2.7~8.1	0~0.4	23~82	53~112	14~280						
M-17	20	1.9~5.1	11~156	1~43	3~471	0~0.1			13.2~18.6	0.01~0.53	0.01~0.02	0.07~0.08
M-18	-	7.1~7.2	6~228	2~37	24~339		0					
M-19	10	6.7	10.8	20	48		0.03	0.03	0.49			0.98
M-20	160	7 ~7.5	9~28	63~129	150~370		0.03~0.09			0.3~0.81	0.08~0.11	
TCVN 5945		5.5~9	1 or 10	50	100		0.1	1	5	2	0.1 (1)	1

load and productivity of some of the plating shops of the state-owned companies are extremely low.

3. The entire picture of the plating industry in Viet Nam is not clear yet. There are no plating companies unions in Viet Nam, so they do not have opportunities for information exchange, and also can not compare their production technologies with other companies.

11.2 Summary of Present Status Analysis

The present status of the plating industry in Viet Nam is as follows:

1. The priority placed on waste water treatment in the enterprises is very low, so the necessity of waste water treatment is not yet recognized.
2. The necessity of data gathering and information exchange for the plating process has not been recognized, because the plating shop makes up only a small part of each enterprise.
3. The plating shops in the SOEs are only processing their own products. There are no opportunities to process other companies' products, so there is no necessity for them to improve their technology and facilities.

11.3 Improvement Plan for the Metal Works Sub-sector

11.3.1 Items for Improvement that Apply Cleaner Production Technology

(1) Proposals for Improvement in the Plating Process

Proposals for Cleaner Production in the plating process are as follows:

1. Perform inspection upon receipt of goods and reject inferior goods before input.
2. Perform preventive facility maintenance, including bath components, and minimize operating hours.
3. Select plating processes, plating material and pre/after-treatment for easy recycling.
4. For plating, use only required parts at their required thickness.
5. Eliminate useless transportation inside and outside of the company.
6. Keep tools in good condition and order.
7. As much as possible, make the plating process simple, except for quality requirements.
8. Perform density control on electrolytes and keep it to a minimum.
9. Maintain an appropriate agitation in baths and maintain uniform current distribution to prevent useless plating.

10. Prevent aging of electrolytes to achieve energy saving and material saving.
11. Perform water saving and recovery to reduce the water treatment load.
12. Perform heat, current and water control to achieve energy savings.
13. Ascertain the material balance of the plating process and water treatment process to prevent chemical waste.
14. Store condensed waste liquid and metal sludge appropriately to make recycled resources.
15. Perform recycling of raw material, facilities and instruments to reduce waste.

(2) Promote Improvement Activities

1. Improve the working environment through good organization and cleaning (5S Activities).
2. Utilize Break Even Point Charts to ascertain improvement.
3. Promote Cleaner Production activities.

11.3.2 Improvement Items that use End of Pipe Technology in the Metal Works Sub-sector

It is important for management to have a philosophy that water treatment units are indispensable for plating shops. For this purpose, countermeasures to be carried out in the mid and long term are as follows:

1. Companies which have no space for water treatment units, or are located in the center of cities, should consider relocating to an industrial zone and utilizing a cooperative water treatment unit.
2. The plating shop in a mechanical process which has a water treatment unit should be independent from other processes, and should accept orders for other companies' plating works as well. This means that plating shops without water treatment units should stop their plating works, and place orders with outside plating shops that have water treatment units to do the work.
3. The government and local government should put effort into instruction. This means that plating companies without water treatment units should be regulated and water treatment costs should be recognized as plating costs.

11.4 Conclusion and Recommendations for Industrial Pollution Prevention in the Metal Works Sub-sector

11.4.1 Proposal for SOEs with Plating Shops

The items proposed to be carried out by SOEs are summarized in Figure 11.1.

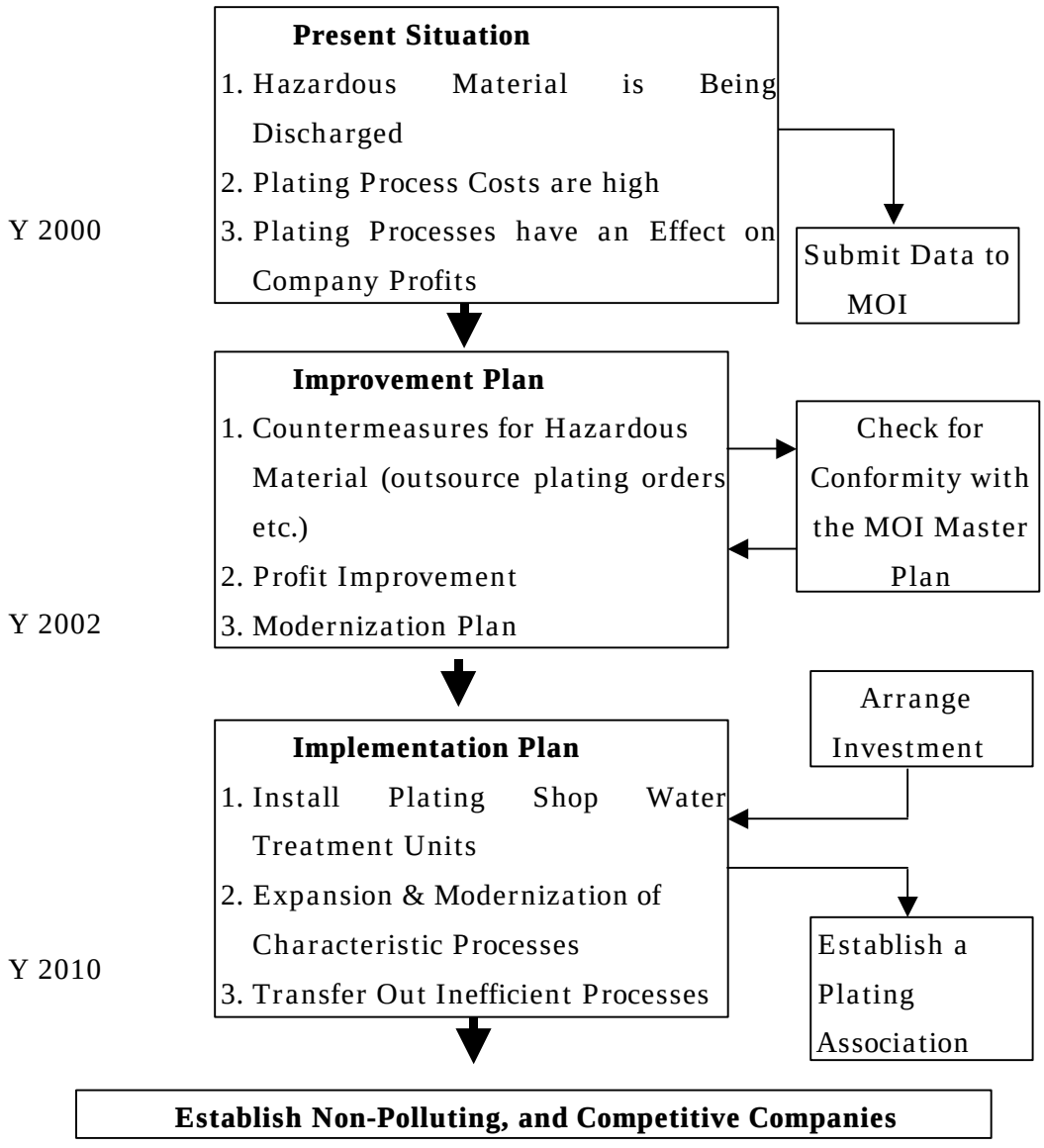

Figure 11.1 Proposed items to be carried out by SOEs

11.4.2 Proposed Countermeasures for the Government to Carry out

Our proposals for MOI (Proposals for the Master Plan) are summarized in Figure 11.2.

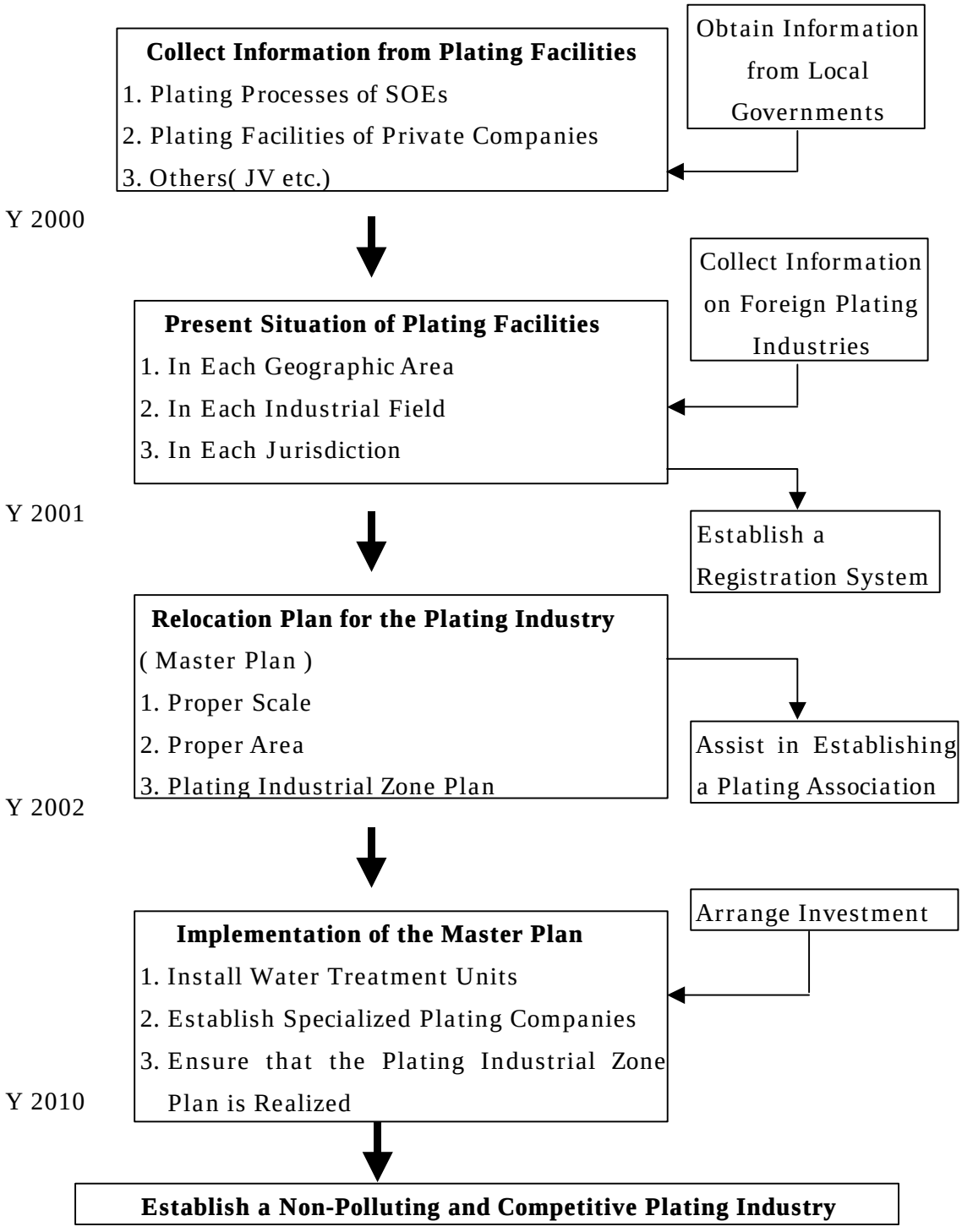

Figure 11.2 Proposals for MOI (Recommendations for the Master Plan)

11.4.3 Investment Demand for Industrial Waste Water Pollution Prevention in the Metal Works Sub-sector

Table 11.4 shows the results of the calculation of the funds required for industrial wastewater pollution prevention in the 22 companies surveyed. The total, required investment for the 22 companies is about 9.2 billion VND (77 million Japanese Yen).

Table 11.4 Estimated Investment Demand for Pollution Prevention Facilities

Unit: million VND

Ownership	Area	Company No.	Name of Equipment	No. Req'd	Investment Required
SOE	HCMC	M-01	Water treatment unit	1 set	700
Private	HCMC	M-02	Water treatment unit	1 set	500
SOE	Hanoi	M-03	Water treatment unit	1 set	370
SOE	Hanoi	M-04	Water treatment unit	1 set	550
SOE	Hanoi	M-05	Not required		
SOE	Hanoi	M-06	Not required		
SOE	Hanoi	M-07	Not required		
SOE	Hanoi	M-08	Not required		
SOE	Hanoi	M-09	Water treatment unit	1 set	410
JV	Hanoi	M-10	Not required		
SOE	Hanoi	M-11	Water treatment unit	1 set	2,900
SOE	Hanoi	M-12	Water treatment unit	1 set	2,000
SOE	Hanoi	M-13	Water treatment unit	1 set	160
SOE	Hanoi	M-14	Not required		
SOE	Hanoi	M-15	Water treatment unit	1 set	400
SOE	HCMC	M-16	Not required		
SOE	HCMC	M-17	Water treatment unit	1 set	400
JV	HCMC	M-18	Not required		
SOE	HCMC	M-19	Not required		
JV	HCMC	M-20	Not required		
SOE	Hanoi	M-21	Water treatment unit	1 set	400
Private	Hanoi	M-22	Water treatment unit	1 set	460
Total					9,250

* HCMC: Ho Chi Minh City

This calculation assumes that there are 65 times as many as the number of metal works companies studied (22) in Viet Nam. The total investment demand in Viet Nam in the Metal Works Sub-sector will be 600 billion VND (5 billion Japanese Yen). However, in actuality, because water treatment units will be consolidated and the situation of private plating companies is not known, this total investment demand figure is for reference use only.