Chapter 3

Attitudes of Japanese Industries Toward Industrial Pollution Control

3 Attitudes of Japanese Industries toward Industrial Pollution Control

This chapter provides basic information that helps to identify factors that are important for effective environmental cooperation with developing countries. It clarifies how Japanese industries addressed pollution control issues, and assesses this experience in light of the current situation in developing countries, identifying key differences in conditions surrounding the manufacturing industry in Japan and in developing countries.

3.1 Subject and Method of Analysis

3.1.1 Subject

It is generally agreed that industrial pollution control after the 1970s in Japan was carried out successfully. Industries are supposed to avoid industrial pollution control because its investment is not productive in the short term and because its operation and maintenance costs certainly increase production costs. Nevertheless, most industries, including small and medium enterprises (SMEs), effectively tackled industrial pollution control in response to the regulations on emission/discharge of pollutants under the pollution control legislation enacted in 1971, and adjusted to the phased enhancement of pollution control regulations. Naturally the question arises as to why they could do it so well.

The primary objective of business operation is to yield profits. Businesses cannot exist if they do not make a profit. Business owners make their best effort to make current profits. Therefore, Japanese business owners must have tried to avoid making losses even if production costs increased due to taking pollution control measures. Except during the oil crises, the industry as a whole did not suffer negative profits. Apparently, there must have been some mechanism to absorb increased costs from industrial pollution control.

The focus of this chapter is to analyze the factors governing Japanese corporate behavior during the time in which industries began to undertake pollution control.

3.1.2 Factors Influencing Corporate Decision Making on Industrial Pollution Control

Companies must make management decisions when considering taking environmental measures. A corporation will never implement environmental measures without a management decision. Business owners have to make comprehensive decisions based upon all available and relevant information.

The business owner needs to make his/her decisions on environmental investments (including facilities, raw materials, and staffing) based on careful examination of factors such as cost and expected returns, turnover, and the overall financial situation.

Business owners are assumed to make decisions on industrial pollution control by considering the factors and taking the steps shown in Figure 3.1.1.

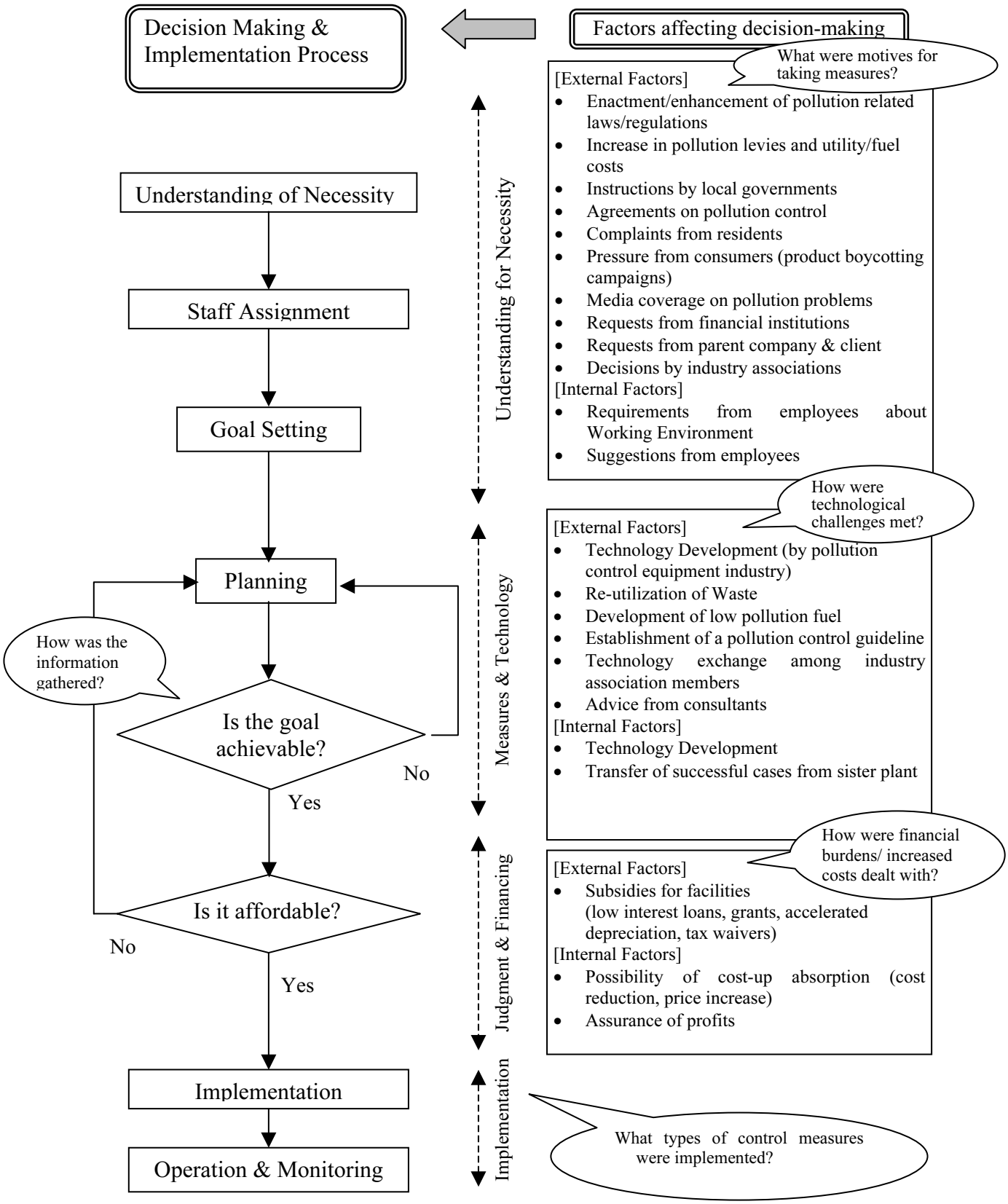


Figure 3.1.1 Decision Making Process and Influential Factors for Pollution Control

3.1.3 Method of Analysis

a. Collecting Information

In order to verify the above assumptions, the Study Team collected information by conducting document reviews and interviews.

b. Information Collected by Interview Survey

The interviews were conducted with 23 companies and covered external and internal factors that affect decision-making on industrial pollution control, as shown in Figure 3.1.1.
In view of the situation in developing countries, interviewees were mainly selected from SMEs. Five industrial sectors were targeted.

- Food processing
- Chemicals
- Pulp and paper
- Metal processing
- Textile (dyeing)

Among the companies in the above-mentioned industries, the Study Team narrowed them down by a preliminary study, listing enterprises whose industrial environmental management information could be found in existing documents and/or who were members of environmental committees in industrial organizations, or who were referred to by expert/key figures. Criteria for narrowing down the selection were as follows:

- Had stayed in business since around 1970s
- The manager's cooperation/understanding could be obtained
- Had previously invested in industrial pollution control for air, effluent, and/or waste control/management
- Availability of past data
- Continuation of environmental management to the present

A summary of the interviewed companies is shown in Table 3.1.1.

Table 3.1.1 Summary of Interviewed Companies

Industries	Number of employees		Total
	Less than 300	300 or more	
Food processing	9 *	1	10
Pulp and paper	3	0	3
Textile	0	1	1
Electroplating/ metal finishing	2 *	0	2
Metal processing	1	1	2
Casting	0	2	2
Chemicals	1	1	2
Leather	0	1	1
Total	16	7	23

* Includes 1 company that did not disclose number of employees

The contents of the interviews focused on the following items, as well as the external and internal factors that influence a corporation's decision-making process, as shown in Figure 3.1.1.

c. Information from Existing Documents

The Study Team sought documents that dealt with past pollution control practices by SMEs, and found two major documents containing extremely valuable information, namely: *White Paper on Small and Medium Enterprises*, and *Cases of Industrial Pollution Control in Small and Medium Enterprises*, published by the Small and Medium Enterprises Agency in the 1970s.

d. Analyzing Information

The Study Team also utilized documents and statistics published in the past. Collected information was classified as follows:

1) External factors surrounding industries.
2) Overview of pollution control practices by SMEs.
3) Motives for implementing pollution control measures.
4) Technical, financial, and land acquisition measures necessary for implementing pollution control measures.
5) Impacts of pollution control costs and countermeasures for the increased costs.
6) Training of employees and outside support.

Table 3.1.2 shows the items analyzed and their details.

Table 3.1.2 Items and Details of Analysis

Items	Details
1. External factors surrounding SMEs	• Outline of factors mentioned in Chapter 1, including laws/regulations, community, media, and economic factors. • SME policies not mentioned in Chapter 1
2. Overview of pollution control by SMEs	• Kinds of pollution control and/or energy/raw material conservation measures implemented by SMEs • Challenges facing SMEs for implementing pollution control
3. Motivation for implementing pollution control	• Factors contributing to promotion of pollution control • Motivation for implementing pollution control in 1970s • Motivations for environmental management after pollution issues shifted to environmental problems.
4. Technical, financial, and land acquisition measures necessary for implementing pollution control	• How SMEs tackled technical issues on pollution control • How SMEs dealt with financial hindrance on pollution control investment • How SMEs secured land/space for installing pollution control equipment/facilities
5. Impacts of pollution control costs and countermeasures	• Levels of pollution control investments • Impacts on production cost • How the impacts on production cost were dealt with • Reasons for absorbing the increased production cost
6. Training of employees and outside service	• Human resources and organizational measures for pollution control in SMEs. • How SMEs collected information on pollution control • How external services for pollution control were utilized

3.2 External Factors Surrounding Small and Medium Enterprises

A variety of external factors exist that influence SMEs, including laws/regulations, citizens' movements, mass media, general economic situation, and industrial promotion policies. Although these factors have already been mentioned in Chapter 1, laws/regulations, citizens' movements and general economic situation will be discussed again here. Furthermore, industrial promotion policies for SMEs were not mentioned in depth in Chapter 1, so this chapter will investigate that area.

3.2.1 Laws and Regulations

Laws/regulations have already been discussed in Chapter 1, but we will briefly touch on some laws/regulations that are necessary for understanding the topics discussed in this chapter.

a. Regulations for Air Pollution

The Air Pollution Control Law was established in 1968. For SOx regulation, the first K-value regulation was implemented in 1970 and strengthened repeatedly till the seventh K-value regulation, employed in 1975. The first sulfur content regulation on fuels was put into force in 1971, and the third revision in 1979. For emissions of NOx from stationary sources, the first regulation was implemented in 1974 and revised repeatedly till the third revision in 1979.

b. Regulations for Water Pollution

Two laws on water quality were established in 1958; however, substantial regulation on water quality began with the Water Pollution Control Law enacted in 1970. In 1971 effluent standards were established, in which wastewater treatment facilities of business entities that discharged more than 50 m^3 per day of organic effluent were designated as specified facilities for regulation.

Industries having difficulty in complying with the 1971 effluent standards were given a certain grace period to meet the standards.

c. Regulations for Noise, Vibration, and Odor Pollution

The Noise Pollution Regulation Law was established in 1968, while the Offensive Odor Control Law was established in 1971.

d. From the Basic Law for Environmental Pollution Control to the Basic Environment Law

The establishment of the Basic Law for Environmental Pollution Control in 1967 marked the beginning of full-scale anti-pollution control measures by the administration, resulting in the formation of the Environmental Agency in 1970. As the scope of issues widened, from pollution control to global environmental issues (global warming, CFC problems, etc), the Basic Law for Environmental Pollution Control was replaced by the Basic Environment Law in 1992.

3.2.2 Community and Mass Media

Anti-pollution community movements had begun to spread nationwide from the late 1960s and early 1970s. The mass media also covered pollution topics extensively (see Figure 1.10.1 in Chapter 1). While the coverage decreased in the 1980s, it jumped again in the 1990s.

This trend coincides with the results of public opinion surveys, i.e., the public's concern for the environment they live in was high in the 1970s, less so in the 1980s, and rising to a high level again in the late 1990s.

3.2.3 The Economic Situation

This topic has already been discussed in Chapter 1, but we will briefly discuss it in this section again.

The era of rapid economic growth in Japan (10% or more growth in GNP) halted in 1970, and the 1970s are now widely regarded as the era where rapid growth shifted to stable growth. In the 1970s the Japanese economy suffered from inflation and recession at the same time. It was the age when deregulation of trade was promoted due to the rounding up of the dollar-JPY exchange rate (the so-called Nixon Shock), and two oil crises that occurred, resulting in steep rises in material prices.

In the 1970s, the era when pollution control was aggressively promoted, economic growth in Japan had slowed down. However, the growth rate was still around 5%, and companies were relatively active in investing in facilities. Economic growth, nonetheless, slowed down significantly after 1975. In the latter half of the decade, the era of quantitative expansion -- products selling as they were produced -- ended, and in the following era, company management concern shifted to the improvement of productivity.

The structural conversion of the Japanese economy continued to progress, especially with the appreciation of the JPY following the 1985 Plaza Accord. Due to the appreciation of the JPY, the corporate goods price index showed signs of deflation from 1986. Likewise, the import price index also decreased by half compared that before 1985. This situation was very favorable for industries importing raw materials but very difficult for industries that manufactured and then exported products overseas. Companies making products that could be manufactured in developing nations were exposed to tough competition with imported products, and bankruptcy of these companies became frequent. As for the companies that exported their products overseas, rationalization of production processes and workforce was advanced in order to deal with the higher JPY. For industries that required manpower, and could not fully deal with the appreciating JPY by rationalization, relocating factories to foreign countries became common in the 1990s.

3.2.4 Policy for Promoting Small and Medium Enterprises

As a background for analyzing the corporate behavior of SMEs on industrial pollution control, the Japanese SME policies will be summarized in this section.

In the Small and Medium Enterprise Basic Law, established in 1963, the aim of policies for SMEs was defined as 'meeting the needs of the growing and expanding national economy,' 'advancing the growth of SMEs,' and 'contributing to the improvement of the financial and social status of SME employees.' For achieving these objectives, goals were set to 'improve conditions of SME productivity and business deals to overcome various differences, like productivity difference among industries'. As for administrative policies, 'to correct the disadvantages of SMEs with their economical and social limitations, and assist SMEs in their own efforts at the same time.' In practice, the tasks for national government was categorized as to 'advancing SMEs structure,' 'correcting disadvantages in business activities,' and 'measures for small size companies.' SME policies after the rapid economic growth period (1963) were carried out based on this Small and Medium Enterprise Basic Law.[1]

As mentioned above, the drive for the policies for SMEs in Japan has been based upon the idea that SMEs were weak and needed help for the correction of the economic differences that existed between SMEs and large companies; thus focusing on modernizing the management of SMEs.

Measures for SMEs can be mainly categorized into a) strengthening management bases, and b) assisting structural reform. The former measures include financial measures, taxing measures,

[1] Small and Medium Enterprise Agency, *1993 White Paper on Small and Medium Enterprises*, Part IV Chapter 1

organizational measures, and management advice. The latter, on the other hand, includes improving technical capacity, environmental and safety measures, modernizing measures, advancing measures, and labor measures.

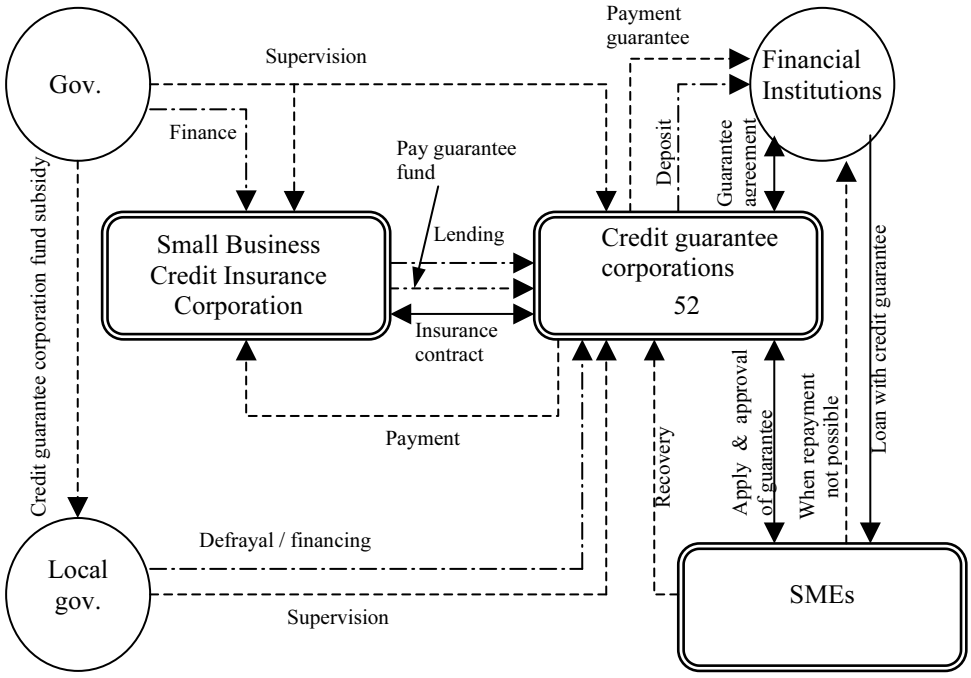
The following subsections are the policies that will be analyzed later.

a. Financial Measures

Difficulty of funding was the major management issue for SMEs. Because SMEs were not attractive borrowers for private financial institutions, funding entities for SMEs had always been lacking. Because of this, three government-affiliated financial institutions – the Japan Finance Corporation for Small Business (1953), the People's Finance Corporation (1949), and the Central Cooperative Bank for Commerce and Industry (1936), were established in order to provide long-term low interest rate funding, at a fixed rate regardless of the economic situation of the time.

Furthermore, those government-affiliated financial institutions provided funding for SMEs on favorable terms for special funding needs, according to the political needs of the time, including industrial pollution control and energy conservation.

The credit insurance system has been especially important. For SMEs that otherwise lacked credit-worthiness, a credit guarantee corporation guaranteed their borrowed indebtedness, and in cases where the SME became unable to repay its debt, the credit guarantee corporation paid the guaranteeing company. The system was put into force in 1953.



Source: Small And Medium Enterprise Management Consultants Association (SMECA) (ed.), *Handbook of Policies for Small and Medium Enterprises 1996*

Figure 3.2.1 Credit Guarantee Scheme

b. Taxation Measures

Taxation measures for SMEs have been mainly divided into a) reduced tax rate on corporate tax aiming for SMEs in general, and b) measures based on specific laws that aim to promote SMEs. The second one is especially important as specific measures based on pollution related laws, Waste Management Law, or energy conservation and recycling laws are the subject of specific measures in terms of taxation.

c. Organizational Measures

In general, SMEs are small in size, low on technical capacity, and short on credit worthiness. Organizational measures were designed to address various issues facing SMEs by organizing associations with other SMEs in the same industry.

Organizational measures include association systems, guidance to the association, and subsidy measures to the associations. They include cooperative business associations, business unions, credit cooperative associations, cooperative associations, and commercial associations. Furthermore, there are federations of business associations and commercial associations as umbrella organizations.

To provide guidance for these associations, federations of small business associations have been established in each prefecture. The National Federation of Small Business Associations has also been established as an umbrella organization for these prefectural federations.

Table 3.2.1 Outline of Organization Systems

	Cooperative business association	Business union	Credit cooperative association	Cooperative association	Commercial association
Purpose	Rationalize management of member companies; promote efficient business activity among members	Rationalize management of member companies, helping to establish businesses	Facilitate financing for small businesses	Rationalize business management by increasing scale through cooperation with other enterprises	Advancement/ development of industry, stabilize & rationalize management of member companies
Business/ activity	Cooperative sales, cooperative orders, financial loans, welfare, guarantee for debt	No restriction	Financial loans for association members, deposits, fixed reserve	Businesses that association members have ran	Educational businesses, cartels, cooperative economic businesses
Minimum number of memberships	More than four people	More than four people	More than 300 people	More than four people	More than half companies operating in a area running qualified businesses
Qualification for membership	Small companies in the area	Individual	Small companies, citizens and workers in the area	Small and medium companies	Small and medium companies in the area running qualified businesses
Ground laws	Small and Medium Enterprises Cooperative Association Law			Law of Small and Medium Enterprise Organization	

Source: Small and Medium Enterprise Agency (ed.), *New Developments in SME Policies*, Doyukan Publishing, 1999, p.187

d. Management Guidance Measures

The Small and Medium Enterprises Guidance Law, enacted in 1963, aimed to promote a systematic guidance program by prefectural and central governments and the Japan Small Business Corporation to assist SMEs in their effective modernization and rationalization. Small and Medium Enterprises General Guidance Centers that were located in each prefecture were conducting diagnosis and guidance and housed Small and Medium Enterprise Management Consultants who provided business management assistance upon request from SMEs. The diagnosis consists of both general diagnosis and that for modernization promotion. The former includes diagnosis for complying with energy and environmental requirements, and the latter refers to the use of a loan system for facilities modernization and construction of industrial complexes and joint factories and the like.

The Japan Small Business Corporation[2], as a government-affiliated firm, carries out training of SME staff, information gathering, research on training methods, public relations and the like.

Regarding the development of human resources, prefectural governments provide long- and short-term trainings. The long term one is for executives and middle-management, and short one is for middle-management and working level employees. The Small and Medium Enterprises Universities, located in nine prefectures, also have training programs for SME managers.

e. Technical Capability Improvement Measures

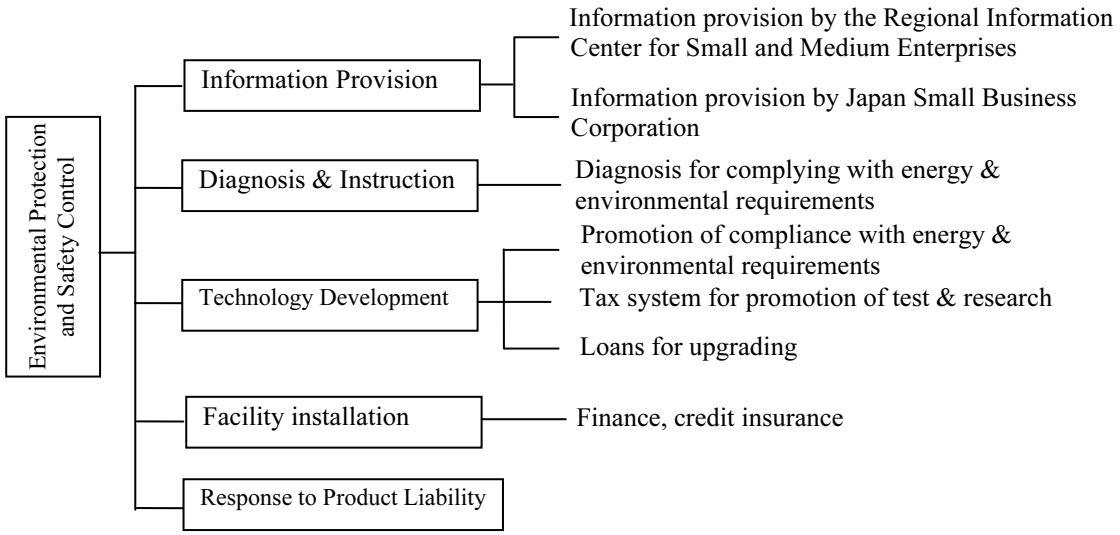
To support technical capability improvement in SMEs, prefectural governments in partnership with the Japan Small Business Corporation carry out technical training and guidance, technology development support and technology exchange.

The Japan Small Business Corporation provides leader training programs and executes research in highly technical areas. Prefectural governments have also set up 185 Public Test and Research Institutes to provide technical guidance for SMEs.

f. Measures for Environmental Protection and Safety

The following measures have been implemented which aim to promote measures for environmental protection and safety by SMEs.

2 The Japan Small Business Corporation was established in 1980 on the base of the Small Business Promotion Corporation which was established in 1967. Later on, it developed into Japan Small and Medium Enterprise Corporation in 1999 and will be changed to the Organization for Small and Medium Enterprises and Regional Innovation in July 2004.



Source: Small And Medium Enterprise Management Consultants Association (SMECA), *Handbook of Policies for Small and Medium Enterprises 1996*

Figure 3.2.2 Scheme of Measures for Promoting Environmental Protection and Safety

g. Upgrading Measures

To deal with structural problems such as small scale and an excessive number of existing companies, programs to reinforce business structure are referred to as upgrading measures, and various programs were undertaken to, for example, increase productivity through cooperative operation.

Upgrading programs can be categorized into two groups, supporting programs and contributory programs. Contributory programs, especially those regarding relocation to a better environment, are relevant to environmental measures. Collectivization of factories and other facilities and sharing of facilities and plants are examples of such programs, and low interest loans and tax breaks were available for these programs.

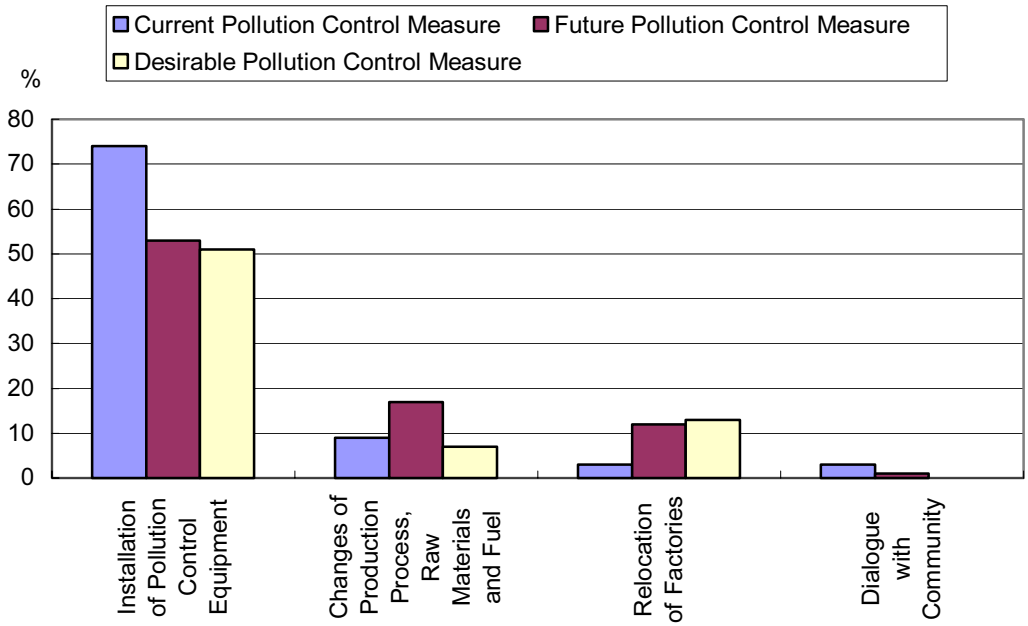
3.3 Pollution Control by Small and Medium Enterprises

This chapter will outline the pollution control measures carried out by SMEs during the first stage, or from the 1970s to the middle of the 1980s, and the second stage, after the mid-80s. In this section, pollution control at source and plant relocation measures will be discussed. Also energy and resource management will be covered as much as possible.

3.3.1 Outline of Pollution Control

a. Pollution control measures in the early 1970s by Small and Medium Enterprises Shown in *the White Paper on Small and Medium Enterprises*

According to *the White Paper on Small and Medium Enterprises*, in 1970, 74% of pollution control at that time consisted of setting up protective devices such as soundproofing, settling tanks, or smoke and soot collection devices, while 9% was for production processes and changes in raw materials or fuel use such as the change from high-sulfur heavy oil to low-sulfur heavy oil, and the change from coke ovens to electric ovens in, for instance, the metal casting industry. These two made up 80% of pollution control measures, and large scale relocation and dialogue with local residents accounted for only 3% of total measures.



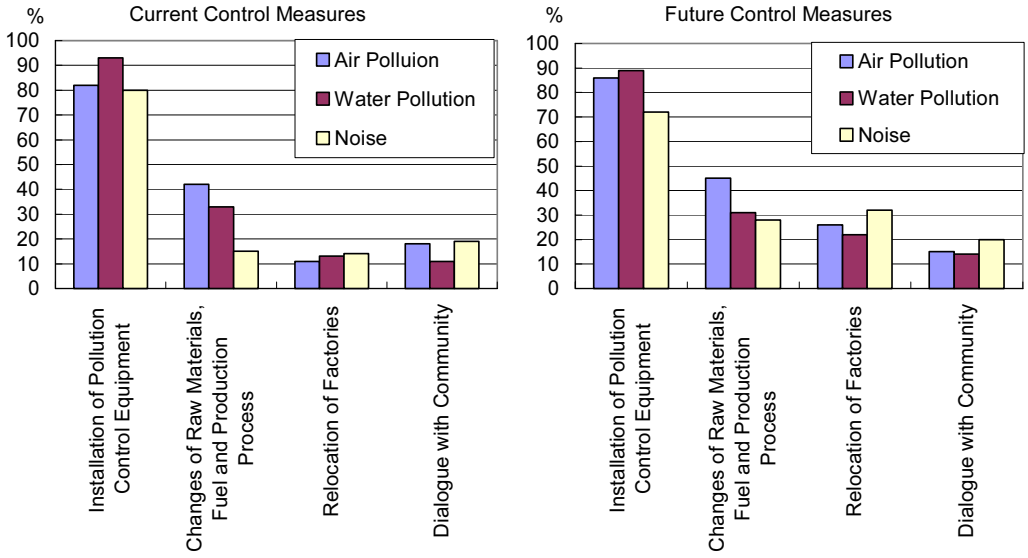
Source: Small and Medium Enterprise Agency, *1970 White Paper on Small and Medium Enterprises*
(Original source: Small and Medium Enterprise Agency, "Survey on Actual Status of Pollution Issues in SMEs")

Figure 3.3.1 Actual Condition of Pollution Control by Small and Medium Businesses

The White Paper compared the ratio of companies that desired and actually implemented pollution control measures. Fifty-one percent of the companies surveyed selected "installing protective devices as the most desirable pollution control measure, which is lower than its implementation rate of 74%. Seven percent of the companies selected "raw material and fuel change" as the most desirable pollution control measure, which is also lower than its implementation rate of 9%. On the contrary, relocation was selected by 13% of the companies as the most desirable measure whereas its implementation rate was 3%. Thus, there are gaps between measures desirable for companies and implemented by them. These numbers indicated that although relocation was desirable for many companies, difficulties of finding suitable locations or burden of funds for relocation forced them to install preventive

devices instead of taking such drastic measures." It also stated that "there are gaps between measures for the future and currently implemented." As for measures for the future 53% of the companies selected "installation of preventive devices" while 74% of them currently implemented it. By contrast, 17% of the companies selected "raw material and fuel changes" while 9% of them currently implemented, and 12% selected "drastic measures such as relocation" while 3% of them currently implemented. It analyzed that "although the companies show positive attitudes toward pollution control, they seems to lack intention to progressively reduce factors generating industrial pollution by installing pollution preventive devices."

As is shown in Figure 3.3.2, *the 1972 White Paper on Small and Medium Enterprises* indicated that pollution measurers by SMEs had been promoted and awareness of the importance of pollution control had increased. Installation of pollution control equipment was the dominant form of pollution control measure as of 1972, which was selected by 80-90% of companies in each industry sector, and this was expected to continue to be so in the future. This fact indicates that the awareness of the importance of establishing pollution control facilities was increasing.



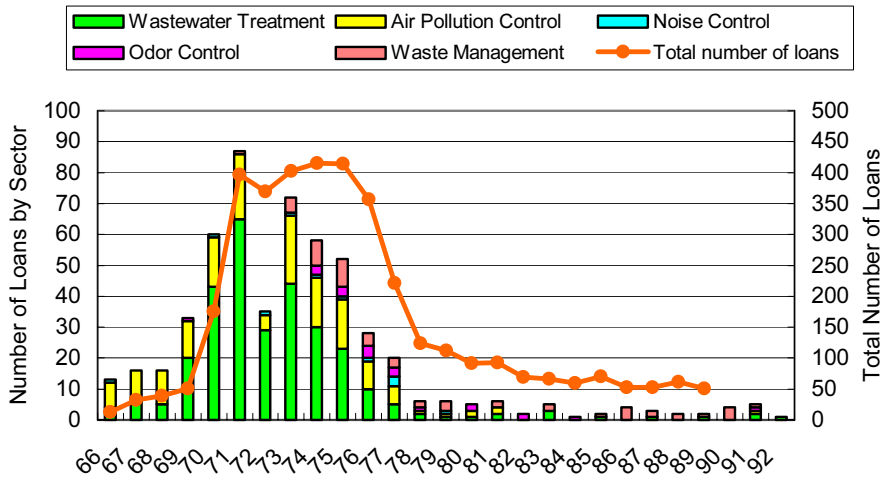
Source: Small and Medium Enterprise Agency, *1972 White Paper on Small and Medium Enterprises*
(Original source: Small and Medium Enterprise Agency, "Survey on Actual Status of Pollution Issues in SMEs")

Figure 3.3.2 Actual Condition of Pollution Controls by Small and Medium Enterprises

When looking at pollution control measures by category of pollution, many pollution control devices were installed to tackle air and water pollution. Also, changes in raw material, fuel, production process were commonly undertaken for the control of air pollution because fuel change is easy to implement. Relocation of factories or plants was rarely considered then, but many companies still retained this option as a possible future measure, especially in areas where noise pollution was serious.

b. Financing Pollution Control Measures by the Environmental Pollution Prevention Corporation

Cases of financing by the Environmental Pollution Prevention Corporation are indicated below. There were many such cases in the 1970s while there were only very few cases in the 1980s.

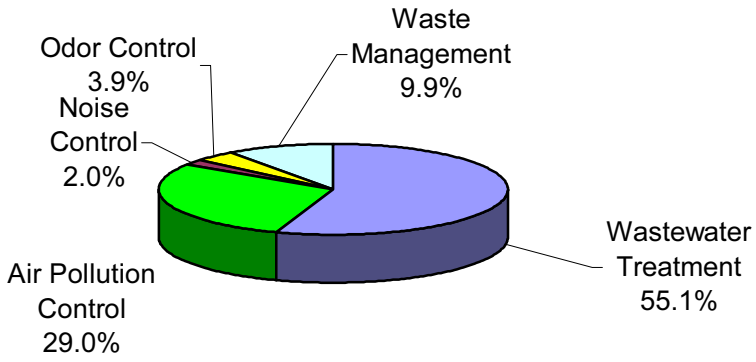


Note: Breakdown number of loans by control measure is shown only for those identified; therefore the sum of the numbers does not match the total number of loans.
Source: Breakdown number of loans by control measure from the loan data sheet of the Pollution Control Service Corporation, the total number of loans from *25 Year History of Pollution Control Service Corporation*, 1991

Figure 3.3.3 Trend in Cases of Financing by Pollution Control Service Corporation (1966-1992)

As the changes in financing trends show, pollution control facilities were constructed mainly from the beginning to the middle of 1970s during which environmental laws and regulations were enacted, and the construction boom ended by the late 1970s.

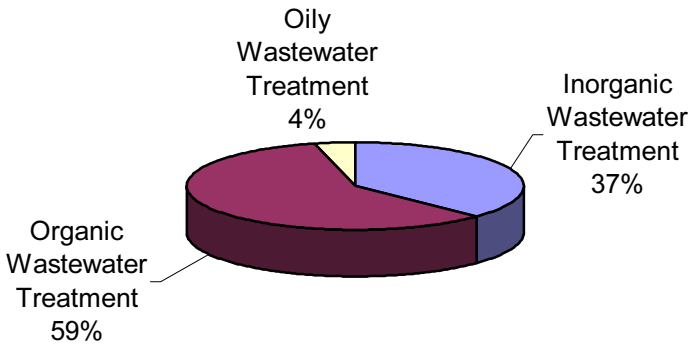
According to data from the Pollution Control Service Corporation, 55% of pollution control measures were for effluent treatment facilities, followed by 29% for air pollution control.



Source: Based on loans data sheet of Pollution Control Service Corporation

Figure 3.3.4 Pollution Control Measures Financed

Regarding effluent treatment facilities, construction of organic drainage treatment facilities accounted for 6 % of total financing. These facilities were mainly for the food processing, pulp/paper, dying, and chemical industries.



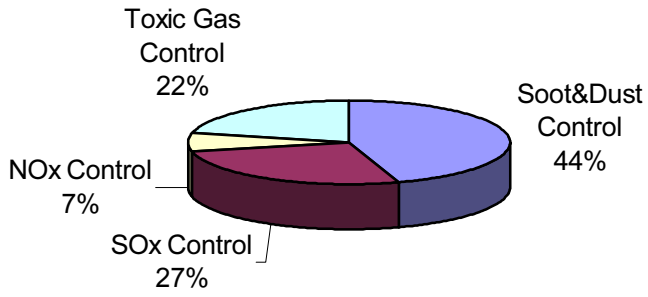
Source: Based on loans data sheet of Pollution Control Service Corporation

Figure 3.3.5 Breakdown of Effluent Control Measures

Metal plating and surface finishing, which use toxic metals, accounted for a large proportion of the construction of inorganic wastewater treatment facilities financed by the Pollution Control Service Corporation followed by the steel industry, which discharges acid wastewater, and the ceramic and soil and stone industries, which discharge highly polluted wastewater.

As for emission gas control, installing of precipitators for soot and dust control was major measures followed by SOx control. Measures for soot and dust control were mainly promoted with the enactment of the Air Pollution Control Law in 1968. SOx measures were strengthened after the amendment of the Air Pollution Control Law in 1970. As soot and dust control, bag filters and electrostatic precipitators were adopted by the steel, metal-processing, inorganic chemical, and ceramic industries. SOx control was mostly installing flue gas desulfurization equipment.

Installation of treatment facilities for toxic gas control, such as for sour gas, ammonia, hydrogen chloride gas, hydrogen sulfide gas and hydrogen fluoride gas, were promoted. Among these gases, hydrogen chloride gas, hydrogen sulfide gas and hydrogen fluoride gas were designated as toxic substances by the amendment of the Air Pollution Control Law in 1970, and their emission gas standards were established. Other substances like ammonia and hydrogen sulfide gas were not given any emission gas standards but designated as special substances in case of accidents.



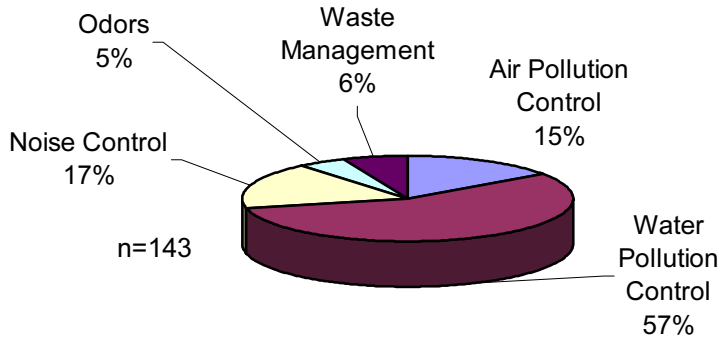
Source: Based on loans data sheet of Pollution Control Service Corporation

Figure 3.3.6 Types of Air Pollution Control

c. Pollution Control Measures Implemented by the Small and Medium Enterprise Agency

According to the "Cases of Successful Pollution Control Measures by SMEs (1973-1979)", the majority of the 143 cases of pollution control measures implemented by SMEs were for effluent control, this being followed by noise, vibration, and air pollution controls. In

addition, the casebook reports that there was a case where SMEs in the same industry modernized their businesses through the establishment of the cooperative association and constructed a common effluent treatment facility. Also, there was a case where SMEs in the same industry collectively relocated and constructed a common wastewater treatment plant through the establishment of the cooperative association for wastewater treatment. These examples might be fairly unique to Japan.

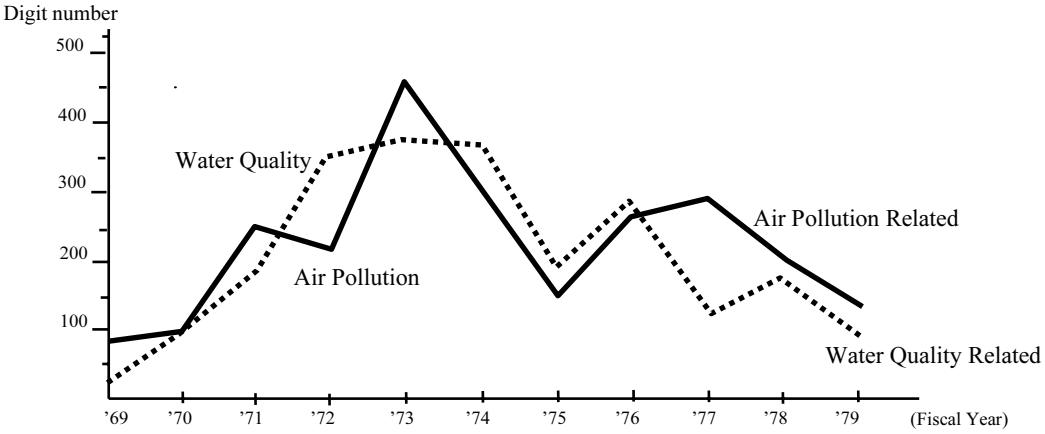


Source: Small and Medium Enterprise Agency, "Case Examples of Successful Pollution Control Measures by SMEs", 1972-1979

Figure 3.3.7 Breakdown of Pollution Control Cases

d. Investment in Pollution Control Measures

Large investments are required mainly for air pollution and water pollution controls. Investment trends are indicated in Section 1.12 of Chapter 1, while Figure 3.3.8 summarizes pollution control investments during the 1970s in Tokyo, where there is a high preponderance of SMEs. According to this, the investment peaked in 1973, and installation of air and water pollution control facilities virtually ceased at the end of the 1970s. From the 1980s, pollution control equipment came to be installed in line with the renewal of existing facilities and construction of new plants.



Air Pollution Related	-NOx Control for Stationary Sources (4th) -Amendment of Environmental Standards for NOx (Relaxed) -Total Amount Control of Pollutants and Fuel Sulfur Control (4th) -NOx Control for Stationary Sources (3rd) -Guidelines for Flue Gas Desulfurization facility -NOx Control for Stationary Sources (2nd) -SOx: K-value Control (7th) -SOx: K-value Control (6th) -SOx: Fuel Sulfur Control (3rd) -NOx Control for Stationary Sources (1st) -Establishment of Environmental Standards for NOx -Amendment of Environmental Standards for SOx -SOx: K-value Control (5th) -SOx: K-value Control (4th) -SOx: Fuel Sulfur Control (2nd/Ordinance) -SOx: Fuel Sulfur Control (1st) -Special Diet Session for Environmental Pollution Problems -Amendment of Air Pollution Control Law -SOx: K-value Control (Ordinance) -Establishment of Environmental Standards for SOx -Enactment of Air Pollution Control Law
Water Quality Related	-Introduction of Total Amount Control of Pollutants -Strengthening of the 'Stringent Add-on Effluent Standard -Amendment of Sewage Law -Guideline for Discharging Effluent to Rivers (administrative advice) -Establishment of Environmental Standards for PCB -Environmental Standards for Mercury (amended) -Establishment of Stringent Add-on Effluent Standard (Ordinance) -Designation of Waters Body Types for Environmental Standards -Establishment of Effluent Standards -Amendment of Sewage Law -Enactment of Water Pollution Control Law -Establishment of Environmental Standards for Water Quality

Source: Environment Agency, *1992 White Paper on the Environment* (Original source: information material of Tokyo Metropolitan Research Institute for Environmental Protection)

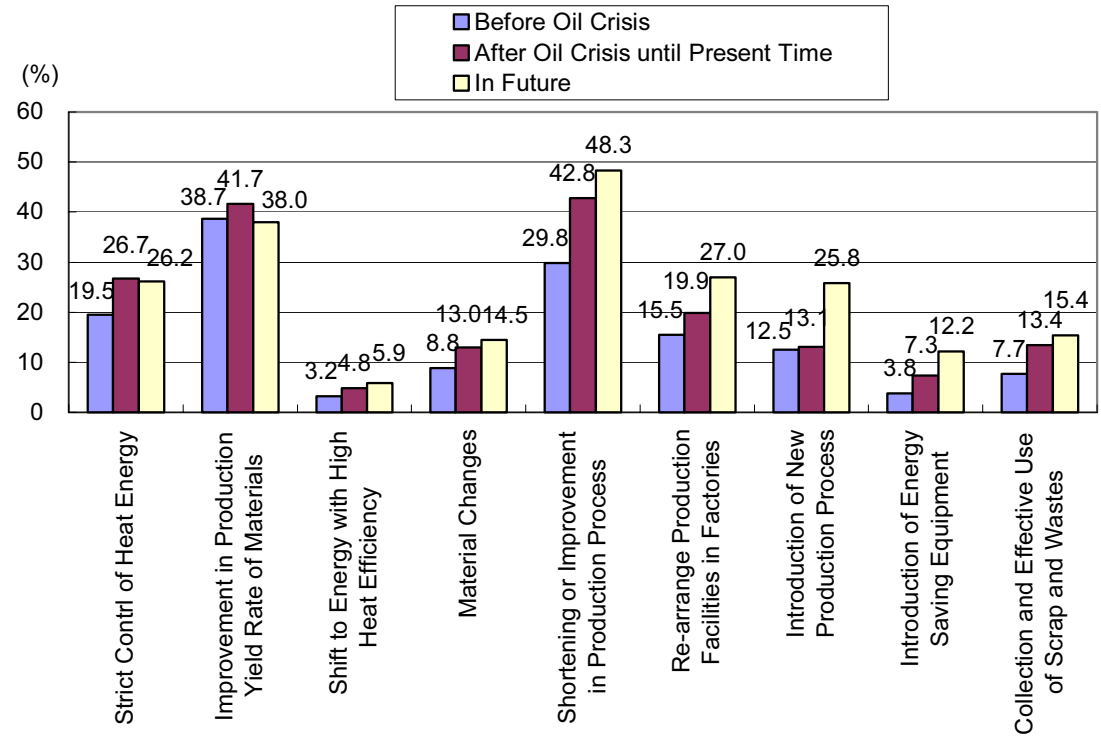
Figure 3.3.8 Trends in Pollution Prevention Investment and Pollution Legislation

e. Energy Saving and Resource Saving Measures from the 1970s to the Mid-1980s

Although they cannot be classified as direct pollution control measures, intrinsically related energy saving and resource saving measures were initiated in the wake of the oil crises of 1973 and 1979. The oil crises led to dramatic increases in energy prices and raw materials prices, and these were translated into rapid inflation in production costs. Analysis of these effects is

conducted in Section 3.6.4 of this chapter, but the type of countermeasures implemented will be reviewed in this section according to *the White Paper on Small and Medium Enterprises*.

The 1977 White Paper on Small and Medium Enterprises mentions the SMEs' approach for resource and energy saving measures as those had become an important issue in corporate management following the first oil crisis. According to the Survey on Actual Status of Technological Activities and Measures for Resource-saving and Energy Saving, implemented by the Small and Medium Enterprises Agency in November 1977, many companies implemented resource and energy saving measures such as increasing yield rate (39% of the companies) and shortening/improving production processes (30%) even before the oil crisis. Indeed approximately 60% of all the companies surveyed implemented some kind of measures. In the wake of the first oil crisis, in reflection of increased energy prices, the number of companies implementing thorough heat and energy management increased to 27%.



Note: Because of multiple answers, the total is over 100
Source: Small and Medium Enterprises Agency, *1977 White Paper on Small and Medium Enterprises*

Figure 3.3.9 Resource Saving and Energy Saving Measures in SMEs

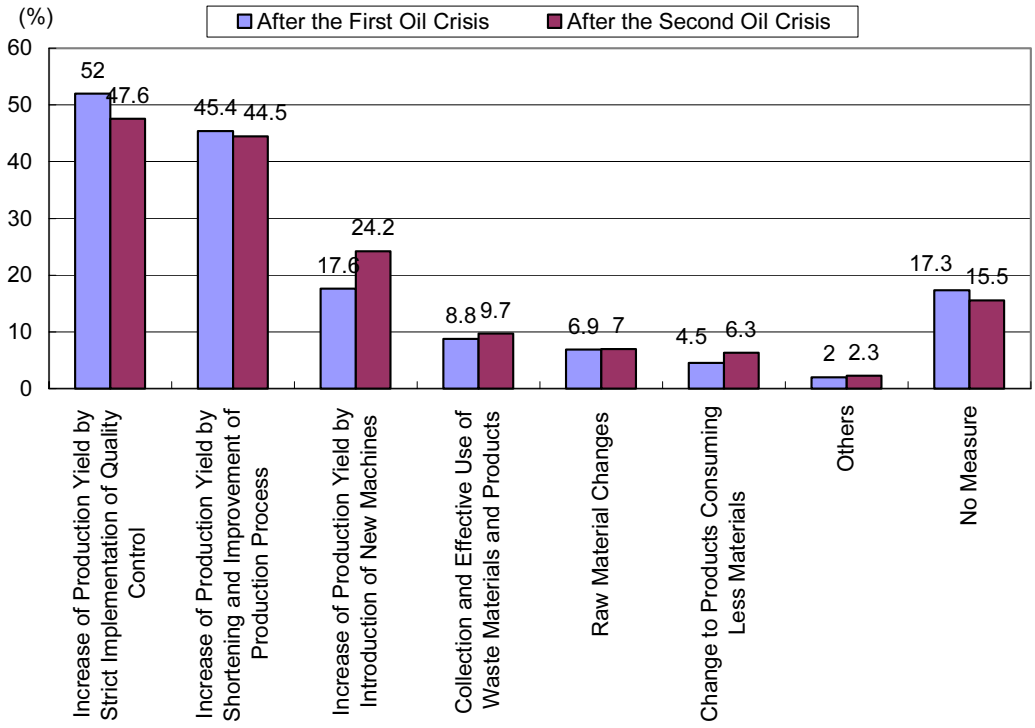
Next, concerning the type of measures that SMEs would adopt in the future, Figure 3.3.9 shows that many firms still hold to the conventional practices of shortening/improving production processes (48%), increasing yield rate (38%), and implementing thorough heat and energy management (26%). A noteworthy trend, however, is that more companies selected countermeasures that entail altering the conventional production setup, for example, rearranging plant production equipment (27%) and adopting new production systems (26%).

The White Paper stated the following:
"It is clear that individual enterprises are implementing, and will continue to implement, various measures for resource saving and energy saving, and the following trends can be observed regarding the timing of measures. In other words, measures that can be realized through efforts of individual companies have mainly been implemented since before the oil crisis and up to the present time. Those efforts include thorough heat and energy

management, increasing yield rate, and shortening/improving production processes. Before the oil crisis, the main emphasis of such measures was placed on business rationalization and cost cutting, and the like. However, following their experiences with shortages of raw materials and energy, and price escalation caused by the oil crisis, companies have implemented such measures with the focus more clearly directed towards resource and energy saving. Meanwhile, concerning the measures that are to be implemented in the future, it will be difficult for an individual company alone to implement measures such as rearranging plant production equipment and adopting new production systems, and the like; rather, greater emphasis will come to be placed on measures that can only be implemented through collaborating with other companies and industrial sectors. Resource saving and energy saving measures are no longer confined to individual enterprises, but are matters that concern whole industries."

The 1982 White Paper on Small and Medium Enterprises stated the following regarding resource saving measures in response to resource and energy price inflation in the wake of the two oil crises.

"Resource saving measures that were implemented in the wake of the first oil crisis, according to the Survey on Shifts in Manufacturing Environments, consisted of improvements in yield rate by thorough quality control and shortening and improvement of production processes. Following the second oil crisis, however, whereas the number of enterprises implementing such measures fell slightly, more and more companies started taking drastic measures such as increasing yield rate through introducing cutting edge machines and so on."



Note: Because of multiple answers, the total is over 100
Source: Small and Medium Enterprise Agency, *1982 White Paper on Small and Medium Enterprises*

Figure 3.3.10 Implementation of Resource Saving Measures

f. Period after the Shift from Pollution Problems to Environmental Problems

Around this time in the fields of air pollution and water pollution controls in existing plants, pollution control had become necessary as target substances increased, but those issues were not large enough to require major investment. Investment in countermeasures mainly accompanied renewal of facilities and expansion of production. However, this was also a time

when more measures came to be required for control of chemicals and industrial waste control. According to the interview survey conducted within this study, water pollution and air pollution control measures were more or less completed from the 1970s to the start of the 1980s.

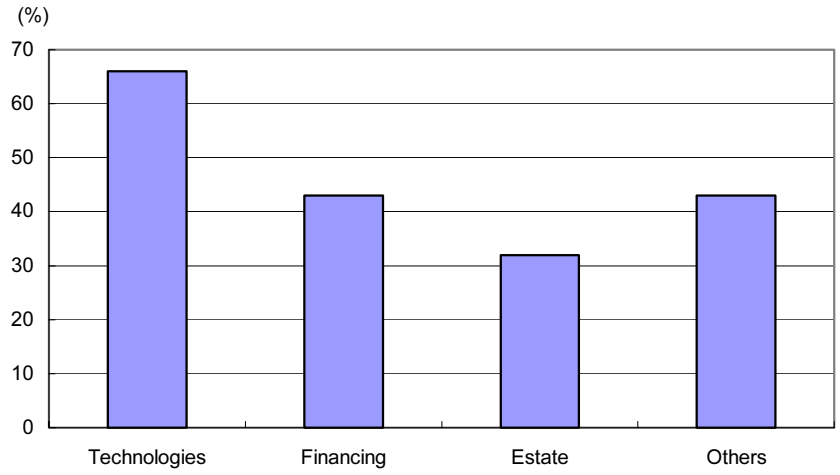
Following this, there were no key countermeasures in these fields; rather, countermeasures came to be implemented in the field of reducing and recycling waste. Energy saving measures continued to be implemented into the 1980s; however, during the 1990s, emphasis switched to cogeneration, methane utilization, inverters, thermal storage systems, photovoltaic power generation, parallel small-scale boilers, and so on.

New plant construction during this period mainly took place in purpose-built industrial estates. When doing this, pollution control measures were regarded as essential investment and were implemented as a natural course.

3.3.2 Issues Confronting Environmental Countermeasures in Small and Medium Enterprises

a. Pollution Countermeasures Implementation in the 1970s

In the 1970s, in line with wastewater and emission gas regulations based on the Water Pollution Control Law and Air Pollution Control Law, pollution sources were required to introduce pollution control equipment. Concerning the implementation of such measures, particularly in the case of SMEs, the kind of problems indicated in Figure 3.3.11 were identified.



Source: Small and Medium Enterprise Agency, *1972 White Paper on Small and Medium Enterprises*

Figure 3.3.11 Impediments to Implementation of Pollution Control Measures

Concerning the largest technical problems, *the 1972 White Paper on Small and Medium Enterprises* pointed out that, "Many of the high-performance pollution prevention equipment currently being developed are expensive, and there is a lack of improvement and development of inexpensive high-performance pollution prevention equipment within the reach of SMEs." Furthermore, it was also pointed out that pollution control devices are expensive because they are difficult to mass produce and have to be custom made; moreover, companies face obstacles for confidentiality when trying to introduce the pollution control equipment as it requires preliminary investigation.

Moving on to financial problems, the White Paper stated the following:
"Investment in pollution control equipment per company was approximately 18million JPY (or 25million JPY overall including relocation expenses) in fiscal 1970. --- This is expected to increase further in fiscal 1971. --- In particular, water pollution control equipment is the most

expensive because it is necessary to systemize wastewater treatment processes and the equipment is large scale and contains numerous parts and attachments. In cases where SMEs install pollution control equipment, it is thus necessary to incur a financial burden that is relatively large compared to existing plant investment; moreover, because such investment does not impart profits, it is frequently difficult to obtain loans. --- Moreover, in order to overcome noise and vibration problems, it is necessary to take drastic measures such as relocation of plants and so on, and again this requires a lot of investment."

In terms of land problems, the White Paper pointed out that, since equipment for preventing air pollution and water pollution, is generally large-sized, SMEs located in urban areas are sometimes unable to secure sufficient installation space because their premises are restricted to begin with. Moreover, because noise and vibration pollution occur when SMEs locate in areas of dense residential population, the fundamental solution is for companies to relocate; however, the White Paper pointed out that finding an appropriate location is not always easy for SMEs.

The White Paper also stated, "Implementation of pollution control measures by SMEs entails numerous obstacles; moreover, because these problems are complexly intertwined, this makes it even more difficult to take countermeasures. For SMEs, which pale in comparison to major enterprises in terms of technological and financial power, it is frequently difficult in cost terms to independently overcome such obstacles."

The White Paper identified the above-mentioned issues in the early 1970s; however, there has not been much discussion on pollution control by SMEs in subsequent years. In 1980, following the second oil crisis, the main emphasis shifted to energy saving and resource measures. In particular, the main issue turned to how SMEs should react to increasing energy and resource prices.

b. Following the Shift from Pollution Problems to Environmental Problems

Since *the 1993 White Paper on Small and Medium Enterprises*, responses to global environmental problems, energy saving, and waste recycling measures have been the central environmental issues. Statements concerning the difficulty of pollution control disappeared and the viewpoint that SMEs do not possess sufficient economic power hardly came to be mentioned at all; rather, the emphasis came to be placed on vigorously promoting environmental measures.

3.4 Analysis of Corporate Behavior

3.4.1 Factors Influencing Corporate Behavior

Officials, managers, former managers and former employees of the target companies were interviewed in order to find out the factors that had the biggest impact in making them realize the necessity of implementing pollution and environmental countermeasures in the past. Factors that indirectly and directly influenced their thinking can be summarized as follows:

- Establishment and strengthening of laws and regulations
- Trends in legal sanctions
- Legal liability concerning past pollution
- Corporate social responsibility for environmental problems
- Social pressure by mass media and so on
- Pressure by consumers (consumer boycott)
- Instructions and guidelines by governments
- Instruction by industrial associations
- Relationship with rival companies
- Relationship with clients
- Trends in global regulations
- Corporate images
- Complaints and opposition movements by local residents

3.4.2 From the Start of Pollution Countermeasures in the 1970s to the Mid-1980s

a. Motivation to Implement Industrial Pollution Control

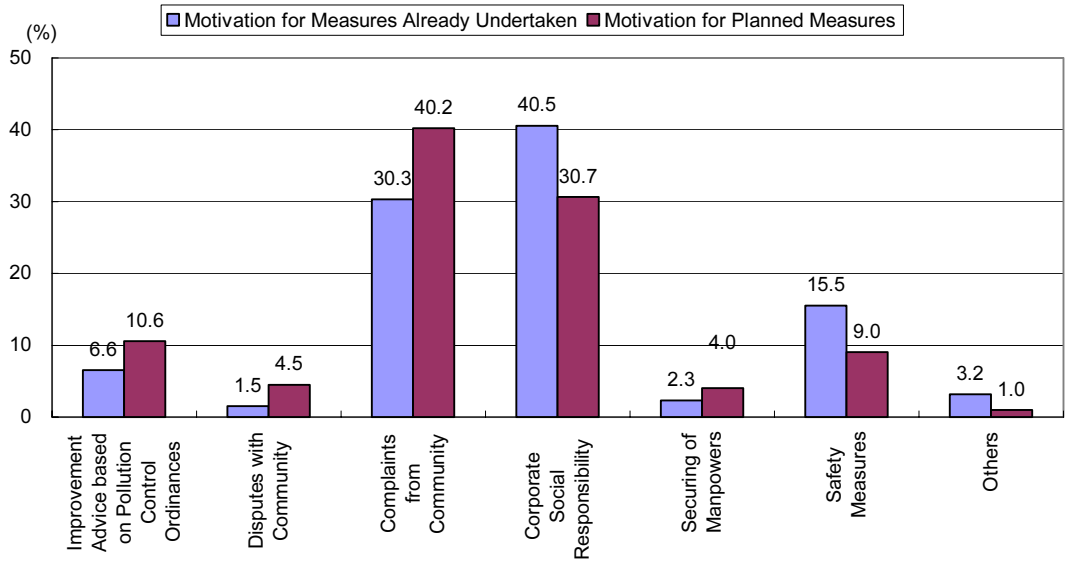
According to the results of a survey by the Japan Finance Corporation for Small and Medium Enterprises conducted in 1970, as shown in Figure 3.4.1, the most commonly given motive for implementing pollution control measures was the social responsibility of enterprises at 41%, followed by complaints from residents at 30%. This social responsibility is thought to include responsibility imposed by stronger legal regulations. The social responsibility and the complaints were major factors in forcing enterprises to take measures. The disparity with other factors is large. Among enterprises thinking of implementing pollution control in the future, the most commonly given factor was complaints by local residents followed by social responsibility.

According to surveys conducted by the Tokyo Metropolitan Government, 60 to 70% of the respondents (companies) listed enhancement of pollution regulations as the major motive to take pollution control measures in the early 1970s. The ratio decreased during the latter half of the 1970s to 40% in 1979 (see Figure 3.4.2). The next major motive is instruction and advice by governments.

In any case, there is no doubt that external pressures such as legal enforcement and guidance by local governments were the most powerful factors to lead industries to pollution control investment.

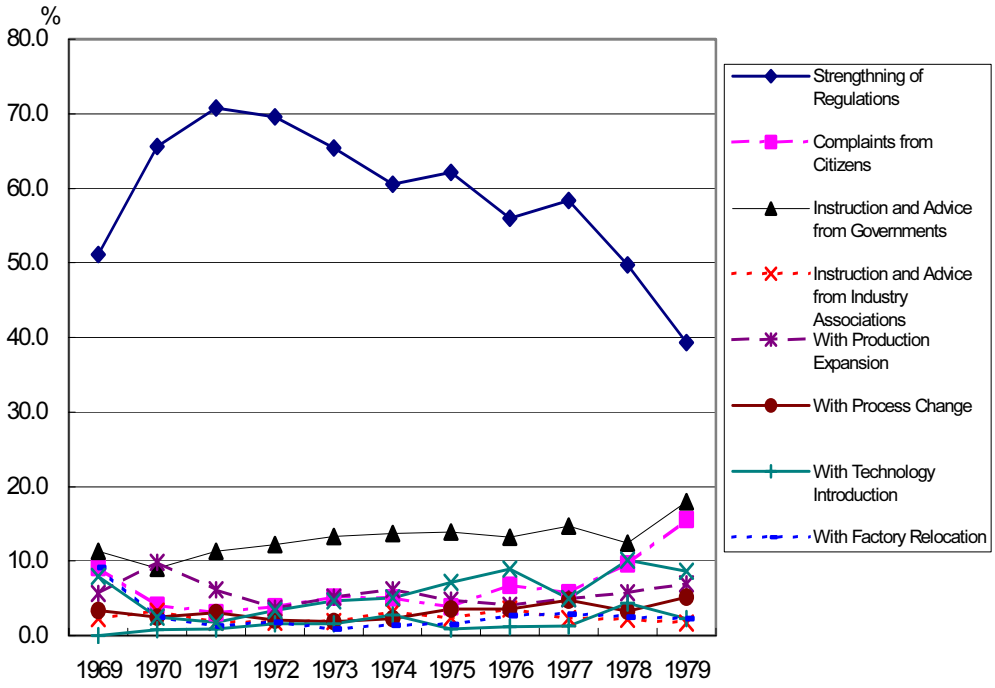
As was shown in Figure 3.3.8, clearly a close link can be found between trends of the external factors (regulations, etc.) and the amount of pollution control investment in Japan.

According to the results of Figure 3.4.2, complaints from residents around factories do not necessarily account for a direct motive for environmental measures. However, as is indicated in Figure 3.4.1, complaints had a major influence in making it unavoidable for enterprises to take measures including plant relocation.



Note: Survey of 1,991 companies by the Japan Finance Corporation for Small and Medium Enterprise in 1970. Number of samples: 1,431 companies.
Source: Toyo Keizai Shinposha, "Chusyo Kigyo ha Kogai wo do Fuseguka," *Shukan Toyo Keizai*, No.3571, December 12,1970

Figure 3.4.1 Motivation for Pollution Prevention Measures



Source: Tokyo Metropolitan Research Institute for Environmental Protection, "Questionnaire to Companies in the Tokyo Area," 1978

Figure 3.4.2 Motivation for Installation of Pollution Prevention Facilities (1969-1979)

According to *the 1972 White Paper on Small and Medium Enterprises*, "SMEs located in urban areas are sometimes unable to secure sufficient installation space because their premises are restricted to begin with. Moreover, because noise and vibration pollution occurs when SMEs locate in areas of dense residential population, the fundamental solution is for companies to relocate; however, finding an appropriate relocation destination is not easy for SMEs."

Moreover, the White Paper went on to point out that because implementation of pollution control measures is very costly and the required plant investment does not yield any profit, "So far, pollution control measures by SMEs have frequently been passively motivated by complaints from residents or recommendations and orders from local authorities and so on."

b. Concerning Factors that Trigger Countermeasures

Following the strengthening of environmental controls that took place in the 1970s, corporate activities underwent further changes as a result of the two oil crises and appreciation of the JPY from 1985 onwards. Following subsection summarizes the results of interviews conducted for the measures taken in the 1970s.

Table 3.4.1 Assessment of Influencing Factors (From 1970s to mid 1980s)

	Air Pollution Control	Water Pollution Control	Waste Management	Environmental Management
Establishment and strengthening of laws and regulations	XXX	XXX	XX	XX
Trends in legal sanctions	X			
Legal responsibility for past pollution	X			
Corporate social responsibility on environmental problems	X	X		
Social pressure by mass media	XX	XX	X	
Pressure by consumers				
Instructions and guidelines by governments	XX	XX	X	X
Instruction by industry associations	X	X	X	X
Relationship with competitive companies				
Relationship with business partner				
Global motivation of regulation				
Company Image	X	X		
Complaints and opposition movements by local residents	XX	X		

Note: XXX: Very Large Influence, XX: Large Influence, X: Some Influence, Blank: No Influence

As shown in Table 3.4.1, the greatest factor in the changing awareness of enterprises towards air pollution and water pollution in the 1970s was the strengthening of laws and regulations on emission gas and wastewater. Companies recognized that complying with pollutant emission/discharge standards was a major prerequisite for conducting business and that they had to take countermeasures for that purpose.

However, even though legal responsibility may have been the greatest factor in raising awareness, the role of various other supplementary factors cannot be ignored. Of particular importance was the role of improvement guidance and pressure on polluting enterprises from local governments and the public health centers. Other important factors, albeit of varying

weight according to sector, were social pressure by the mass media, trends in legal sanctions, complaints and opposition movements by local residents, and so on.

Taking the example of the plating industry, advice and guidelines by governments, trends in legal sanctions, and advice from industry associations were major factors in raising awareness. The fact that information collected in accordance with the Factory Location Law of March 20, 1959 was available to the prefectures and ordinance-designated cities, had significant importance because this permitted the authorities to promptly contact plating companies and provide up to date information concerning water pollution controls. Such information had been collected even before the enactment of Water Pollution Control Law.

Furthermore in the plating sector, industry associations were organized on the prefectural level, through which information was disseminated to individual companies. In addition, there were incidents where the drinking water intake was closed down because sodium cyanide used for plating had been discharged into rivers, and personal-injury had occurred in the sewage system, leading to the plating industry as the most priority target for strict enforcement of the legislation and a police clampdown. Such incidents had a major influence on the thinking of business owners in the plating industry.

In the metal processing sector, which involves chemical conversion coating and other coating processes, emission gases, hydrocarbon, and wastewater containing waste acid and waste alkali, and the like are generated. The major factors that made the companies realize the need for countermeasures were legal requirements, followed by social pressure from the mass media, and site inspections by government agencies. Other factors did not have such an important influence.

Taking the case of animal feed manufacturing industry, complaints by local residents reported to the local government were the major factor in triggering change in awareness of the enterprise of the need to take environmental measures. These complaints led to encouragement by the local government for the enterprise to take the required measures and created its recognition that resolving environmental problems was essential for corporate survival.

As for the pulp and paper industry, which is the biggest source of pollution in terms of the wastewater pollutant load, there was indeed a conflict between pulp and paper plants on the Edo River in Tokyo and the fishermen of Urayasu in Tokyo Bay that led to the enactment of the former Water Quality Conservation Law and Industrial Wastewater Control Law of 1958.[3] This manifestation of pollution problems in the pulp and paper industry also contributed to the implementation of wastewater control measures from the 1960s onwards. Paper mills also generated problems in terms of noise, odor, air pollution and solid waste. Moreover, use of slime prevention agents in plants caused mercury discharge problems, and this substance was eventually banned in 1965.

In the 1970s, paper mills came to regard themselves as pollution sources needing to comply with laws and regulations. The issue they faced was how to implement pollution control measures that were inexpensive and rational. With respect to air pollution, joint malpractice by industrial complex companies was recognized in the Yokkaichi pollution suit. Moreover, the fact that companies could not escape joint liability even if the amount of particulate discharged by a factory was small and the connection with individual cases of damage could not be proven came as a major shock to the industry[4]. Another prominent case was Minamata disease, and there are numerous testimonies that industrial pollution lawsuits gave corporate personnel a large shock. Moreover, it may be said this shock spread through the entire manufacturing industry.

3 HASHIMOTO Michio, *Shishi Kankyo Gyosei*, Asahi Shinbunsha Publishing, 1988, p.46
4 Japan Technical Association of the Pulp and Paper Industry (Japan TAPPI), “Kankyo Taisaku - Yosui”, 1978

As may be gathered from the above, almost all companies discharging pollutants realized that they had to respond to the pollution control legislation of the 1970s, and much of this realization came as a result of pressure from local governments, the mass media and the public.

c. Supplementing of Factor Analysis

The Small and Medium Enterprise Agency compiled and issued the anthology of cases of pollution control in SMEs from 1972 to 1979.[5] Many of the cases from 1972 to 1975 describe the motives behind the measures. Although it is not possible to view data in statistical terms, it is clear that the cases fell into the following three categories.

'Cases where measures were forced by complaints and opposition by residents':
In these cases, measures were taken in response to complaints about damages to the living environment caused by noise, odor, soot and dust and wastewater.

'Cases where measures were forced by complaints and requests from fishermen's unions and agricultural cooperatives':
In these cases, measures were taken in response to damages caused by water pollution.

'Cases where it was necessary to respond to legal regulations':
In these cases, measures were taken to comply with effluent/emission gas standards for wastewater and emission gases.

These were the three main patterns, although pollution control measures were also adopted in other types of cases. For instance, there were small factories that implemented organic wastewater treatment even though those factories were not regulated by the Water Pollution Control Law, which regulates 50 m^3 or more of daily effluent discharges of wastewater. In such cases, business owners implemented the measures for social responsibility, believing that plants should exist in harmony with communities, or that contaminated wastewater would certainly become a problem in the future if left unattended.

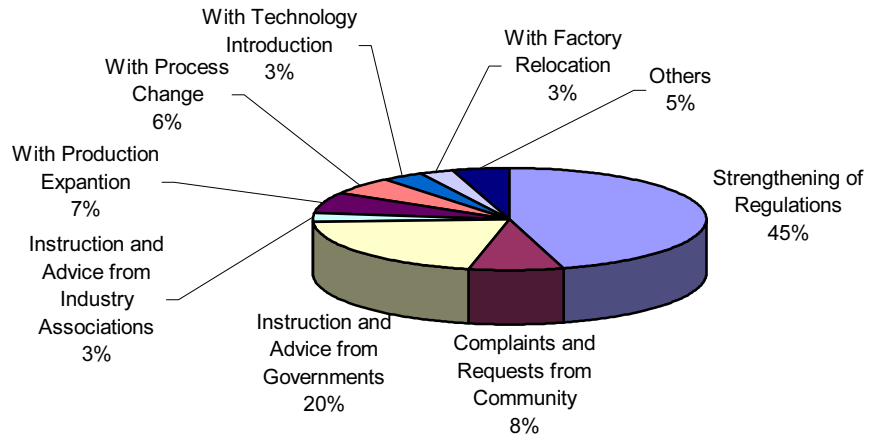
The motives directly affecting measures were as indicated above. Generally speaking, the largest factor in forcing enterprises to take pollution control was undoubtedly the fact that companies were subjected to pressures from all directions in the 1970s by victims of pollution i.e. citizens, farmers, and fishermen, as well as the mass media and pollution control regulations.

3.4.3 1986 (when Pollution Problems Shifted to Environmental Problems) and After

a. Motivation for Environmental Measures

As a relatively recent study on the motives behind pollution control investment, there is a survey carried out by Tokyo Metropolitan Government in 1990. According to this study, as can be seen in the Figure 3.4.3, it has not fundamentally changed from the situation in the 1970s where the external pressures such as strengthening of regulations and advice/guidance from authorities occupied a large weight in motives to carry out pollution control measures. However, compared to the early 1970s, the ratio of the investment motivated by strengthening of regulations was lower.

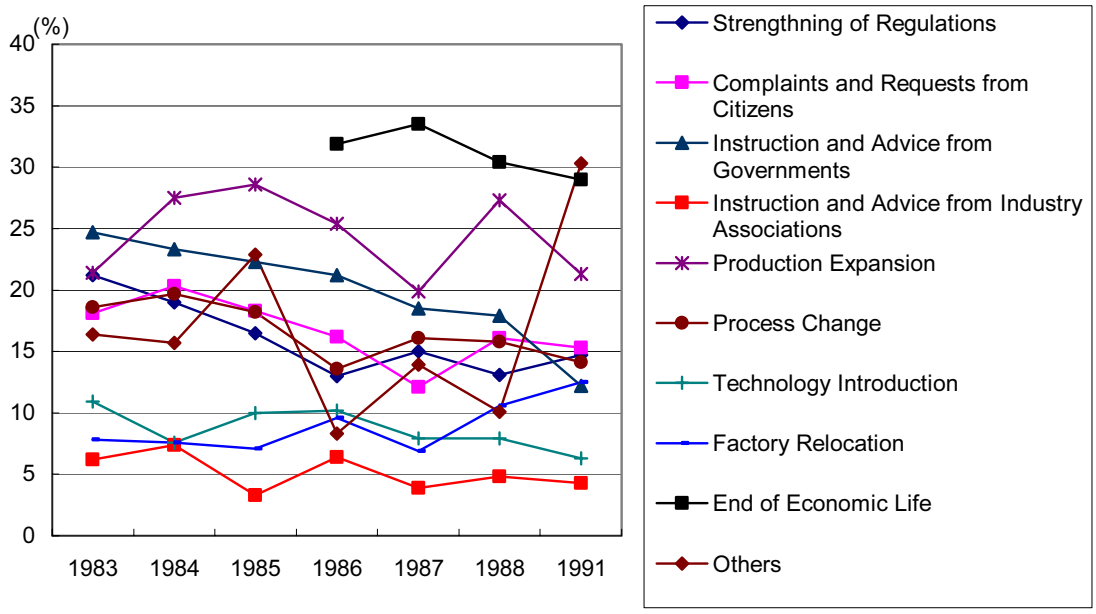
5 The anthology of case examples, edited by the Small and Medium Enterprise Agency, has organized examples of successful pollution control measures taken by SMEs. Many of these businesses are already out of business or bankrupt.



Note: Results from questionnaire to 2,087 offices of manufacturing businesses in Tokyo
Source: Tokyo Metropolitan Research Institute for Environmental Protection, "Survey on Status of Pollution Control Investments" 1990

Figure 3.4.3 Motives Behind Pollution Prevention Investment

In addition, the survey on shifts in pollution control investment by SMEs pointed out that the factors behind future investment plans was the necessity of renewal of existing facilities at the end of their useful life. This is indicative of the fact that facilities that were installed in the 1970s required renewal from the latter 1980s through to the 1990s.



Source: Environment Agency / Small and Medium Enterprise Agency, "Survey on Shifts in Pollution Control Investments by SMEs"

Figure 3.4.4 Motives for Pollution Control Investment by SMEs (1983-1991)

b. Factors Triggering Countermeasures

From the latter part of the 1980s, except for the issue of industrial waste, the emphasis shifted from pollution problems to environmental problems. This can be clearly gathered from the weight of factors influencing company awareness. The factors pertaining to the relationship of enterprises with society came to account for a higher weight. Out of the factors given below, the most specific one is relationship with business partners; here, the fact that

acquisition of ISO 14001 came to be required in relationships with business partners (supply chain) affects the attitude companies adopt towards environmental measures.

- Corporate social responsibility for environmental problems
- Social pressure from mass media
- Relationship with competitors
- Relationship with business partners
- Global trend in environmental regulations
- Company images

Table 3.4.2 Assessment of Influencing Factors (1986 onwards)

	Air pollution control	Water pollution control	Waste management	Environmental management
Establishment and strengthening of laws and regulations	X	X	XX	XX
Trends in legal sanctions			X	
Legal responsibility for past pollution	X			
Corporate social responsibility on environmental problems	X	X	XX	XXX
Social pressure by mass media			XXX	XX
Pressure by consumers				X
Instructions and guidelines by governments		X	XX	X
Instruction by industry associations	X	X	X	X
Relationship with competitive companies				X
Relationship with business partner				XX
Global motivation of regulation				
Company Image	X	X		XX
Complaints and opposition movements by local residents				

Note: XXX: Very Large Influence, XX: Large Influence, X: Some Influence, Blank: No Influence

For the plating industry, the main issues facing the industry today are a) need for fluorine control in wastewater, b) controlling zinc concentration to meet effluent standards, c) organic solvent management containing toxic metals and hazardous solvent, and d) proper treatment of sludge from wastewater treatment. Nonetheless, the plating industry has become hollowed out in recent years, and many companies have gone out of business. Enterprises that lack prospects for future development only try to comply with the relevant laws; whereas more ambitious enterprises realize that future business expansion is limited unless they switch to plating processes with lower environmental loads.

In the pulp and paper industry, the traditional problems of air pollution, water pollution, noise, vibration and odor remain important issues but have settled down. Major issues today are centered on countermeasures for global warming, reducing the waste generation, effective utilization of waste, countering of environmental risks caused by minute quantities of

chemicals, and establishment of environmental management systems.[6] Companies consider it is necessary to tackle these issues for social responsibility, in particular. Although the Ministry of Economy, Trade and Industry and the Japan Federation of Economic Organizations also give encouragement to prepare and implement an industry-wide voluntary action plan on environmental protection, the most important factor is that top management realize the need for the plan. The industry association also gives its member companies encouragement to implement the plan, and SMEs in this sector may be classified into willing companies that positively respond to such calls and unwilling companies that only take measures to keep up with their rivals.

Furthermore, the pulp and paper industry is regarded as the prime sector for recycling in the future, and some enterprises consider environmental conservation activities to be the main component for future company development. These changed attitudes have largely been formed by public opinion on global environmental problems and the fact that business managers have grown accustomed to dealing with environmental issues.

Incidentally, conflict with residents over management of industrial waste has become the most contentious issue, and this has caught the attention of business managers regarding industrial waste problems. Having said that, it is often wrongfully believed by SMEs[7] that they are released from liability once they have consigned their industrial waste for treatment/disposal to waste treatment/disposal operators.

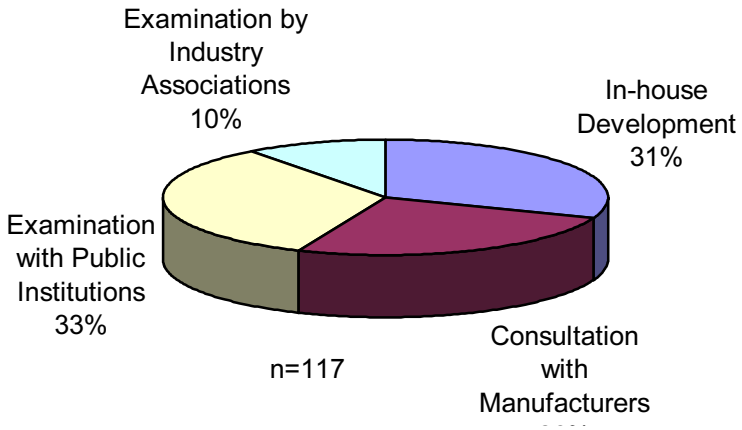
[6] Japan Paper Association, *Kankyo ni kansuru Jishu Kodo Keikaku*, prepared in 1997 and partly revised in 1999 and 2001

[7] The definition of SMEs is companies " where the total amount of capital/total amount of investments are below 3 billion yen and whose regular employees are below 300", according to the Small and Medium Enterprise Basic Law.

3.5 Approaches to Technology, Funding and Land in Promoting Pollution Control Measures

3.5.1 Approach to Technology

Figure 3.3.11 showed the importance of selecting inexpensive and appropriate pollution control technology for enterprises in the 1970s, when they had no choice but to implement pollution control. This section summarizes how enterprises responded to this challenges based mainly on the "Cases of Successful Pollution Control by SMEs" by the Small and Medium Enterprise Agency as well as the results of the interview survey conducted in this study.



Source: Small and Medium Enterprise Agency, "Cases Example of Successful Pollution Control Measures by SMEs", 1973-1978

Figure 3.5.1 Approach to Examining Pollution Control Technologies

There are 17 cases in the report where technical measures were taken. Nine of these cases were dealt with inside the business for reviewing and/or developing the technology. Next, there were seven cases where enterprises received advice from public agencies/institutions. There were two cases of enterprises conducting examination by organizing study sessions under the industry association and establishing a cooperative association. Although it cannot always be said that these examples are representative cases, they are considered to represent the characteristic trends of Japanese enterprises.

The first thing that can be noticed from the case examples and the interview survey is the existence of business owners possessing an engineering background, followed by the fact that many business owners regard technical capability to be vital to company survival. Such trends are reflected in the fact that numerous enterprises conducted their own investigation and technological development when it came to examining pollution control technology. Of particular importance is the fact that the attitude of business owners determined such examination and development irrespective of the scale of enterprises.

This trend among business owners of taking personal responsibility for examining pollution control technology is reflected in the fact that enterprises were willing to listen to the opinions of engineers in authorities and public research institutions, to observe pilot cases in rival firms, and to learn through study sessions staged with other companies in the same sector.

Following are summaries of some of these cases:[8]

8 The cases that have the names of the companies are from Small and Medium Enterprise Agency, "Case Examples of Successful Pollution Control Measures by SMEs."

- Taiho Industries Co., Ltd. (plating): This company had 78 employees in 1972. A plant expansion plan was opposed by local residents, which led to the examination of the installation of a wastewater treatment facility. A plant manager and two engineers led the examination in which they started analyzing the quantity and quality of wastewater. Then, they examined the optimal treatment facility and ended up designing and installing the facility by themselves. The plant manager subsequently played an important role as instructor in the field of pollution control.

- Kawai Senko Limited Company (dyeing): This company had 11 employees in 1972. It received technical advice from the Fukuyama Textile Research Institute under Hiroshima Prefecture and attended dyeing workshops held in the institute. For one year, the institute continued to provide detailed advice, introduced case studies on wastewater treatment facilities and held factory tours. The company staff observed and studied operating conditions of the treatment facility at the manufacturer with proven operation records. Receiving the advice of the institute, the company held tests in joint efforts with the manufacturer and designed its wastewater facility based on the results.

- Shinmen Tekkojo Co., Ltd. (metal processing): In 1972, this company had a workforce of 60 employees. In order to remove particulate in the sandblast process for removing dirt and rust from the surface of steel products, it developed a bag filter filtration device; however, the device was ineffective due to the lack of volume of air and area of filtration. Consequently, the company tentatively implemented wet washing while seeking more drastic measures. The company examined the possibility of installing an electrostatic precipitator, however, it abandoned this option due to the massive cost entailed. Instead they conducted development of a dust control device with a casting manufacturer, S Co. The company's technical staff examined and assessed the concentration of dust and approved development of the device, then ordered it from S Co.

- Shiga-Ken Pharmaceuticals Co., Ltd. (chemical industry): In 1977, this company had a work force of 128 employees and produced medical supplies. Soluble organic substances generated in the manufacturing process required proper treatment. In 1972, it established a project team to examine ways to respond to the Water Pollution Control Law. The basic survey sub-team investigated legal systems, wastewater channels and fluctuations in wastewater flow, while the countermeasure sub-team examined measurement technology and treatment technology. The team examined an appropriate treatment facility and introduced it in 1975.

- Hida Seishi Co., Ltd. (pulp/paper): In 1973, it was a small enterprise with 53 employees manufacturing tissue paper. In response to request from local fisheries cooperatives, it decided to implement pollution control measures. Under the initiative of the vice president, all technical personnel in the company were mobilized to thoroughly examine and introduce a wastewater treatment unit.

- Niigata Food Industries Center (Cooperative): In 1965, 12 SMEs including eight micro businesses relocated to a food industrial estate. Although each company discharged less than the 50 m^3 prescribed for wastewater treatment under the law, they decided to develop a joint wastewater treatment plant because the combined volume of discharges from all the companies amount to 370 m^3. The type of treatment system was determined by preliminary study and research with a water treatment equipment manufacture under guidance of Niigata Food Research Institute.

- Kuroda Plating Co., Ltd. (plating): In 1974, it was a small enterprise having 54 employees. The president proclaimed the goal of a pollution-free plant and recruited an external engineer as head of the research department to examine possible measures. As a result of these efforts, the company introduced a closed wastewater system.

- Kakunan Senkojo Co., Ltd. (dyeing): In 1974, it was a small enterprise having 60 employees. Supported by the prefectural Industrial Research Institute and plant manufacturers, the company carried out wastewater quality surveys and treatment tests. Moreover, it observed pilot presentations staged by an informal technical gathering of the prefectural textile dyeing industries cooperative association. Whereas rival companies in the sector consigned examination of proper types of wastewater treatment facilities to plant manufactures, this company independently designed and constructed its own one.

- Nagoya Oil and Chemical Industries Co., Ltd. (chemical industries): This small manufacture of adhesives had 40 employees in 1974. Under advice from Aichi Prefecture Industrial Guidance Center, it installed an emission gas desulfurization facility for small boilers and developed and introduced an efficient desulfurization agent.

- K Spinning Co., Ltd.: It is a large enterprise and in 1969 formed a project team comprised of the company technical research institute, the facilities department, the processing department and the factory staff. The team embarked on full-scale research into pollution control. In 1970 it developed emission gas desulfurization equipment utilizing waste alkali from the bleaching process. Also in 1970, it established an engineering division and started to retail the unit. The textiles are still the main product of the company, but its engineering department has also developed into one of the top pollution control equipment manufacturers in Japan.

- N Fish Meal Manufacturing Co., Ltd: This small enterprise currently has 80 employees. The company determined that the odor issue was a problem that affected the very existence of the company, and the vice president in charge of engineering started reviewing the countermeasures. In examining new technologies, the company received guidance from the Japan Environmental Sanitation Center. In addition, it evaluated treatment devices under technical support provided by plant manufacturers.

The above cases represent only a fraction of the entire effort put by Japanese SMEs into the control of pollution. However, they clearly show the characteristics of the measures taken by industry, i.e. number of companies reviewed and/or developed their own technologies, and prefectural industrial research institutes provided detailed technical guidance. In particular, companies in the dyeing, food processing and pulp/paper industries that were rooted in a local economy, typically sought the advice and guidance from public institutes established in their prefecture.

At the beginning of the 1970s, SMEs had little choice but to examine pollution control measures independently; however, by the second half of the 1970s, public institutions started to provide diagnostic services. This point will be further discussed in Section 3.7.3.

3.5.2 Funding

a. Early 1970s (at the start of pollution control investment)

It was apparent that funding was a big burden for SMEs. Although SMEs were facing the problem of excessively small capital, they had no choice but to depend on financial institutions for funding. However, it is said that SMEs had hard time to get funding from private financial institutions because banks felt high risk in lending to SMEs due to their financial status.

Banks in general were not positive for lending money on a long-term basis because pollution control investment did not directly contribute to industries' revenue. Entrepreneurs on the

other hand were afraid of the fact that increased interest costs adversely affected operational profitability.[9]

Banks at that time advised SMEs to utilize public financing programmed under the Pollution Control Service Corporation, the Small Business Promotion Corporation, the Central Cooperative Bank for Commerce and Industry, the Japan Finance Corporation for Small Business, for long-term funding for investment to pollution control measures. In fact, many SMEs successfully utilized such public loan programs. Public loan programs offered long-term repayment periods with low interest rates. They contributed to some extent to stabilizing the business operations of some industries in spite of the increased loan burden. In particular, obtaining long-term funding from commercial banks was generally difficult for SMEs, but there was a system whereby government financial institutions responded to SMEs' demand for funds, which is very different from the situation in developing countries.

In the early 1970s, the nominal market interest rate was rather high at 6-8%, and the financial environment for SMEs was further worsened by the fact that they held low own capital rates (excessively small capital). The harsh nature of the financial environment for SMEs was also stated in *the White Paper of Small and Medium Enterprises* in 1970 and 1972.

However, in spite of this difficult environment, banks provided SMEs with funding, and the main reasons for this were that high real economic growth was continued, future growth could be anticipated, and expected profit levels of companies were extremely high. Although SMEs held a low capital adequacy ratio, they sustained high profits and were able to take a positive attitude towards investment because sales were growing and future expected profits were high. Moreover, conditions for borrowing funds were not as difficult as they first appeared because the domestic savings ratio at the time was high, financial agencies held relatively large amounts of funds, and the real interest rate was still low for companies.

Furthermore, a very important factor in raising funds was whether or not SMEs and financial institutions had a trading history and good relations.

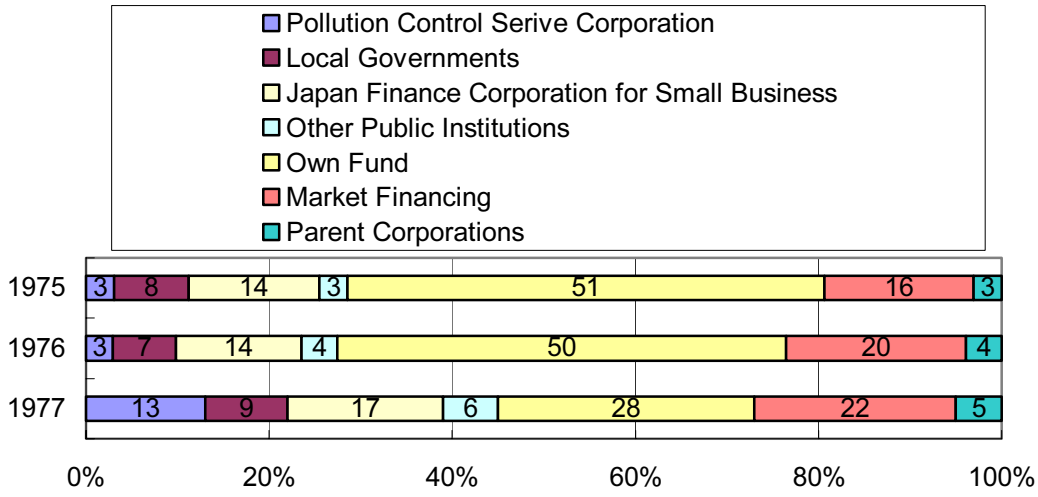
Looking at the case examples of successful pollution control measures by SMEs compiled by the Small and Medium Enterprise Agency, pollution control investment was divided into cases where measures were implemented in line with factory construction, plant relocation, or expansion and cases where measures were implemented for existing plants. Demand for funds arose in all cases, and it can be seen that public funding was utilized in both. Particularly in cases of pollution control measures by individual enterprises, public funding provided by local governments was utilized in many cases, and there were also examples of funding by the Pollution Control Service Corporation. Public funding of the Small and Medium Enterprise Agency was utilized in cases of implementing pollution control through cooperative or grouping efforts by SMEs or financing investment in pollution control measures in line with facility modernization in SMEs.

According to survey findings for 1970 given in *the 1971White Paper on Small and Medium Enterprises*, investment in pollution control measures was 18 million JPY per enterprise. Also, according to the anthology of the case examples, the pollution control investment cost for one wastewater treatment plant was approximately 47 million JPY, and the average public loan for this purpose was approximately 37 million JPY. In the case of emission gas treatment equipment, the average investment cost per case was approximately 66 million JPY, whereas the average public loan was approximately 25 million JPY (see Section 3.6.1).

The following Figure 3.5.2 shows a breakdown of the sources of funding for pollution control investment by SMEs in 1975 (ratios based on multiple answers). Although care is required in interpreting this information due to the fact that the ratios do not indicate financial amounts, it

[9] Small and Medium Enterprise Agency, *1970 White Paper on Small and Medium Enterprises*, Chapter 2 Section 4

can be seen that there were few cases of enterprises conducting activities based on own funds while relying on public financing and rarely utilizing private financial institutions.[10]



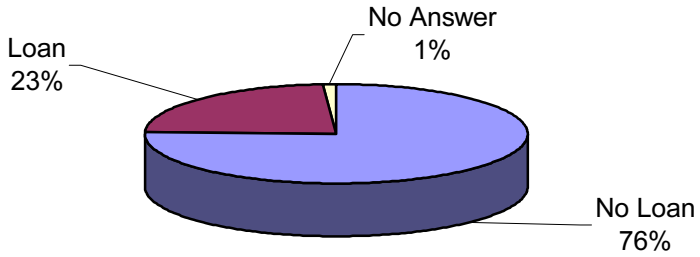
Note: Percentage of each article to the total of multiple answers. Forecast data for 1977.
Source: Pollution Control Service Corporation, "Survey on Shifts in Pollution Control Measures by SMEs", 1976

Figure 3.5.2 Sources of Funding for Pollution Control Measures by SMEs

b. Periods after Pollution Problems became regarded as Environmental Problems

Key pollution control investments had been completed by this time period, and new investments were for renewal, modification, and improvement of pollution control equipment/facilities to satisfy new regulations. As may be seen in Figure 3.6.2, pollution control investment by SMEs was around 10 million JPY per enterprise, which was lower than the amount being spent in the 1970s.

Similarly, based on the results of the "Survey on Shifts in Pollution Control Investments by SMEs", by the Environment Agency and the Small and Medium Enterprise Agency, far more enterprises implemented pollution control measures using own funds rather than borrowed funds, as is indicated in Figure 3.5.3. This shift was influenced by the fact that the amount of investment per case was relatively small and the fact that SMEs enjoyed relatively high capital adequacy ratio and financial health in the 1990s compared to the 1970s.

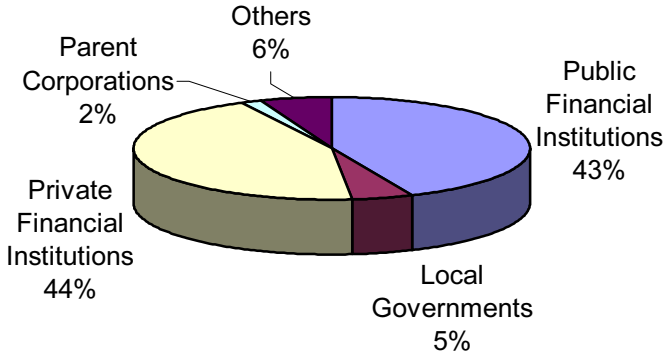


Source: Environment Agency/Small and Medium Enterprise Agency, "Survey on Shifts in Pollution Control Investments by SMEs", 1990

Figure 3.5.3 Pollution Control Investment Cases with or without Loans (1990)

[10] Judging from the cases of public financing, a great percentage of investments for pollution control by SMEs were probably covered by public financing.

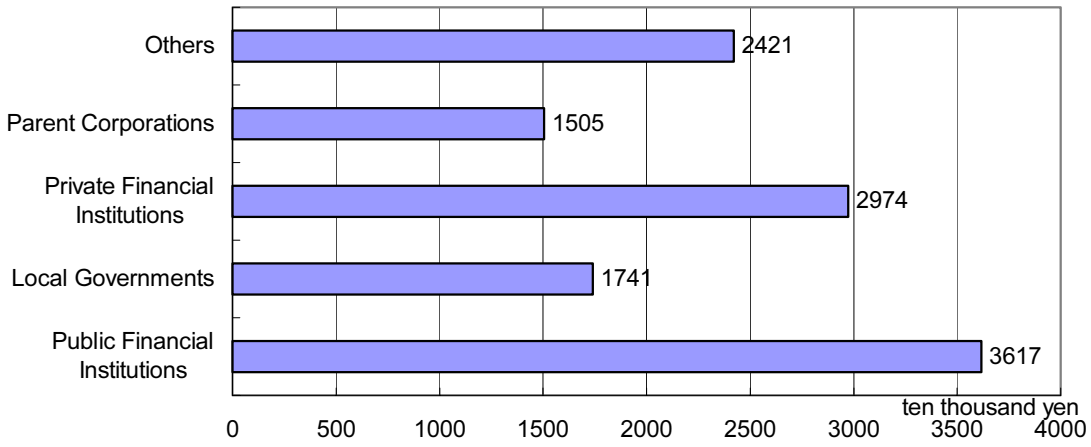
The ratio of borrowed funds according to the source of financing, as shown in Figure 3.5.4, was largely divided between public financial institutions and private financial institutions. It can be seen that for borrowing enterprises the weight of public financial institutions remained large even at this time.



Source: Environment Agency / Small and Medium Enterprise Agency, "Survey on Shifts in Pollution Control Investments by SME", 1990

Figure 3.5.4 Source of Finance for Pollution Control Investment by Amount(1990)

Figure 3.5.5shows the average amount of funds borrowed from each source, that is 36 million JPY from public institutions and 29 million JPY from private institutions. It may be gathered that public financial institutions were utilized more often in cases requiring relatively larger investment.



Source: Environment Agency / Small and Medium Enterprise Agency, "Survey on Shifts in Pollution Control Investments by SMEs", 1990

Figure 3.5.5 Average Amount Borrowed by Source of Finance

3.5.3 Measures for Factory Location

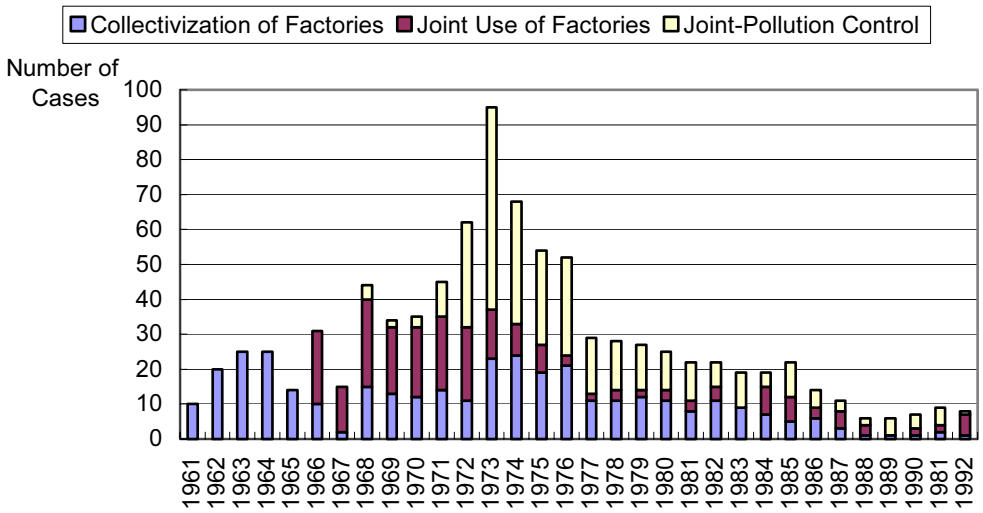
Almost none of SMEs during the 1950s and 1960s were located in purpose-built industrial estates, but rather in and around urbanized areas. Moreover, hardly any enterprises were able to secure ample land for premises at this time. Even if surrounding areas were not densely populated in the beginning, as urbanization progressed in line with a high rate of economic growth, residential areas grew and friction started to occur with local residents over pollution

problems. Many of these SMEs did not have spare space to start with, and they were faced with a dilemma when it became necessary to install space-consuming wastewater treatment plants in order to comply with legislation. Moreover, concerning noise and vibration problems, since relocating was the only effective solution, companies were forced to move their premises.

In these circumstances, among SME policies designed to promote relocation to better environments, a grouping program (industrial estates, etc.), a joint facilities utilization program (factory complex, etc.) and a factory sharing program (joint factories) were promoted. Figure 3.5.6 shows movements in grouping and factory sharing. These policies were commonly implemented during the 1970s but less so in the 1980s. Particularly in large cities, group relocations were aggressively promoted in order to resolve issues created by residential and industrial mixing. It may be gathered that SMEs made active use of these policies.

Looking at the "Case Examples of Pollution Control in SMEs", the 1970s were also a time when enterprises actively promoted the new construction and expansion of plants in order to expand business operations. By relocating production facilities for pollution control purposes, enterprises frequently accomplished the expansion and modernization of business activities at the same time. Put another way, not having sufficient land meant enterprises had no space or options to expand their production. Accordingly, since it was the era of high economic growth from the 1960s into the 1970s, enterprises relocated their facilities and acquired land in order to expand production, and implemented pollution control measures as well as overcoming the land issues that previously impeded pollution control facilities.

Land problems were also resolved by enterprises grouping together to establish cooperatives and developing joint pollution control facilities.



Source: Small and Medium Enterprise Agency, "List of Measures for Small and Medium Enterprises", and "Summary of Measures for Small and Medium Enterprises"

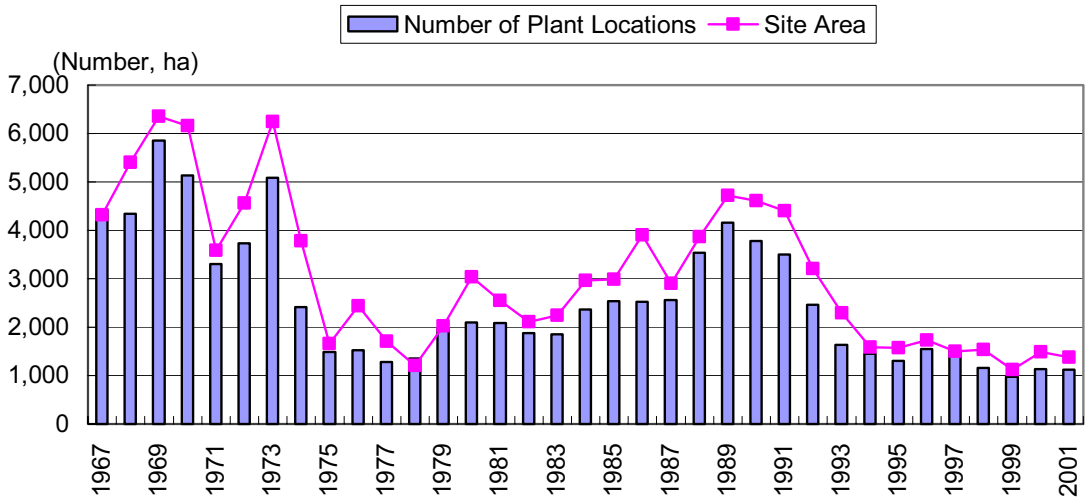
Figure 3.5.6 Numbers of SME Grouping Projects, etc. (1961-1992)

Figure 3.5.8 shows the trend in the number of plant relocations. Industrial sites increased in terms of both number and site area from the late 1960s to the early 1970s. However, the numbers receded in the latter half of the 1970s following the first oil crisis.

There are no cases of land problems concerning pollution control facilities since the early 1980s. Many SMEs located in industrial estates prepared by local governments and the Japan Regional Development Corporation, but rather than securing land for pollution control facilities, the main purpose of these locations was to secure premises for business expansion.

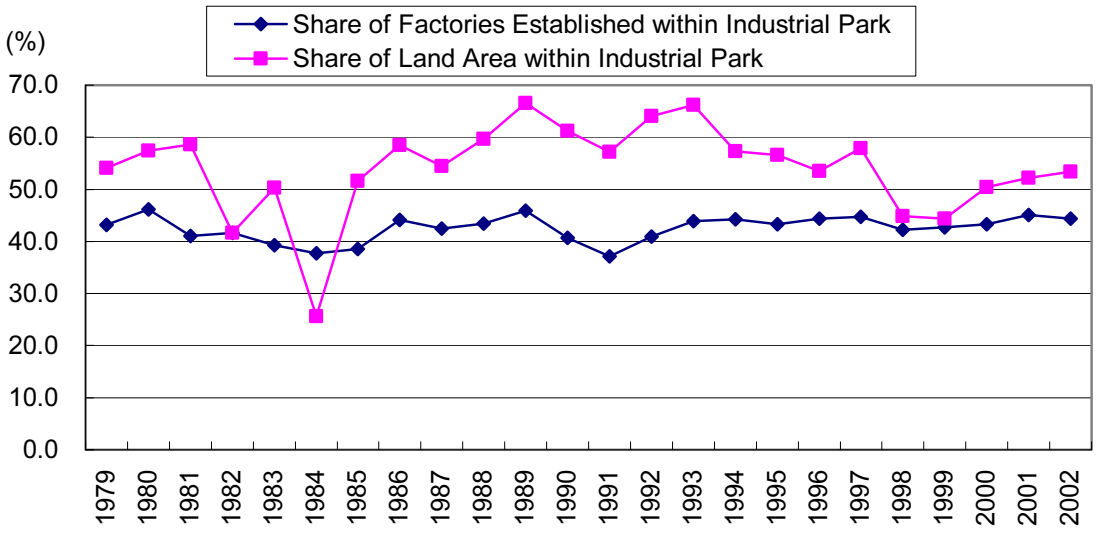
In the case of such locations, investment into pollution control was incorporated as an essential element.

Particularly concerning plant locations in the 1980s, the ratio of locations in industrial estates was around 40% in terms of the number of locations, however, it was between 50-60% in terms of land areas. This shows how industrial estates responded to the demand for industrial land.



Source: Ministry of International Trade and Industry, "Survey on Situations of Industrial Sites"

Figure 3.5.7 Trends in Plant Site Location (1967-2001)



Source: Ministry of International Trade and Industry, "Survey on Situations of Industrial Sites"

Figure 3.5.8 Coverage of Industrial Location by Industrial Estates (1979-2001)

3.6 Cost Impact of Environmental Measures

3.6.1 Rate of Pollution Control Investment and Invested Amounts

a. Early 1970s (at the start of pollution control investment)

Pollution control investment incurs costs, which in turn leads to higher production costs. This cost increase was viewed as a major problem affecting business from the early 1970s.

The rate of pollution control investment for the manufacturing sector as a whole also includes companies that did not made any investment, as discussed in Chapter 1 section 12. Accordingly, this investment rate is lower than the actual rate of investment for companies that did invest. It has been possible to gauge the pollution control investment rate in companies that actually invested from 1974 onwards. According to this, the investment rate was 11.8% in 1974, 17.3% in 1975 and 14.8% in 1976, and then it varied between 1-3% during the 1980s. In the 1990s, the investment rate increased to between 3-5%.

The investment rate also differs according to sector; it was particularly high in the heavy and chemical industry such as oil refining, chemicals, pulp and paper, iron and steel, metals and ceramics, etc., and the resulting impact on costs was also relatively higher in these sectors.

Looking at the amount of pollution control investment by SMEs at the start of the 1970s, according to *the 1972 White Paper on Small and Medium Enterprises*, approximately 18 million JPY of investment was made per company in 1970. Moreover, according to a survey carried out by the Japan Finance Corporation for Small and Medium Enterprises, as shown in Table 3.6.1, the average amount of pollution-related investment was 11 million JPY per company.

Although the rate of pollution control investment varies by industry sector, one can say it was approximately 12% on average.[11]

Table 3.6.1 Pollution-related Investment by Industrial Sector (1970)

	Number of companies investing in pollution control	Average amount of capital investment per company (million JPY)	Average amount of pollution control investment per company (million JPY)	Ratio of pollution control investment (%)
Foods	26	98.0	12.0	12.2
Textiles	18	106.7	13.3	12.5
Woods, wood products	34	98.5	8.1	8.2
Pulp and paper	11	62.1	13.4	21.6
Chemicals	34	86.1	11.5	13.4
Rubber and leather	7	78.3	6.8	8.7
Ceramic, soils and stones	33	65.6	3.1	4.7
Iron and steel, metals	101	111.1	13.2	11.9
Machinery	53	74.2	13.4	18.1
Car maintenance	7	45.4	19.7	43.4
Other manufacturing	11	48.4	11.5	23.8
Total	335	89.2	11.4	12.8

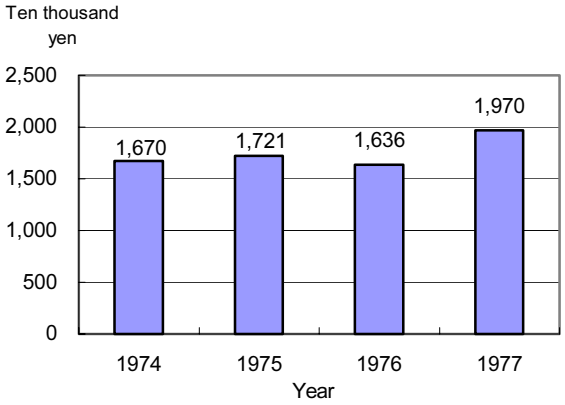
Note: Survey of 1,991 companies, done by the Japan Finance Corporation for Small and Medium Enterprise in 1970, Number of samples, 1431 companies

Source: Toyo Keizai Shinposha, "Chusho Kigyo ha Kogai wo do Fuseguka", Shukan Toyo Keizai, No.3571, December 12, 1970

[11] The percentage of pollution control investments, including the companies not practicing pollution control investments, is 3.3%(*Shukan Toyo Keizai*, No.3571, December 12, 1970)

The pollution control investment rate was high among the pulp and paper, iron and steel, metals, machine and automobile industries. Accordingly, it is estimated that pollution control investment had a larger impact on cost in these industries than in other sectors.

According to the results of a survey by the Pollution Control Service Corporation, the amount of pollution control investment by SMEs during the 1970s was between 16 million-20 million JPY as is shown in Table 3.6.1.

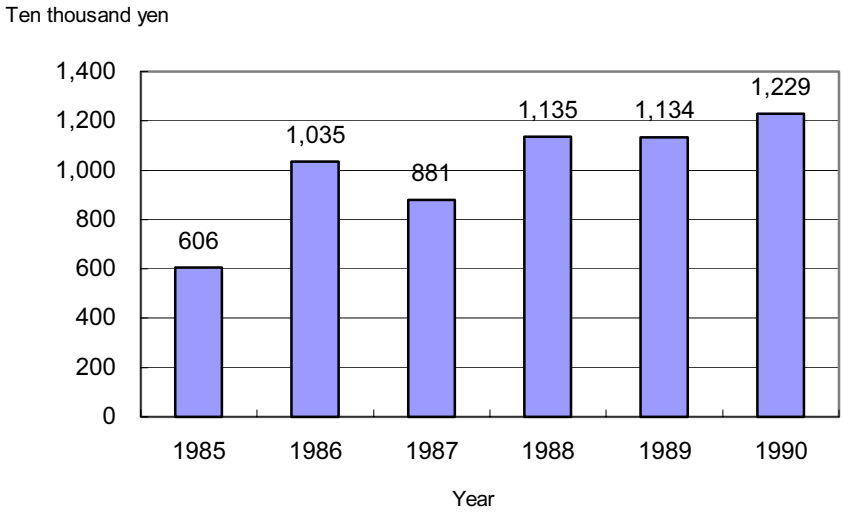


Note: Forecast data for 1977
Source: Pollution Control Service Corporation, "Survey on Shifts in Pollution Control Investments by SMEs", 1975 and 1976

Figure 3.6.1 Pollution Control Investment per SME (1970s, 1974-1977)

b. Mid-1980s onwards

The average amount of pollution control investment in the 1980s was lower than that in the 1970s. During the 1980s, it is thought that new large-scale capital investment decreased and was replaced mainly by investment in improvement and expansion works.



Note: Forecast data for 1990
Source: Environment Agency / Small and Medium Enterprise Agency, "Survey on Shifts in Pollution Control Investments by SMEs"

Figure 3.6.2 Pollution Control Investment per SME (1985-1990)

c. Pollution Control Service Corporation Lending for Pollution Control

It is clear that the rate of investment for pollution control among those SMEs that actually made such investments was higher than for large corporations. This indicates that pollution control investment generally had a greater impact on costs in SMEs.

Table 3.6.2 Aggregate Pollution Control Investment and Investment Ratio (1986-1991)

	The amount of investment (billion JPY)	Ratio of pollution control investment (%)
Small and Medium Enterprises	642	4.37
Large Enterprises	472	1.66

Source: FUJIKURA Ryo, "Kigyo no Kogai Boshi Hiyo ni kansuru Shisan", *Shigen Kankyo Taisaku,* Vol.35 No.14, 1999, pp.53-60 (Original source: "Survey on Shifts in Pollution Control Investments by SMEs" and "Survey on Pollution Control Investments by Industry")

The following Table 3.6.3 shows the distribution of installation costs of pollution control equipment based on case examples of loans made by the Pollution Control Service Corporation. The amount invested becomes smaller as the size of enterprises decreases, and number of cases with investments of less than 100 million JPY accounts for 42% of the all the cases for air pollution control facilities and 53% of all the cases for water pollution control facilities. Looking at SMEs alone, the average cost of air pollution control facilities was 136 million JPY and that for water pollution control facilities was 90 million JPY, thereby showing far higher figures than the average amount of pollution control investment among SMEs. This reflects the fact that many companies utilizing loans by the Pollution Control Service Corporation were large-scale enterprises (LEs).

Table 3.6.3 Distribution of Companies by Scale and Amount of Investment

Investment Cost (million JPY)	Air Pollution				Water Pollution				Waste Management			
	SMEs		LEs		SMEs		LEs		SMEs		LEs	
3.2 <	0	0%	0	0%	2	1%	0	0%	1	2%	0	0%
3.2 - 10	1	2%	1	1%	3	1%	0	0%	0	0%	0	0%
10 - 32	2	3%	2	2%	13	6%	3	3%	1	2%	0	0%
32 - 100	23	37%	19	20%	91	45%	29	25%	10	24%	4	24%
100 - 316	19	31%	26	27%	77	38%	54	47%	20	49%	7	41%
316 - 1,000	15	24%	28	29%	12	6%	22	19%	8	20%	5	29%
1,000 - 3,162	2	3%	16	17%	2	1%	8	7%	1	2%	1	6%
3,162 >	0	0%	4	4%	1	0%	0	0%	0	0%	0	0%
Total	62	100%	96	100%	201	100%	116	100%	41	100%	17	100%
Average	136 mil. JPY		298 mil. JPY		90 mil. JPY		188 mil. JPY		148 mil. JPY		188 mil. JPY	

Note: Data from 604 cases, extracted from 4,061 cases of loans made from 1966
Source: FUJIKURA Ryo, "Kigyo no Kogai Boshi Hiyo ni kansuru Shisan", *Shigen Kankyo Taisaku,* Vol.35 No.14, 1999, pp.53-60

3.6.2 Influence of Increased Costs

a. Cost Impact of Pollution Control Investment in the Early 1970s

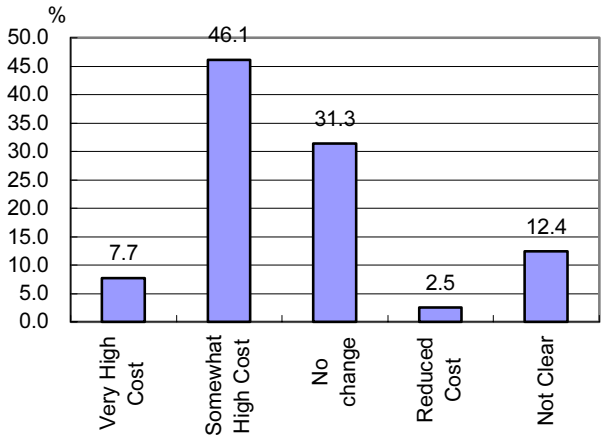
Pollution control investments incur capital and running costs, which increase production costs. This problem was realized in the early 1970s and the extent of the influence on industrial operation was much discussed. Referring to case studies made by Kiyoura[12], about 6% of the cost increase was estimated for the power and oil refinery industries around 1970. For other industries, it was estimated as equal to or less than 3 - 4%. This study was based on the

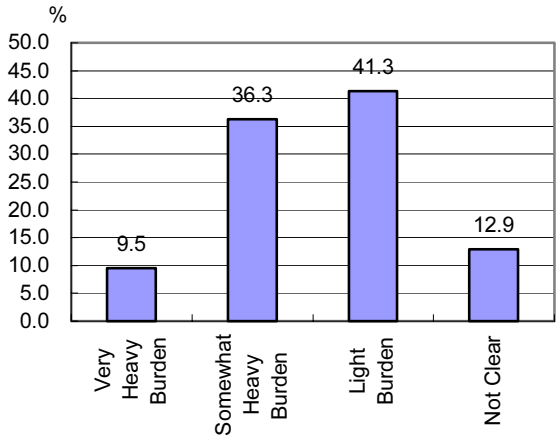
[12] KIYOURA Raisaku, *Kogai no Keizai Shogeki*, Kodansha Publishing, 1972.

pollution investment ratio during 1969 to 1971, which is presumably a rather low indicator since the peak period for pollution investment came in around 1975. It can be expected that the influence of the costs incurred due to pollution control investment was in practice much higher than the estimated figures in the said case study. According to the rate of pollution control investment by industry sector shown in *the 1973 White Paper on Small and Medium Enterprises*, the investment ratio increased steeply in 1972 and 1973. At that time, it is presumed that the actual cost impact of pollution control investment in the pulp/paper, ceramics, oil refining, textiles, chemicals, iron and steel and non-ferrous metals industries was larger than indicated above.

The above study mainly targeted large enterprises, but *the 1972 White Paper on Small and Medium Enterprises* touched on the impact on SMEs. This report shows that on average, pollution control costs in SMEs accounted for 0.6% of total production costs in the manufacturing sector, according to the results of a survey of business awareness by SMEs implemented by the Small and Medium Enterprise Agency in 1971. Moreover, this ratio increased as the scale of enterprises grew larger (2.6% in enterprises with 30 or less employees, 1.0% in enterprises with 31-100 employees, 0.6% in enterprises with 101-300 employees, and 0.3% in enterprises with 301 or more employees); there was a large fluctuation between sectors (for example, the ratio was 4.9% in the plating industry, which was regarded as a heavy polluting sector).

Figure 3.6.3 shows the results of a survey of the impact of pollution control investment on businesses in 1970. This shows that there was some cost impact, although the extent of it was not all that large.





Note: Survey of 1,991 companies by the Japan Finance Corporation for Small and Medium Enterprise in 1970. Number of samples: 1,431 companies

Source: Toyo Keizai Shinposha, "Chusho Kigyo ha Kogai wo do Fuseguka", Shukan Toyo Keizai, No.3571, December 12, 1970

Figure 3.6.3 Cost Impact of Pollution Control Investment 1970

Figure 3.6.4 Impact of Pollution Control Investment on Financial Burden 1970

However, the impact indicated above was that in 1970. When the increases in investment amounts in subsequent years are taken into account, it is estimated that the impact of pollution control investment on production costs and profits became even higher in subsequent years.

b. Ratio of pollution control investment against turnover according to loan cases by the Pollution Control Service Corporation

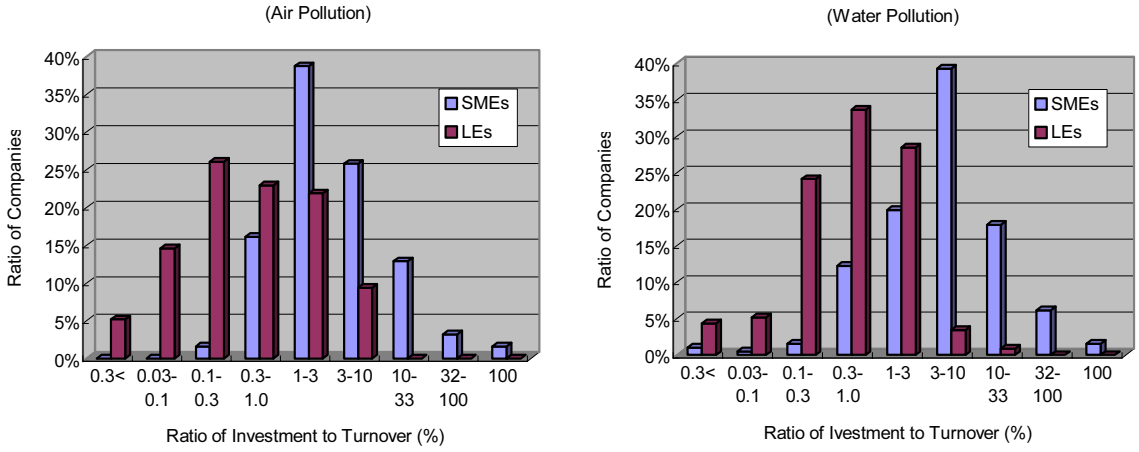
According to the loan cases reported by the Pollution Control Service Corporation, the amount of investment is less in SMEs. The ratio of pollution control investment against total turnover was much higher in SMEs than in large enterprises. Thus, the burden of pollution control cost

was heavier in SMEs. The average ratio of pollution control investment against total turnover was 3.1% in SMEs and 0.38% in large enterprises for air pollution control, while 4.46% and 0.49% respectively for water pollution control (see Figure 3.6.5).

Table 3.6.4 Distribution of Companies according to Size of Enterprise and Ratio of Pollution Control Investment to Turnover

Ratio of Investment to Turnover (%)	Air Pollution				Water Pollution				Waste Management			
	SMEs		LEs		SMEs		LEs		SMEs		LEs	
0.3 <	0	0%	5	5%	2	1%	5	4%	0	0%	1	6%
0.03 - 0.1	0	0%	14	15%	1	1%	6	5%	0	0%	3	18%
0.1 - 0.3	1	2%	25	26%	3	2%	28	24%	0	0%	1	6%
0.3 - 1.0	10	16%	22	23%	24	12%	39	34%	2	6%	7	41%
1 – 3	24	39%	21	22%	39	20%	33	28%	6	17%	5	29%
3 - 10	16	26%	9	9%	77	39%	4	3%	11	31%	0	0%
10 - 33	8	13%	0	0%	35	18%	1	1%	8	22%	0	0%
32 - 100	2	3%	0	0%	12	6%	0	0%	3	8%	0	0%
100	1	2%	0	0%	3	2%	0	0%	6	17%	0	0%
Total	62	100%	96	100%	196	100%	116	100%	36	100%	17	100%
Average	3.10%		0.38%		4.46%		0.49%		14.63%		0.43%	

Source: FUJIKURA Ryo, "Kigyo no Kogai Boshi Hiyo ni kansuru Shisan", *Shigen Kankyo Taisaku,* Vol.35 No.14, 1999, pp.53-60



Source: FUJIKURA Ryo, "Kigyo no Kogai Boshi Hiyo ni kansuru Shisan", *Shigen Kankyo Taisaku,* Vol.35 No.14, 1999, pp.53-60

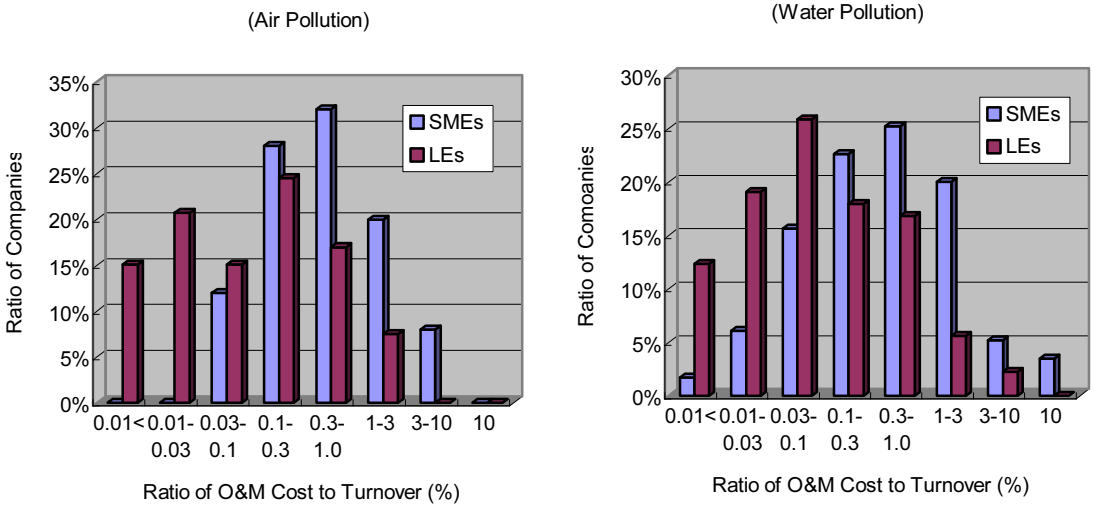
Figure 3.6.5 Ratio of Pollution Control Investment to Turnover

Similarly, it was found to be the case that the ratio of pollution control investment to capital investment is higher in SMEs compared to large enterprises. It was 0.48% in SMEs and 0.07% in large enterprises for air pollution control, while 0.38% and 0.08% respectively for water pollution control.

Table 3.6.5 Distribution of Companies according to Size of Enterprise and Ratio of Operation and Maintenance Cost of Pollution Control Equipment to Turnover

Ratio of O&M cost to turnover (%)	Air Pollution				Water Pollution				Waste Management			
	SMEs		LEs		SMEs		LEs		SMEs		LEs	
0.01 <	0	0%	8	15%	2	2%	11	12%	0	0%	1	9%
0.01 - 0.03	0	0%	11	21%	7	6%	17	19%	0	0%	3	27%
0.03 - 0.1	3	12%	8	15%	18	16%	23	26%	0	0%	1	9%
0.1 - 0.3	7	28%	13	25%	26	23%	16	18%	1	13%	4	36%
0.3 - 1.0	8	32%	9	17%	29	25%	15	17%	2	25%	2	18%
1 - 3	5	20%	4	8%	23	20%	5	6%	2	25%	0	0%
3 - 10	2	8%	0	0%	6	5%	2	2%	2	25%	0	0%
10	0	0%	0	0%	4	3%	0	0%	1	13%	0	0%
Total	25	100%	53	100%	115	100%	89	100%	8	100%	11	100%
Average	0.48%		0.07%		0.38%		0.08%		1.71%		0.08%	

Source: FUJIKURA Ryo, "Kigyo no Kogai Boshi Hiyo ni kansuru Shisan", *Shigen Kankyo Taisaku,* Vol.35 No.14, 1999, pp.53-60



Source: FUJIKURA Ryo, "Kigyo no Kogai Boshi Hiyo ni kansuru Shisan", *Shigen Kankyo Taisaku,* Vol.35 No.14, 1999, pp.53-60

Figure 3.6.6 Ratio of Estimated Operation and Maintenance Cost of Pollution Control Equipment to Turnover

c. Impact of Pollution Control Investment on Increased Production Cost

According to the results of the interview survey conducted in this study, wastewater treatment accounts for 10% of production costs and has a major impact on businesses in the pulp and paper industry. However, in the other cases, there were no reports claiming the impact on business to be especially high.

Moreover, according to the cases of pollution control improvement in SMEs compiled by the Small and Medium Enterprise Agency, numerous cases showed pollution control investment to account for only a few percent of turnover, in findings that matched those of the above-mentioned study by the Pollution Control Service Corporation. Hardly any of the enterprises identified the impact of pollution control cost on increased production costs. According to cases of loans by the Pollution Control Service Corporation, the operation and maintenance cost of pollution control accounts for less than 1% of sales turnover. Even

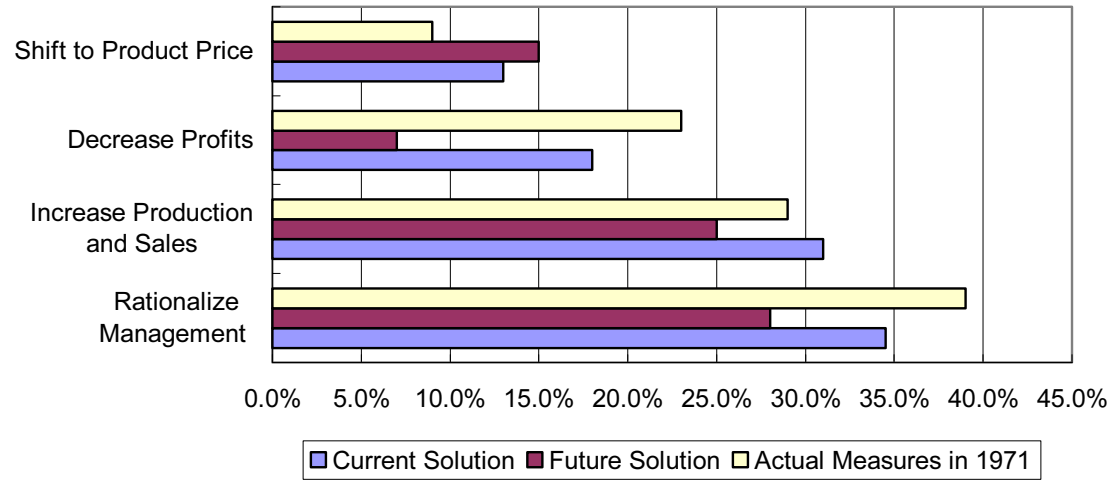
assuming the cost rate to be 80% of turnover, pollution control measures still only accounted for 1.25% of production cost.

This is not a small weight when one assumes that the current profit rate is around 5%; however, the weight within production cost makeup was extremely small and could be absorbed by making an overall effort to reduce production costs. The next section takes a look at how companies responded to the increase in pollution control cost.

3.6.3 Influence of Costs Incurred for Pollution Control and Response to Increased Production Costs

If cost increases due to pollution control investments are translated into higher product prices, this will result in reduced demand. If the extra cost is not passed on to product price and turnover remain the same, profits will go down.

A survey was carried out to find the responses adopted by enterprises for higher production costs arising from pollution control investment. Figure 3.6.7 shows the results of the survey of pollution problems in SMEs implemented by the Small and Medium Enterprise Agency in 1969. This shows the breakdown of replies concerning measures to address the cost impact of pollution control. This clearly indicates that business owners usually responded to cost increases by rationalizing management or increasing production and turnover.

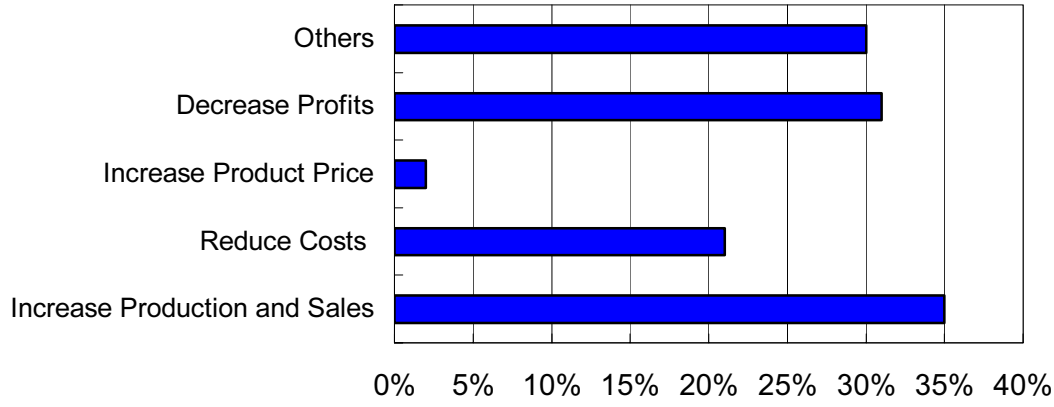


Source: Small and Medium Enterprise Agency, *1972 White Paper on Small and Medium Enterprises* (Original source: Small and Medium Enterprise Agency, "Survey on Pollution Control Investment by Small and Medium Enterprises", 1971)

Figure 3.6.7 Response to Increased Cost due to Pollution Control (1)

As may be gathered from Figure 3.6.7, absorption of pollution control costs through rationalization and increased turnover advanced more than anticipated, while increasing product prices was not as significant as expected, judging from economic conditions at the time.

Similar results were obtained in a survey of 939 companies (including 840 companies with capital of less than 100 million yen) implemented by the Osaka Chamber of Commerce and Industry in 1970. This showed that only 2% of surveyed companies passed pollution control costs onto product prices. This survey showed that companies were willing to strive for reduced costs, but that there was a limit to this. Rather, companies were more prepared to deal with higher pollution control costs through expanding production and turnover, i.e. increasing facility operating rates.



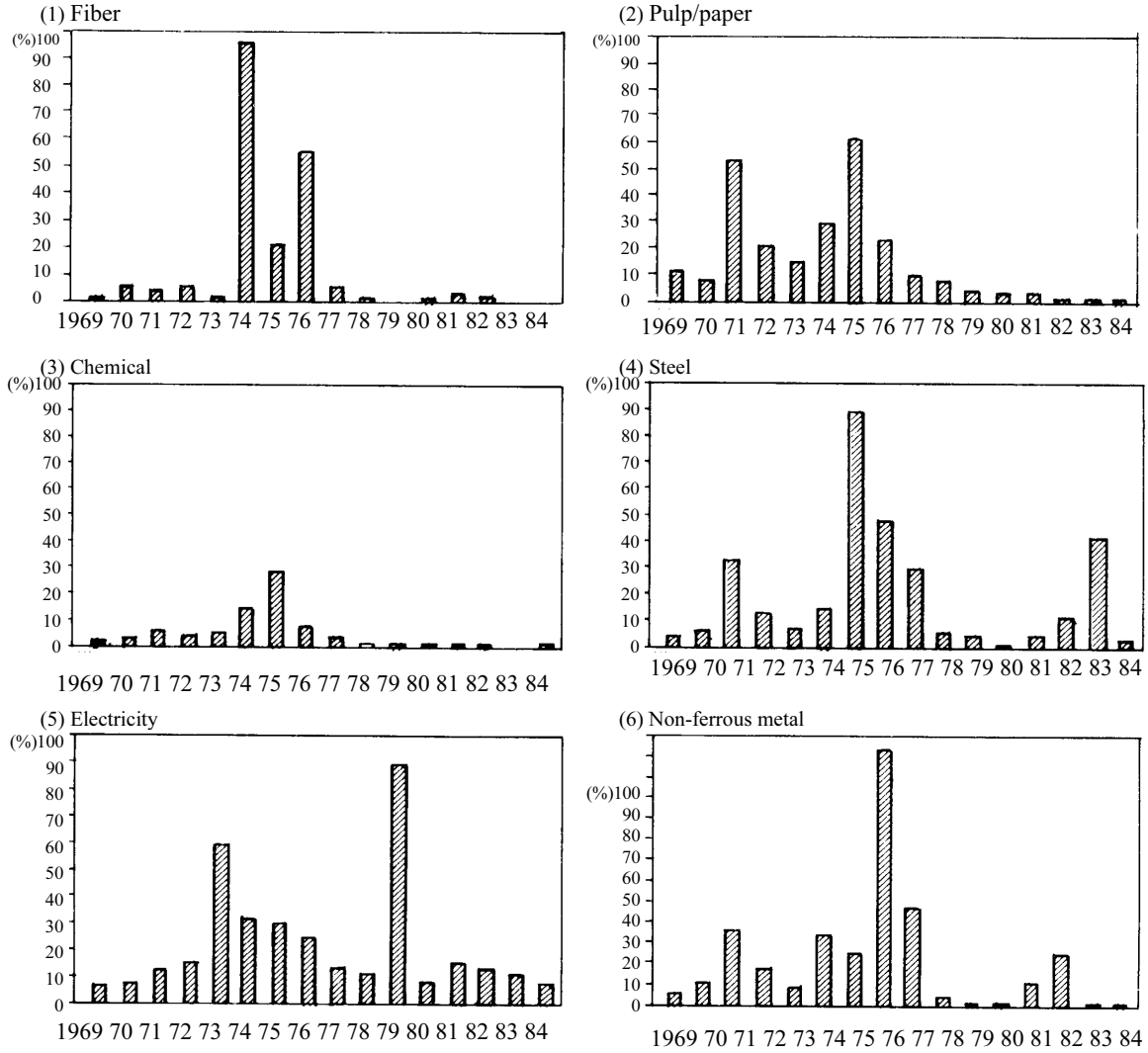
Source: KIYOURA Raisaku, *Kogai no Keizai Shogeki*, Kodansya, 1972 (Original source: Osaka Chamber of Commerce and Industry, "Osaka Shokokaigisho Questionnaire Survey", 1970)

Figure 3.6.8 Response to Increased Cost due to Pollution Control (2)

The influence of pollution control investment on production cost is greater for industries having a heavier pollution load. In manufacturing industries, they can be steel, chemical, cement, non-ferrous metal, and pulp/paper industries. In non-manufacturing industries, the prime example is the power industry. Moreover, the smaller companies are, the lower the capital ratio is, and the harsher the cost competition becomes. Accordingly, it is more difficult for the smaller enterprises to absorb higher costs.

The 1992 White Paper on the Environment analyzes the impact of pollution control investments on business management by industry sector. This addressed the rate of reduction in net profit resulting from the cost of pollution control accompanying pollution control investment.[13] These results are as indicated in Figure 3.6.9, which shows that the pollution control cost burden was large enough to halve profits (profit in that term plus the pollution control cost) that would otherwise have been gained if no pollution control investment were made.

[13] This can be considered as financial cost, as an interest rate is set on both the operation maintenance costs of pollution control facilities and the costs of depreciation,as opportunity costs for capital stock. (*Shukan Toyo Keizai*, No.3571, December 12, 1970)



Note: Profit reduction rate due to additional costs of pollution control = additional costs for pollution control / (additional costs for pollution control + net profit for this term before tax deductions)
Additional costs of pollution control = cost of deprecation for pollution control investment (fixed installment of 10% per year) + interest rate (10% per year) + annual operating costs (20% of initial investment)

Source: Environment Agency, *1992 White Paper on the Environment* (Original source: Ministry of Finance, "Annual Statistics on Corporations", and Japan Development Bank, "Survey on Shifts in Investments")

Figure 3.6.9 Estimated Profit Reduction Rate due to Pollution Control Investment (per company, 1969-1984)

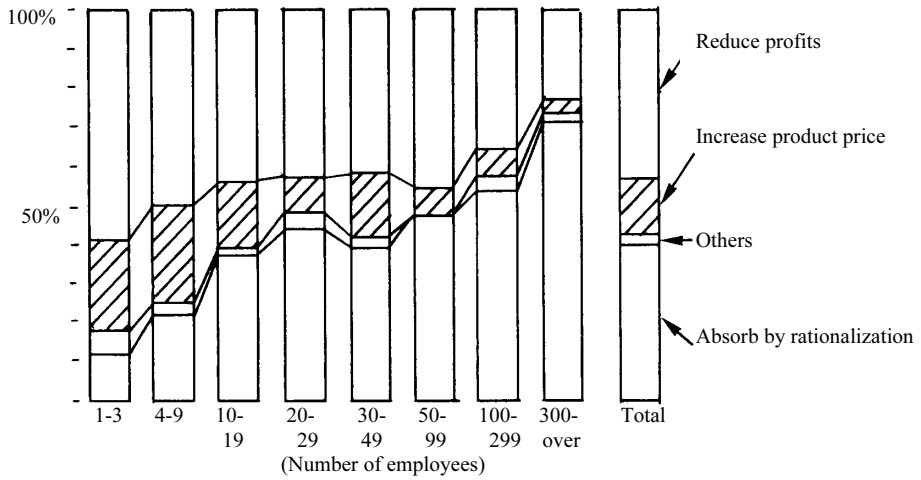
Pollution control costs do not only arise in single fiscal years but also require continued outlays over an extended period; Figure 3.6.9 only shows the impact of additional costs for pollution control on profit in a single year. The profit reduction rates are smaller than those at the peak, and this is because it is assumed that pollution control costs ordinarily incurred are internalized.

There is little doubt that pollution control cost was a major element in profit reduction; however, so long as company profit ratio was normally secured, this indicates that the burden of pollution control cost had little impact on business administration.

A major proportion of capital investment in the 1970s was said to be for production expansion. In the power industry, because numerous large-scale thermal power plants were constructed, which resulted in increased power generating efficiency, it is said that the power industry did not have to increase electricity charges except for the impact of the oil crises.

Concerning the response to this increased burden due to pollution control costs, *the 1992 White Paper on the Environment* stated the following:

"How did companies cover the necessary expenses? The first response that can be considered is an increase of product prices; however, since the period of heaviest pollution control investment coincided with the immediate aftermath of the oil crises, it is not possible to clearly distinguish how much increased prices were derived from pollution control costs and how much were caused by runaway inflation (for example, increased fuel prices, and supply and demand relationship for goods, etc.) resulting from the oil crises. However, according to the results of a survey conducted by the Tokyo Metropolitan Government concerning the response to increased pollution-related costs, although there is some fluctuation between sectors, generally speaking, many companies that experienced a heavy burden responded by constricting profits or passing costs onto product prices, whereas almost all companies for whom the burden was light avoided product price increases through absorbing the additional burden in cost rationalization."



Source: Tokyo Metropolitan Research Institute for Environmental Protection, "Questionnaire to Companies in the Tokyo Area", 1978

Figure 3.6.10 Response to Increased Costs due to Installation of Pollution Control Facilities and Equipment

The response to increased costs according to the scale of enterprises can also be seen from Figure 3.6.10. In large-scale enterprises, there are numerous cases of absorption through rationalization; however, in small-scale enterprises, there are numerous cases of constricting profits and passing the costs on product prices. Accordingly, the White Paper concluded that, "The smaller the scale of the plant, the greater the difficulty in absorbing pollution control costs."

3.6.4 Response to Energy and Resource Price Increases

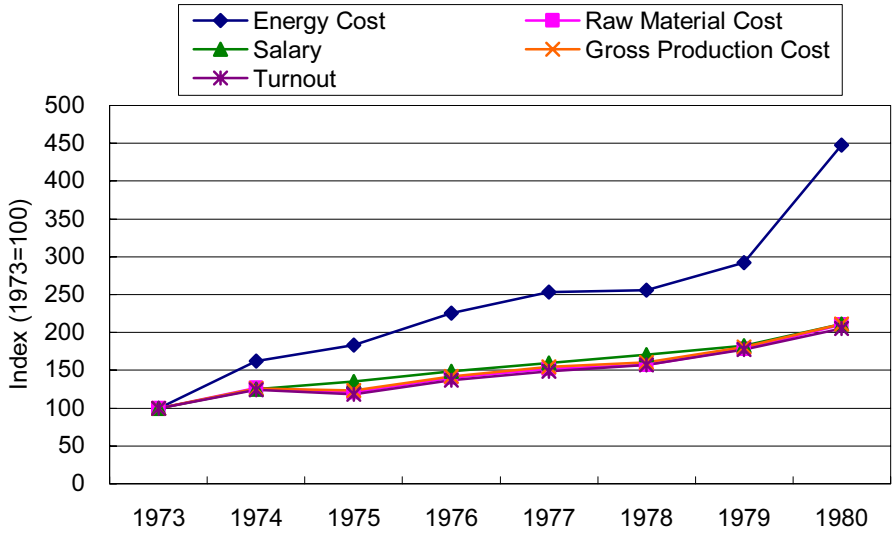
The previous section dealt with the impact of pollution control investment on production costs; however, pollution control investment was not the only factor behind increased costs. Section 3.3.1 (e) indicated that increased energy and resource prices also played a major part in increased production costs, and the way in which this impact was absorbed provides useful information concerning the way in which pollution control investment costs were absorbed.

The following Table 3.6.6 shows the ratio of energy and raw materials costs in total production cost. This shows that raw materials costs account for a major weight and that increases in the cost of raw materials have a major impact. Moreover, energy costs are not always high in SMEs. Nevertheless, they still account for 3-4% and are considered to be higher than pollution control costs.

Table 3.6.6 Weight of Energy and Raw Materials Costs in Manufacturing Industry

	Energy cost		Raw material cost		Manpower cost	
	SMEs	LEs	SMEs	LEs	SMEs	LEs
1973	2.2	3.3	67.4	67.5	17.1	15.1
1974	2.8	4.7	67.9	69.3	17.0	14.0
1975	3.4	5.5	65.8	68.0	18.6	14.8
1976	3.5	5.4	66.5	68.6	17.8	14.4
1977	3.6	5.4	66.5	68.7	17.7	14.3
1978	3.5	4.8	66.0	67.9	18.1	14.8
1979	3.5	4.6	66.7	69.1	17.2	12.9
1980	4.6	6.1	67.2	70.6	15.8	12.0

Source: Small and Medium Enterprises Agency, *1982 White Paper on Small and Medium Enterprises in Japan* (Original source: Ministry of International Trade and Industry, *Industrial Statistics Table*)



Source: Small and Medium Enterprises Agency, *1982 White Paper on Small and Medium Enterprises* (Original source: Ministry of International Trade and Industry, *Industrial Statistics Table*)

Figure 3.6.11 Energy and Raw Materials Costs in Manufacturing Industry (1973-1980)

This shows that increases in energy and raw materials costs in the 1970s had an impact on production cost inflation. Concerning this impact, *the 1982 White Paper on Small and Medium Enterprises* concluded that SMEs responded by altering business operating systems and pursuing higher operating efficiency. The following extract summarizes the manner in which the White Paper described the response to increased energy and raw materials prices.

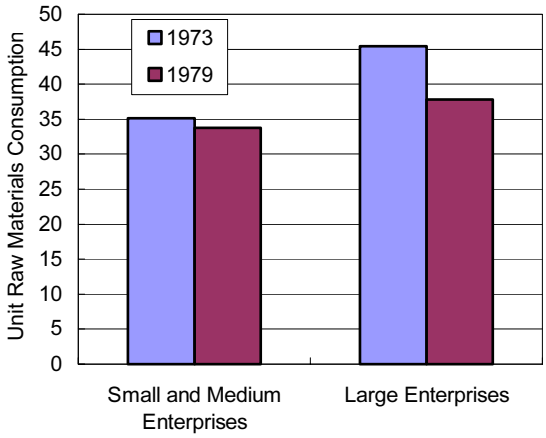
"The changes in the operating systems of SMEs in the wake of the first oil crisis are characterized as a greater orientation towards realization of efficient corporate activities in response to inflationary pressure of production costs and changes in the competitive environment." It sums up by saying, "The major components in realizing efficiency of corporate activities were reduction of production costs including energy costs, raw materials costs and personnel expenses, improvement of productivity, stabilization of the financial base, and enhancement of durability in responding to changes in the business climate."

a. Efforts to Reduce Production Costs

The 1982 White Paper on Small and Medium Enterprises summarizes the reduction of production costs in the three categories as measures responding to increases in energy costs, raw materials costs, and personnel expenses.

Concerning the response to increased energy costs, the White Paper states the following: "The unit energy consumption (energy consumption per unit production turnover) in SMEs in the manufacturing industry displayed a fall between 1973 and 1979 from 6.2 kcal/JPY to 5.5 kcal/JPY. --- Moreover, concerning reduction in petroleum consumption, approximately 60% was realized through oil saving, while the remainder was achieved through energy substitution, when factors behind improvement in the unit energy consumption are analyzed. --- In this way, SMEs responded to inflationary pressure on energy prices by making vigorous efforts to reduce energy consumption."

Concerning the response to increased raw materials costs, the White Paper states the following: "The unit raw materials consumption in SMEs in the manufacturing industry improved by approximately 4% (17% in large enterprises) between 1973 and 1979, and dramatic improvement was especially displayed in the basic materials industry, where the level of unit raw materials consumption is high."



Note: Unit raw materials consumption = expenses of raw materials consumption/turnout
Source: Small and Medium Enterprises Agency, *1982 White Paper on Small and Medium Enterprises* (Original source: Ministry of International Trade and Industry, *Industrial Statistics Table*)

Figure 3.6.12 Improvement in Unit Raw Materials Consumption

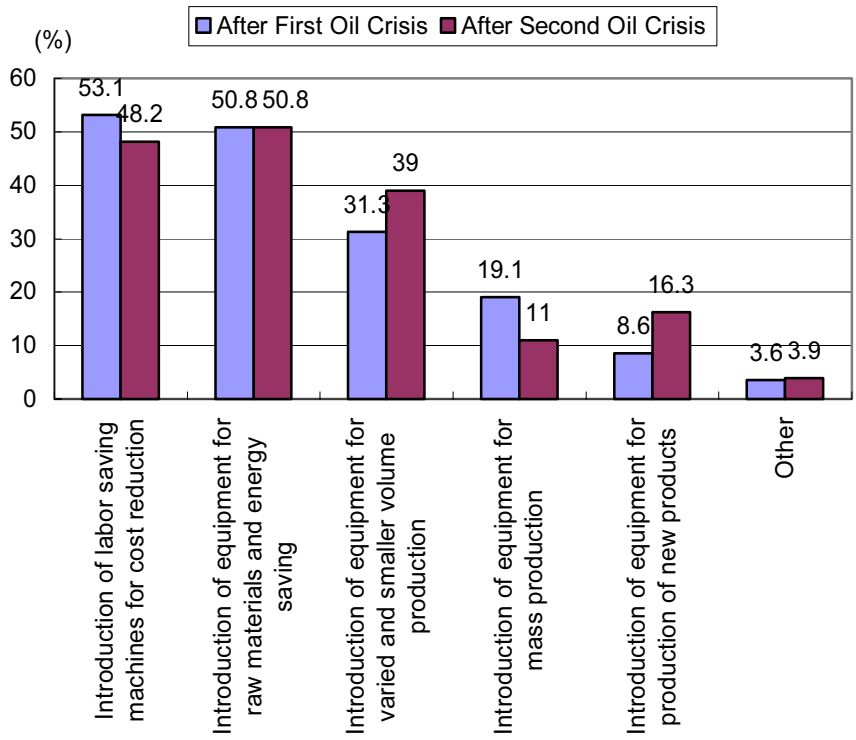
Moreover, concerning the energy saving measures that were implemented in the wake of the first oil crisis, according to the survey of business environment shifts in the manufacturing industry, as shown in Figure 3.3.10, the main measures were thorough implementation of quality control, and improvement of yield rate through shortening and improvement of production processes. However, following the second oil crisis, the ratio of companies implementing these measures fell slightly, whereas more enterprises resorted to drastic measures such as improvement of yield rate through introduction of cutting edge technology.

Concerning the response to the third factor of increase in personnel expenses, "Three measures, i.e. employment adjustment, wage restraint, and labor saving investment, were implemented." Concerning employment adjustment, "This was implemented on a large scale following the first oil crisis, however, the ratio of companies implementing it has been declining since then." Concerning wage restraint measures, "Throughout both oil crises, many companies restrained overtime, special salaries and periodic salary hikes; however, among large enterprises, the ratio of the companies that cut overtime working hours was a little higher." Concerning labor saving investment, "Approximately 60% of companies implemented this, and the investment

after the second oil crisis targeted to the indirect department (back-office section) showed a higher weight than that to the direct department, indicating that the scope of labor saving investment is expanding."

b. Efforts to Improve Production Efficiency and Labor Productivity

During this period, in addition to reduction of production costs, efforts were made to improve production efficiency through improving production technology integrated with plant investment. The White Paper stated the following: "According to the survey of business environment shifts in the manufacturing industry, plant investment by SMEs following the first oil crisis mainly comprised plant investment and improvement of production processes aimed at reducing production costs, savings on resources and energy; however, following the second oil crisis, less companies introduced mass production equipment whereas more companies invested in plant equipment suited to producing various items in smaller quantities and lines for producing new products." It continued, "Comparing the material production industry with the processing industry, in the material production industry, greater emphasis is placed on reducing production costs through increasing yield rate, saving on energy and labor, whereas in the processing industry, greater emphasis is placed on adapting to more varied and smaller volume production."



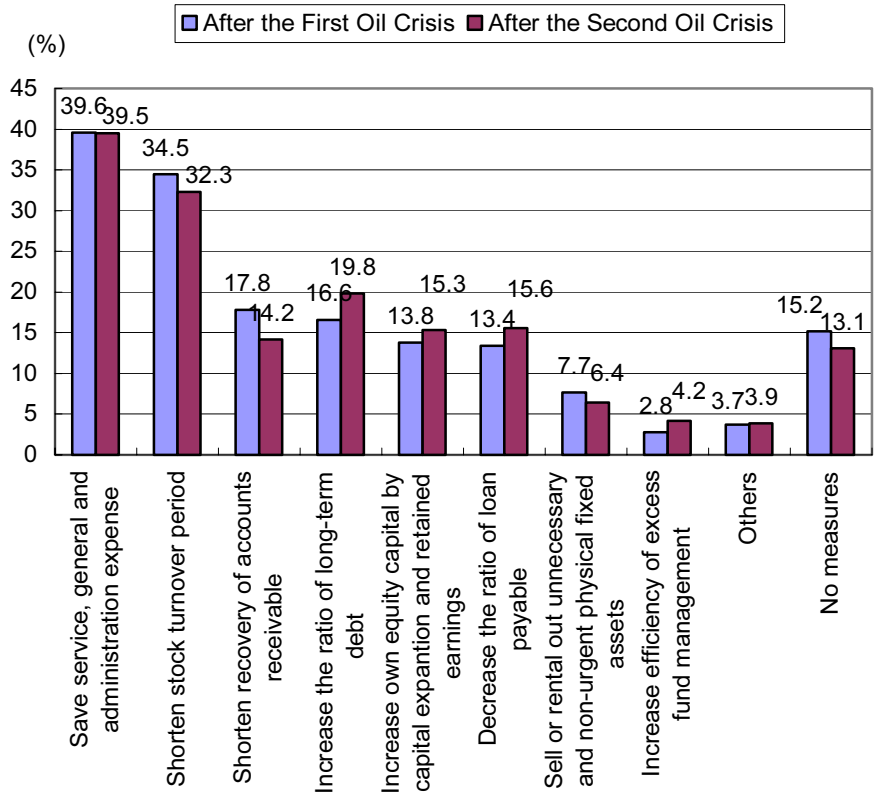
Note: Because of multiple answers, the sum total is over 100
Source: Small and Medium Enterprise Agency, "Survey on Shifts in the Business Environment of the Manufacturing Industry", 1981

Figure 3.6.13 Breakdown of Capital Investment

c. Stabilization of Financial Bases and Improvement of Durability regarding Business Fluctuations

Companies also made a big effort to strengthen their financial bases in response to higher production costs. According to the White Paper, "In response to environmental changes in the wake of the first oil crisis, many companies sought to improve the efficiency of fund operations through economizing on general administration and retail costs, as well as shortening inventory

turnover times and speeding up recovery of accounts receivable. Following the second oil crisis, the ratio of companies cutting down on general administration and retail costs went up, and so did the ratio of companies seeking to raise financial security and stability through increasing the ratio of long-term borrowing, enhancing own capital, reducing loan ratio and so on. Thus, greater diversification of measures can be gathered following the second oil crisis."



Note: Because of multiple answers, the sum total is over 100
Source: Small and Medium Enterprise Agency, "Survey on Shifts in the Business Environment of the Manufacturing Industry", 1981

Figure 3.6.14 Financial Countermeasures (SMEs in Manufacturing Industry)

"Before the first oil crisis, supported by increasing sales turnover, variable price factors had a positive effect on profit ratios, whereas fixed cost factors had a negative impact. In contrast, during the period of recovery following the first oil crisis, variable price factors consisting primarily of increased raw materials prices worked negatively, whereas compression of fixed costs comprising general administration and retail costs and financial expenses contributed to higher profit ratios."

The White Paper also pointed out: "Small and medium enterprises reduced their breakeven point through compressing fixed costs and raised their adaptability to business fluctuations when demand slowed down against higher raw materials costs following the oil crisis."

3.6.5 Factors for Successful Absorption of Increased Costs

a. Manufacturing Industry in General

The extent of cost increases resulting from pollution control investment during the 1970s was of the order of a few percent for SMEs although it varied by industrial sector. The cost increase was clearly higher than in large enterprises, and operation and maintenance costs were

also around 1%. Based on the results of analysis in this chapter, this cost impact seems to have been well absorbed in most of the SMEs in view of the fact that industries in general showed sound net profits in their financial results (see Table 3.6.4 & Table 3.6.5).

Pollution control investments by large enterprises with capital stock of 1 billion JPY or more reached a peak from 1974 to 1976 when companies were striving to comply with new regulations. Pollution control investment at this time accounted for a very high share (around 13%) of overall plant investment, and although this varied by sector, it reached as high as 20 - 30% in the basic materials industry.

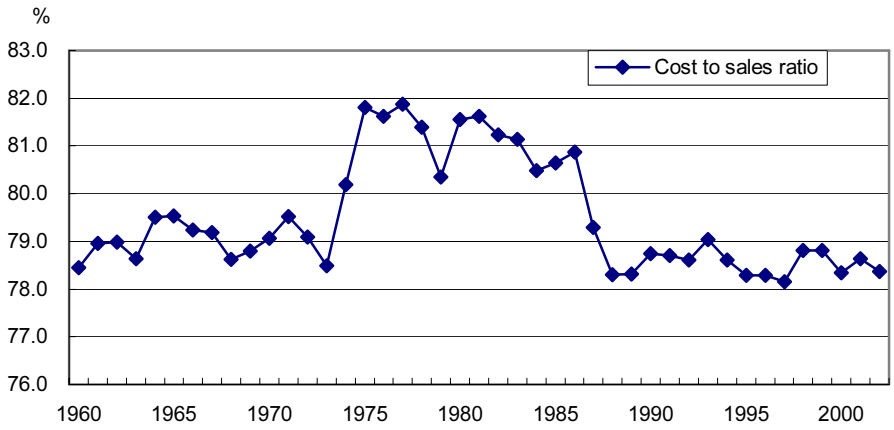
The ratio of pollution control investment was less than 10% before and after this period, and fell further to between 4-7% from 1992 onwards.[14] Currently this figure stands at around 3-4% in industrial sectors other than the basic materials industry.

Large-scale pollution control investments by large enterprises in the materials industry in the mid-1970s led to a large burden of interest, depreciation, and maintenance costs, and companies responded to these cost increases by improving productivity and passing on the extra costs to product prices.

It may be said that these price increases were implemented in line with the impact of sudden inflation in the price of crude oil as a result of the oil crises in 1974 and 1978. Between 1973 and 1981, the corporate price index of industrial products greatly increased, so the passing-on of higher costs to product prices took place in an inflationary environment. There was also temporary appreciation of the JPY around this time, but the JPY was relatively weak and there was still not much competition with imported products.

An increase in productivity was mainly realized through investing in new highly efficient facilities, expanding the scale of facilities and raising facility operation rates. From the 1970s to around 1985, nominal shipment value of manufacturing products increased greatly, and it is thought that this expansion in production absorbed some of the increase in pollution control costs.[15]

Figure 3.6.15 shows trends in the cost to sales ratio in the manufacturing industry overall. From 1960 to the start of the 1970s, this was 78-79%, however, from 1975 onwards, it increased by 2-3% until 1987. It is possible that pollution control costs caused this increase of around 2%, but as is shown in Figure 3.6.11, it may also be that the impact of higher energy prices and higher raw materials costs linked to depreciation of the JPY during this period was greater. The desperate efforts made by companies to respond to these increases in production costs were as described in Section 3.6.4.



Source: Policy Research Institute, Ministry of Finance, "Financial Statements Statistics of Corporations by Industry"

Figure 3.6.15 Cost to Sales Ratio in Manufacturing Industry (1960-2000)

14 Ministry of International Trade and Industry, "Survey on Facility Investments for Pollution Control," 1973-2002
15 Ministry of International Trade and Industry, *1980 White Paper on International Trade*

This demonstrates that, as a result of determined efforts to deal with factors leading to increased production costs, SMEs throughout the manufacturing industry succeeded in maintaining normal current profit ratios, except for the period following the first oil crisis.

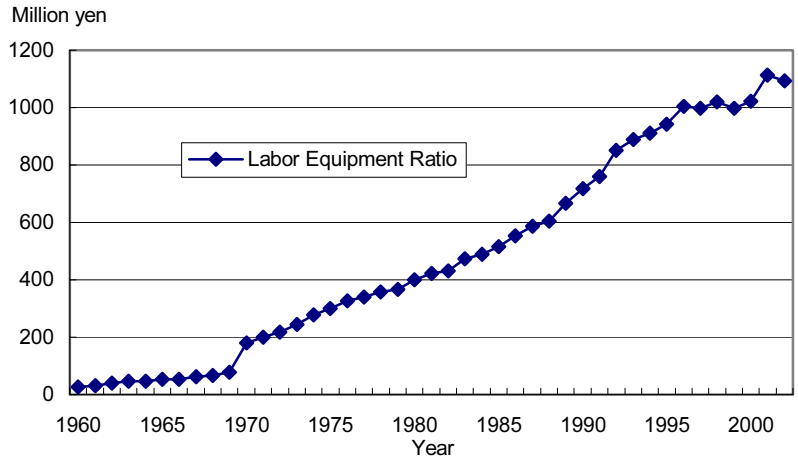
b. Absorption of Increased Cost

Improved productivity is the most fundamental way of absorbing cost increases incurred due to pollution control investment. Productivity can be improved through introduction of high-productivity facilities, increase in facility operation ratios, minimization of loss/waste by effective production control, and improvement of yield rates.

The most important economic indicators for entrepreneurs are business confidence and overall economic growth rates. The most important factor for entrepreneurs is not to miss the timing of decision-making for capital investment to enhance production capacity when the market expands (demand increases), and increases in turnover and profit rate are expected. The Japanese economy during the 1960s and the 1970s was in the condition of excess demand and supply shortage. It could be the days industries could sell whatever they produced.

Real economic growth rate in the 1970s did not reach the 10% rate achieved during the 1960s, yet was a comfortable 5%. The shipment volume of the manufacturing industry increased threefold in nominal terms and 2.6 times in real terms over the 10 years from 1970 to 1979. The average growth rate during this period was a nominal 11.8% and real 9.98%.

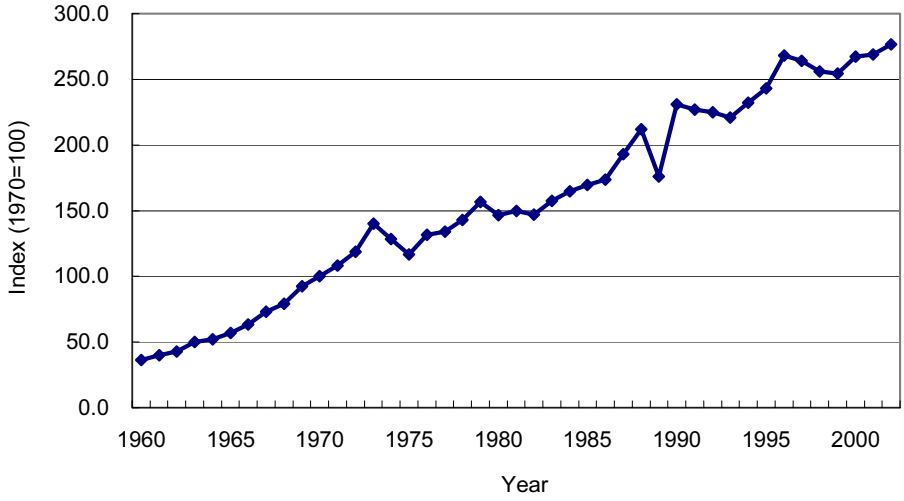
As Figure 3.6.16 shows, labor equipment ratios in the 1970s grew rapidly, doubling over the decade. This means that substantial capital intensity took place during this period, and productivity increased accordingly due to capital investment, although the growth was even more rapid after 1985.



Source: Policy Research Institute, Ministry of Finance, "Financial Statements Statistics of Corporations by Industry"

Figure 3.6.16 Labor Equipment Ratio in Manufacturing Industry (1960-2000)

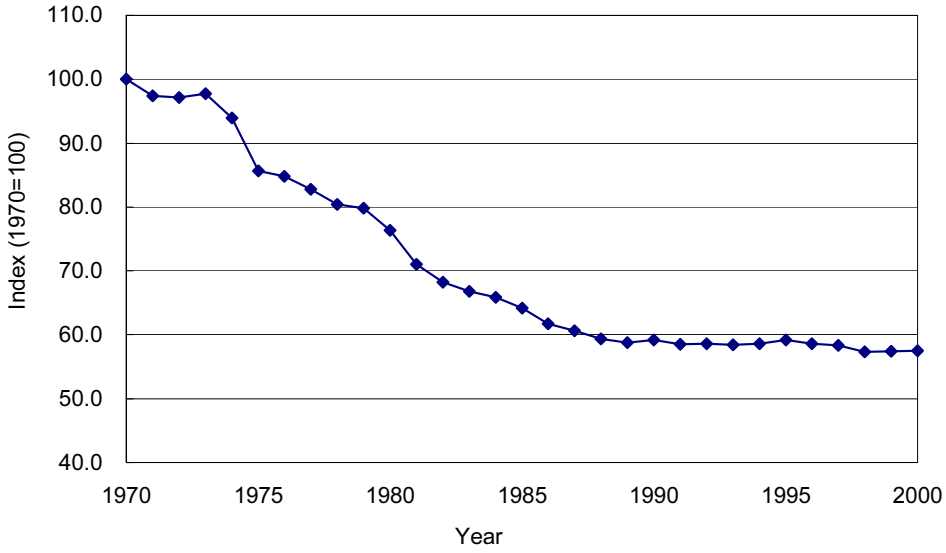
It may be seen how enterprises raised productivity by capital investment during the 1970s. Although there was a temporary decline in labor productivity during this decade, caused by the first oil crisis in 1974 and 1975, it steadily increased over the period. Indeed, labor productivity increased by 50% between 1970 and 1980.



Note: Deflator treated
Source: Policy Research Institute, Ministry of Finance, "Financial Statements Statistics of Corporations by Industry"

Figure 3.6.17 Labor Productivity in Manufacturing Industry (1960-2000)

The value of relative material input ratios[16], decreased significantly after 1970, implying that productivity improved greatly during this period.

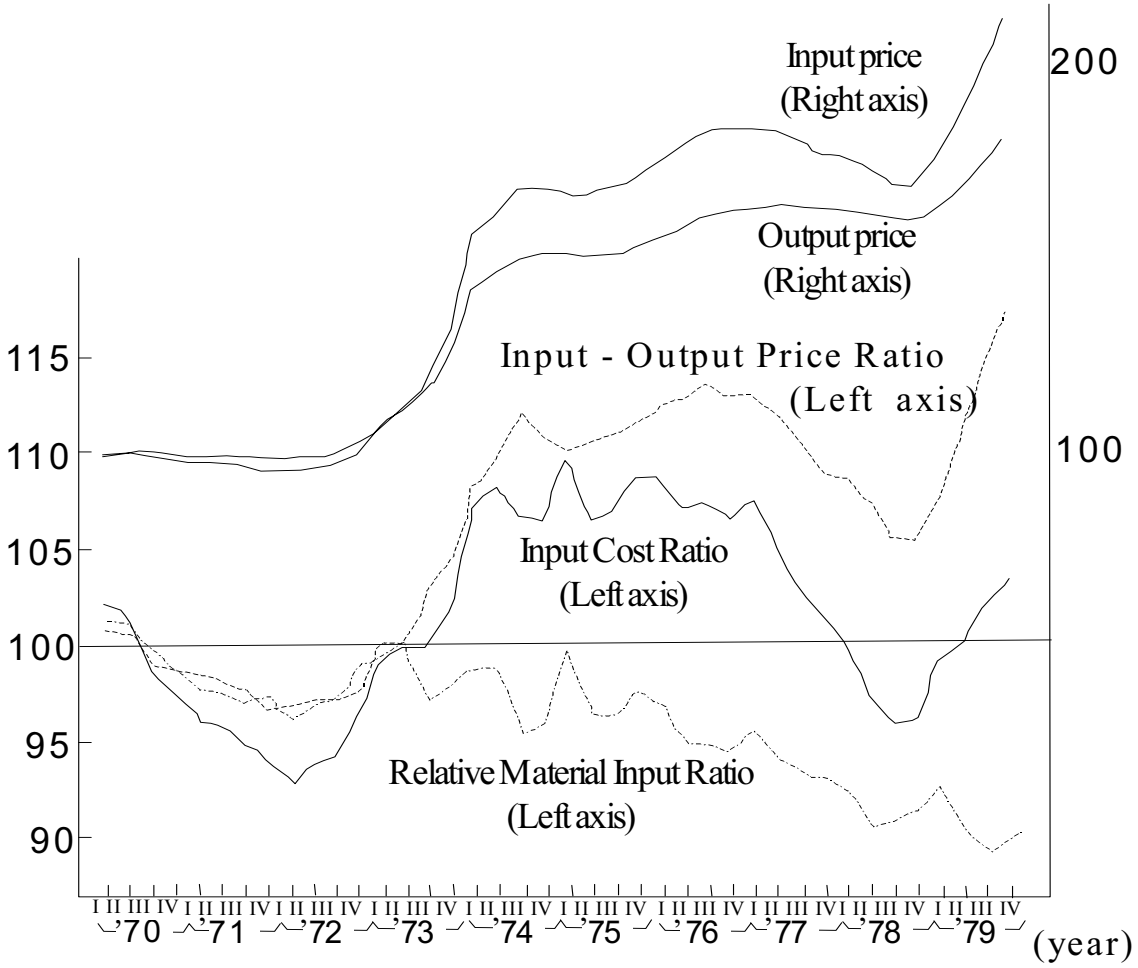


Source: Policy Research Institute, Ministry of Finance, "Financial Statements Statistics of Corporations by Industry"

Figure 3.6.18 Relative Material Input Ratio in Manufacturing Industry (1970-2000)

Figure 3.6.19 shows a sample examination of changes in variable costs (input cost) during the 1970s. Whereas the input cost ratio changed significantly from 1974-1976 due to the effects of the first oil crisis starting from 1973, efforts to reduce the input unit ratio during this period were highly effective and resulted in recovery of corporate profit ratios in 1977.[17]

[16] Relative Material Input Ratio = Raw Material Consumption Index/ Production Index
[17] Ministry of International Trade and Industry, *1980 White Paper on International Trade*



Note1: All index are adjusted to the average in 1970 as 100.
2: Input - Output Ratio = (Input price index / Output price index) x 100
3: Relative Material Input Ratio = (Raw Material Consumption Index /Production Index) x 100
4: Input Cost Ratio = (Input - Output ratio) x Input Units Ratio
Source: Ministry of International Trade and Industry, *1980 White Paper on International Trade* (Original source: Bank of Japan, "Price Index of Manufacturing Industries according to Industry", and Ministry of International Trade and Industry, *International Trade and Industry Statistics)*

Figure 3.6.19 Ratio of Input Costs in the Manufacturing Industry

As far as the overall manufacturing sector was concerned, there were substantial cost increases due to pollution control investment and related costs in the 1970s. However, the cost impact was absorbed into the strengthened production capacity and improved productivity. It should be noted that the economy in the 1970s continued to maintain a high growth rate although there was a temporary drop due to the oil crises. In such an economic environment, entrepreneurs must have behaved in such a way that it was more important to them to secure market share in the expanding market by way of capital investment and improved productivity rather than to be concerned about the increased costs due to pollution control measures.

c. Absorption of Increased Cost by Small and Medium Enterprises

The ways in which cost increases were absorbed are demonstrated based on case examples of companies as shown in the results of the interviews and in literature. There were two patterns of absorption: one was to raise productivity through conducting plant investment with a view to modernizing facilities (for example, mechanization and introduction of the latest production technology). Even if companies implemented pollution control investment, it is thought that they could easily absorb the cost impact through this approach. The second pattern was to

absorb the impact of pollution control investment by raising productivity through improving existing equipment and eliminating waste.

c.1 Absorption of the impact of pollution control investment through raising productivity based on modernization of production facilities

In the case examples and interviews, it is estimated that the modernization of plants raised productivity in the order of 10-20% although there were few cases of specific quantitative data. Applicable case examples are as indicated below.

- Case of Feed Factory A

The turnover of this feed factory that generated a large wastewater load was around 200-300 million JPY in 1970, increasing to 3 billion JPY by 1985. During this period, the factory implemented pollution control investment of approximately 300 million JPY. The estimated expenses arising from the pollution control investment (depreciation cost, interest, operation and maintenance costs) were approximately 90 million JPY. Since the cost ratio was estimated at around 80%, it is estimated the ratio of investment cost to production cost was around 4%.

From the 1980s to the 1990s, the factory vigorously invested in production facilities. By introducing the latest technology with a high yield rate and a waste heat recovery-type thickening plant, production yield per worker increased. Raw material processing capacity per worker increased by six times from 2.5 ton/day to 14.2 ton/day at this time. Also during this period, the estimated added value per worker increased from 3 million JPY (5.2 million JPY at 2000 prices) to 8.6 million JPY (7.6 million JPY), and actual productivity increased by approximately 50%.

The product price of feed did not change after the mid-1970s. Since the company was unable to pass on environmental protection costs to product prices, it secured profits by investing in the newest plant and equipment and raising productivity by increasing yield rate and reducing energy consumption. During this period, it invested in odor measures and wastewater treatment equipment and, although these measures were costly, the company comfortably absorbed the additional cost through increasing productivity.[18]

- Pulp and Paper Factory B

Forecasting that demand for sanitary paper would increase in accordance with the transition to a consumer society, this company started investing aggressively in expanding production of sanitary paper made from waste paper from around 1975. At the same time, it invested in a wastewater treatment plant, a emission gas desulfurization unit, a boiler that utilized residue, and baking of sludge for use as insulation material in iron and steel works. Whereas the plant had a production capacity of 15,000 tons/year in 1970, this was raised to 70,000 tons/year. When expanding production capacity in this way, the company was able to absorb various pollution control investment costs by introducing a high-productivity paper-making process and automating processes, introducing the energy saving 'Earth-shaped Digester'[19] to the pulping process, and utilizing waste products and so on in order to reduce energy costs.

- Pulp and Paper Factory C

The pulp and paper companies surveyed in this study said that it was not possible to transfer the costs of pollution control on to product prices. Each company seems to have absorbed the additional cost through raising productivity by aggressively introducing highly productive production equipment. With respect to existing production equipment, the companies made

[18] Other businesses belonging to the same industry that did not take measures like Feed Factory A lost in the competition and had to close down.

[19] The normal pulpers can only process 3 tons at once, but Earth Kettle has the ability to process 20 tons, using only a tenth of the power of the usual pulpers

thorough rationalization efforts to raise productivity by raising the yield of white water, increasing rolling velocity, preventing system interruptions, installing hoods on the drying process (energy saving measures), and so on. Moreover, equipment automation and measured data control were also important factors in raising productivity.

- Plating Factory C (collective plant)

In 1972, a group of small plating businesses relocated together in facilities equipped with the latest manufacturing equipment, automated processes and a wastewater treatment plant. Through introducing new high-efficiency facilities, production and sales turnover increased, and pollution control costs were hardly a problem at all.

- Taiho Industries Co., Ltd.[20]

This small metals processing and plating enterprise employed 78 workers. When expanding facilities in 1972, it examined production processes with water treatment as an integrated flow since wastewater treatment costs were too expensive. By automating its processes, it was able to reduce manpower by 50 personnel. Moreover, it implemented the following measures for wastewater treatment:

- Alteration of the production process: continuation and automation; reduction of handling in chrome and zinc plating processes
- Wastewater control measures: reduction of wastewater flow through adoption of spray washing, treatment according to type of wastewater

In particular, through taking the latter measure, the company obtained large benefits in terms of the efficient treatment of wastewater and reduction of construction costs.

c.2 Absorption of the impact of pollution control measures while raising productivity in existing equipment

Following are cases of companies absorbing increased production costs caused by pollution control investment by raising productivity of existing equipment.

- Shinshu Miso Co., Ltd.[21]

This company started examining wastewater control measures in response to harsher wastewater regulations around 1973. The source of pollution was soybean liquor from the *miso* (bean paste) plant: this had BOD of 4,000-6,000 ppm and contained proteins and sugars. The dissolved content was 2-3% of the soybeans used. Viewing this as a loss of soybean raw materials, the company raised production efficiency and yield rate by installing a soybean continuous digester[22] and reverse osmosis equipment. By doing this, the company was able to reduce investment in wastewater treatment facilities and experienced no problems in terms of extra costs.

- The Second Yoshikiyo Casting Co.[23]

This casting plant, which employed 20 workers, installed a new soot and dust control unit for cupola emission in 1972 and subsequently spent approximately 16 million JPY in improvements and approximately 5 million every year in operation and maintenance costs.

[20] Small and Medium Enterprise Agency, “Case Examples of Successful Pollution Control Measures by SMEs”, 1972
[21] Small and Medium Enterprise Agency, “Case Examples of Successful Pollution Control Measures by SMEs”, 1974
[22] The Soybean continuous digester is a widely used technique nowadays. It has made possible the drastic shortening of operation time, automation of controls (eliminating the need for an operator), the upgrading of product quality by uniform processing of material. It is also energy saving, and heightens productivity.
[23] Small and Medium Enterprise Agency, "Case Examples of Successful Pollution Control Measures by SMEs", 1977

By 1977, faced with declining order prices caused by excessive competition, spiraling personnel costs, and rising raw materials costs, the company needed to reduce costs including pollution control costs. In response, it increased product yields by improving production equipment and researching and developing new casting technology, and used the resulting gains to make improvements to its pollution control equipment.

d. Following the Shift from Pollution Problems to Environmental Problems

Following appreciation of the JPY in the aftermath of the Plaza Accord in 1985, companies adopted totally different thinking as to handle the increasing cost burden. Moreover, since Asian currencies adopted the dollar peg system in response to appreciation of the JPY, Asian currencies were extremely low compared to the JPY. Consequently, price competition by products produced in Asia increased, and the Japanese manufacturing industry responded by establishing production facilities in Asian countries. Whereas imports from Asia continued to increase, the price index of imports declined markedly, falling to 0.72 in 1990 and 0.52 in 2000 compared to 1985 figures.[24]

The corporate price index of industrial goods after 1985 declined sharply along with the stronger JPY. In such deflationary environment, it was not possible to increase selling prices to cover pollution cost impacts.

However, there was no large-scale pollution control investment from the latter half of the 1980s to the present; instead expenses were centered on modification or renewal of existing pollution control facilities, or certain levels of investment to satisfy stricter regulations and requirements to control additional harmful substances. The share of the pollution control investment against total capital investment during this period was around 5%.

In the case of renewal of pollution control equipment, the cost was already structured internally. Thus, it should not be counted as an added cost. Investment for new requirements certainly influenced production costs, but not significantly.

In this deflationary environment, companies were faced with little prospect of increasing sales and requirement of product price discount. In such a trend of deflation, it was not possible to increase product prices to cover pollution cost impacts. There was no other solution than productivity improvements. Thus, strenuous efforts in cost reduction in all production processes are currently underway in industries. In cases where companies cannot beat off imported rivals in spite of such efforts, they are faced with a choice between transferring production overseas or going out of business. Other companies are ceasing to manufacture products in competition with imports, and instead are pinning their hopes of survival on products with high added value.

[24] Ministry of Finance, "Shifts in Foreign Trade Index"

3.7 Human Resource Development in Factories and Use of External Support

3.7.1 Human Resources and Organization for Industrial Pollution Control

a. Presence of Production Engineers and Understanding of Business Managers

Lack of qualified human resources has been a subject repeatedly discussed in SMEs, but the situation on the part of those that have survived is slightly different. Many of them assigned production line engineer(s) and developed their ability, as business managers recognized the importance of production technology and management for corporate management. Business managers gave such specialized engineers a responsibility to evaluate and introduce latest production technologies of overseas. In the process, they gained experiences in evaluating and introducing new technologies during the high economic growth of the 1960s.

QC (Quality Control) movements, including TOC (Total Quality Control), were widely introduced and well established in the 1960s. In particular, QCD (Quality, Cost and Delivery Date) management, operation standardization, and teamwork improvement were strengthened. This indicates an "organizational ability in manufacturing[25]" had begun to form. Since business managers in Japan recognized that human resource development and establishing organizational ability is key to business competitiveness, engineers have been trained to address industrial pollution problems in the context of overall business planning and operation.

When air pollution and water pollution control was required in the 1970s, the production line engineers in SMEs played a central role. As the case examples in Section 3.5.1 show, pollution abatement measures were examined/reviewed by in-house engineers, not pollution control experts.

b. Human Resources Development

Only a few SMEs had pollution control specialists when pollution control measures became necessary. When a manufacturer of pollution control devices approached a company for sales of the pollution abatement equipments/facility, the company did not simply accept the sales talks but examined the adequacy of the prospective items. Through such examination, general engineers developed the skills required to judge the feasibility of investments in pollution control equipment.

In the SMEs in our case studies, for example, the engineers went to factories that had already installed pollution control equipment to examine systems first hand, and/or asked for professional opinions from an industrial research institute established by the local government. These activities helped them to build their own capacity to evaluate the suitability of technologies to satisfy pollution control regulations.

c. Pollution Control Managers and Organizations

Pollution control managers, who were appointed based on the 1971 Law for Establishment of Organization for Pollution Control in Specified Factories have been an important component of Japan's environmental strategy. Even for SMEs, it is necessary to assign a pollution control manager and register the name with the governor in the region if they have the facilities regulated by relevant laws such as the Air Pollution Control Law and Water Pollution Control Law. It was normal practice for SMEs to have engineers on the production line qualified for such positions. This practice is still true at present. There were few SMEs which had independent divisions specializing in safety and environmental issues, but they managed to

[25] FUJIMOTO Takahiro, *Noryoku Kochiku Kyoso*, Chuko Shinsho, 2003

create the required administrative structures in accordance with the Law for Establishment of Organization for Pollution Control in Specified Factories.

Prefectural governments in turn provide pollution control managers in industries with guidance and information in connection with pollution control from time to time. If illegal conditions are detected as a result of periodic inspection conducted by the local authority, the pollution control manager is normally called on and the problem is explained in detail for him to report to the owner of the company instead of penalties being immediately enforced. The pollution control manager is normally told that improvement should be made in due course, otherwise, a heavy penalty will be assigned, and that if such administrative guidance is ignored, not only the pollution control manager but also the owner of the company will be subject to the penalty. In this way, owners (managers) of SMEs are well informed about legal issues on pollution control, which enabled enforcement of pollution control on the part of SMEs to be very successful.

d. Response to the Restriction of Qualified Personnel

As seen in Section 3.2.4, in cases where a SME lacks the capacity to carry out a technical evaluation of pollution control measures, that company can utilize a business diagnosis system, including environmental aspects, run by local governments. This will be discussed in detail in Section 3.7.3.

3.7.2 Channels to Obtain Information

a. Information on Pollution Regulation

In the early 1970s there were two channels for obtaining information about pollution regulations in Japan. One was from local authorities and the other was from industry associations. Local governments suffering from severe industrial pollution due to accumulation of industries in the area had provided pollution sources with relevant information and guided them on pollution control measures even before key pollution legislation was enacted in 1970.[26] In particular, environmental sanitation inspectors were assigned to public health centers under each prefectural government. The inspectors provided information to the polluters and gave advice on public hygiene, such as wastewater, waste, and night soil.[27]

After an organizational structure for pollution control was established in prefectural governments, relevant companies were informed about the details of the laws and regulations. Beginning in the latter half of the 1970s, information networks from prefectural governments to the companies through pollution control managers were established.

With regard to the schedule for law establishment and timing of law enforcement, the Ministry of International Trade and Industry (present Ministry of Economy, Trade and Industry) and its local agencies disseminated information through major industry associations to individual companies from time to time. Many companies realized the need for pollution control measures prior to the establishment of pollution related laws in 1970. They contacted local governments and agencies such as chambers of commerce, industry associations, and the like and also with industrial technology centers for required information. For example, the plating and pulp/paper industries that had well developed organizations in regions exchanged information among experts from industry associations and industrial technology centers, and local governments.

[26] For example, Tokyo Metropolitan Government, Kawasaki city, Yokohama city, Osaka city, Osaka prefecture, Mie prefecture, Kitakyusyuu city etc.

[27] According to HASHIMOTO Michio, environmental sanitation inspectors became involved in the first stage of pollution control policies as engineers. Existing systems of public health centers and environmental sanitation inspectors formed a sound basis for future environmental management in Japan.

b. Information about Public Financing and Preferential Tax Treatment

Public financing and preferential tax treatment were established at an early stage. The financing was implemented by public financial institutions such as the Japan Small Business Corporation, the Shoko Chukin Bank, the Japan Finance Corporation for Small Business, the Japan Development Bank, and the Pollution Control Service Corporation. The information about public financing was disseminated to SMEs through an existing network of SME related organizations established before the 1970s, namely the National Federation of Small Business Associations --> Prefectural Federation of Small Business Associations --> local chamber of commerce and local industry associations --> individual companies.

Besides the above-mentioned network, manufacturers of pollution control devices also provided information on public financing to the companies at the time of sales activities.

c. Information on Technology and Costs of Pollution Control Devices

There are three channels for SMEs to obtain information on technology and pollution control devices. One is from an industry association; the second is from prefectural industrial laboratories (present industrial technology center) that were established in the 1950s. The third is from manufacturers of pollution control devices.

As seen in Section 3.5.1 of this chapter, there were many cases where companies took advantage of local governments and/or industrial technology centers for gaining necessary information when examining pollution abatement technologies in the early 1970s.

When the plating, pulp/paper, food processing, and dye industries are local industries, SMEs frequently interacted with experts in local industrial technology centers. The following example illustrates this point:

- The plating industry in Tokyo actively sought advice on pollution control measures from the Tokyo Metropolitan Industrial Technology Center (presently the Tokyo Metropolitan Industrial Technology Research Institute).
- The Shizuoka Prefectural Paper Industrial Laboratory (presently the Fuji Industrial Research Institute) examined anti-pollution control measures for the pulp and paper industry. Through the laboratory, information on industrial pollution control technology was disseminated to the local pulp and paper companies. Furthermore, it was common for the industry to establish committees and/or groups for studying pollution control measures in which information was exchanged among relevant bodies.

As one of their activities, these committees/study groups conducted study tours to visit advanced factories. These committees/study groups have official status, which made it possible for individual companies to visit and see the factories that they could not visit by themselves.

As for information obtained through manufacturers of pollution control equipment, companies acquired necessary information not only on the technology itself but also technical as well as cost information from the manufacturers who had begun sales activities to prospective customers since around 1965.

For information gathered from small business promotion organizations and industry associations, as indicated in Figure 3.2.2, there were opportunities to gain information from Small Business Information Centers in the region and the Japan Small Business Corporation. Particularly important were local industry associations, chambers of commerce, and national industry associations. Those organizations held seminars on pollution control technologies and amendments of related laws and regulations to disseminate information to businesses. However, the information gained through those organizations was of a general nature only, and not specific enough for companies to examine pollution control technologies.

When a company makes a decision to invest in pollution control, it must analyze and evaluate the concerned technology as well as its cost. In the early 1970s, the companies tried to obtain good quality of information by conducting their own research activities or utilizing public organizations.

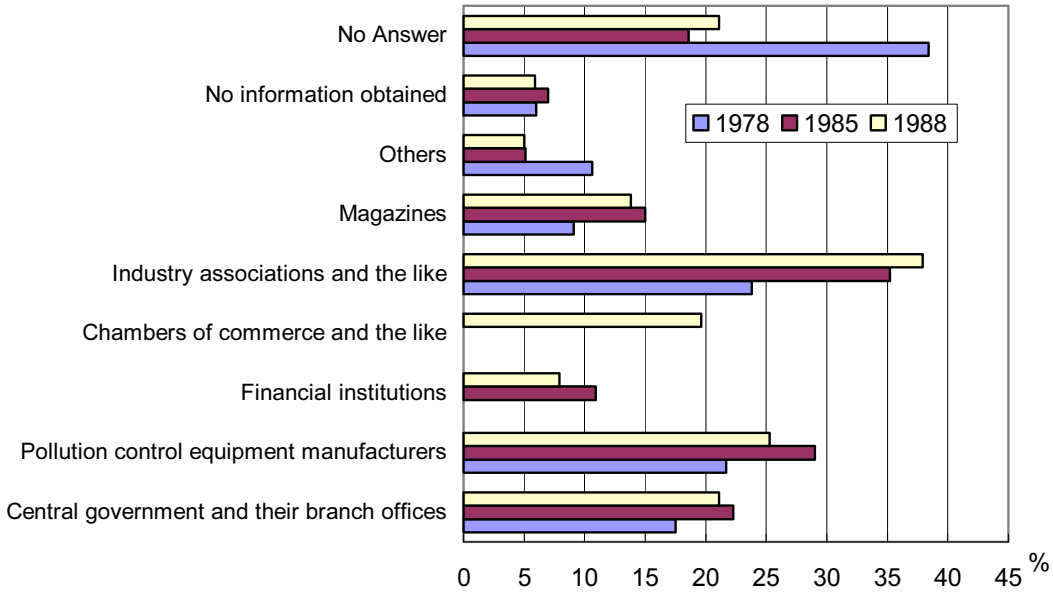
Companies carefully examined and evaluated the sales proposals of pollution control equipment manufacturers. At that time, pollution control technologies were still in a developing stage, and many methods were proposed. Thus the companies were very cautious about installing technologies that had not been practically applied in many cases. *Case examples of successful Pollution Control Measures by SMEs* records the words of many companies that it is important not make a decision on introduction of pollution technologies based only on sales proposals of pollution control device manufacturers.

There were cases when a company carried out research on pollution control technologies and successfully prepared specification of the devices. In another case, a company collected numerous sales proposals from many manufactures, and in the process gained vital information for evaluating the technologies.

d. Information Sources on Pollution Control Technologies in the 1980s

By the 1980s, anti-pollution control measures had been almost completed, and only a few manufacturers of well-engineered equipment, remained in the market. There had been much investment in pollution control technology, and with this experience obtaining required information became relatively easy.

Figure 3.7.1 shows how SMEs obtained information on pollution control equipment and technology, which was reported in *the Survey on Trend in Pollution Control Measures* conducted by Pollution Control Service Corporation.



Source: Pollution Control Service Corporation, "The survey on shifts in Pollution Control Measures by SMEs"

Figure 3.7.1 Information Sources on Pollution Control Technology for Small and Medium Enterprises

As this figure indicates, companies gained necessary information on pollution control technologies through industry associations. Likewise, administrative bodies and manufactures of pollution abatement equipment played vital roles in disseminating information. Although not indicated in the above figure, there were many cases where SMEs with a certain scale or

larger received information from the pollution control device manufacturers, which indicates that information provided by the manufactures through sales activities had a significant impact on the companies with relatively high demand for such devices. According to the survey conducted in 1988, Chambers of Commerce also played an important role in providing information about technologies and costs of pollution control.

3.7.3 Outside Support

When companies considered pollution abatement measures in the 1970s and 1980s, they received support from outside organizations. The types of support from outside the companies use can be categorized as follows:

1. Utilizing business diagnosis system by local governments
2. Utilizing support system of public organizations for assisting SMEs
3. Utilizing joint research organizations established by industry associations
4. Collaboration of research activities by public and industrial organizations
5. Utilizing pollution control device manufacturers

The first approach mentioned above, utilizing the business diagnosis system, was based on the Small and Medium Enterprise Guidance Law as mentioned in Section 3.2.4d. The diagnosis included environmental aspects. Following is an example of the use of this system that took place in the late 1970s.

- Sagami Craft Corporation: Small company with six employees.
  The firm engaged in paint baking of switchboards and the process required odor control. The City of Sagamihara gave guidance in 1975 to the business which also received diagnosis of industrial technology from an industrial technology center. The diagnosis pointed out problems which the firm decided to address based upon consultant advice provided by a prefectural industrial technology center.

The Japan Small Business Corporation and the Pollution Control Service Corporation were examples of the second category of support. The Japan Small Business Corporation was in charge of organizing and upgrading SMEs, as shown in Section 3.2.4. In particular, the Japan Small Business Corporation provided services like preliminary diagnosis of business operations and plans when SMEs were developing common facilities including joint wastewater treatment plants. On the other hand, the Pollution Control Service Corporation developed facilities and then transferred them to companies and/or unions. The scheme reviewed business plans and implemented them with the agreement of business entities.

There are not many cases of the third approach, establishing joint research organizations; however, it was common in industries with large corporations, such as steel, petroleum refining, chemical, pulp/paper, non-ferrous metal and cement industries.[28] Since the early 1970s, environmental committees were established within the organizations, under which individual study groups were formed to tackle each issue. The research organization in the pulp and paper industry is particularly well known. A similar organization was established in the plating industry among SMEs.

The fourth approach, joint research by public and industrial organizations, was commonly seen where a local industrial technology center collaborated with local industry. There are many examples of this kind of collaboration in the dyeing, plating and food processing industries in the early 1970s.[29]

[28] Japan Institute for Social and Economic Affairs, “Sangyo to Kankyo no Hensen”, 1989
[29] Small and Medium Enterprise Agency, “Case Examples of Successful Pollution Control Measures by SMEs”, 1972-1979

There were not many cases of the fifth approach, utilizing pollution control device manufactures. From the late 1960s to 1970s, pollution control was recognized as promising business opportunities, and the industry manufacturing pollution control devices had grown. In the air pollution control area, many companies adopted Western technologies and developed desulfurization equipment, dust collectors, low NOx burners, and optimal combustion systems. Of course, those industries developed unique technological expertise and built up competitiveness in the market, especially after the market expanded when environmental laws and regulations were strengthened. Similar cases can be seen in the wastewater control industry.

Many manufacturers adopted and introduced Western technologies, but lacked knowledge and experience on the practical applicability of such technologies. Pollution laws and regulations in the early 1970s resulted in an expansion of the market, but the manufacturers of the devices delivered them in a trial and error manner. Since companies planning to install devices were also not familiar with pollution control, both manufacturing and installing companies jointly searched for optimal systems when mutual trust was built up. Manufacturers of pollution control equipment built testing facilities within their premises, but also developed test facilities in customers' sites for joint research. When both parties developed a trusting relationship, the pollution control device developed for a particular customer was used for that particular factory, even if similar factories existed. This was partly because confidential information was often involved. The companies having these kinds of relationships tended to consult pollution control equipment manufacturers about relevant laws and regulations. This custom is one of the factors behind why consultants specializing in pollution control have not grown in Japan.

This custom is changing in recent years because a) new manufacturers have entered the market which has increased competition among the manufacturers, and b) companies are in need of rationalizing their management which inhibits them from dealing with only certain manufacturers. In the sense, technical information can now easily flow into the installing companies. On the other hand, pollution control device manufacturers gradually shifted to offer not only the devices per se but also consultation services for solving environmental issues.[30]

[30] Traditionally, pollution control device consulting was regarded as a supplementary part of product sales, but recently, some moves to sell the consulting itself, apart from products, can be seen.

3.8 Summary and Implications for Industrial Pollution Control Measures by Small and Medium Enterprises

3.8.1 Response of Small and Medium Enterprises to Industrial Pollution Control

a. Social Pressure

Factors that directly pressured SMEs into taking pollution control measures in the 1970s were complaints by local stakeholders and residents and enforcement of pollution legislation. In particular, for business owners of SMEs, who were also part of the local community, complaints from the local community were a major pressure that had to be responded to. Moreover, almost all business owners felt pressure from the mass media and local authorities in charge of pollution control. It may be said that a sense of responsibility to comply with legislation permeated the thinking of business owners at this time.

Many local governments had strived to increase pollution administration enforcement capacity even before pollution-related legislation was enacted, and they became able to immediately respond to problems after the laws went into effect. Moreover, local authorities used ordinances to establish additional standards on top of legally set effluent standards, and thus were quick to respond to enforcement of the law.

In this way, almost all companies, under pressure from local residents, mass media and local authorities, regarded implementation of pollution control measures as unavoidable.

In particular, following the Minamata case and cyanide discharge cases, the plating industry, which uses hazardous substances, realized that erring in their response to pollution control problems could mean companies going out of business. As a result, plating companies took a very serious approach to pollution control measures.

From the 1980s onwards, enterprises regarded compliance with industrial pollution control laws to be part of their social responsibility and implemented the pollution control measures as required.

b. Initiative of Business Owners in Pollution Control

Japanese business owners well recognized the need for pollution control measures in the 1970s, realizing that such measures were a hurdle that had to be cleared in order for companies to grow. Although pollution controls were mainly implemented as end-of-pipe measures, business owners positively investigated and promoted them.

Looking at examples of SMEs in the manufacturing industry, there were many cases of engineers taking the initiative in establishing companies. Moreover, since management included engineering staff, technology issues were viewed as highly important in terms of company's operation. This bias towards technical matters worked positively when it came to examining pollution control measures; in particular, production engineers were able to seriously examine pollution control measures with the full backing of management.

At the start of the 1970s, owners of SMEs and large enterprises alike instructed production managers and engineers to look into pollution control. After that, in the case of relatively large companies, environmental control systems were established in companies, engineers in charge of environmental matters pointed out problems to managers, and managers in turn instructed technical staff to investigate countermeasures. However, in the case of SMEs, generally speaking examination of environmental measures did not begin until managers issued instructions to technical personnel and staff in charge of production control since many enterprises adopted the top-down system of management. This system still remains today.

Even following the shift in emphasis from pollution problems to environmental problems, concerning the response to stronger controls on air pollution, water pollution and industrial waste, the conventional approach has remained more or less unchanged with measures only being examined after environmental staff point out issues to business owners.

c. Efforts to Examine and Evaluate Pollution Control Technologies by Small and Medium Enterprises

The features of SMEs when they examined and selected pollution control technology in the 1970s were as follows:

- In-company organizations were established. In particular, production engineers filled important roles.
- Enterprises did their homework.
- Enterprises did not blindly follow the measures proposed by equipment manufacturers.
- Enterprises strived to acquire information. In particular, they utilized external public agencies.

Common themes in SMEs were that they did not possess personnel in charge of environmental measures and pollution control at the start, and that engineers in manufacturing departments assumed responsibility for examining alternative measures. It was common for these personnel and another member to collect information and examine measures, i.e. enterprises did not necessarily establish examination teams. (In the case of large enterprises, examination teams were established).

Since the staff in charge of examination were usually machine-related engineers, even though they were not specialists in environmental technology, they were able to understand the technology behind environmental control. Enterprises utilized various channels in order to obtain information on environmental control technology.

Responsible personnel utilized information garnered in pollution control textbooks and seminars, as well as information from pilot facilities. Since it was difficult for an individual company to visit pilot facilities by itself, visits were frequently organized via workshops and study groups arranged by industry associations. Moreover, industry associations organized missions to visit pioneering facilities overseas and collected information from other countries.

When introducing pollution control equipment, responsible personnel in enterprises collected information and required multiple manufactures to submit proposals and cost estimates. Then they determined which manufacturers they would use for the pollution control equipment upon comparing and assessing the merits of each proposal. The responsible personnel showed the results of findings to top management and awaited the decisions. This process was exactly the same as that applied when purchasing plants for conventional production, so personnel were well experienced in the procedure.

However, responsible personnel in enterprises were not able to acquire detailed information which enabled them to prepare purchase orders for pollution control equipment, and the above process was not necessarily the norm. At the beginning of the 1970s, manufacturers of pollution control equipment often investigated the optimum measures in partnership with enterprises since the manufacturers also had little prior experience and were still in the research and development stage regarding the necessary technology. For example, in some cases, pollution control equipment manufacturers obtained permission to dispatch engineers to their client enterprises in order to analyze pollutant concentrations at pollution sources, and they proposed equipment based on the resulting data.

Equipment manufacturers became deeply involved in this process of pollution control technology examination in enterprises for the following reasons: 1) because the manufacturers

themselves had little experience of constructing plants using imported technology from Europe and U.S.; 2) because equipment was often custom-made according to each factory; and 3) because it was necessary to adequately gauge wastewater and emission gas properties in order to prevent problems following delivery.

After pollution control equipment became disseminated, the situation greatly changed in that new equipment manufacturers appeared, past cases and related information were abundantly available, and specialist pollution control managers came to be nurtured within enterprises.

Some enterprises still tend to determine order destinations according to past business relations and capital affiliations when installing new pollution control equipment; however, on the whole enterprises now decide order destinations upon acquiring technical information and proposal estimates from numerous manufactures.

d. Governmental Assistance to SMEs for Responding to Land Constraints

In urban areas, many SMEs originally located in mixed residential and industrial areas. In such cases, the enterprises did not have a lot of space. As a result, numerous enterprises were faced with problems when they needed space to install pollution control equipment, in particular wastewater treatment facilities. Furthermore, the only way to solve the problem of factory noise was to relocate production facilities to areas away from populated areas.

Concerning land constraints, rather than seeking new land in order to install pollution control equipment, SMEs, viewing this as an opportunity to develop, implemented pollution control in tandem with strengthening of plant production capacity and modernization of production equipment.

Local governments prepared industrial estates in order to secure new sites for relocating enterprises and to constructively bring pollution sources together. At such times, funds for relocation presented new major issues. However, through providing abundant public financing schemes for modernization and so on within SME promotion policies, it was again possible to overcome the difficulties.

The pace of industrial estate development increased from the 1960s and, as a result of designation of industrial areas in city planning from the 1970s onwards and efforts to develop industrial estates by local authorities and the Japan Regional Development Corporation, it was possible to respond to the demand for plant site land.

e. Assistance by Public Financial Institutions for Financing Pollution Control Investment

During the period of rapid development by enterprises from the late 1960s into the 1970s, many enterprises implemented pollution control investment in tandem with investment in production facilities for expanding the scale of operations.

The capital investment ratio at this time was extremely high at around 30%, and increased still further at 50% over the previous year in both 1967 and 1968. Although this rate of increase temporarily slowed down in 1970, capital investment continued to grow at a fast rate until 1974. From 1975 onwards, due to the slowdown in economic activity caused by the first oil crisis, the rate of growth in capital investment slowed down.

Almost all enterprises in Japan implemented pollution control to coincide with the enforcement of legislation. As a result, investment into pollution control was concentrated in a certain period and a temporary demand for funds was created. However, public funding systems were able to mitigate this situation.

It is said that the low real interest rate in the 1970s triggered investment in pollution control, but this relationship is not necessarily clear. Although the 1970s did not offer the high growth rates that were enjoyed during the period of rapid economic growth, business owners could still

make investment in expectation of good growth, and private financial institutions were still relatively willing to offer loans. Accordingly, SMEs did not experience major difficulties in securing funds for pollution control investment.

However, in the case of micro enterprises, since it was not advantageous to invest autonomously, national SME promotion policies encouraged them to take necessary pollution control measures upon pooling operations and forming business groups.

f. Efforts to Absorb the Impact of Pollution Control Investment on Production Costs

The impact of pollution control investment on production costs differed according to scale and sector. In particular, the impact was larger for SMEs compared to large enterprises.

However, the impact on costs turned out to be smaller than anticipated. First, rather than pollution control costs, personnel and raw materials costs accounted for a far higher share of production costs, and inflation in the cost of these items had a far greater impact on final production costs. In the 1970s, against a background of production cost inflationary pressure caused by personnel, energy and materials price increases caused by the oil crises, many enterprises advanced measures to cut the primary elements of production cost. As a result of these cost cutting efforts, enterprises were able to absorb the costs of pollution control.

When SMEs implemented new investment including that for production equipment, increased productivity resulting from the introduction of new facilities and an increase in the scale of production enabled them to secure lower production costs even taking into account the cost of pollution measures.

In particular, enterprises were able to absorb the impact of pollution control investment on production cost through implementing employment adjustment by raising labor equipment ratios, thoroughly increasing process yields and automating production processes.

In this way many SMEs were able to offset the impact of pollution control investments on production costs, but enterprises that failed to make these efforts struggled to survive.

Nowadays, pollution control costs are incorporated into production costs in every enterprise, and pollution control investment no longer represents a problem. However, particularly from the 1990s onwards, ceaseless efforts have been made to reduce production costs in the face of harsh competition in the global economy. For example, it is necessary to cut the costs of environmental measures. Effort continues to reduce environmental loads by raising the productivity of raw materials and energy.

g. Approaches to In-House Organizations and Staff Training

The above paragraphs have summarized pollution control measures among SMEs in Japan. Two other noteworthy points are as follows:

- Establishment of in-house pollution control system, and
- In-house education of employees concerning environmental problems

SMEs originally did not have internal system for dealing with pollution control matters, but following enactment of the Law for Establishment of Organization for Pollution Control in Specified Factories in 1971, the situation changed. This law legally required enterprises to establish pollution control structures, and enterprises also established company-wide safety and environment committees for personnel not directly concerned with pollution control measures, even though such committees were not required under the law.

In relation to this, Japanese SMEs implemented company-wide movements for production control, believing it pointless to do if not implemented company-wide, and they adopted a similar approach to pollution control measures. Environmental education was provided for all employees in order to reform awareness regarding pollution matters (environment) in everyday

activities. Although these activities did not attract that much attention, they undoubtedly played an important part in the promotion of industrial pollution control measures in Japan.

3.8.2 Implications for Industrial Pollution Control by SMEs in Developing Countries

Based on analysis of the pollution control measures implemented by Japanese SMEs, the following lessons can be drawn for promoting industrial pollution control measures among SMEs in developing countries.

a. Awareness of the Need for Countermeasures by Business Owners is Vital

When it comes to making decisions on industrial pollution control, it is essential for business owners to correctly understand the need to comply with effluent and emission gas standards established in legislation. When business owners lack this understanding, enterprises cause pollution problems and become subject to administrative advice and orders, thereby damaging the social standing of the enterprises concerned.

b. Pressure from Communities, Mass Media and Local Authorities is Essential for Shaping Awareness of Business Owners

External pressure from the parties surrounding enterprises is essential in order to make business owners realize the need for and implement pollution control measures. Guidance provided in on-the-spot inspections by local authorities is highly effective in putting pressure on business owners. Having said that, since pressure from communities and mass media seeking social responsibility from enterprises plays an important part in making local authorities take such steps, this type of pressure is also important.

c. Examination of Pollution Control Measures by Production Engineers in Enterprises is Important

Since pollution sources and production processes are closely linked, it is important for production engineers to be involved in examining pollution control. Also, in order to facilitate such examination, it is important to collect and analyze data on pollutant concentrations in wastewater, wastewater flow rates and flow rate fluctuations from each discharge source. Concerning pollution control technology too, acquiring information from as many equipment manufacturers and reliable experts as possible facilitates the selection of appropriate countermeasure technology.

d. Need to Acquire and Analyze related Data

When implementing pollution control measures, it is a good idea to start by obtaining data concerning the quantity and quality of emission gas, wastewater and solid waste discharged from multiple processes in the plant concerned. In developing countries, such quantitative and qualitative measurements are not implemented in general, but gauging flows of pollutants within plants in this way makes it possible to understand the state of yield rate and waste of raw materials in processes, which is important for production control.

Japan's experience shows that data control regarding pollutant substances, etc. in processes is effective for selecting appropriate pollution control measures, raising productivity through process control, limiting emissions of pollutants, preventing excessive investment in pollution control equipment and reducing the burden of equipment maintenance.

e. In-House Systems for Pollution Control are Necessary

Among SMEs, it is normal for a small number of business owners in charge of technical matters and engineers from production processes to conduct examination of pollution control. This is sufficient in the early stage of examination, but when it comes to the operation and maintenance of equipment, it is desirable to establish an internal organization specifically

responsible for pollution control (environmental management). In the case of Japan, the same department frequently handles safety management and environmental management, but other enterprises establish control committees for each area, and staff from departments not directly concerned with pollution control take part in these internal arrangements. By establishing such control systems within companies, it is possible to conduct internal checks and audits.

f. Understanding of All Employees is Important

In the early days of promoting pollution control measures in Japanese SMEs, it was very important to make sure that employees understood the measures concerned.

In particular, in plants that dealt with hazardous substances, it was important to make employees fully realize that such substances were the cause of pollution and to ensure that they were aware of pollution control in their everyday work.

g. Responding to the Cost Burden of Industrial Pollution Control Investment is Not Necessarily Difficult

Industrial pollution control investment by SMEs rarely exceeds 10% of sales turnover and is not necessarily a large cost component.

In cases where pollution control investments are made at the same time as conducting plant investment for expanding production, since productivity is also increased, the additional cost of pollution control measures does not constitute a major problem, providing that increased sales turnover and profits can be expected. If enterprises have the capacity to secure funds for production investment, it should be relatively easy for them to secure funds for pollution control investment too.

In cases where investment is only required to implement pollution control measures at existing plants, the investment amount is not necessarily large compared to sales turnover. However, even so, since it is common for SMEs in developing countries to secure investment funds from their own resources and cash flow, it may be difficult to satisfy temporary funding requirements by such methods alone, and enterprises may react negatively to investment that is non-productive. On such occasions, if low-interest public loans are available, it provides a great incentive for enterprises. However, there is a strong possibility that private financial institutions will view enterprises that are unable to implement pollution control measures without receiving public financing as lacking in financial viability.

For ambitious business owners who realize that pollution control measures are an essential investment, it is normal to make efforts to secure the necessary funds. However, even for such enterprises, it is difficult to adopt a positive mindset since pollution control investment is viewed as unproductive investment. Accordingly, the existence of low-interest public finance schemes is an effective means of encouraging enterprises to carry out pollution control measures.

h. It is not Difficult to Absorb the Impact of Industrial Pollution Control Investment on Production Cost

Industrial pollution control costs account for just a few percent of sales turnover and even of production costs. Compared to raw materials costs and personnel costs, the impact of pollution control costs on the cost of production is small. The most effective means of absorbing additional costs is to raise productivity through introducing the latest production equipment. However, if existing production equipment is used as it is, it is necessary to absorb pollution control costs through raising productivity by raising yield rate, increasing facility operation rates and improving product quality levels, etc.

Japan's experience shows that raw materials, energy and personnel costs have a bigger impact on production cost than pollution control costs, and that the cost of pollution control measures can be comfortably absorbed through cost cutting based on raising productivity.

i. Public Long-term Loan Schemes are Effective for Pollution Control Investments by SMEs

For SMEs, even if pollution control investment does not necessarily involve large amounts, it is still not easy to secure substantial funds in the short term. Even if enterprises possess sufficient resources to cover such investment, unproductive investment in pollution control takes away other more promising investment opportunities and is not so appealing for entrepreneurs.

Enterprises usually make investments when they expect them to lead to increased profits in the future. The Japan's experience shows that it is effective to invest in pollution control measures at the same time as making such lucrative investments. Looking back at Japan's experience, following the end of the era of rapid economic growth and with the onset of the 1970s, many enterprises invested in production equipment while utilizing public financing schemes for pollution control measures. In paradoxical terms, enterprises took advantage of opportunities to utilize such public financing systems to promote equipment renewal. In this sense, public financing schemes were extremely effective.

In Japan's experience, enforcement of legislation made it necessary for enterprises to implement pollution control investment in a definite period. Particularly for SMEs, public finance was made available at the same time as the legislation, since it was forecast that they would have difficulty securing funds for that purpose, and this proved effective in aiding the smooth implementation of measures. Furthermore, since limiting public financing schemes only to pollution control measures is restrictive from the viewpoint of enterprises, such schemes are more attractive when they can also be utilized for improving production equipment and expanding operations.

j. Nurturing of Experts and Strengthening of Advisory Functions of Public Research Agencies

When it comes to implementing pollution control, enterprises possess production technology experts but they often do not have environmental experts. Accordingly, production engineers have to play the central role in examining pollution control technology and selecting appropriate measures. At such times, these personnel need to collect and examine information concerning the said technologies, but utilizing such information in order to assess validity of the technologies is not an easy task. Manufacturers provide information, but this is not technically neutral.

In the case of Japan, the existence of experts belonging to research agencies attached to local authorities, who are able to impartially judge various technologies and provide advice to enterprises, has been extremely important. In developing countries too, it would be highly significant to assign experts capable of providing technical advice in public agencies.

k. Collaboration between Governments and Industry Associations (Chambers of Commerce and Industry, etc.)

The activities of chambers of commerce and industry associations play extremely important roles in promoting understanding of pollution control measures among business owners. Such groups make it possible to communicate information on government controls to individual enterprises. Moreover, awareness of environmental problems among business owners can be deepened through explanatory meetings, lectures and policy dialogue concerning government environmental controls conducted by such groups. Industry associations are also effective in

preparing joint environmental action plans and encouraging members to act in accordance with such plans.

l. Development of expert personnel in pollution control measures

It has already been mentioned how important it is for production engineers to take a leading role in examining pollution control measures in enterprises. However, in order to operate and maintain pollution control equipment and deal with other environmental issues, it is desirable for enterprises to develop human resources endowed with the specialist know-how to examine and assess pollution control technologies.

In the case of Japan, during the period when pollution control measures were first advanced, business owners responsible for technical matters and production engineers in SMEs examined and selected technologies while studying the fields concerned. At the same time, the national government established a qualification system for pollution control managers with a view to nurturing experts with basic specialist knowledge of pollution control measures. This development of experts was effective in raising the capability of enterprises to deal with environmental issues.

m. Dissemination of the Social Responsibility of Enterprises

Many enterprises in Japan recently pointed to social responsibility as a motivation for pollution control measures. Based on this new awareness, more and more enterprises are introducing environmental management systems as well as preparing and publicly disclosing environmental reports. Green procurement is also advancing in corporate purchasing activities.

Moreover, agencies for rating enterprises based on their environmental approach and degree of social responsibility have started to appear. In this way, establishment of social systems for monitoring the social responsibility of enterprises will constitute a major pressure in encouraging enterprises to implement environmental measures.

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Chapter 3: Contents

Chapter 4

Improvement of Productivity and Development of Cleaner Production (CP)

4 Improvement of Productivity and Development of Cleaner Production

4.1 Framework of Analysis

While Japanese companies had achieved remarkable improvements in productivity after World War II, there were many achievements which contributed to reduction of environmental loads resulting in concurrent improvements both in productivity and reduction of environmental loads.

Energy saving measures quickly developed through the two oil crises and water saving measures initiated by the control of the use of groundwater is typical examples of the above achievements.

In this chapter, cases in which energy saving (for example, efficiency improvements in use of heat), rationalization of water use (for example, reduction of unit use of water and reuse of wastewater) and improvement of product yield (for example, reduction of unit input of raw material and reduction of rate of rejects) resulted in the reduction of environmental loads in gaseous emission, water effluents, solid waste, etc. are presented. It is shown how compatibility between productivity improvement and reduction of environmental loads is achieved.

First, a conceptual definition of "improvement of productivity" and "Cleaner Production" is shown (-->4.1) This is followed by a historical overview of productivity improvement (-->4.2) and development of Cleaner Production (-->4.3) Cases of achievements cited in published literature as well as from personal interviews are categorized (-->4.4), and finally effective mechanisms for information transmission, manpower training, and financing are identified. (-->4.5).

4.1.1 Definition of Productivity in the Study

Productivity is defined as the ratio of the output to the input. OECD defines productivity as "the value when output production is divided by one of the amounts of input resources."[1] Various productivities, such as labor productivity, capital productivity, resource productivity, etc. can be defined depending on selection of the inputs and outputs from the following:

- Inputs: labor, capital (land and machinery), other resources (fuel, water, raw materials, etc).
- Outputs: amount of production, value of production, sales of products, value added, GDP, etc.

Improvement of resource productivity means reduction of losses of fuel, water, raw materials and the like, and it is likely to contribute to reduction of environmental load such as air/water pollutants and solid wastes.

Resource productivity or similar concepts are defined like

- "Inputs Target of Material Flow" : "Resource Productivity" written in the Basic Plan for the Promotion of Establishment of Recycling Oriented Society (Decision by Cabinet, March, 2003)*[1]
- Index of Environmental Management in an environmentally advanced firm in electronic manufacturing industry: " Environmental Efficiency"*[2]

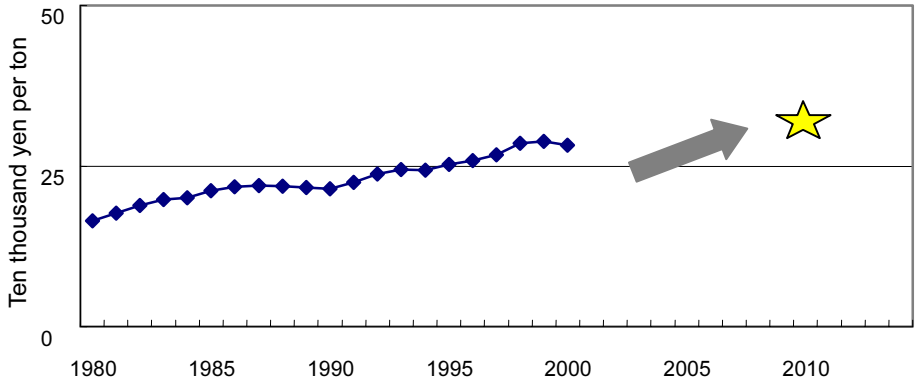
[1] Productivity Research Center, "Definition of Productivity"
URL http://www.e-js.jp/productivity01/main.html

- Policy Goal: "Eco Efficiency" advocated by World Business Conference for Sustainable Development (WBCSD, former BCSD)*[3]

as a target or factor to show compatibility of environment and economy.

Often, the word "productivity" means labor productivity which regards labor as an input in many cases but since "resources productivity" is newly developed term, we will use "productivity" in this chapter.

*1: In the Basic Plan for the Promotion of Establishment of Recycling Oriented Society (March 2003), as the target of input of material flow, "Resource Productivity (=GDP/Input of Natural Resources) is planned to almost double to ¥390000/t in 2010 from about ¥210,000 in 1990, or about 40% above the level of ¥28,000/t in 2000.



Source: Ministry of the Environment, *2003 White Paper on Sound Material-Cycle Society*

Figure 4.1.1Trend in Resource Productivity

*2: A large electronic appliance company A has shown its "Environmental Efficiency" target of 1.3 times in 2004 and twice in 2100 (reference).
Environmental Efficiency = Sales/CO_2 Emission where

CO_2 Emission=Business CO_2 Emission - Reduced CO_2

+ CO_2 Emission by Customers, and

Environmental Efficiency = Sales/New Resource Input, where

New Resource Input = Total Resource Input - Recycled Resource Input

- Reused Resource Input - Renewable Resource Input

*3: WBCSD (BCSD, 1993) confirmed 7 standards for Eco Efficiency listed below.

- Minimization of material density in goods and services.
- Minimization of energy density in goods and services.
- Minimization of dissemination of toxic substances.
- Improvement of capability of recycling of material.
- Maximizing use of renewable resources.
- Expanding durability of products.
- Increase density of goods and services.

4.1.2 What is Cleaner Production (CP)?

Cleaner production (CP) is one of the approaches to reduce environmental loads from a production process by changing or modifying the process itself, raw materials, or design of the product. It intends to solve pollution problems at places closer to the origin of environmental loads in contrast to the end of pipe (EOP) approach which treats emissions and wastes after they are generated[2].

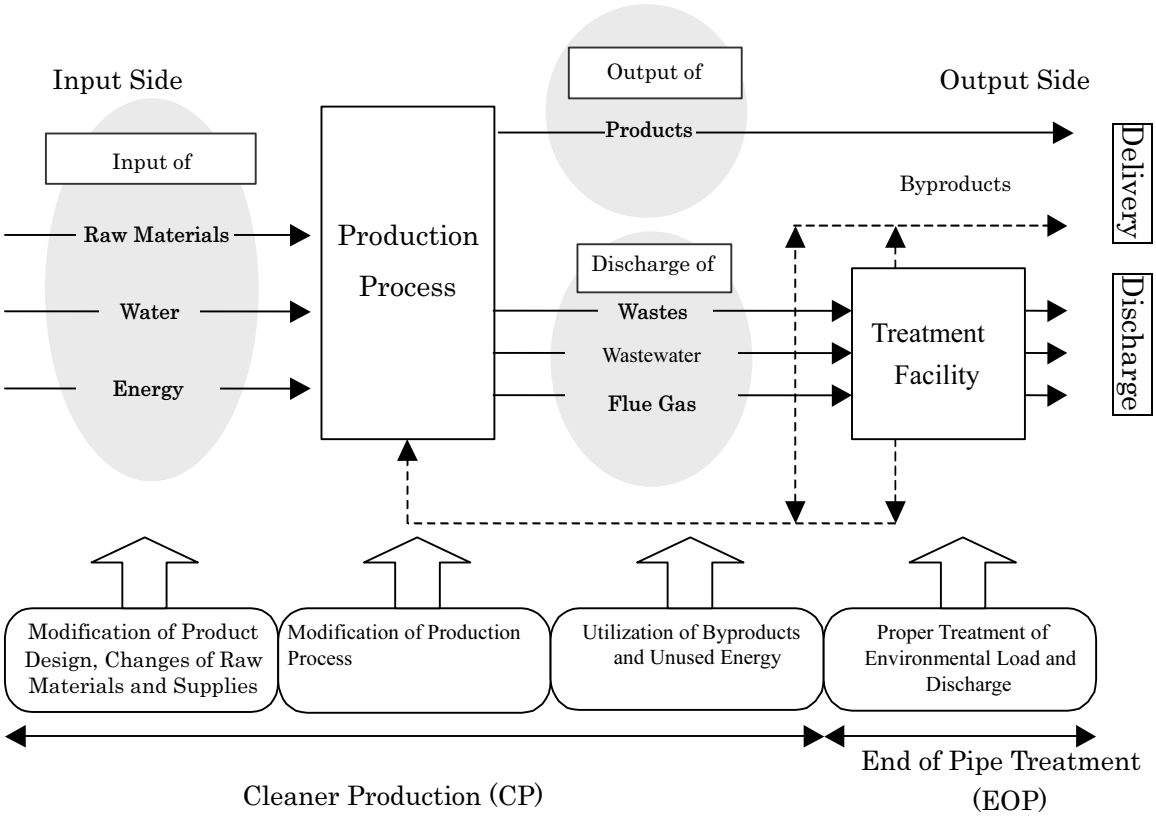


Figure 4.1.2 Concept of Cleaner Production

Generally speaking, CP can be introduced with lower investment cost than EOP (in some cases it may be implemented by changing the operational process without large capital investment) or even with some profit by improving resource productivity (environmental load is reduced through reduction of resource inputs). Introduction of CP is a method which has relatively lower obstacles to an individual firm.

On the other hand, CP is more specific to an individual firm; success stories of other firms cannot necessarily be replicated. It also involves various departments of a firm; design, purchasing, production technology, operating and other departments may be involved to realize the benefits.

[2] According to the definition by UNEP, CP includes reduction of environmental loads at the stage of product use and disposal in a broad sense; however, only the actions taken to reduce environmental loads at the production process stage are discussed in this chapter.

4.2 History of Productivity Improvement in Japanese Manufacturing Industry

4.2.1 Changes in TFP and Contributory Factors

Total Factor Productivity (TFP) is an index of efficiency of a production structure. It is defined as the ratio (TFP=Y/X) of production (X) to total inputs (Y). Its growth rate is calculated as a residue by subtracting the growth rate of labor and capital stock contributions from the growth rate of production.

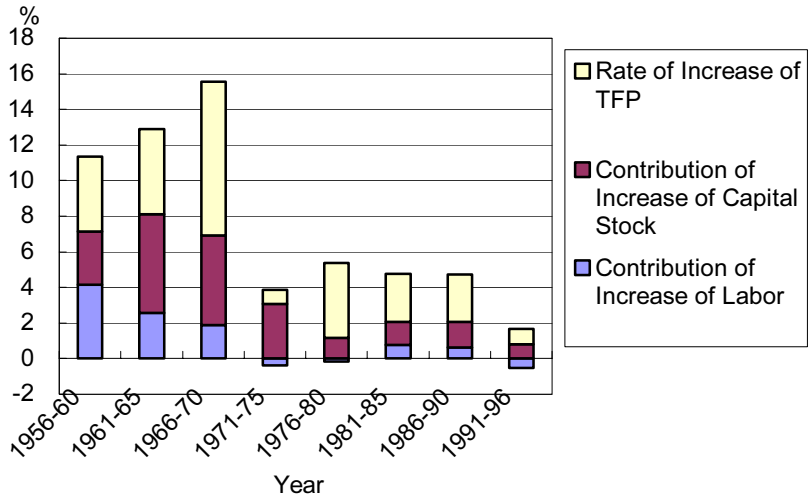
Growth Rate of TPF = Substantive Growth Rate of Added Value
- Growth Rate of Input Index, where

Growth Rate of Input Index = Labor Cost / Total Cost x Growth Rate of Population of Employed
+ Capital Cost / Total Cost x Growth Rate of Capital

Factors underlying TFP growth include progress of technology, improvement of management, improvement of the skill level of the labor force and realization of economies of scale. Progress in technological systems and production organizations is realized mainly in longer term improvements in the operating rate of fixed investments and shorter term improvements in the skill level of the labor force[3].

The contributions of labor and capital stock to the overall economic growth rate of Japanese manufacturing industry were substantial prior to 1960, they decreased significantly thereafter, and the growth rate of TFP became major contributor to the economic growth of the manufacturing industry from the late 1970s.

While there are many individual factors contributing to increase in growth rate of TFP such as technological improvements, improvement of skill level of labor force, better management, and economy of scale, resource productivity is another factor. Improved resource productivity through, for example, energy saving, spread widely after the oil crises and contributed substantially to the increase in growth rate of TFP between 1976 to 1985.



Source: Japan Productivity Center for Socio-Economic Development, *Comparison of Productivity by Industry Sector*, 1998

Figure 4.2.1 Analysis of the Economic Growth of Manufacturing Industry (1956-1996)

[3] Bureau of Public Life, Office of Cabinet, "Explanation of Terminology" http://www5.cao.go.jp/seikatsu/koukyou/explain/ex21.html

These improvements in productivity would have contributed to reduction of environmental load in the following three ways.

- Improvement in resource productivity decreases environmental load (= material and energy losses)
- Losses causing environmental load are identified in the process of data collection, plant inspection, process and work analyses.
- Improved productivity makes investments in plant facility possible.

4.2.2 Historical Development of Productivity Improvement in Japan

Improvement of productivity in Japan after WW II is classified into seven periods as shown in the table below.

Table 4.2.1 Historical Development of Productivity Improvement in Japan

Reconstruction Period after WW II 1945 - 54	• Limited resources are concentrated and invested in coal and steel industries (tilted production system). --> Efficient use of coal was urgent --> Enactment of the Law of Heat Management (predecessor of the Energy Saving Law) • Demands from Korean War --> Increase of production capacity (Productivity improvement to increase production) was the agenda. • Quality control seminars by Union of Japanese Scientists and Engineers, and establishment of Japanese Industrial Standards (JIS) --> Statistical quality control was gradually disseminated as a prerequisite of JIS license.
First Stage of High Economic Growth Period 1955 - 64	• The economic issue was to obtain foreign currency and to strengthen export competitiveness after the demand stimulated by the Korean War ended. --> Japan Productivity Center (present Japan Productivity Center for Socio-Economic Development) was established and productivity campaign started in cooperation with labor unions. • Advocacy of improvement (Kaizen) activities by Union of Japanese Scientists and Engineers --> QC circle, ZD movement, JK activity started (but full dissemination in the next period). • Jinmu economic boom, Iwato economic boom, and preparation of the National Comprehensive Development Plan. --> Vigorous private capital investments, increase in investments in production capacity expansion through development of new plants
Later Stage of High Economic Growth Period 1965 - 72	• Increase of exports to the U.S. at full throttle to overcome the recession in 1965, constant positive trade balance thereafter. -->Economy of scale based on export sales was pursued. Construction of gigantic plants increased. • Full employment of labor force. Countermeasure against labor shortage became an issue. --> Labor saving measures such as investments for longer assembly lines and automation of plants increased • Izanagi economic boom, rapid increase of consumer durable goods production --> Systemization of production control methods progressed. (Total quality control-TQC, Toyota production system, etc.) • Victims of so-called four major pollutions became a social problem and accused as pollution dumping --> Though CP measures were promoted as fundamental solutions, EOP measures were mainstreamed.

Period after the First Oil Crisis 1973 - 78	• Crude oil price quadrupled. --> Productivity improvement to reduce input, like energy saving was the issue. • Recession due to anti-inflationary measures. --> Rationalization without large investments (lean management), Attention to Toyota management system.
Period after the Second Oil Crisis 1979 - 85	• Second rise of oil price, Recognition of continuing high oil price among production managements. --> Know-how acquired from oil crises is built into plant facilities, increased energy conservation investments. • Introduction of numerically controlled machine tools advanced, assets for production increased. --> Maintenance and improvement of existing plant facility and other ways of efficient use of existing assets became to major issues.
Period of Bubble Economy 1986 - 90	• Appreciation of yen after Plaza accord made prices of imported fuel and raw materials cheaper, the first round of investments to reduce air and water pollution completed. --> Research and development and plant investment against energy saving and pollution started to decrease. • Japan-US trade friction, high yen, high-mix low-volume production. --> Compatibility of high-mix low-volume production and cost reduction became to a major issue. • Movement to service oriented economy (shift to the tertiary industry). Shortage of workers for the production floor. --> High productivity seeking development of fully automated integrated machinery system.
Period after Burst of Bubble Economy 1991-	• Stagnation of domestic demand, increased pressure for cost reduction to compete with emerging Asian countries. --> Productivity improvement by reduction of inputs of labor, capital, raw material, etc. became an issue. • Exhaustion of waste dumping space and strengthening of waste dumping rules made disposal costs high. --> Measures to improve yields to reduce generation of waste, so-called zero emission movement. • Environmental management system (ISO14001 etc.), spread of green purchasing. --> Popularization of vendor selection by environmental concern in addition to cost, quality and delivery.

Source: compiled from information in MITSUI Hayatomo*, Assessment and Outlook of Japanese Production System*, Minerva Book, 1999 and YABE Yozo et al., *Chronological Table of Modern Economic History of Japan*, Nihon Keizai Shinbun-Japan Economic Daily, 2001

a. Pre-history of Productivity Improvement (- 1945)

There were many mines of nonferrous metals and coal in Japan before the Second World War, but resources of precious metal which were once a major export item from Japan had become exhausted. Resources of other metals were relatively limited both in volume and grade and reliance on imported materials increased with the increase of industrial production. Though coal supported Japanese industrial development through the Meiji era and following years until the Reconstruction Period after the WWII, its dominance was replaced by petroleum before Japan entered into the High Economic Growth Period. Productivity improvements in the High Growth Period and later years were achieved when Japan depended upon mostly imported natural resources.

This reliance of petroleum, iron ore and other resource materials which are subjects of wider fluctuation of market price and availability due to paucity of domestic resources was one of the major factors characterizing improvements in productivity of heavy and chemical industries of Japan.

In addition to the above, which may not be directly related to the recent improvement of productivity after the WW II (referred to in the next section), the experience of a

resource-scarce situation before the Meiji era and through the war years would have fermented habits and knowledge of how to use limited resources efficiently, and helped building the capacity for improved resource productivity.

In the Edo Period (before Meiji Period) Japan was almost completely closed to foreign trade and there were elaborate systems to recycle primary products, such as human and animal excreta, paper and textiles, and metals. There were even dealers who purchased ash from firewood and charcoal and sold it to farmers and manufacturers of sake, paper, textile, dyeing, china, etc.[4]

During WW II when resource supplies from overseas were disrupted, technical assistance organizations were established to promote production for the war. After the war, these organizations were reorganized; they included the Japan Management Association and Union of Japanese Scientists and Engineers, and they contributed to improvement of productivity and quality and industrial standardization among other things, with guidance and assistance from the GHQ (General Headquarters of American Occupied Forces).

In the Periods of Reconstruction and early High Growth, there were some remaining businesses from the Edo era that specialized in recycling resources like paper, metals and glass bottles. Much reliance was placed on older executives, managers and engineers who had survived from the resource- scarce situation in the War years. These factors became the foundation for future productivity improvement[5].

b. Reconstruction Period after WW II

b.1 Tilted Production System

Industrial production in Japan immediately after the war went down to a level lower than one tenth of the time of peak production before the war (average between 1934 and 1936). The extreme shortage of foods and essential daily goods as well as excess money supply in the war time for military procurement financed by governmental bonds caused hyperinflation very quickly.

By the end of the war, there were 7.6 million released veterans, 1.5 million returnees from war areas and old colonies and 4 million workers laid off from military related industries However, only close to 5 million were absorbed in agriculture, and finding jobs for the remainder was a serious problem. The production capacity for consumer goods remained only about a quarter of what existed before the war. On the other hand, heavy and chemical industries had plant production capacity equal to 180% of the capacity before the war though many plants were outmoded, since much plant and equipment had been converted to military supply production. Foreign trade was almost non-existent during the war and exports and imports in 1946 were below one tenth of the amount before the war. Stocks of basic resource and energy materials were expected to become exhausted by March 1947[6].

It was urgent to overcome this situation by more effective use of raw and fuel materials in order for industrial production to recover. Increased production of domestic coal was a matter of utmost urgency. The Headquarters of Economic Stabilization (1946~1952) decided that imported raw and fuel materials should be allocated to iron and steel mills and coal mines preferably for the phenomenal increase of steel and coal supply which supported other industries. This policy was called “Tilted Production System”.

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[4] MAKINO Noboru / OHISHI Shinzaburo / YOSHIDA Yutaka, “Origin of Japanese Style Environmental Protection”, *Modern Agriculture*, Special September Edition 1991, pp.66-70

[5] At interviews held for this study, there were cases identified by some firms (food processing, textile/dyeing) where the policy of not wasting goods and/or materials had been observed as the basic policy of the founder; the results of these practices in effect became pollution abatement measures.

[6] TAKEUCHI Hiroshi, *Chikuma Library 16 - Economic History of Showa*, 1988, pp.104-110

At this time the Rules of Heat Management (1947) and the Law of Heat Management (1951) were enacted and system of Heat Management Engineer was introduced. This was the predecessor of the present Energy Saving Law (1979) and contributed to make the calculation of energy balance a habit of plant operation and eventually became the foundation for further improvement of productivity[7].

b.2 Retrenchment Finance

In 1947 - 1948 when dominance of the Chinese Communist Party became clear, the occupation policy of the GHQ shifted from democratization and demilitarization to promotion of economic independence and with easing of war reparations, other new regulations such as setting the single exchange rate of $1=¥360, reduction of various government subsidies, and conversion of domestic consumption to exports, were executed based on tight fiscal policy, called the Dodge Line. Due to these measures, including a freezing of bank deposits and conversion to a new yen in 1946, persistent inflation was terminated, while bankruptcies and unemployment had increased again.

Under the above circumstances, the need to strengthen competitive ability made efforts for increased productivity very popular.

At that time Toyota Motors was on the brink of bankruptcy due to union strikes and excessive product stock. They learned lessons from the experience of this difficulty that was useful for future Toyota style management based on demand-pull instead of supply-push ("The biggest waste is waste of overproduction.") and quality control within assembly line ("The following process is your customer." or "Quality should be made into products within the assembly line.").

b.3 Generation of Special Military Demand: Expansion of Civilian Consumption by Korean War

The outbreak of the Korean War in 1950 generated war demands which absorbed increased exports from steel mills and textile factories. The demand was across the whole spectrum of industries, including small and medium size firms. Standards of living of average Japanese rose, and demand for clothes, furniture and other households are also increased. Therefore even after the truce in 1951 along the 38 degrees latitude line the economy continued at a good level, thanks to civil demands.

The foreign exchange income from exports enabled the country to increase imports of raw materials and investment in plant facilities and licensing arrangements for new technology became popular. Due to the above, bottlenecks in production, namely plant capacity and raw materials, became a major constraint. Depending on the industry, demands increased more than rapidly than the industry could satisfy, and products were sold as soon as they were produced. Productivity increased as a result of theses pressures,

b.4 Introduction of Statistical Quality Control (SQC)

Between the Reconstruction Period after WW II and the First Stage of High Economic Growth Period, various new methods of production control and productivity improvement such as Industrial Engineering (IE) and Operation Research (OR), had been introduced from the United States. Among others, Statistical Quality Control (SQC) was the earliest to be introduced substantively and widely disseminated.

Statistical quality control is a method to measure and control quality fluctuations of mass produced industrial products applying methods based on statistical mathematics and developed and disseminated for procurement of military supplies as American war time industrial standards.

[7] SOMA Kiyotaro, "Twenty Years of Heat Management and Future Trend," *Plant Engineer*, September 1971

The introduction of statistical quality control was initiated in 1946 by GHQ which suggested the application of the method to Japanese communication equipment producers, as the quality of service of the Japanese telephone system was unacceptable. In 1949, Japan Industrial Standards (JIS) based on Industrial Standardization Law were introduced and a JIS marking rule started. SQC was becoming popular since the law required use of SQC as part of JIS qualification review.

In this process the Union of Japanese Scientists and Engineers (UJSE, founded in 1946) played an important role by inviting Dr. W. E, Deming in 1950 and Dr. J. M. Duran in 1954 to hold SQC courses for corporate executives, launching a monthly magazine "Quality Control" in 1950 and establishing the Deming Prize (A major prize awarded for outstanding achievement in research and promotion) and a practicing prize for remarkable improvement of business performance and other prizes in 1951.

c. First Stage of High Economic Growth Period (1955 – circa 1964)

In the periods of Jinmu economic boom in 1956-57 and Iwato economic boom in 1959-61, Japan entered into a real economic growth process. Vigorous capital investment in the private sector became the traction force and entering into the 1960s foreign trade liberalization and the citizen income doubling plan (1960) and the national comprehensive development plan (1961) initiated increases in expansion of productive capacity involving new plant locations and economy of scale.

At this time there were the following activities for improvements in productivity.

c.1 Establishment of Japan Productivity Center

The end of the Korean War in 1953 resulted in the termination of military demands, and trade balance became deficit again; export promotion outside of military purchases then became the issue. Improvements in quality and productivity were the major policies aimed at export competitiveness.

Under the above circumstances, a proposal was initiated by the United States government for technical assistance for improvements in productivity. The proposal triggered the establishment of an organization which intended to promote improvement in productivity as a national movement involving government, management and labor.

The largest labor union, the General Council of Labor Unions refused to join originally, but finally decided to join after agreeing the three principles of productivity movement (1: maintenance and expansion of employment, 2: cooperation and consultation between labor and management, 3: fair distribution of productivity gains, and the Japan Productivity Center was founded as a non-governmental organization in 1955.

Emphasis on labor management cooperation and involvement of labor unions from the very beginning characterizes the uniqueness of productivity movement in Japan[8].

At the same time QC was disseminated by mass media like "QC Course for Floor Supervisors" (1956, Nippon Short Wave Radio), "New Management and QC" (1957. NHK, the quasi-governmental broadcasting organization both in radio and TV) and "QC and Standardization" (1959, NHK) among others[9].

[8] Kansai Productivity Center, *Productivity Movement, Yesterday, Today and Tomorrow*, 2001, pp.4-5, pp.46-49
[9] NHK Group of Reporters et al., *Anatomy of Japan 2 - Source of Economically Great Nation*, 1987, p.71

c.2 Initiation of Small Group Activity (QC circle, ZD movement, JK Activity)

In 1962 the Union of Japanese Scientists and Engineers (UJSE) launched a magazine called "Working Floor and QC" and called for organization of small groups at the floor level (QC circle) aiming the following targets.

1. Upgrading leadership and managing capability of first line supervisors,
2. Attempting elevation of desire for improvement and staff morale by involving all members including floor workers,
3. Acting as the working floor nucleus for efficient management for corporate wide QC activities.

To make livelier activities of QC circles, the Center of QC Circles headquartered within the UJSE), regional chapters were organized and events were held by chapters and/or other regional branches to exchange experiences among circles (national meeting of QC circles) and to commend outstanding achievements (prizes of Center of QC Circles) for the promotion.

Within individual firms, management encouraged and supported QC circle activities and autonomous QC study activities by paying subsidies and/or overtime wages for the activity, holding corporation-wide or operation-wide QC meetings and commendation of exemplary activities.

c.3 Increase of Overseas Inspection Trips

In the latter half of the 1950s, traveling missions to the United States to study various production control methods increased as shown in the table below (see Table 4.2.2)

Table 4.2.2 Study Missions on Production Control Methods in the Latter Half of 1950s

Areas	Activities
IE	3S (1956), IE Training (1959)
OR	OR (1959)
Quality Management	Quality Management (1958)
Other	Cost Management (1955), Transportation (1956) Marketing (1956), Office Management (1956) Human Relations (1956), Industrial Training (1957) Industrial Relations (1957), Packaging Technique (1958)

Source: Prepared based on Asian Productivity Organization, *New Paradigm of Productivity Movement*, 1989, pp.8-9

d. Latter Stage of High Economic Growth Period (1965 - 1972)

After observing a recession period between the two high growth periods, in the latter part of 1960s, a second economic boom called Izanagi continued.

At this time, shortage of manpower became an issue, while acquisition of imported raw materials and fuel became easier reflecting the positive foreign exchange balance. Importance of resource productivity had been downgraded compared with other productivity factors.

d.1 Pursuit of Economies of Scale by Construction of Large Plants

In the process of moving out of the 1965 recession caused by over-production, exports to the United States were taken for granted and pursuit of a larger economy based on increase of exports was planned. In addition to the above, full employment was realized in 1965 and measures to counteract the shortage of manpower became an issue for the first time after WW II.

Therefore for improvement of productivity, emphasis was placed on maximizing production with minimal new workers, and measures such as extension of assembly line belts, construction of the world's largest plants, and manpower-saving arrangements were popular to cope with the situation. Operating rates of such gigantic plants were low because ever increasing demands were realized.

d.2 Popularization of Small Group Activity and Systematization of Methods of Production Control

After the late 1960s, various small group activities such as QC circle, Zero Defect movement and autonomous control (jishu kanri, JK) activities became widespread, while systemization of control methods covering all phases of corporate quality control (TQC, TQM) or Toyota production control style integrating small group activities based on statistical quality control had advanced.

d.3 QWL Movement, Rewarding Work, Flexibility

After the late 1960s, a gradual increase in unemployment initiated a movement called quality of working life (QWL) to attempt to recover comprehensive humanity of the life of production plant workers.

Reflecting the movement, contrary to the large plants cited above, trials of flexibility oriented production methods including module production, cell production, elimination of conveyor belts, free flow lines, and module production by small groups were carried out at electric and electronic plants, but these did not cause to any major change in production management.

e. Period After First Oil Crisis (1973 - circa 1978)

The skyrocketing crude oil price and measures to control following inflation decelerated the economy rapidly in 1973. Due to the recession, GDP in 1974 showed a negative growth for the first time since WW II, and even after recovery from negative growth, years of low growth followed.

Under the above situation, improvement of resource productivity counteracting price increases of crude oil and other resource materials became an important and urgent issue. Within productivity improvements in these years are many CP measures including energy and water use rationalization.

e.1 Energy Saving as a Countermeasure against the Higher Crude Oil Price

As countermeasures against the higher crude oil price, energy saving measures advanced rapidly in the industrial sector.

However, the higher oil price was seen only for short duration of time and quick actions were needed, so rationalization without substantial plant investment (improvement of burning method, better insulation, etc.) was implemented.

e.2 Adjustments to Negative and Low Growth

With the first oil crisis as a turning point, the Japanese economy moved from high growth to stable growth. Since a continual rapid expansion of markets was unrealistic to assume, the major objective of productivity improvements shifted from more output to less input.

Under the above social environment, "make as much as we can sell", the lean management system, particularly Toyota Production System attracted attention.

e.3 Countermeasures against Increasing Expenditures for Environmental Protection Investment and Operation

After the 1970 Diet session called the "Environmental Session", rules and regulations for industrial pollution became stricter and stricter. While capital investment in general was decreasing, investment in environmental protection including desulfurization of gas from atmospheric emission increased rapidly and a peak was observed in 1975.

With increasing expenses for these End of Pipe (EOP) type environmental investments, efforts to reduce operating costs were strengthened, and movements to reduce generation of polluting substances, and ideas based on CP were introduced.

e.4 Conversion of Industry Structure

With the increasing crude oil price, international competitiveness of Japanese manufacturing industry with high imported oil dependence deteriorated, and this most strongly affected the high energy consuming materials industry, which consequently lost its status as the basic key industry.

In parallel with the above the share of tertiary industry within GDP increased and contributed to improvement of resource productivity of Japan as a whole.

f. Period After the Second Oil Crisis (1979 - circa 1985)

f.1 Increase of Capital Investment for Saving Energy

An effect of the second oil crisis was that higher oil prices were recognized as a continuing matter and not a temporary matter. Methods to earn profit under the higher oil price environment were sought and permanent countermeasures including substantial investment for facilities integrating latest research and development achievements were made.

f.2 Maintenance and Improvement of Existing Production Facilities

In late 1970s, numerically controlled (NC) machine tools were introduced. A reasonable amount of production equipment was accumulated, but risks for expansion of such investments were quite high because an ever-expanding market could not be expected. Many firms tried to improve productivity by fully utilizing existing facilities and improving maintenance, and modification of existing facilities for better performance became a major issue.

With the above needs, TPM (Total Productive Maintenance) has been propagated.

g. Period of Bubble Economy (1986 - 1990)

Arrangements based on energy saving legislation including introduction of energy management engineers progressed, but oil prices declined after the second oil crisis had ended. This reduced the incentive for energy saving, and the activity lost its momentum.

In addition to the above, rapid revaluation of yen after the Plaza Accord of 1985 resulted in lower yen prices of imported resource materials, and the incentive for resource productivity in general declined.

Though the higher yen required higher productivity and cost reductions for exporting industries, the costs of raw and fuel materials were kept relatively low by the above same reason, so improvement of resource productivity was not seen as a priority issue.

h. Period After Burst of Bubble Economy (1991 and after)

A dull economy after the bubble burst, increased product imports from Asian countries and overseas movement of domestic manufacturing plants initiated higher pressure to lower costs and reassessment of ways to economize on the use of raw and fuel materials was advanced.

The scarcity of final waste disposal sites triggered a particular interest in solid waste which had not been a priority issue when compared with atmospheric air and water, but now received increased attention for appropriate treatment and recycled use.

The remaining potential for improvement in productivity at each unit process was limited and summation of improvements of individual parts of a process might not produce the best result for an operation as a whole. In the late 1990s, environmental management systems characterized by ISO 14001 were propagated rapidly around the world and progress of operational integration among various functional departments of firms (planning and design - acquisition of raw materials - production technology - production control - measures for pollution and environmental control, etc.) were considered for the introduction and promotion of CP related activities

4.2.3 Systemization of Productivity Improvement Measures

During the period of reconstruction after WWII and the following high economic growth, statistical quality control (SQC), industrial engineering (IE), operations research (OR), preventive maintenance (PM) and other production management practices were introduced, integrated with the Japanese employment system (e.g. life time employment) and business customs (e.g. keiretsu) and evolved into a unique Japanese approach. Representative practices are listed below.

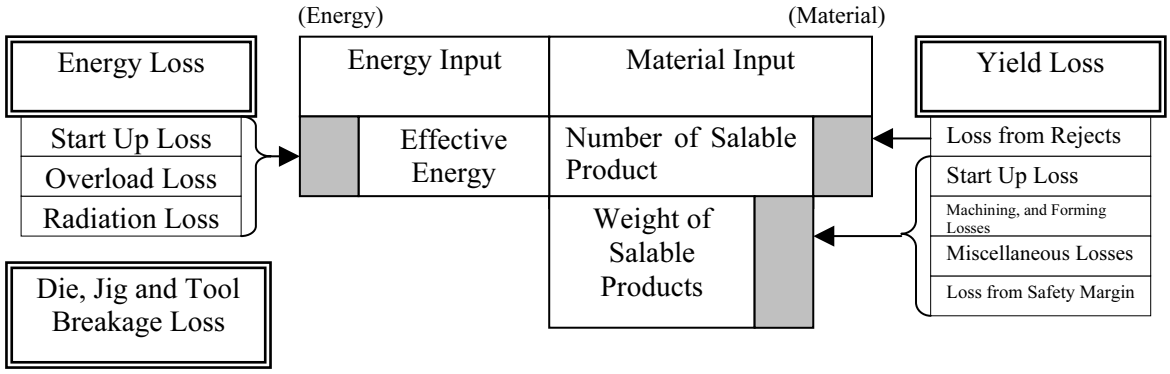
- Total Quality Control (TQC) or Total Quality Management
- Toyota Production System (Kanban Method, Just In Time: JIT) or Lean Production Management
- TPM (Total Productive Maintenance)

Their common characteristic features are:

a Targeting thorough elimination of losses starting from their elicitation.
b Problem solving not only within production process but also in the upstream activities (planning, design, purchasing, etc.).
c Integrating activities in small groups at the floor level for innovative improvements. It may be called bottom-up practice instead of top-down.

While these practices for productivity improvement are not primarily intended for CP, the above items (particularly a. and b.) have commonality with CP. Losses to be reduced include “energy loss” and “yield loss,” and in many cases the reduction of the losses contributed to reduction of environmental load.

From experiences at the time when acquisition of raw materials and fuels was difficult (Reconstruction period after the WWII and Periods of the first and second oil crises) and when excess product inventory due to shrinkage of domestic market and deflation trend existed, CP was practiced in Japan to improve productivity by reduction of inputs before it was proposed by UNEP in 1989.



Source: Japan Institute of Plant Maintenance, "Total Productive Maintenance"

Figure 4.2.2 How to Identify Three Major Losses which Hinder Improvement of Unit Consumption Efficiency in TPM

a. TQC (Total Quality Control)

TQC was developed along three axes of the production process, functional departments of management and hierarchic structure of organization from production floor through the whole corporation. Directions of development are shown in the table below.

Table 4.2.3 Structure of Corporate-wide Development of TQC

Development Axis of TQC	Origin	Direction of Development
Production Process	Product Manufacturing	Development, Acquisition (Purchasing) and Sales
Functional Department	Quality Control of Product	General Management (Personnel, Finance, etc.) and Production Management (Cost, Scheduling, Maintenance, etc.)
Hierarchy	On the field	Total Involvement including Middle Management and Top Executives

Source: Prepared based on KUMAGAI Tomonori, "Development and Future of Industrial Management in Japan," *Current Society and Production Technology*, 1992, p335.

For the development of TQC, the Union of Japanese Scientists and Engineers established the yearly Deming Prize[10] for an individual with outstanding achievement in research and/or propagation of TQC and related statistical methodology (Deming Main Prize) and for corporations with remarkable achievements applying TQC (Deming Application Prize) and has continued to award the application prizes to about 170 corporations from 1950 to 2000. Based on resumes of presentations at award winning occasions, the following results were reported.

[10] Deming Prize is a world-class prize on TQM established in 1951 to honor Dr. W. E. Deming whose achievement became the central foundation to upgrade quality of Japanese products to the highest level in the world. (Excerpt from "What is Deming Prize" distributed by the Committee of Deming Prize, 2002)

Table 4.2.4 Tangible Results by Activities Awarded Deming Prizes

Tangible Results \ Year			1950	1960	1970	1980	1990	Total
Tangible Results \ Number of Firms			34	16	34	54	39	178
Management (General)	Growth		1	9	21	46	30	107
	Profitability		5	7	15	37	25	89
	Productivity		1	5	25	20	19	70
	Safety				4	5	1	10
Management (Elements)	Quality	Process Failure Process Control	22	6	15	19	18	80
		Product Inspection	11	1	2	13	8	35
		Reduction of Customer Complaints	8	9	26	42	26	111
		Increase of Customer Value		3	6	16	16	41
		Market Competition		1	12	17	9	39
	Cost	Reduction	10	5	8	21	14	58
		Rationalization		4	4	3	7	18
	Quantity Delivery	Productivity	4	2	5	14	6	31
		Stock	3	2	7	4	8	24
		Delivery		3	5	17	12	37
	Safety	Safety/Environment	1		6	14	5	26
	Manpower	Career Development		2	14	40	28	84
	Society	Social Contribution					1	1
Activity of Sections	Development Capability			6	18	35	24	83
	Sales Capability			1	1	7	2	11
	Information Capability						3	3
General	Self Assessment						8	8

Source: Prepared based on data from "Deming Prize 50" 2000, p29, by Union of Japanese Scientists and Engineers

Table 4.2.5 Intangible Benefits by Activities Awarded Deming Prize

Intangible Benefits \ Year		1950	1960	1970	1980	1990	Total
Intangible Benefits \ Number of Firms		34	16	35	54	39	178
Management	1. Promotion of Improvement of Constitution		3	12	39	15	69
	2. Establishment of Management Vision				10	15	25
	3. Clarification and Through Penetration of Management Vision and Policy	6	10	16	33	16	81
	4. Establishment of Company Wide Cooperative System	3	11	27	48	20	109
	5. Exact Definition of Function and Responsibility	4	2	6	12	7	31
	6. Smoothing of Inter-departmental Cooperation	1	5	22	37	15	80

Intangible Benefits \ Year / Number of Firms		1950 34	1960 16	1970 35	1980 54	1990 39	Total 178
	7. Accomplishment of Group-wide QM		2	3	11	2	18
Quality Assurance	1. Establishment of Quality Assurance System	1	3	10	16	13	43
	2. Smooth Transmission of Customer and Company Information	3	2	12	19	8	44
	3. Esteeming of Counterparts and Next on Line	3	1	7	24	13	48
	4. Upgrading of Trust from Customers		1	4	10	5	20
	5. Leadership in Quality		2	5	9	1	17
	6. Accumulation and Improvement of Technology	3	1	3	10	4	21
Attitude and Habitual Manner	1. Propagation of Philosophy and Practice of QC	16	6	21	18	14	75
	2. Promotion of Standardization	9	4	5	4	1	23
	3. Realization of Importance of Data	2	2	15	14	2	35
	4. Result First to Process First		3	15	20	10	48
Human Factors	1. Advancement of Consciousness on Quality	5	8	20	37	14	83
	2. Advancement of Consciousness on Cost		5	7	8	7	27
	3. Advancement of Consciousness on Problem Identification and Innovation	2	2	15	27	17	63
	4. Advancement in Problem Solving Skill	2	2	15	29	15	63
	5. Advancement of Self-managing Ability		4	17	20	10	51
	6. Improvement of Employee Morale		4	18	12	14	48
	7. Career Development of Employees		1	8	11	9	29
Social Contribution	1. Responsibility and Contribution to Customers and Society		1	1	5	1	8
Labor Relation	1. Pleasant Work Place/Happy to Work		1	3	13	7	24
	2. Improvement of Welfare of Employees	1	1	1	1	1	5
	3. Improvement of Labor Relations		2	1		1	4

Source: Prepared based on data from *Deming Prize 50*, 2000, p31 by Union of Japanese Scientists and Engineers.

b. Toyota Production System

The Toyota Production System is to identify losses which are ready to happen under multi-product manufacturing environment and to remove them as complete as possible. The Toyota Production System quotes the following seven losses (wastes) as typical losses.

1. Loss of Waiting -- Waiting time loss like machine waiting time for the next working piece.
2. Loss of Over-manufacturing -- Loss of unnecessary intermediate stocks which are not used immediately.
3. Loss of Movement -- Waste of unnecessary or inefficient movements and reloading.

4. Loss of Unnecessary Fabrication -- Inappropriate fabrication demands essentially unnecessary time and work.
5. Loss of Stock -- Excessive production aiming cost reduction by large lot increases unnecessary intermediate stock.
6. Loss of Action -- Waste of inefficient action or actions which could be removed by smart arrangement of actions.
7. Loss of Rejects -- Manufactured rejects, materials used for them, time and work used for them are all wasted.

The system indicates following two methodologies to make the above seven losses visible and remove from the shop floor.

- Among above seven losses, losses 2 -- 7 are difficult to be understood by floor workers as waste. To overcome this situation they could be converted to type 1 waste which is simpler and easier to recognize by a floor worker and efforts should be shifted for removal of the type 1 loss.

- Improvements to remove losses were classified into operational improvements and equipment improvements. In principle, operational improvement precedes equipment improvements for the following reasons.

    - ✓ Based on the original objective of cost reduction, an operational improvement does not cost as much as an equipment improvement.
    - ✓ Operational improvements are easy to modify again and again while equipment, once modified, is difficult to modify again.
    - ✓ When an equipment improvement is made before an operational improvement is made, the design of equipment improvement cannot be based on the best available practice.

Also Toyota is using the following measures to make losses visible, to improve and to avoid losses in advance.

- "Kanban System" for Just In Time
- "Flattening" to cope with fluctuating demand
- "Shortening of Preparation Time" to reduce production lead time
- "Standardization of Work" to synchronize material flow on line
- "Machine Layout" to enable flexible manpower allocation for individual products
- "Improvement Activities" and "Proposal System" to reduce manpower requirement
- "Visible Control Method" for automation
- "Functional Control Process" for promotion of QC

Transition of introduction and development of the Toyota Production System is shown in Table 4.2.6.

c. TPM (Company-wide TPM)

TPM is defined by the Japan Institute of Plant Maintenance as below.

- Making a corporate constitution to pursue the limit of efficiency in production system as the corporate target,
- Establishing a system to prevent all losses from the whole lifecycle of a production system including "zero accident, zero rejects, zero trouble" on the production floor level,
- Throughout all divisions starting from production down to development, sales, administration and other departments and
- Involving everyone from the very top down to floor workers,

- To achieve zero loss by overlapping small group activities.

TPM is a program developed by Japan Institute of Plant Maintenance and can be said that it supports complete application of JIT production which produces what is needed when needed, by the amount needed in an advanced plant equipped with automatic control. TPM has improvement of the corporate constitution as its target like TQC, while TQC tries to focus on its activity to "quality (output side)", TMC concentrates its activity on "equipment (input side)" to realize its target picture of working floor[11].

TPM has been developed as management of equipment (planning, design, maintenance and disposal of equipment), starting in the 1950s as preventive maintenance, and changed to productive maintenance in 1960s, further developing into TPM as time based maintenance in the 1970s. Entering into 1980s, TPM became condition based maintenance and continuing to the present.

In Japan, the concept of preventive maintenance was introduced from the United States after WW II. Japanese plant facilities then were quite old and suffering frequent unexpected breakdowns and general practice was to repair after a breakdown.

After the concept of preventive maintenance was introduced, standards for equipment maintenance were developed and inspection, conditioning and exchange of parts were performed by plant staff centering around departments in charge of maintenance. After that, the concept of productive maintenance meaning maintenance with the highest productivity was proposed by General Electric Company[12]. Productive maintenance is not limited to maintenance of production equipment and means maintenance of the total production system consisting of the process and working system (equipment, labor and activity) and the management system[13]. TPM which is also called PM involving everybody is an outgrowth of the preventive maintenance introduced from the United States with additional concept of productive maintenance.

The condition based TPM introduced after the 1980s dictates that maintenance timing be decided by condition of the equipment. For the application of the method, it is necessary to develop technology to diagnose the condition of equipment and its application to actual cases[14].

To promote TPM, the Japan Institute of Plant Maintenance has played a central role, including research and development of TPM technology, judging and awarding of PM prizes, distribution of information for propagation of TPM knowledge and activation of group activities and consulting for promotion of TPM (see Figure 4.2.3).

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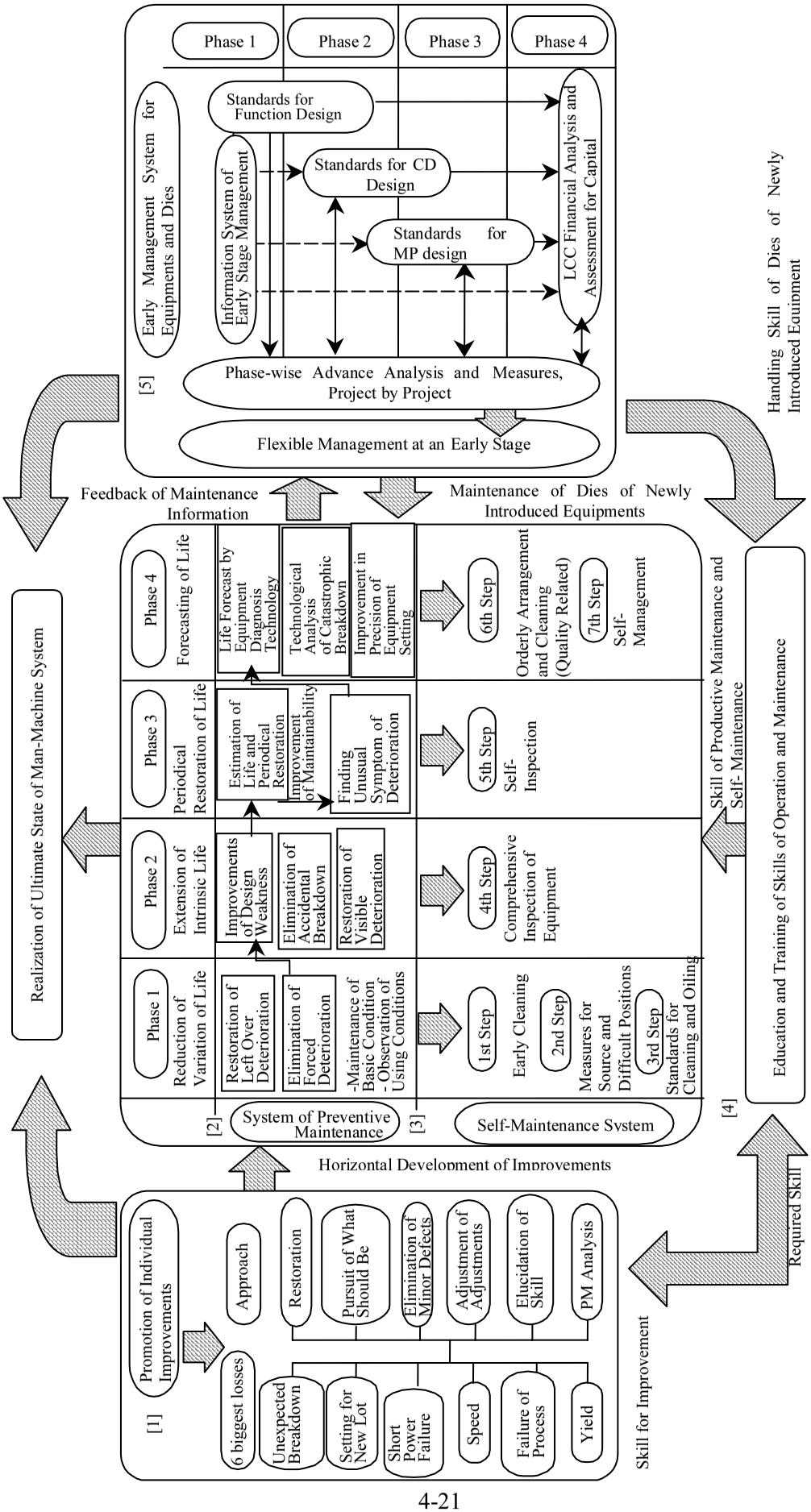
[11] Japan Institute of Plant Maintenance, http://www.jipm.or.jp/tpm/main.html/
[12] NAGATA Takashi, *TPM for Innovation of Manufacturing*, 1977, pp.9-12
[13] KUMAGAI Tomonori, "Development and Future of Industrial Management in Japan" in *Current Society and Production Technology*, 1992, p.347
[14] Japan Institute of Plant Maintenance "Research Report on Maintenance Technology of Manufacturing Plants - Systemization of Equipment Maintenance," 1987, pp.15-18

Table 4.2.6 Transition of Introduction and Development of Toyota Production System

	Item	(1945-1955) ('55-'65) ('65-'75) ('75-'85) ('85-)
Just In Time	(a) Fluidization and Synchronization of Process	('50) Fluidization of Mechanical Fabrication Process ('50) Synchronization of Mechanical Fabrication with Assembly Line ('55) Synchronization between Assembly and Body Plants ('60) Synchronization of All Plants ('75) Promotion of Synchronization between Unit Processes (Development of Equipment Suitable to Flow Line Operation)
	(b) Conveyance System	('53) Call System in Machining Plant ('55) Conveyance of Preset Quantity ("Water Beetle") ('59) Inter-plant Transfer System ('70) Conveyance Call System in All Plants ('73) Transfer System with Venders ('77) Circuit Conveyance System ('77) Relay Conveyance System ('83) Review of Total Material Flow Upon Consolidation of Production and Sales Companies
	(c) Reduction of Setting (Preparation) Time	('62) Reduction of Press Setting Time (Headquarters Plant) ('71) Single Press Setting Arrangement (All Press Plant) ('75) Single Press Setting at all Out Sources
	(d) "Kanban System"	('48) Return from Following Step ('53) Kanban System Introduced to Machining process ('55) Level Production ('62) Corporate-wide Use of Kanban System
	(e) Controlling Outsourced Items	('55) Introduction of Delivery Units to Outside Sources ('61) Red/Blue Identification of Outsourced Items ('65) Use of Kanban for Outsourced Items ('77) Introduction of Bar Code Readers Automatic Readers for Kanban)
	Order Receiving, Production and Delivery System	('66) Order System for Ten Day Period ('70) Daily Order System ('74) New Order System (NOS) ('79) Reduction of NOS Lead Time ('85) Lead Time Reduction Project
	(f) Instruction for Production	('57) Use of Order (Queue) Sheet ('63) Use of Instant Instruction System Just in Time Instruction ('71) Development of Ways of Instructing, Plant by Plant (Assembly-Label-Body Tamadashiki) ('80) Use of Automated Instruments for Production Instruction Use of Label Printers, Memory, TV and Bar Code

	Item	(1945-1955)	('55-'65)	('65-'75)	('75-'85)	('85-)
Automation	(g) Multiple Unit Process Assignment and Standard Work	('47) Dual Machine Assignment			('75) Development of Standard Practice to All Processes	
		('49) Three to Four Machine Assignment (Segregation of Manpower and Machine-power)				
		('53 Setting of Standards of Work)				
			('63) Assignment of Multiple Work Steps			
	(h) Visible Control QC within Process	('50) Visible Control System ("Andon") for Engine Setting				
				('66) Completion of Automatic Line for Engines (Automated with JIT)		
			('62) Development of Machining Process Control		('70) Development of Automated Body Press Line	
			Control of full Work			('80) Development of Automated
			Elimination of Careless Mistakes			Line by New Technology (NC and Robot)
						('82) Emphasis on Making Quality Within Products
Education System of Toyota Production System					('70) Toyota Production System Is Integrated into	
					Training Program of Front Line Supervisors and Foremen	
					('70) Complete Systematization of Toyota Production System	
					('76) Spontaneous Study Meetings	
					('78) Trainer Course of Standardized Work	
					('80) Course for Managers, Course for Engineers	
					('82) Thorough Comprehension of Principles	

Source: developed from SATAKE Hiroaki, *Birth, Development and Metamorphoses of Toyota Production System*, Toyo Keizai Shimpo, 1998, pp.16-17



Source: Japan Institute of Plant Maintenance, "Research Report on Maintenance Technology of Manufacturing Plants - Systemization of Equipment Maintenance", 1987, p.19

Figure 4.2.3 Example of Evolution Process of TPM

4.3 Development of CP and Its Background

4.3.1 Motivation for CP

Expected benefits of CP are:

- Input side: Savings of material, water and fuel costs by reduction of resource inputs, preservation of scarce resources.
- Output side: Reduction of environmental control cost and risk, reduction of environmental load.

Depending on the socio-economic situation, major motivations for the introduction of CP are different but grouped into the following:

a Response to high price and difficulty to acquire input resources.
b Reduction in treatment costs of environmental pollutants.
c Response to price cutting pressure.

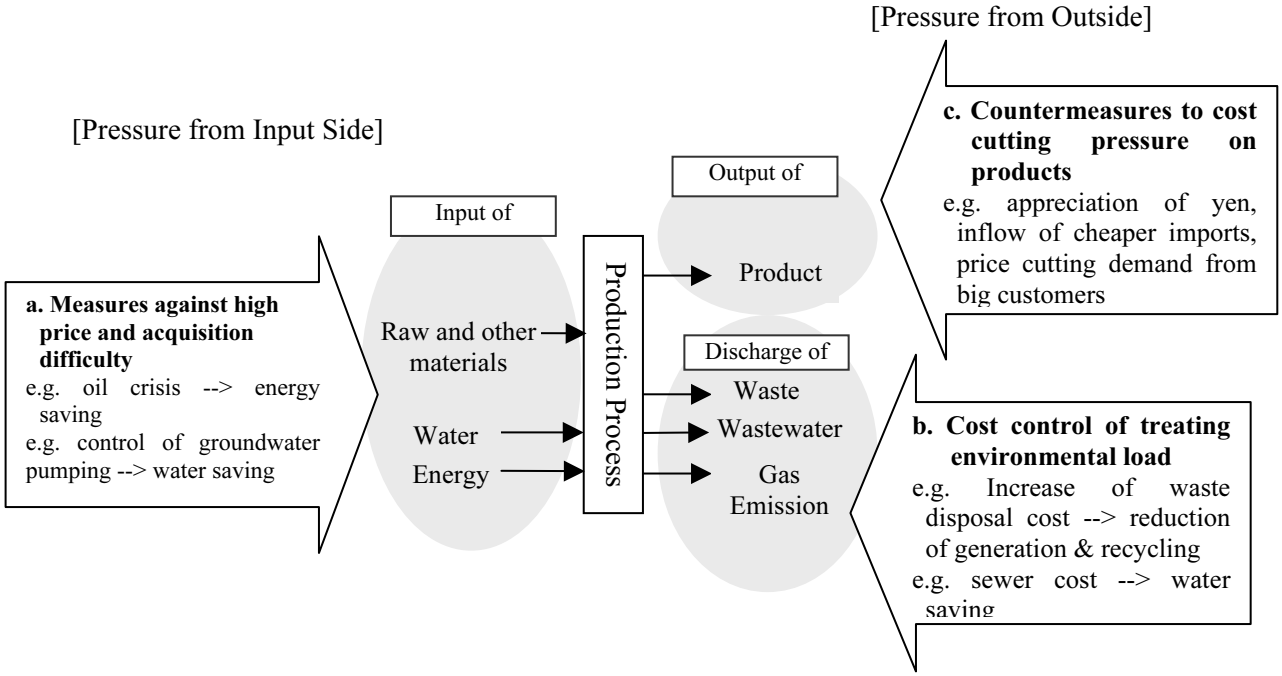


Figure 4.3.1 Types of Motivation for Introduction of CP

4.3.2 Transition of Motivations for Introduction of CP

Table 4.3.1 summarizes trend of motivations for introduction of CP and their major background factors by the time periods shown in "4.2.2 Historical Development of Productivity Improvement in Japan."

Table 4.3.1 Transition of Major Motivations for Introduction of CP

	a. Response to high prices and acquisition difficulty of input resources	b. Reduction of treatment costs of environmental pollutants	c. Response to price cutting pressure
Reconstruction Period after WW II 1945 - 54	General scarcity of fuels and raw materials including coal (XXX)	-	-

	a. Response to high prices and acquisition difficulty of input resources	b. Reduction of treatment costs of environmental pollutants	c. Response to price cutting pressure
First Stage of High Economic Growth Period 1955 - 64	Regulation on groundwater pumping (XX)	-	-
Later Stage of High Economic Growth Period 1965 - 72	(X)	Strengthening of pollution control regulations, expansion of public sewer system coverage (XX)	-
Period after the First Oil Crisis 1973 - 78	Price increase of petroleum and petroleum products (XXX)	Dissemination of EOP facilities, introduction of total amount control of pollutants (XXX)	(XX)
Period after the Second Oil Crisis 1979 - 85	Price increase of petroleum and petroleum products (XXX)	Expansion of areas under total amount control of pollutants and sewer system (XX)	(X)
Period of Bubble Economy 1986 - 90	-	(X)	High yen value (X)
Period after Burst of Bubble Economy 1991- Present	(X)	Increase of waste disposal cost and tightened discharger responsibility (XXX)	Slow growth economy, inflow of cheap imported goods (XXX)

Note: XXX: Major factor, XX: Influential factor, X: Effects to limited sectors, - : Not known or none

Major events that led the motivations and CP cases that were promoted by the motivations are shown below.

a. CP as Response to High Price and Difficulty of Acquiring Input Resources

There are many cases in which efforts to reduce consumption of fuel, water, input materials and others due to their high prices and difficulty of acquisition resulted in reduction in the generation of exhaust gas, wastewater and solid wastes.

Triggering events include regulations on groundwater pumping, shortage of fuel and raw materials in the early years after WW II, as well as the first and second oil crises. Introduction of the CP concept triggered by this type of motivation was more prevalent before 1970 and decreased after the last half of 1980s because of the stabilization of oil prices and the decrease of imported material prices due to higher yen value.

- In 1947 and 1948, when shortage of coal supply was an issue and transport was still mainly by rail, regulations and organizations to promote efficient use of energy were introduced for efficient use of coal, such activity eventually serving as the foundation for today's laws on energy saving, the heat control engineer system, and licensing and energy saving assessment activities subsidized by the government[15].
- In the 1950s, land subsidence due to excessive groundwater pumping became a social issue, and most of the local governments of large cities instructed industries limiting groundwater pumping by introducing rational water use programs. In 1956, a law to

[15] According to SOMA Kiyotaro, "Twenty Years of Heat Management and Future Trend," *Plant Engineer*, September 1971, there were records of reasonable fuel consumption saving before the first oil crisis.

control industrial use of water was enacted, and groundwater pumping became regulated, which promoted conversion of water sources from groundwater to municipal or industrial water and rational water use.

- In the decades of the 1960s and 1970s firms which experienced rationing of water in drought years and price increases of municipal water at progressive rates brought further progress in efficient use of water for stable operations and cost cutting[16].
- Responding to the first and second oil crises, energy saving measures penetrated rapidly into many plants. After the first oil crisis, improvements without major investments, such as insulation of equipment and advanced burning control were at the center of technology. After the second oil crisis energy investments were made, incorporating energy saving know-how accumulated after the first crisis and results of technical research and development.

Table 4.3.2 CP Case 1: CP to deal with high price and acquisition difficulty of input resources

Implementing Company	H Company, Pastry Manufacturer
Company Profile (At the time of interview)	Capital: ¥100 million Sales: ¥5.3 billion (as of August, 2000) Manufactured goods: cream puff, marron glace, cake etc.
Implementing Place	M Factory, Hyogo Prefecture (Closed in 1997)
Implementing Time	1970s
Contents of Measures	(1) Reduction of washing draining and improvement of yield rate of milk and fresh cream • Before the early 1970s, milk and cream, which clung to the equipment and containers, were not washed and drained. Milk was washed with a little water, and cream was scraped and reused as raw material for other products. • Moreover, wipers were installed inside of the cream regulator to conduct scraping cream safe and effective. * Around 1974-1975 the extent of cream reuse was reviewed, and it was decided to reuse scraped cream without containing washing water and to wash and drain the cream clung to the container after being scraped. (2) Reuse of blackstrap molasses from the making process of marron glace • Sugar water to boil chestnuts in the making process of marron glace deteriorates with over-use. A part of blackstrap molasses was used for sweet sauce for breaded pork cutlet by sauce maker and the rest was entrusted to the waste treater as industrial wastes (animal and plants wastes).

[16] According to HONDA Atsuhiro, *Challenge to Closed System - Pollution Control Measures that Pay*, Energy Conservation Center, 1975, the Tokyo metropolitan water service lost water sales by introducing progressive rates which encouraged large users to reduce their consumption more than price hike.

Contents of Measures	• The total amount of waste blackstrap molasses became almost zero, and acquisition costs of molasses were reduced by reusing waste blackstrap molasses by letting them pass the activated carbon. Moreover, the activated carbon was also recycled. (3) Dry washing of creams adherent to inside the pipeline • Inside the factory, adjusted cream was transported in the pipeline. Up to that time, cream remaining inside the pipeline was washed out and drained. • Around 1974 to 1975, a sponge ball with the same diameter of the pipeline was installed into the pipe and pressured by the air in order to push out the cream. By this method, sponge wiped out cream without water, then, the whole pushed out cream could be reused. (4) Stationary washing of the production equipment • At the time of starting and the finishing the working day and changing line of products, pipelines and cream regulator were disassembled, washed, sterilized and assembled again. The series of work required a lot of washing water and took about two hours while their average working period was eight hours per day. • From the beginning of the 1980s, the washing method for the main part of the production line (input raw materials, adjustment, transport and storage) was changed to stationary washing. Without disassembling the equipment, it was washed and sterilized by acid, alkali and boiling water. The acid and alkali were naturalized, and they become no trouble to be discharged into river and generate no precipitate; only treatment of organic matter was required as before. After this change, time productivity was improved drastically, and drain became reduced and condensed which was easy to be treated.
Background (Why was it necessary?)	• The effort to avoid wasting raw materials had been made around 1972, when the interviewee started to work for this factory. The founder was a pastry cook who had an old-fashioned way of thinking and there was no doubt to do such activities as stated above even before the reinforcement of effluent control. Accordingly, it was effective to reduce effluent loads.
Means (Why was it possible?)	• Actual measures were studied and implemented by a project team consisting of persons in charge of production management, product development and so on at each factory. Many measures as stated above in M factory around 1974 to 1975 were results of the studies by the project team.

Table 4.3.3 CP Case 2 : CP as a response to high price and acquisition difficulty of input resources

Implementing Company	D paper manufacturing company
Company Profile (At the time of interview)	Capital: ¥16.2 million Sales: ¥5.4 billion (1995) Number of employees: 70 Manufacturing goods: printing paper and package paper from used paper
Implementing Place	Main factory in Shizuoka prefecture
Implementing Time	Up to 1973

Contents of Measures	White water circulation in a process of pulping and straining used paper • In 1973, a filter was installed to one of the two production lines, and fibers were collected and reused as ingredient. Also filtered water with 200ppm of SS was reused in dissolution process. * Same kind of white water circulation had been implemented on the other line before 1973.
Background (Why was it necessary?)	• Main sources of pollution loads were macerating, bleaching and straining facilities. These facilities were designated facilities under the Water Pollution Control Law. Drainage volume was 10,000t/day. • In the first half of the 1960s, saltwater was intruded into groundwater; potable water became salty, and additives ineffective. Groundwater Use Council of Gakunan Region was formed in 1967 with a participation of industries using groundwater, the central government, the prefectural government and the city office. The Council conducted a survey on necessary measures, promoted rational water use and the construction of industrial water works at east Suruga bay, and introduced an approval system for setting up new wells. In 1971, the regulation on groundwater pumping was introduced by the enactment of the ordinance on the proper utilization of groundwater. The ordinance was made stricter in 1977. • Before industrial water works were completed in 1966, groundwater was the only water source for the factory, but at present it uses industrial water (2,100t/day) and groundwater (8,100t/day). Covenanting industrial water using limit is 2,500t/day, which costs ¥1 million every month, and ¥30/t would be charged for overrun. The maximum allowable amount of pumping groundwater is 9,000t/day. • Treated wastewater was discharged to the Gakunan drainage pipe constructed in 1973 and managed by the Gakunan drainage pipe cooperative association established in 1952. Discharge cost was 1.9JPY/m^3. Wastewater discharge to the river from pulp and paper mils caused water pollution problems, and the Gakunan drainage pipe was constructed in order to transport wastewater to offshore. Planned drainage volume was 1.3 million t/day, and present situation is 1.16 million t/day. Companies that use the Gakunan drainage pipe concluded an agreement about water quality and following conditions must be fulfilled. - pH: 5.5-8.5 - SS: 60ppm at the maximum, 45ppm/day for daily average - COD: 80ppm at the maximum, 60ppm/day for daily average • White water circulation had been practiced for the improvement of yield rate and rationalization of service water, but the regulations on pumping groundwater and wastewater prompted the white water circulation.
Means (Why was it possible?)	• The production department of the company did technical studies, planning and operation of measures. Production facility manufacturers also assisted installation of the filter. • The guideline for service water rationalization, Meetings of Shizuoka Technical Association of the Pulp and Paper Industry and lecture presentation of Shizuoka Prefecture Fuji Industrial Research Institute were helpful to get technical information. • No subsidy was used for the installation of the filter.

Effects (Introduction at own company)	• Water consumption for a ton of products (paper) was about 150t in the 1970s and is 100t at present. * Large company could use a high performance filter and reuse highly treated wastewater (SS: 10-20ppm) in many ways, so their unit water consumption was no more than 100t/t-paper. High level treatment requires large capital investments; medium and small enterprises could not set up such expensive facilities. Limiting factors for this factory to practice further cyclical use of white water include necessity to change water once or twice a day caused by the small lot production system

Table 4.3.4 CP Case 3: CP as a response to high price and acquisition difficulty of input resources

Implementing Company	M Sugar Manufacturer	
Company Profile (At the time of interview)	Manufactured goods: white sugar and sugar related products * The company was newly established by consolidation of two sugar companies in 2001. This table shows the one company's activities before their consolidation. The company had about 300 employees and 140,000-150,000 ton annual production as of 1980.	
Implementing Place	Factory in Tokyo	
Implementing Time	Around 1980	The early 1980s. (After the second oil crisis)
Contents of Measures	Reuse process drainage for exhaust gas desulfurizer • Changed the source of water for the exhaust gas desulfurizer from piped water to process wastewater, and reused a part of wastewater from the exhaust gas desulfurizer in the production process again. • Reduced water consumption by 20-30%.	Introduction of automatic measurement system for product management • Compiled a manual on effective operation method (requiring les fuel consumption) based on skilled workers' experiences and established an automatic measurement system. With this system, everyone could operate in the same way as the most skilled worker. • Reduced production time (5 hours --> 3-4 hours) and energy consumption.
Background (Why was it necessary?)	• Groundwater was not available because of the regulation on pumping groundwater, and piped water was used for the purification process and seawater for coolant. • The construction of the factory was approved with the condition that its wastewater is discharged to the sewer system. It was obliged to connect to the sewer system.	• Energy cost increased by three times due to the second oil crisis, and reduction of energy consumption became one of the management policies. • It was identified that energy consumption varies by different way of operation. Energy saving by the introduction of the automatic measurement system was expected.

	• Rationalization of water consumption was one of the management policies because water rate was 670JPY/t and cost 0.3-0.4 billion JPY per year.	
Means (Why was it possible?)	• The engineering division played a central role in planning the measure and implemented with approval of the board of directors about the contents, cost and estimated effects of the measure.	• The engineering division, especially certified energy managers played a central role in planning the measure and implemented with approval of the board of directors about the contents, cost and estimated effects of the measure. • The automatic measurement system became practical due to the improvement and price-reduction of computers and established by joint operation with the outsourcing partner. • The Energy Conservation Center's technical seminars were useful to get technical information. • The cost to establish the system was recovered from the reduction of fuel cost, without using subsidies.
Effects (Introduction at own company)	• Unit water consumption improved by 20-30%.	• Energy efficiency improved by more than 30%.

b. CP Intended to Reduce Treatment Cost of Environmental Load

To comply with strengthened environmental regulations, CP was introduced because EOP measures alone could not meet the emission/effluent standards or require excessive capital investment or running costs.

Triggering events include expansion of public sewer systems, strengthened pollution control (concentration control, total amount control), and increase in waste disposal costs.

- After the 1960s public sewer systems expanded, and plants that were required to connect their wastewater discharge to the sewer system tried to reduce water consumption in order to minimize sewer user fees.
- After the enactment of the Law concerning Measures for Comprehensive Environmental Protection of the Seto Inland Sea of 1973, total amount control of water pollutants was gradually applied to other areas, and further rationalization of water use and reduction or even elimination of the use of polluting materials was achieved.
- At the start of sulfur oxides (SOx) regulation by the Air Pollution Control Law of 1967, imports of low sulfur crude oil and establishment of desulfurization facilities of heavy oil were promoted because the technology for flue gas desulfurization was not good enough for actual use. Along with strengthening of emission standards and improvement of desulfurization technology accelerated the introduction of flue gas desulfurization facilities. The reduction in SOx emissions by conversion to low

sulfur fuel and saving of fuel is estimated to exceed contributions by flue gas desulfurization facilities (EOP) [17].

- Minamata disease and other health damages by exposure to heavy metals became a social issue, and industries were required to avoid discharge of toxic substances from their production processes. Since EOP measures seemed difficult for complete removal of toxic substances, production processes free of toxic substance were introduced. Examples are production of acetaldehyde (carbide process --> ethylene process) and caustic soda (mercury electrolytic --> ion exchange membrane).
- In the latter half of the 1980s, generation of wastes increased rapidly. In the 1990s declining capacity of landfills and seashore reclamation areas and stricter waste disposal standards substantially raised waste treatment/disposal costs. In addition, amendment of the Waste Management Law increased responsibility of waste generators. To avoid these environmental costs and risks, waste generators shifted to reduction or recycling of solid wastes previously incinerated or landfilled, and reduction or even elimination of toxic substances.

Table 4.3.5 CP Case 4: CP intended to reduce management cost of environmental load

Implementing Company	K iron casting pipe manufacturer
Company Profile (At the time of interview)	Capital: ¥1,855 million Sales: ¥13,615 million (March 2002) Number of employees: 360 in K factory, (270 are from the company, 90 were outsourcing) 436 in the whole company. Manufactured goods: ductile cast-iron pipe (for water supply and sewerage systems, gas, industrial water, agricultural water and so on.), polyethylene pipe (for water and gas) etc.
Implementing Place	K factory in Saitama prefecture
Implementing Time	Since 1981
Contents of Measures	Reduction of repair frequency of fire resisting materials (cupola furnace). • Operated two fire pits alternately. Around 1981, the operating term was changed from three days to one week in a row. After that, the operation term has been changed constantly, and now the term is 8-14 weeks. Following are the actual number of reductions in waste management cost and resisting material cost. Operation term of cupola / Cupola repair cost May 1981 — 1 week — about 350JPY/t by unit Dec. 1983 — 1.5 weeks — about 270JPY/t by unit Oct. 1984 — 2 weeks May 1986 — 3 weeks Nov. 1998 — 6 weeks Mar. 1999 — 8 weeks 2001 — 14 weeks — about 200JPY/t by unit • After one operation term was finished, it used to be that the bottom of the cupola was opened, then, cokes, residues and bald fire resisting materials were taken out. Then the bottom of the cupola was closed, and new fire resisting materials were installed for the next operation. Today, the cupola is repaired by opening not its bottom but the manhole on its side.

[17] Committee for Studying Japan's Experience in the Battle against Air Pollution, *Japan's Experience in the Battle against Air Pollution Control*, Japan Times, 1997

Background (Why was it necessary?)	• Since disposal costs of industrial waste had been increased every year, measures for restraining waste generation and reducing disposal amount by waste recycling were implemented.
Means (Why was it possible?)	• The production department played a central role in visiting other companies, conducting self-tests, meeting with the manufacturer of fire resistant materials several times. • Reduction of repair frequency of the cupola became possible because of changes in fire resistant materials, the improvement of operating method, and changes in treatment of raw materials.
Effects (Introduction at own company)	• The amount of waste fire resistant materials was reduced by 90%.

Table 4.3.6 CP Case 5: CP for the reduction of management cost of environmental load

Implementing Company	Electroplating business cooperative association
Company Profile (At the time of interview)	Capital: ¥134.55 million Member of the association: 7 metal plating companies and 1 related business, total 8 companies. History: 1970, the Tokyo Metropolitan Government developed a master plan for pollution control and cooperation of the metal plating industry. 1971, the Tokyo metal plating industrial association solicited participation from members in Jho-nan area. 1974, Organization meeting 1975, Completion ceremony for the Metal Plating Center Work contents: wastewater treatment, analysis, development etc.
Implementing Place	K Tokyo industrial park
Implementing Time	Since 1975
Contents of Measures	Introduction of multistage cleaning on cleaning process
Background (Why was it necessary?)	• Reduction of wastewater treatment costs and prevention of toxic substance discharge were nationwide objectives for the introduction of multistage cleaning, but water rationalization was promoted by water price increase in areas where industrial water was not supplied in Tokyo because they must use drinking water for their operation. Water cost was only 3JPY/t in groundwater available areas, almost as same as electricity, but in Tokyo, water rate was 700JPY/t including effluent charge. • At that time, an accident of cyan effluent from a plating plant resulted in the death of a victim. Police control for plating plants became stricter in the urban area; measures to control wastewater were required to maintain the plating operation.
Means (Why was it possible?)	• Until the 1970s, they were in a good business, and capital investment could be recovered easily. • The multistage cleaning method was developed by plating engineers and university researchers using technologies from Europe and the U.S.A. The multistage cleaning method spread sequentially through study

	sessions organized by the industry with the subsidies from the Ministry of International Trade and Industry and instructions provided by public research institutes. • Pollution control projects by the Ministry of International Trade and Industry had a great impact. - In 1971, the Mines and Coal Bureau of the Ministry of International Trade and Industry conducted on-site instructions for thoroughgoing industrial wastewater measures. The electricity and metal plating wastewater treatment research committee consisting of academic experts and industrial leaders was formed. The public research institutes gave plating plants instructions on wastewater treatment based on the guidelines for electricity and metal plating wastewater treatment developed by the committee. - Since 1984, in each of the six regions (Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku, Kyushu), the local offices of the Ministry of International Trade and Industry held workshops on wastewater treatment techniques in addition to the on-site instructions. • It was a disadvantage for plating companies not to be a member of the association at that time in terms of planning and implementing pollution control measures; during the 1960s and the 1970s, majority of the plating companies (2,400 out of 3,300) joined the association.
Effects (Introduction at own company)	• National average of daily water consumption per worker was 8t in 1975, later 3.7t in 1986 and 2.47t in 1992. Especially in Keihinjima area in Tokyo, which had really limited water supply, the amount was 0.2-0.8t/day/worker. • Wastewater treatment facilities can be smaller if wastewater is concentrated by the introduction of multistage cleaning, and wastewater treatment cost was reduced.

Table 4.3.7 CP Case 6: CP for the reduction of management cost of environmental load

Implementing Company	N leather manufacturer
Company Profile (At the time of interview)	Capital: ¥3.5 billion Number of employees: 492 (March 31, 2003) Manufactured goods: leather products 35%, collagen 39%, gelatin 17%, others 9% * N is one of the largest companies in the leather industry and leading in pollution control measures, products and technical development, etc.
Implementing Place	T factory in Tokyo
Implementing Time	Around 1978 (utilize technology studied since 1950)

Contents of Measures	Collection and Re-use of Wastewater to make Chrome Soft They have collected wastewater, separated from other kinds of wastewater, and put it through filters to strain impurities. • Chrome tanning wastewater is collected by separating from other wastewater and is closed (recycled in chrome tanning process by filtering out impurities and then a chrome tanning agent is added to thinned wastewater).
Background (Why was it necessary?)	• Organic wastewater mainly containing protein and inorganic wastewater including chrome produced respectively in the liming and un-haring process and in the chrome tanning process. Compared with other industrial wastewater, it is difficult to deal with due to much precipitate (sediment) and large fluctuation in load at 2,000 to 15,000mg/L. • Although the effluent treatment facility (equipment to exclude hazard for drawing off to a sewerage system) was installed in 1972, since chrome tanning wastewater was also processed in those days, it couldn't satisfy the effluent criteria. • Although milder provisional effluent criteria than other industries are applied to the tanning industry, it was difficult to achieve the provisional criteria through the existing effluent treatment. • Many residents were located in the neighborhood so that the effluent treatment was necessary as an environmental measure.
Means (Why was it possible?)	• Around 1950, from the viewpoint of effective utilization of by-products and unused resources, a method to collect and to utilize proteins in chrome tanning wastewater or in wastewater in the liming and un-haring (epilating) process had been examined so that the level was close to the practical use. • Although the company has independently conducted technological development and facility improvement without receiving a public aid, other leather manufacturers, especially some small and medium enterprises receive the following public support. • Support of public testing & research institutions: Public testing & research institutions such as the Tokyo Metropolitan Leather Technology Center and the Hyogo Prefectural Industrial Technology Center support to provide information, etc. • Common wastewater treatment facility through public involvement: Administration in the leather industry built-up area such as Himeji, Tatsuno and Kawanishi cities in Hyogo Prefecture and Wakayama City in Wakayama Prefecture has developed and operates a common wastewater treatment facility in some cases. • The leather industry is frequently observed in so-called Dowa (anti-discrimination) area. Consequently, funds for Dowa measures are invested in the countermeasures for environmental pollution in some cases.

Effects (Introduction at own company)	• The purchase amount of chrome tanning agent could be reduced by approximately 20%. Since the company's own chrome tanning wastewater is again utilized in the same process in the company, in addition to chrome tanning agent, necessary various pharmaceuticals are included so that it is relatively easy to re-use only by replenishing insufficient components (ingredients). Accordingly, the amount to utilize various pharmaceuticals can be reduced making it easier to adjust components. • By separating chrome tanning wastewater from other processed wastewater, the effluent treatment cost could be reduced. An amount of plant and equipment investment was less than ¥50 million (not more than 10% of approximately ¥500 million of the plant and equipment investment in the total effluent treatment facility and system). Due to the reduction in the purchase cost of chrome tanning agent, etc. and in the effluent treatment cost, it was possible to collect the cost approximately in 2 to 3 years. • The chrome discharge amount in wastewater could be reduced to almost zero (0).
(Diffusion to other companies)	• Since it is possible to design fitting to business scale, lot and pharmaceuticals utilized, this can be applied to small-scale establishments. (There are some cases that the small-scale system at a level of ¥1 million in investment amount was designed or introduced.) The Tokyo Metropolitan Leather Technology Center evaluated the source-separated collection and re-use of chrome tanning agent and promoted to its diffusion to other similar companies. • However, only a few other companies actually introduced it due to the following factors. - With respect to the discharge of wastewater in the leather tanning industry into sewerage or rivers, milder provisional effluent criteria than other industries are applied (although the provisional criteria were abolished in March 2001, its uniform standard of application will start from April 2006 due to a 5-year transitional period) and inspection and supervision were not sufficient, so the incentive toward its introduction was difficult. - Since it was difficult to secure labor force due to the characteristics of hard, dirty and dangerous, many employers could not spare personnel for facility operations and management.

Table 4.3.8 CP Case 7: CP for Containment of Management Cost of Environmental Load

Implementing Company	K fiber and chemical product manufacturer
Company Profile (At the time of hearing)	Capital: ¥2.204 billion Sales: ¥101 billion (FY2002) Number of employees: 1,945 Manufactured goods: Cotton synthetic fiber (52.4%), wool (10.7%), chemical products (24.4%) and others (12.5%)* • Others include plant engineering (such as exhaust gas treatment equipment and water treatment equipment).
Implementing Location	H plant in Osaka (presently shut down due to transfer for integration of production base)
Implementing Time	1969 to 1970

Contents of Measures	Development, introduction and sales of an exhaust gas desulfurizer by effectively utilizing alkali wastewater • In response to enforcement in the effluent regulations of Y River, full-scale research has been done on a wastewater neutralizer from February 1969, and an exhaust gas desulfurizer by effectively utilizing alkali wastewater was developed in March 1970. By taking initiatives in the industry in September 1970 and installing No.1 equipment in H plant, the full effects of this were realized. • By blowing acid boiler exhaust gas containing sulfurous acid gas and carbon dioxide into sodium hydroxide wastewater (approximately pH 11) generated in the bleaching process in order to create a bubble state for easy chemical reaction, the pH value in wastewater is reduced and sulfurous acid gas in smoke exhaust is removed. By utilizing the jet scrubber theory, there was less energy loss, and the contact area between gas and wastewater was expanded. Through the relatively simple facility, characteristically increased economic processing is possible compared with the conventional neutralizing process utilizing sulfuric acid.
Background (Why was it necessary?)	• Since the company's wastewater (strong alkali wastewater resulted from sodium hydroxide utilized in bleaching process) was discharged into Y River, in order to meet the Water Pollution Control Law (later the total amount control of pollutants was applied in accordance with the Special Measures Law Concerning Seto Inland Sea Environmental Conservation which has more stringent prefectural standards than Osaka), a neutralizing process through sulfuric acid has started and the processing cost has accumulated. • Although exhaust gas from the heavy-oil burning boiler (C heavy oil in those days) was required to comply with the emission standard provided by the Air Pollution Control Law (although the total amount SOx control was applied in accordance with Notification in Osaka later, only the Air Pollution Control Law was applied at the time of taking measures), there was no exhaust gas desulfurizer (realistically feasible) at that time. Although it is possible to reduce SOx by replacing low sulfur fuel, this was not introduced due to a huge difference in fuel prices at the time. Therefore, other countermeasures were necessary.
Means (Why was it possible?)	• The development of the desulfurizer was entirely implemented by in-house staff, who had necessary knowledge on production facilities and chemistry, without any support from the governments.
Effects (Introduction at own company)	• Water contamination and air pollution were controlled, and it became unnecessary to procure previously utilized neutralizers (sulfuric acid) or to replace fuel by low sulfur one. • Consequently, compared to the costs to implement wastewater treatment by neutralization with sulfuric acid and emission control by using low sulfur fuel, the investment in the desulfurizer could be recovered in a shorter period (a few years).
(Diffusion to other companies)	• The exhaust gas desulfurizer was specially evaluated by the Environmental Pollution Department of the Osaka Prefecture Government. In response to advice that it might contribute to the alleviation of environmental pollution in the entire industry and the overall region, the company newly established the Engineering Business Department in March 1970 and made inroads into the pollution control industry. Sales have been rapidly expanding. The clients are primarily dye works (plants) and those having boilers with generation of alkali wastewater. The exhaust gas desulfurizer can be applied to boilers with

	capacity of 30 to 500 t/hour. • Furthermore, through improvements of the desulfurizer made in order to respond to the stricter emission controls, an exhaust gas desulfurizer and a fume cleaning, de-nitrification and deodorization equipment applicable to factories without producing alkali wastewater was developed. The developed desulfurizer uses calcium and magnesium type chemicals as alkali agent. Many factories such as those in the paper and pulp industry introduced the desulfurizer. • In those days, due to the huge price difference between regular and low sulfur fuels and the introduction of the SOx levy in accordance with the Pollution-Related Health Damage Compensation Law of 1974, significant economic merits were realized through the introduction of the desulfurizer at the time. Accordingly many companies adopted this equipment.

c. CP as Part of Response to Price Cutting Pressure

CP was introduced as a part of several measures for general cost reduction in response to eroding competitiveness or facing price-cutting pressure from large customers including parent companies.

Triggering events include the shift of production to overseas sites, higher yen value for export-oriented firms or loss of competitiveness due to inflow of cheaper imports for firms marketing in domestic markets.

After the middle of the 1980s when sudden appreciation of the yen were common, the effect was starting from export oriented industry and propagated to many other industries encountering slow economic growth, due to accelerating imports from emerging Asian countries.

There was no specific reduction of particular resource or reduction of specific environmental load; cost reduction as a whole was the goal and there were varieties of actually reduced items.

In the latter half of the 1990s, acquiring the ISO14001 certification, publishing environment reports, and greening the supply chain (e.g. green purchasing) were promoted. With this background, the following CP cases were observed:

- Tackling reduction of waste generation as a part of ISO14001 related activities, and
- Selecting environment-friendly raw materials for the production process as a part of green purchasing.

Table 4.3.9 CP Case 8: CP as a partial measure to reduce production cost

Implementing Company	S feed manufacturer	
Company Profile (At the time of interview)	Capital: ¥12 million Number of employees: 80, subcontractors (feed stock transportation business): 120 Manufactured goods: fish meal, fish oil, dregs of fish oil extraction	
Implementing Place	S factory in Saitama Prefecture	
Implementing Time	1981, 1984	1990
Contents of	Recovery of proteins by	Improvement in yield due to the

Measures	introducing an exhaust heat recovery type condenser • 2 units of exhaust heat recovery type condensers (Investment cost: ¥120 million + ¥300 million) were introduced. • After the thermal process of ingredients, by separating solid and liquid ingredients, squeezed liquid is segregated into 1) fish oil, 2) fish meal and 3) liquid containing soluble proteins through a solid and liquid separator.	enhancement of ingredient recovery efficiency • By shortening the time from ingredient collection at the source of release to the processing at the plant, spoilage can be prevented so that the ratio of ingredients feasible for utilization is improved.

Contents of Measures	Liquid containing soluble proteins is led to an exhaust heat recovery type condenser, and then protein components (thick liquid) are collected at a high rate and added to fish meal to produce high protein feed. • Fish oil and fish meal are separately re-used as before.	
Background (Why was it necessary?)	• Because fish meal competes with fish flour or substitute protein (such as soy beans), it is a product on the international market greatly affected by the catch of sardines or harvest of soy beans. In order to keep the cost for collecting ingredients (fish leftovers) from fresh fish shops and supermarkets inexpensive and to maintain competitiveness, improvement of quality and production efficiency is constantly required. • Due to its location in a built-up area, it is important to take countermeasures to eliminate offensive odors and to treat effluent.	
Means (Why was it possible?)	• Because heat recovery type condensers are different from general effluent or exhaust gas treatment technology and have a small market because they can be used in a very limited number of industries. Sufficient information could not obtained within Japan, so technological information was collected by visiting Northern Europe where fish meal manufacturing is prospering.	• Since a highway was developed the traffic situation has improved. It is possible to collect ingredients in a short period of time. • Other than Saturdays and Sundays, the company conducts daily collection of ingredients and has established a system to process them on the day of acceptance. • At plants of a similar industry operated by public corporations in other areas, generally speaking operations are conducted between 9:00 a.m. and 5:00 p.m. and the yield is lower because it takes time from the collection of ingredients to processing.

Effects	• 80 to 90% of proteins in wastewater are collected and re-used. • By collecting proteins and oil, BOD load is reduced, which contributes to a reduction in offensive odors.	• Offensive odors resulted from freight congestion and spoilage of ingredients can be prevented. • It is possible to reduce the amount of animal and plant residues which are discarded due to spoilage.

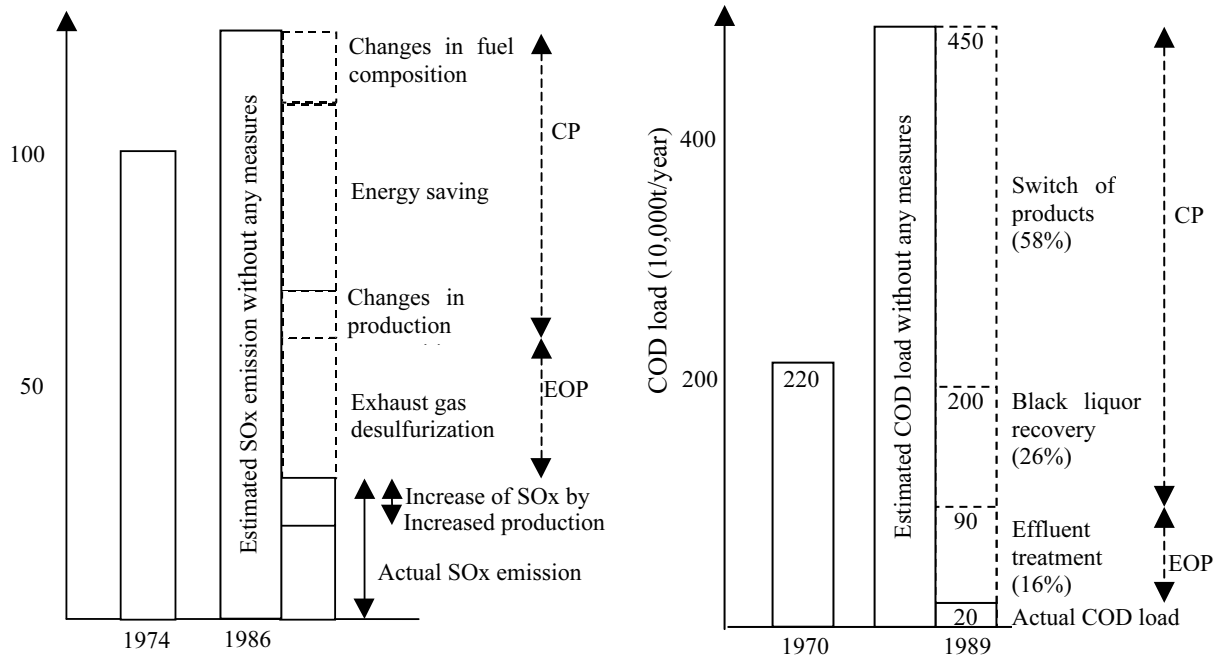
Table 4.3.10 CP Case 9: CP as a Partial Measure for Pressure to Reduce Product Cost

Implementing Company	J metallurgical manufacturer	
Company Profile (At the time of interview)	Capital: ¥23.65 billion Number of employees: 436 (as of April 1, 2003) Manufactured goods: storage drums, pails and high-pressure gas containers	
Implementing Place	K plant in Kanagawa Prefecture	
Implementing Time	1992	1998
Contents of Measures	Improvement in yield of steel plate through 2-rows of top and bottom steel metal punching • A storage drum is composed of a trunk (side panel) and the top and bottom plates. Although the trunk yield was always about 100%, there was room to improve the yield of the top and bottom plates. • By changing the inserted coil width from 660mm to 1,240mm, the punching method for the top and bottom plates of storage drums was improved. (2-rows of top and bottom steel metal punching)	Collection and re-use of over-spray coating • Since low-pressure particulate coating utilized in internal lining is expensive, by targeting the coating most frequently utilized (80% of usage for internal lining), the collection and re-use of over-spray coating was implemented. • By installing a funnel-shape saucer under the coating line, a simple mechanism is used to receive over-spray coating and to collect it in pails. The system was initially tried in one of the four booths; and after observing the progress made, it was used in all booths.
Background (Why was it necessary?)	• Product price of drums has fallen gradually from approximately 4,000JPY/per drum (around the 1970s) to 3,000JPY/per drum. Customers are able to control prices, especially since the later half of the 1990s when the pressure to reduce delivery prices became intense. • Steel cost accounts for 50% or more of the production cost per 1 drum. In order to reduce the production cost, it is important to improve the yield of steel materials, coating and solvents, etc.	
	-	• In responding to the lowering sales price of drums, there was the goal to reduce the unit consumption of coating throughout the overall plant.
Means (Why was it possible?)	• At the time of renewing the facility in accordance with the K plant refresh plan (1992 to 1996), measures were taken aimed at improving yield. • Production cost management has been practiced since plant inauguration, so data used for identification of priority issues and evaluation of investment effects were available. Investment in countermeasures against environmental pollution and the environment were evaluated in a similar manner to normal investment.	

Means (Why was it possible?)	• Since plants in the drum industry visit each other in a relatively open manner, measures taken by other companies in the same industry were also observed. In addition, the Japan Steel Drum Association set up a technical committee to carry out research, dissemination and PR on improving productivity and environmental measures, etc.	
	-	• One of the QC activities (JK activities) is a system in which employees propose improvements, and cash reward is provided for effective improvement proposals. In this case, an improvement which was proposed by the line operator was highly evaluated by the company and put into practice.
Effects	• The yield of the top and bottom plates improved from 78.5% to 94.2% so that the quantity of steel usage was reduced by 77t/month, and steel procurement cost was reduced by 46.2 million JPY/year. • In the case of 200L plain cans which are the primary products, steel procurement cost accounts for 50% or more of the total production cost, so the effects of the cost reduction were quite significant.	• The monthly average of 430kg/month is collected and re-used. Without special facility investment, the procurement of the coating could be restrained due to the collection. • Over-spray coating before the implementation of the recovery (collection) is mixed into the coating booth circulation water, which is fed out to be disposed as coating dregs. The discharge of coating dregs of the internal lining could be reduced from 1,240kg/month to 800kg/month or by approximately one third (1/3).

4.3.3 Effects of CP

Figure 4.3.2 below shows the ratio of estimated effect of Cleaner Production (CP), for the reduction of environmental load in comparison with EOP measures. It is easily conceivable that a substantial portion of the reduction of environmental loads was achieved by the contribution of CP in a wide sense, though the number of cases analyzed was relatively limited.



Breakdown of SOx reduction by measure (emissions in 1974 = 100)

Breakdown of COD load reduction in the pulp & paper industry

Source: EX Corporation, "Japan's Experience in Urban Environmental Management", Metropolitan Environment Improvement Program, World Bank, 1996

Figure 4.3.2 CP contribution to the reduction of environmental loads

4.4 Steps for Introduction of CP

4.4.1 Preparatory Stage: Organization and Collection of Data

Before tackling the problem, the first important task is to make the loss visible. In preparatory and early stages of CP, the steps listed below were practiced and these were effective in improving productivity and at the same time reducing environmental loads.

a. 5S (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke)[18]

Improvement of awareness is not only for the immediate object of the improvement of working efficiency, but also for the continuous improvement of whole workplace including the working environment itself. These are not always aimed at reducing losses, but defects of equipment and work environment become obvious in the processes of organizing and cleaning as a first step in cutting losses.

Rudimentary methods to cut losses that can apply to any capital investment like a leakage from surface plumbing and facilities should be treated in this stage.

The following case illustrates how loss identification can result from repair activity.

Table 4.4.1 CP Case 10: Loss Identification

Implementing Company	I ink manufacturer
Company Profile (At the time of interview)	Capital: ¥2 billion Number of employees: 859 (420 at Tokyo plant) Manufactured goods: news ink, offset lithographic ink, rotogravure ink, image processing chemical products
Implementing Place	Tokyo plant
Implementing Time	Around 1970 to present
Contents of Measures	• Upon connecting to the sewerage system, a coolant chiller was installed, and coolant in the product cooling process has been recycled. --> A volume of drinking water consumption (≈discharge to the sewage) was reduced from 4,500m3/month to 3,000m3/month. • Based on past results of water consumption, water leakage from buried pipeline within the plant was predicted, and roads actually caved in due to the leakage. --> Not only were the leakage spots repaired but buried water supply pipelines were completely replaced by aerial pipeline, so leakage could be easily observed. --> Since then, there has been no leakage.

b. Identification of losses need to be managed to reduce burden on the environment

Comprehending the current situation is the basis for improvement and identification of issues to be focused on. This step corresponds to the identification of "remarkable environment aspect"

[18] Seiri: Organized Storage; to segregate what is needed and what is not needed and throw away all what is not needed. Seiton: Neat Storage; what is needed should be stored at a predetermined well-marked place. Seiso: Cleaning; removing garbage dusts and stains, identify unusual condition of equipments to keep them under desirable operating condition. Seiketsu: Cleanliness; maintaining organized and neat storage and keeping cleaned condition to prevent losses in advance. Shitsuke: Discipline; the above four are made to habit of all employees. These slogan words in Japanese all start with S sound, so these are called 5S.

(management target of ISO14001) from the viewpoint of reducing burdens on the environment. At this stage the following losses and environmental loads inside the whole factory should be understood.

[Losses]
- Raw materials and fuels whose amounts consumed are higher than the estimated appropriate amount.
- Expensive raw materials and fuels etc.

[Environmental loads]
- Environmental loads having a possibility of legal violation
- Environmental loads that can be an obstacle to stable operation due to residents' complaints.

c. Identification of processes and reasons for generating losses and environmental loads

As for the important losses and environmental loads in the former step, the amount of generation and the contribution of each process should be identified, and then the process that should be tackled with top priority should be selected. For example, when the impact of a substance in the effluent on the environment is in question, the discharge amount and concentration in each process should be calculated, and the processes with highest contribution to the total losses and environmental loads in the factory should be specified[19].

Since exhaust gas amounts, effluent volumes, and waste volumes for each production process are in many cases not monitored, an orifice meter or V notch needs to be installed. For this step, there are some cases in which prefectural research institutes and certified environmental laboratories have helped small and medium enterprises having difficulties to cope with such matters by themselves.

Moreover, causes of generating losses and environmental loads in specific production processes should be identified from each aspect of raw materials, manufacturing facilities, production method and operating condition.

The Toyota production system urges the necessity of "ask why for five times" to get to the true cause for the discovery of appropriate measures[20].

4.4.2 Implementing Stage: Vantage Points for Loss Reduction

The following viewpoints are suggested to identify and to study ways to reduce losses.

- Are there any easily reducible losses (heat radiation or leaking liquid)?
- Isn't it possible to get rid of input materials or processes that are the cause of resource consumption and/or environmental load?

[19] From the beginning of the 1970s, making "Negative flow sheet" (or "back flow sheet") that quantifies wastes discharges on each process has been advocated. (NAKA Shoji / HISHIDA Kazuo / HONDA Atsuhiro (eds.), *Pollution Control Handbook*, 1972; HONDA Atsuhiro et al., *Waste Reduction at Plants – 3R Manual for Working Floor,* 2003)

[20] OHNO Taiiti, *Toyota Production System*, 1978, lists examples of getting to true causes by asking why for five times as follows:

Machine stopped working. --> 1. Why the machine stopped?
That's because the fuse was blown out due to over load. --> 2. Why was there the over load?
That's because lubrication in the roller bearing part was not sufficient. --> 3. Why wasn't there sufficient lubrication?
That's because the lubrication pump did not pump up sufficiently. --> 4. Why didn't it pump up lubricant sufficiently?
That's because the shaft of the pump is bald. --> 5. Why is the shaft bald?
That's because swarf intruded due a lack of strainer.

- Is it possible to eliminate losses of input material due to its quality or processing yield (trimmings and cropping of fabrication, spilled splashed liquid material like paint, washing water and other wastes in cleaning and in changing setting up of machinery, packaging material of input material, etc.)?
    - Is it possible to utilize byproducts as input materials either in the plant itself or at some other plant?

Cases found from publications and interviews are classified by viewpoints and shown in Figure 4.4.1.

A. Making Processes with High Resource Consumption and High Environmental Loads Unnecessary
B. Reduction of Loss and Environmental Load in Production Process (Reduce)
C. Effective Use of Recycling Material (Reusing and Recycling within Closed Loop)
D. Effective Use of Recycling Material (Reusing and Recycling in Open Loop)

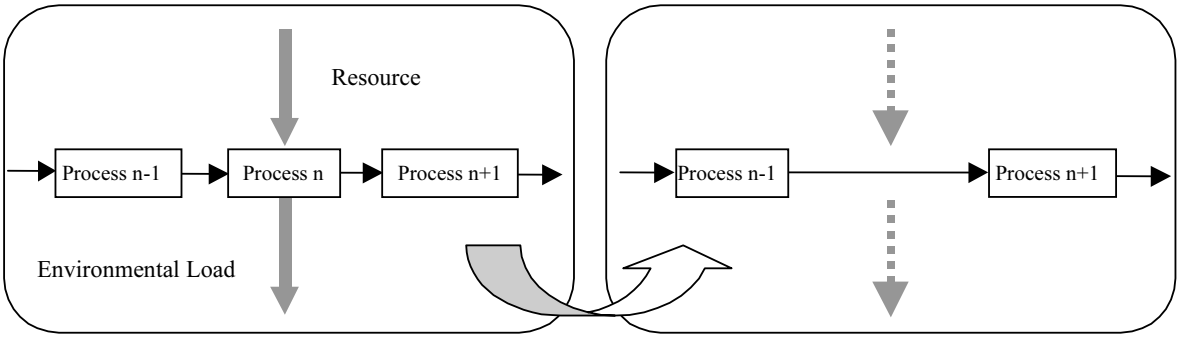
4.4.3 Development and Propagation Stage: Continuing Improvement through PDCA Cycle

Firms with multiple plant operations implemented the CP concept at a model plant first and extended the result to other operations. There are cases to disseminate to other companies within Keiretsu firms (member firms of affiliated companies).

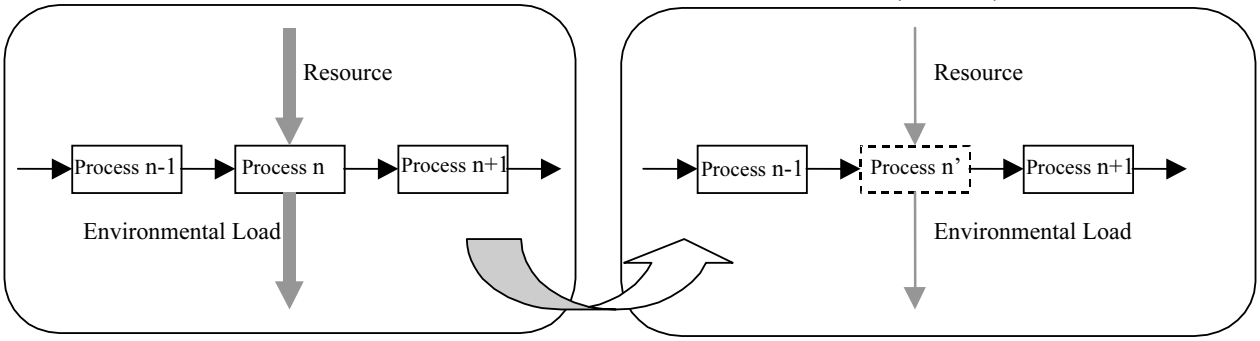
Ways of operation and conditions of equipment to include loss reduction were formalized as operational and equipment maintenance standards. Such practices are continuously reviewed and revised based on the idea of PDCA cycle[21] with the background of diffusion of management systems such as ISO14000 or ISO9000.

[21] A cycle of making a plan (plan), execute a plan (do), evaluate the result (check), improve inconvenience and make next plan based on gained information (action), aims at continuance improvement. This cycle is also called as Deming Cycle named after doctor Deming who systematized this idea.

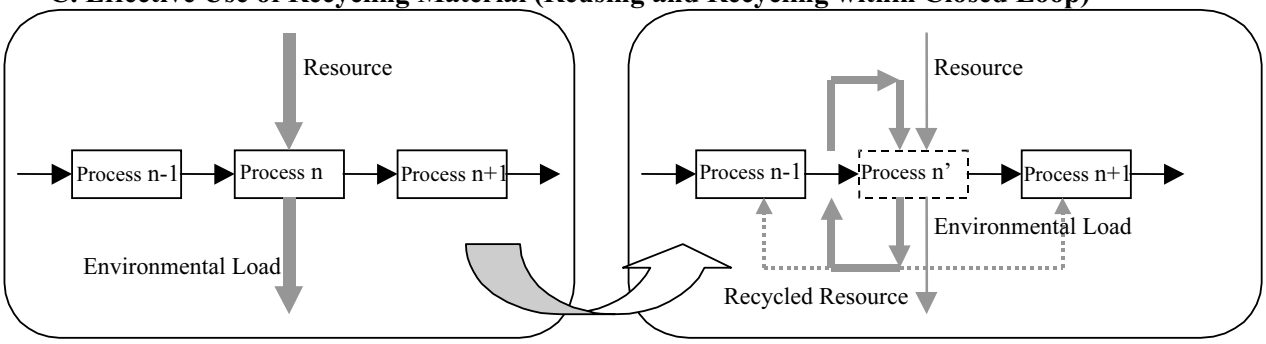
A. Making Processes with High Resource Consumption and High Environmental Loads Unnecessary



B. Reduction of Loss and Environmental Load in Production Process (Reduce)



C. Effective Use of Recycling Material (Reusing and Recycling within Closed Loop)



D. Effective Use of Recycling Material (Reusing and Recycling in Open Loop)

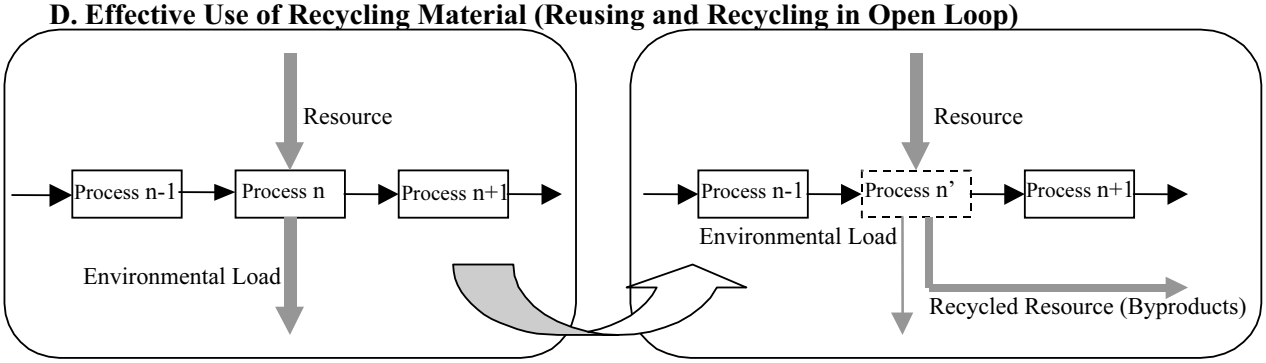


Figure 4.4.1 Images of CP Practice, Four Directions

Table 4.4.2 Classification of Main CP Cases Found in Publications and Interviews

Viewpoint \ Type of CP Contribution		Energy Conservation (-->Measures for Exhaust Gas and Waste Heat)	Rationalization of Water Use (-->Measures for Water Discharge)	Improvement of Product Yield (-->Measures for Solid Wastes)
Can materials and processes with high resource consumption and environmental load be eliminated?	Is the process absolutely necessary? Can it be omitted?	-	Omission of washing containers of liquid material by changing them to exclusive for a single material [Chemical]	
	Is there another material which could eliminate the process?	-	Purchasing of pretreated material [Dyeing]	Purchasing of chromate tanned leather [Leather fabrication]
	Is there any other material with lower loss and/or environmental load	Conversion of fuel (low sulfur crude oil, desulfurization of heavy oil, heavy oil C-->heavy oil A-->kerosene-->gas	Preventing oil leaks to omit floor cleaning by washing [Food] Prevention of splashing by addition of chemical reagents	Use of higher purity material to reduce residue
Is there any equipment or operating method with lower loss and environmental load?	Conversion to equipments and facility with lower environmental load	Insulation of processing equipment under hot and cold condition Low SOx-NOx boiler Introduction of co-generation	Rationalization of changing interval of plating solution by instrumentation for conductivity [Metal (plating)]	Conversion of stamping method to reduce forming loss and trimmings [Metal] Reduction of ink residue at the tine of color change [metal]
	Conversion to operating method with lower environmental load	Improvement of combustion Leveling machine load Development of low temperature processing	Reduction of washing water by dry washing or steam washing Operation at higher concentration [Food] Change of operating condition and chemicals for surface treatment to reduce N and P load [Metal]	Reduction of product rejects and reprocessing by strengthening inspection at each process [Machinery]
Can byproducts from production process be used in the plant?	Cascading use of input material	Effective use of low temperature waste heat	Multistage countercurrent washing [Plating]	Innovative use of discarded material, mixed residual dye for low grade black dyeing [Textile (dye)]
	Segregation of recyclable materials and return to the same process	Recovery and effective use of waste heat	Recovery and reuse of cooling water	Reuse of returned chromate tanning material (leather) Recycling of plastic trimmings in forming process [Plastics]

Viewpoint	Type of CP Contribution	Energy Conservation (-->Measures for Exhaust Gas and Waste Heat)	Rationalization of Water Use (-->Measures for Water Discharge)	Improvement of Product Yield (-->Measures for Solid Wastes)
	Segregation of recyclable materials and use at another place of the same company	Recovery and effective use of waste heat		Use of waste alkaline solution from bleaching process to the waste heat boiler exhaust gas processing --> application to desulfurization [Textile]
Can byproducts and wastes from production process be used in another company?	Segregation of recyclable materials and delivery to another company	Recovery and sale of energy as hot water or electric power		Delivery or recycling of various wastes
	Development of a new product using recyclable materials	-		Recovery of valuable component like protein from waste liquid [Food, leather]

Note: Industries in [ ] have practical CP examples. CP without specific industries can be commonly observed in many industries.

4.5 Mechanism of Diffusion of CP to Small and Medium Enterprises

Arrangements which were observed to function as good vehicles to promote diffusion of CP into sectors of small and medium enterprises are now identified. Considering the facts that scarcity of information, qualified people and financing are big obstacles of CP diffusion into firms in developing countries[22], factors are classified into supply of information, manpower training and financing. In addition to the above, motivation as a important basis for aggressive introduction of CP, and points to be considered when multiple measures are combined, are described from Japanese experience with points of reflection.

4.5.1 Arrangements for Information Dissemination

In Japan, information about governmental policy and actions, technology, and ways to improve productivity related to pollution prevention were conveyed to small and medium enterprises mainly through organizations shown in the following table. The existence of multiple channels from the hierarchical structure of national-prefectural-city/town/village governments contributed to diffuse activities of pollution abatement and energy saving.

For the transmission of information on measures by the government and technology as well as methods for productivity improvement to private industries, particularly for small and medium sized businesses, routes in the table below were used.

Table 4.5.1 Channels for Information Dissemination to Small and Medium Enterprises

Type	Example	Pollution Control etc.		Productivity Improvement
		Measure	Technology	
Administration	Regional Office of Ministry of Economy, Trade and Industry			X
	Section under jurisdiction Prefectural Small and Medium Enterprise Promotion	X		X
	Section under jurisdiction Prefectural Environmental Pollution Control	X	X	
Public Testing and Research Institute	Prefectural Industrial Technology Institute, Industrial Research Institute, Regional Industry Promotion Center etc.	X	X	X
	Prefectural Institute of Health and Environmental Sciences, Institute of Environmental Sciences etc.	X	X	
Industry Association	Corporation in Public Interest under jurisdiction of Ministry of Economy, Trade and Industry	X		X
Business Ties	Parent Company - Subsidiary		X	X
Small Business Association	National Federation of Small Business Associations - Prefectural Federation of Small Business Associations - Various Small Business Associations (Cooperative Association, Business Union, Commercial and Industrial Association etc.)	X		X

[22] JICA Committee on Promotion of Collaboration, "Report on Collaboration Promotion Projects (Cleaner Production)," 2001

Type	Example	Pollution Control etc.		Productivity Improvement
		Measure	Technology	
Small and Medium Enterprise Promotion Organization	Japan Small and Medium Enterprise Corporation Prefectural Small and Medium Enterprise Promotion Center	X		X
Chamber of Commerce and Industry etc	Japan Chamber of Commerce and Industry - Prefectural Federation of Chamber of Commerce and Industry - Chamber of Commerce and Industry Central Federation of Societies of Commerce and Industry, Japan - Prefectural Federation of Societies of Commerce and Industry - Societies of Commerce and Industry	X		X
Corporation in Public Interest (Productivity)	Japan Productivity Center for Socio-Economic Development Union of Japanese Scientists and Engineers Japan Management Association Japan Institute of Plant Maintenance			X
Corporation in Public Interest (Environment)	Japan Environmental Management Association For Industry The Energy Conservation Center, Japan Water Reuse Promotion Center	X	X	
Service Provider	Japan Small and Medium Enterprise Management Consultants Association-Prefectural branch division-Small and Medium Enterprise Management Consultant			X
	Plant Engineering Manufacturing Corporations	X	X	

Note: X: Some cases

While vertical transmission of information went smoothly, horizontal coordination was not adequate. Information on reduction of environmental loads (measures against pollution) and information on productivity improvements are conveyed through different channels and handled in different departments of businesses, and coordination of the two activities relevant for CP was seldom considered jointly.

Consolidation and dissemination of information about technologies and practical cases from the viewpoint of CP had in fact rarely been conducted[23], and most of such information has been disseminated after the latter half of the 1990s[24]. Before then, promotional activities by the national government were limited to energy conservation, and promotion of CP was mostly done by individual officers of institutions of prefectural and other local governments.

a. Technical Consulting and Advising by Testing and Research Organizations of Prefectural Governments

A prefectural industrial testing center or a similar institution is organized to service local industry and has staff well informed of both productivity improvement and pollution abatement of major local industries. On items b through e below there are many cases in which officers

[23] This is because concept of CP is not widely known (even if practices based on CP are implemented many of them are not recognized as CP projects) and because many firms consider CP measures as corporate secret know how to keep their competitive superiority.
[24] Exceptional examples of introducing CP cases are found in literary works of HONDA Atsuhiro.

of local industrial testing centers taught technology and trained personnel at individual business firms.

b. Study Activities of Industry Associations and Cooperatives of Small Businesses

There are cases in which trade organizations of industries with high environmental loads like the plating industry held periodical study courses with some subsidy from the national government and helped small and medium size businesses within the industry to introduce CP technology, such as rationalization of water use.

c. Information Exchange and Arrangement of Technology Transfer by Chambers of Commerce and Industry

There is a case where a committee on recycling technology was organized by nearby chambers of commerce and industry and operated a system to exchange technological information and waste itself (a system to coordinate utilization of by-product from one firm to another)[25].

d. Information and Technology Transfer from Parent Company to Affiliated Company

There is a case in which a parent company (manufacturer of finished goods) supplied information and technical assistance to a subsidiary (subcontracting parts supplier) to reduce cost in connection with a request to cut price. In the case, a proven technology developed within the parent company was successfully transferred to the subsidiary.

e. Energy Conservation Diagnosis by a Corporation in the Public Interest

The Energy Conservation Center, Japan has been helping small and medium enterprises through its diagnosis and guidance programs on energy conservation, subsidized by the government from its foundation in 1978. At the prefectural level, staff of prefectural testing and research organizations organized diagnosing teams to develop diagnosing methods and taught diagnosing technique and prepared manuals using model operations[26].

f. Plant Manufacturers

From late 1960s through 1970s, responding to increasingly strict pollution control rules and regulations and meeting the particular environmental requirements of individual customers simultaneously were a difficult job for plant manufacturers. With cooperation of customers (emitting business of environmental loads), recognizing various emission of gases and water, problems associated with polluting substances and amounts, applicability of regulatory standards and current practices, most of the plant manufacturers collected data and developed and designed plants in cooperation with customers. Through this experience, emitting businesses gradually accumulated engineering know-how on EOP with more organized process data for their own production process, such knowledge being important in the development of CP methods.

g. Small and Medium Enterprises Diagnostic Consultants, etc.

For small and medium businesses in manufacturing, Small and Medium Enterprise Diagnostic Consultants in Mining and Manufacturing Division[27] are providing advice based on a government subsidized diagnosis program. Although this study could not include actual cases,

[25] HONDA Atsuhiro / Committee on Recycling Technology of Eastern Osaka Chamber of Commerce and Industry, *Waste Reduction at Plants Q&A - 3R Manual for Working Floor*, Energy Conservation Center, 2003
[26] YOSHIDA Fusao, "Accomplishments and Problems of Energy Conservation Diagnosis Activity at Small and Medium Enterprises in Osaka Prefecture", *Plant Engineering*, vol.35 No.7, 1983
[27] According to the change in the system in 2001, the categorization of Small and Medium Enterprise Diagnostic Consultants was eliminated.

such diagnoses made losses visible and organized data on production processes which would have contributed to propagation of CP.

4.5.2 System for Manpower Training

Manpower training at small and medium enterprises is an important factor for implementation and smooth management of transferred technology. In the above cases, manpower training was conducted for employees by staff of public testing and research institutions.

At the national level, designation of energy conservation managers (certifying of thermal energy conservation engineers and electric energy conservation engineers) by a new law of 1979 contributed to manpower training at small and medium enterprises.

Among the certifications, arrangements for heat management engineers goes back to the law of heat management enacted in 1947 which emphasized not only conservation of resources and energy but also identification and keeping records of the energy balance at each processing step. This tradition would be recognized as the foundation for CP in general[28].

Small and Medium Enterprise Diagnostic Consultants were trained as an official qualification. Many staff in private companies also acquire the certificate of Small and Medium Enterprise Diagnostic Consultants.

4.5.3 System for Financing

In Japan, public financing for pollution control investment by small and medium enterprises promoted the reduction of pollution, but CP related investment was not considered as pollution abatement and outside of the subsidy plan except energy conservation investment. Therefore funds for CP were mostly supplied by local financial institutions specialized in financing of small and medium enterprises as was done for general production investments.

On the technological development side, a subsidizing system on “Technological Development of Closed System” was established in 1972, but the use of the system was limited to large primary material producers like mercury-free production of caustic soda producers.

Due to the above reasons, CP investments had a substantial handicap against EOP investments which received many forms of subsidy.

4.5.4 System for Motivating Companies

To transform information provision, manpower training and financing for the realization of a CP project, it is a prerequisite for top management to have strong commitment and demonstrate it to employees. Therefore the development of CP projects is strongly affected by socio-economic environment of the time. Unfortunately however timing of the introduction of CP coincided with a most difficult time for capital investment and cost expenditure.

Companies should be motivated to introduce CP before they face a crisis; raising awareness of top management should be conducted prior to that of engineers, and it is effective to show the management successful results of market competitors.

4.5.5 Combination of Measures

As successful cases of combination of measures, a combination of the following three items will be a model[29].

[28] SOMA Kiyotaro, “Twenty Years of Heat Management and Future Trend”, *Plant Engineer*, September 1971
[29] MATSUI Kenichi, *Energy – Review of 50 Years after the Word War II*, Denryoku Shimposha, 1995

- Presentation of guidelines of the law, energy saving diagnosis --> Information provision, motivation.
- Certification and designation system of energy conservation engineers, energy saving diagnosis --> Manpower training.
- Preferential tax treatment and public soft loans for energy conservation --> Capital financing.

Since only few CP measures can pay for themselves from reduction of resource acquisition costs only, cost superiority is achieved when reduction of treatment cost of environmental load is taken into account. A proper level of environmental regulation and its strict enforcement is desirable. At that time, when enforcement of regulation on emissions of environmental loads is inadequate (when improper emissions are not identified by regulating authorities), there is no incentive for the use of CP. Strict enforcement of regulation at a proper level considering technological feasibility and technical and financial capability of the enterprise into account is desired.

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4 IMPROVEMENT OF PRODUCTIVITY AND DEVELOPMENT OF CLEANER PRODUCTION 4-1

Chapter 5

Case Studies on Industrial Pollution Control in Developing Countries and Japanese Technical Cooperation

5. Case Studies on Industrial Pollution Control in Developing Countries and Japanese Technical Cooperation

5.1 Introduction

5.1.1 Structure and Aim of This Chapter

This chapter consists of the following issues:

1. Research results and analysis of industrial pollution control measures in developing countries that differ from Japanese cases
2. Current status of programs on industrial pollution control by aid agencies.
3. Characteristics of and issues in the Japanese approach to technical cooperation in the field of industrial pollution control.

The objectives of examining these issues are as follows:

i To obtain basic data from research and analysis of industrial pollution control cases in the Philippines and Thailand, for the purpose of examining the manner of Japanese pollution-control technology transfers (including points, priority areas, methods and approach.)
ii To make clear what is necessary for effective technology transfer by looking back at past Japanese technical cooperation approaches in industrial pollution control.

5.1.2 Selection of Industrial Pollution Control Cases in Developing Countries

The Philippines and Thailand are selected as case study countries.

In the Philippines, the following items were studied. An example of industrial pollution control measures that differ from Japanese cases is the levy system on effluent discharges by the Laguna Lake Development Authority (LLDA). Survey areas are as follows:

- Levy system on effluent discharges by LLDA
- Loan policy by Development Bank of the Philippines (DBP)
- Tax incentive on investments by Board of Investments (BOI)
- Pollution Control Officer (PCO) system
- Organizational structure of Environmental Management Bureau (EMB), Ministry of the Environment and Natural Resources

In Thailand, the Environment Fund and Energy Conservation Fund are unique systems and the following items were studied:

- The Environmental Fund
- Energy taxes and Energy Conservation Fund
- Economic instruments
- Provision of CP related information
- Organizational Structure of Department of Industrial Works, Ministry of Industry (DIW) and Pollution Control Department, Ministry of Natural Resources and Environment (PCD)

5.2 Case Studies on Industrial Pollution Control in the Philippines and Thailand

5.2.1 Methods for Case Analysis

The following information/factors for the target countries were gathered and analyzed.

(1) Economic conditions

- Economic growth, national income, population growth rate
- Industrial structure

(2) Environmental conditions

Qualitative analysis of pressure on the environment, state of the environment, effect on the environment, and response, or the "DPSER" related to industrial pollution (the first factor, driving force, is excluded) was conducted.

(3) Current status of the factors concerning corporate behavior towards industrial pollution control

Information about the following factors as identified in Chapter 3 is gathered and analyzed.

a. Push factors (Factors Putting Pressure on Companies from Outside)

- Realization of Damages due to Industrial Pollution
- Protest by victims and NGOs
- Pressure by mass media
- Pressure by local governments
- Revelation of environmental crime by police and its legal resolution
- Establishment and enforcement of legal system

b. Pull factors (Factors Driving Companies to Take Action against Industrial Pollution)

- Economic growth
- Measures regarding plant location: plant relocation measures by central and local governments
- Economic incentives: financial support and tax preference for pollution control activities
- Existence of leading companies in environmental management
- Dissemination of information from the governments: an information network in which the information on various schemes, technologies, and financial support flows to the smallest unit of companies
- Industrial pollution control measures by industry associations: joint research & development and exchange of information on pollution control measures
- Support from public industrial technology centers
- Service from environmental equipment manufactures

c. Internal factors within companies

- Special characteristics of companies
  (company structure, export- or import- oriented, import substitute companies)
- Awareness of top management of companies
- Business management of a companies
- Status of engineers in companies

(4) Conditions concerning government policies

Current conditions and effects of several policy cases were analyzed.

5.2.2 Case Study on Industrial Pollution Control in the Philippines

a. Economic Conditions

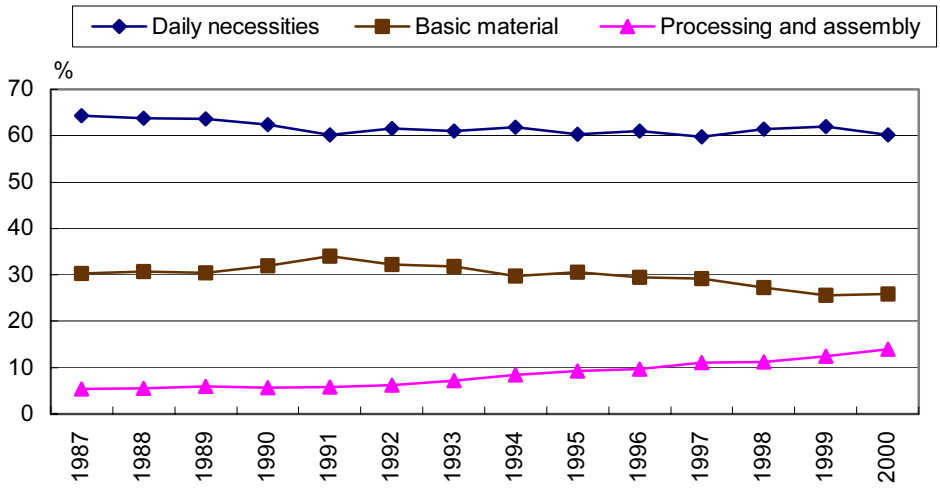
The World Development Report by the World Bank shows the basic economic indicators of the Philippines as follows:

- General national income per capita (GNI, 2001): 1,050US$
- Growth rate of gross national product (1990-2001): 3.3%
- Growth rate of gross national product per capita (1990-2001): 1.5%
- Population growth rate (1990-2001): 2.1%
- Industrial structure (the ratio of added value against GDP, Agriculture: Industry: Services): 15:31:54

Economic growth over the past 10 years has been steady although it was not always higher than other Asian nations. The impact of the Asian monetary crisis was also relatively minor. The economic growth rate per capita stayed at a low level due to high population growth rates. The agricultural sector accounts for 15% in the Philippines' GDP although its weight has been decreasing.

Energy consumption was 1.176 Tera Btu in 2002 while consumption per capita was 15 Million Btu. Per capita consumption is still at a low level[1].

The ratio of automobile ownership stayed very low although it increased from 7 vehicles per 1,000 persons in 1990 to 10 vehicles per 1,000 persons in 2000. Primary school enrollment rate reached 100% in 2002. The enrollment rates in secondary school and higher education were 77% and 31%, respectively. One can say the educational level certainly has increased. For life expectancy at birth, it was 61 years in 1980 and is 69 years in 2001. The infant mortality rate for age 0 - 5 also dropped from 81% in 1980 to 38% in 2001, which indicates social development[2].



Source: Data from National Statistical Coordination Board

Figure 5.2.1 Trend in Industrial Structure of Manufacturing Industry in the Philippines (1987-2000)

[1] USA Energy Information Administration, "International Total Primary Energy and Related Information", http://www.eia.doe.gov/pub/international/iealf/tablee1.xls
[2] World Bank, World Development Indicators 2003

The industrial sector has gradually grown. Although the industrial sector saw a great growth of foreign direct investment in the 1990s, this has declined in recent years. Heavy and chemical industries were relatively unimportant in the Philippines. Major industries were food, fiber, and pulp & paper.

b. Status of the Environment

b.1 Overview

The growth of population, industrialization and urbanization over the past 50 years has been increasing the pollution load and pressure on natural resources in the Philippines. Relevant authorities[3] and international donor agencies[4] have pointed out that this natural resource degradation is placing serious and increasing constraints on the country's economic and social development. The following subsection outlines the impacts of these pressures by industry types, in particular, for air, water and soil (solid wastes). The following subsection also provides indicators of impacts on human health and the economy.

b.2 Air

Emissions of particulate matter and carbon monoxide are mainly from households, i.e. fuel wood burning (for cooking) and garbage burning. About 80% of particulates are re-suspended dust, followed by mobile sources (predominantly PM10 and VOCs), emitted from the cement, food, and construction industries. The energy, manufacturing, food and mining sectors account for most of the SO_x, NO_x and VOCs. Indoor air pollution (households) is ubiquitous. For ambient air pollution, except for some remote, large, stationary sources such as power stations and pulp / paper plants, most ambient air pollution is concentrated in and around urban areas, primarily Metro-Manila and Metro-Cebu, although mobile sources and re-suspended dust are increasingly affecting other secondary cities and small settlements strung along major arterial roads.[5]

The most significant air pollution sources are emission from households and vehicles. The growth of manufacturing industry also poses an increasing threat to the ambient air quality. The USAID-supported Industrial Environmental Management Project (IEMP) and Environment and Natural Resources Accounting Project (ENRAP) gave several sub-sectors of manufacturing industry primary importance in terms of the levels of pollution load. As to air and water pollutants, ENRAP made a sub-sector wise ranking of pollution load by manufacturing sources as well as regions (see Table 5.2.1).

Table 5.2.1 indicates the relative importance of specific sectors such as cement, sugar, and petroleum refining in addressing air pollution control. It also shows the difference in sources of air pollution among regions.

[3] DENR, the NSO and NEDA estimates in the Philippine Environmental and Natural Resources Accounting Project (ENRAP).
[4] Notably the World Bank and Asian Development Bank.
The World Bank's "Philippines Environment Monitor" publications of 2000 and 2001 provide much useful data, some of which is used in this report.
[5] DENR/USAID, "The Philippine Environmental and Natural Resources Accounting Project (ENRAP-PHASE III) Main Report", 1996

Table 5.2.1 Sub-Sector Wise Ranking of Pollution Loads in Manufacturing Industry (Air Pollution)

Sub-Sector (Manufacturing)	NCR and Region 4		Region 7	
	Particulates	SO_2	Particulates	SO_2
Cement	1	2	2	1
Sugar	2	4	1	3
Petroleum Refining	4	1	-	-
Beverage and Liquor	5	8	4	2
Coconut Oil Refining	9	5	-	-
Flour	3	6	3	-
Paint and Varnish	6	9	-	-
Pulp and Paper	7	3	-	-
Rice and Corn Milling	10	10	-	5
Wood and Wood Products	8	7	-	4
Fertilizer Manufacture	-	-	5	-
Tanning and Leather	-	-	-	-
Bakery	-	-	-	-

Note: The above ranking is made in accordance with the comparison of pollutants volume among sub-sectors. The volume of pollutants was estimated by making use of the sub-sector wise industrial production data in the Philippines and emission factor data of the above pollutants per unit production taken from USEPA inventory. The ENRAP data omits other air pollutants such as NO_x, VOCs, CO, and so forth. If these were included, it would raise the priority of other sub-sectors.

Source: DENR/USAID, "The Philippine Environmental and Natural Resources Accounting Project (ENRAP-PHASE III) Main Report", 1996

b.3 Water

According to the USAID-supported ENRAP Study, sources of water pollution (BOD and SS) are dominated by households and agricultural, mining, and urban run-off, which together account for about 70% to 80% of this type of pollution (43% of total BOD is accounted for by households, and for SS, agricultural, forestry and mining run-off is about 95% of the total). The remaining 20% to 30% emanates from industry and is dominated by the livestock and poultry processing, sugar, coconut oil refining and pulp/paper industries. The major sources of toxic pollutants include gold mining (mercury), tanning and leather (chromium and sulfides), fertilizer production (P_2O_5, fluoride and sulfates), cement (TOC and ammonia), and iron and basic industries (heavy metals, potassium). Between 1988 and 1992, BOD increased by 12% (for urban areas 15%), but SS reduced by 19%, due mainly to the slow-down in the mining sector. Toxic and heavy metal pollutants increased by up to 22% over this period, except for phenols, P_2O_5, fluoride and sulfates (8% to 12% increase). 1992 was an exceptionally dry year, and the run-off was low. These increases are therefore an understatement of the average trend.

Except for some areas in southern Mindanao, almost all of the surface water bodies in the country are polluted. In the study regions, as in all urban areas, rivers are heavily polluted, being most severe in Metro-Manila, where all surface waters can be considered biologically dead during the dry months[6]. This is due to heavy concentration of population and industrial activities as well as an inadequate sewerage treatment system that services only about 8% of the 9 million residents. Wastewater is not used to recharge aquifers or for irrigation, but discharged directly into Manila Bay and rivers. The coastal waters of Manila Bay are also deteriorating. The total load of organic matter in the Bay is about 250,000 tons of BOD/year, with more than 90% coming from the Pasig and Bulacan river systems in Metro-Manila, and there are high levels of ammonia nitrogen and severe oxygen depletion (as low as 1.9 mg/l).

[6] World Bank, "Metropolitan Environmental Improvement Program (MEIP)/Industrial Efficiency and Pollution Control (IEPC) Program, Final Report of Metro Manila Study", 1992

Heavy metals have been rapidly accumulating in the Bay – between 1982 and 1992 copper concentrations increased by 50%, mercury more than doubled, and zinc levels tripled[7]. Studies conducted in 1996-1998 revealed a significant decline in benthic organisms, and an increase in algal blooms in the eastern part of the Bay and in the Pasig and Bulacan rivers. In Laguna Lake, the biggest freshwater body in the country, and whose watershed covers 50% of Metro-Manila and most of Region 4, the BOD load is 73,400 tons/year, of which 69% is from domestic sources, 19% from industry and 12% from agriculture. While the water quality is still Class C (suitable for fisheries), and is also a source of drinking water for Metro-Manila, the lake is facing increasing BOD loads and siltation (estimated at 4M m^2/year). The culture period for fish is increasing, and fish kills have occurred in the western part of the lake where industries and settlements are concentrated. The expansion of industry in the lake watershed (especially since the implementation of several large industrial estates) has given rise to increasing levels of toxic and hazardous wastes (THW), which, while not yet at critical levels (still meeting class C standards), are a cause for concern. Finally, groundwater extraction is also a cause for concern.

There are, however, some bright points in this generally gloomy scene. Efforts to rehabilitate the Pasig river system resulted in a 30% reduction in BOD from 1990 to 1996, achieving Class C BOD, although dissolved oxygen (DO) did not improve. Most of the decrease in BOD is attributable to reduction in the load from industry and solid wastes (the focus of the clean-up program in the absence of an effective sewerage system).

In addition, the Laguna Lake Development Authority (LLDA) has a fairly efficient monitoring system (ambient and source), and registers most polluters within its area. Efforts to get industry to contain and store their effluent is having some success, and monitoring for toxic and heavy metals showed improvements between 1984 and 1999. In 1997, LLDA initiated a BOD pollution charge system on industries (called the Environmental User Fee), and by 2001 had registered and collected charges from over 650 industrial establishments. LLDA claims that this has produced a dramatic reduction in industrial BOD of over 80% during this time period due to industries implementing cleaner production methods and installing end-of-pipe treatment plants to avoid the charge. Other industrial water pollutants are also likely to have been reduced through this measure. LLDA is now extending the user charge to commercial establishments, housing sub-divisions and condominiums. The success of this approach has encouraged GOP to apply it nationwide through the upcoming water pollution legislation. Finally, initiatives by DENR/EMB to promote environmental management (such as 'Eco-watch' and river associations), and by industry associations (such as PBE) have raised environmental awareness and supported measures for waste reduction by a range of enterprises.

In summary, the impacts of manufacturing industry are i) a minority, but still significant share of urban BOD and SS, especially from livestock, food and beverage and dye and textile industries, ii) an increasing share of toxic and heavy metal pollutants, originating from industrial chemical and fertilizer industries, tanneries, foundries and metal finishing, pulp and paper production, entering both surface and sub-surface water, and iii) health impacts of these toxics, whose effects have not been properly assessed in the Philippines, but which may be more serious than realized. More research is urgently needed on this matter. Table 5.2.2 shows the sub-sector wise ranking within manufacturing industry in terms of water pollution loads based on the ENRAP Study.

[7] World Bank, "MEIP/IEPC Program, Final Report of Metro Manila Study", 1992

Table 5.2.2 Sub-Sector Wise Ranking of Pollution Loads in Manufacturing Industry (Water Pollution)

Sub-Sector (Manufacturing)	NCR and Region 4		Region 7	
	BOD	SS	BOD	SS
Cement	-	-	-	
Sugar	1	-	1	4
Petroleum Refining	-	-	-	
Beverage and Liquor	3	1	-	2
Coconut Oil Refining	2	2	-	3
Flour	-	-	-	
Paint and Varnish	-	-	-	
Pulp and Paper	4	3	-	6
Rice and Corn Milling	-	-	-	5
Wood and Wood Products	-	-	-	
Fertilizer Manufacture	-	-	-	1
Tanning and Leather	5	-	-	
Bakery	-	-	-	

Note: The above ranking is made in accordance with the comparison of pollutants volume among sub-sectors. The volume of pollutants was estimated by making use of the sub-sector wise industrial production data in the Philippines and emission factor data of the above pollutants per unit production taken from USEPA inventory. Since the above ranking only covers the estimation of BOD and SS loads, it still needs further elaboration through incorporation of the loads by other toxic pollutants.

Source: Based on DENR/USAID, "The Philippine Environmental and Natural Resources Accounting Project (ENRAP-PHASE III) Main Report", 1996

b.4 Wastes

Solid Wastes (SW) and much Hazardous Wastes (HW) are the main pollutants to the land, where they may remain for some time, posing a danger to public health and clogging drainage, before leaching out to surface and sub-surface water, or becoming air pollution in the form of dust and aerosols. Most SW are generated by households and commercial enterprises (i.e., municipal wastes: 10 million tons/yr - 81%), then commercial and industrial HW (2.4 million tons/yr 'net'[8] – 19.3%), and hospital infectious wastes (6,750 tons/yr – 0.05%). Of the total municipal wastes generated, urban areas claim about 60%, and rural areas 40%[9].

HW from industry and hospitals comprise a significant, and rapidly growing proportion of the waste problem. The main generating sectors of industrial HW are fabricated metal, plating and machinery, chemicals, food and beverages, tanning and textiles. Although EMB is making efforts to address HW[10], there is a general lack of awareness of the dangers of HW, and its health and economic impacts need urgent study. Higher priority needs to be given to its monitoring, transport and safe disposal. The lack of effective HW management in the country is dissuading foreign investment and is likely to hamper the image and sales of Filipino products in overseas markets. A major means to reduce solid wastes would be for industry to take greater responsibility for the eventual fate of their products through 'extended producer responsibility'. This should be a major area of attention for industrial leaders and government policy.

[8] About 4 times this amount of HW is produced by industry, but much is in liquid form (especially acids), which are recycled by the plant, or neutralized or otherwise treated on-site. The 2.4 million tons/yr shown here is a conservative estimate of the amount requiring off-site treatment in specialized HW treatment facilities. Please refer to EX Corporation / Kokusaikogyo Co. Ltd., "Study on Industrial Hazardous Wastes Management in the Republic of the Philippines (Phase 1)", 2001.

[9] World Bank, "Philippine Environment Monitor 2001"

[10] A master plan was prepared, and a feasibility study for a HW treatment plant was conducted.

c. The Legal System and Organizations

c.1 Legal system

The legal system concerning industrial pollution control is fully furnished in the Philippines. The system consists of the following:

1. Philippine Environment Code (Presidential Decree No.1152 1998)
2. Pollution Control Act (PD No.984 1976)
3. Environmental standards for water and effluent standards
4. Clean Air Act of 1999: Ambient air quality standard and emission standard (Republic Act 8749)
5. Toxic Chemicals and Hazardous and Nuclear Wastes Control Act (incl. Chemical substances) (Republic Act 6969)
6. Ecological Solid Waste Management Act (Republic Act 9003)
7. Environmental Impact Statement System Decree (Presidential Decree No.1586)

The Environment Code is a fundamental law and represents the basic principle behind environmental management in Philippines. The fundamental law on controlling pollution from industrial activities is the Pollution Control Act, which defines the polluters' responsibilities. Based on the Pollution Control Act, water quality standards and effluent standards, ambient air quality standards and emission standards have been set by government orders. Polluters are required to comply with each standard. Regional offices of DENR/EMB and the LLDA have authority over industrial effluent control.

The ambient air quality standards and emission standards have been integrated into the Clean Air Act of 1999. The Toxic Chemicals and Hazardous and Nuclear Wastes Control Act (RA6969) and its implementing rules and regulations (DAO92-29) regulate the discharge and treatment of hazardous wastes from and at the sources. Industrial wastes (excluding hazardous wastes) are treated as municipal wastes, and local governments (LGU) are responsible for their disposal. The discharges of pollutants from private companies are controlled by these legal systems.

On the other hand, the Environmental Impact Statement System exists as a unique regulation system. This system is provided by Presidential Decree no.1586, and its implementing rules and regulations are concluded in DENR Administrative Order 96-37: DAO96-37. DAO96-37 defines projects that need to be targeted for the Environmental Impact Statement and ECC (Environmental Compliance Certificate). Although DAO96-37 does not target all the factories in general, the Procedural Manual of DAO96-37 expands the scope of the regulation; factories other than those exempted from ECC system by DENR must acquire the ECC regardless of the status of the factory (new or existing). Targeted factories have potential to seriously impact the environment by their activities, and it is necessary for them to obtain ECC for their construction and operation.

ECC includes an agreement on environmental management between the factories and DENR, which integrates various legal requirements. ECC is an important regulatory tool since it makes it possible for DENR to monitor the factory. As for the establishment of an organizational structure for environmental management at a factory, there is a Pollution Control Officer system.

The Philippines has been actively promoting development of industrial complexes. Some industrial complexes are not designated as export processing zones; new investments such as joint enterprises with foreign capital tend to locate such industrial complexes.

Existing economic instruments are; the levy system on effluent discharges by LLDA, tax exemption for import and investment duty regarding environmental protection by BOI, and

special loans for environmental investments by DBP[11]. There is a plan in the Philippines to expand the levy system for charging effluent discharges to the whole country by promulgating a new law on water.

The CCA (Clean Air Act) defines the fee system for permits for installation of exhaust gas emitting facilities as well as the market for emission trading. There is a provision about the establishment of an environment fund (based on the Toxic Chemicals and Hazardous and Nuclear Wastes Control Act and the Environmental Impact Statement System Decree), but it has not been realized. The CCA provides quality standards for benzene, lead, aromatics and sulfur contents in petroleum products, to which the petroleum industry is required to respond.

Of the cases motioned above, the levy system on effluent discharges by LLDA and ECC are successful cases that have had a great impact on factories.

On the other hand, economic incentives for investments and loans for environmental protection measures are not well utilized. Also, the Pollution Control Officer (PCO) system does exist, but PCOs do not necessarily have high status in companies.

c.2 Organization and system of environmental administration

The Environmental Management Bureau (EMB) under the Department of Natural Resources is responsible for industrial pollution control.

The major functions of EMB, as mandated by EO 192, are as follows:

1. Formulation of possible legislation, policies and guidelines related to pollution control, environmental impact assessment, toxic chemicals and solid and hazardous wastes management;
2. Formulation of environmental quality standards for air and water quality, noise and odor;
3. Technical and laboratory services as support to formulation of environmental quality standards;
4. Legal support for the formulation of environmental legislation, policies and guidelines, and assistance in the adjudication of pollution cases;
5. Campaigns for environmental information and awareness;
6. Technical assistance to the DENR Regional Offices (now EMB Regional Offices) concerning the implementation of laws on pollution control, environmental impact assessments, and management of toxic chemicals and solid and hazardous waste.

Figure 5.2.2 shows organizational structure of EMB.

[11] Laguna Lake Development Authority: LLDA, Board of Investment: BOI, Development Bank of the Philippines: DBP.

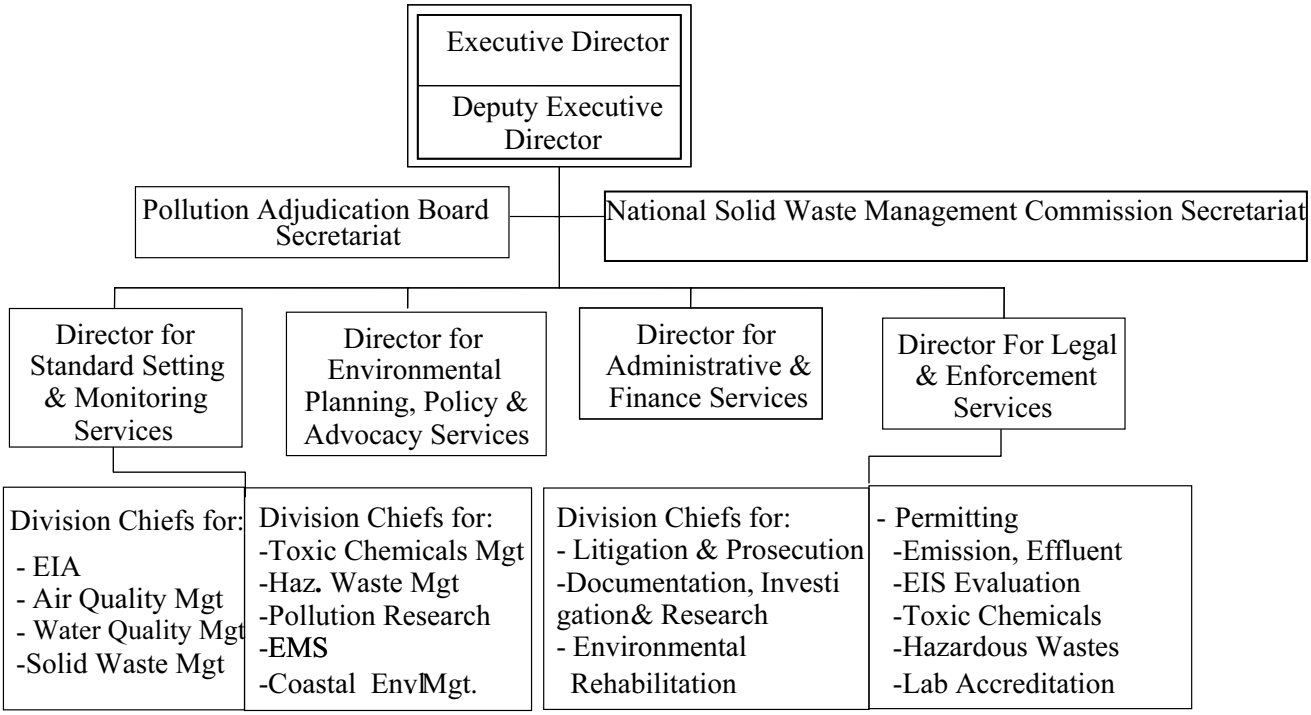


Figure 5.2.2 EMB Organization Structure

Office of the Director /Assistant Director
- National Solid Waste Management Commission Secretariat (NSWMC)
- National Ecology Center
- Pollution Adjudication Board Secretariat (PAB)

Administration and Finance Division (AFD)
Environmental Policy and Planning Division (EPPD)
Environmental Quality Division (EQD)
- Air Quality Management Section
- Water Quality Management Section
- Solid Waste Management Section
- Toxic Chemicals Management Section
- Hazardous Wastes Management Section
- Pollution Research Section
- Coastal Environmental Management Section
- Environmental Management System

Environmental Impact Assessment Division (EIAD)
Research and Development Division (RDD)
Legal Division (LD)
Environmental Education and Information Division (EEID)

Laboratory Services Section (LSS)

There are 15 Regional Offices of DENR/EMB in each region. In 2002, the EMB Planning Division reported that EMB has about 558 staff, of which 168 are in the Central Office while 390 the Regional Offices. Each Regional Office has only 26 staffs on average.

The EMB Regional Offices were set up in pursuit of the provisions of the Clean Air Act that mandated the conversion of EMB into a line agency as the lead implementer of this Act.

The EMB Regional Offices were organized out of the environmental management sector of the DENR Regional Offices' Environmental Management and Protected Areas Services (EMPAS). The transfer of staff, budget and equipment from the DENR Regional Offices to EMB Regional Offices is still being completed and formalized.

The EMB Regional Offices, headed by Regional Directors who report to the EMB Director at the Central Office, discharge the mandate of the Bureau at the regional level. The existing structure of the EMB Regional Offices is shown in Figure 5.2.3.

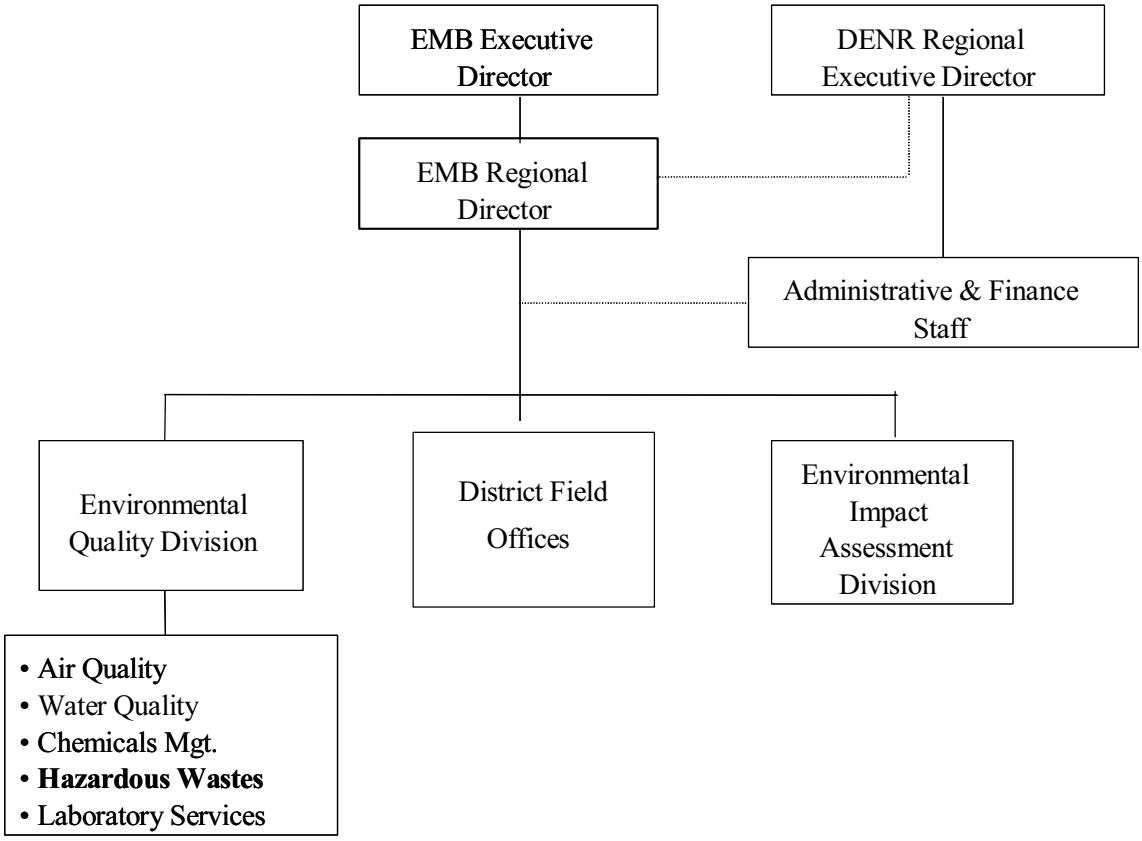


Figure 5.2.3 The Organizational Structure of the EMB Regional Office

A laboratory for analyzing major pollutants is located in the Central Office. The Regional Offices also have laboratories but only with basic facilities. The central laboratory also has a function of certifying private laboratories; it issued certificate of recognition to 7 laboratories in 2002. The central laboratory received and analyzed 12,254 environmental samples (with 48,845 determinations).

The Regional Offices have not been staffed and equipped for collecting and analyzing samples for the compliance monitoring of discharge/emission standards. As an exception to this rule, the LLDA has established a monitoring unit.

Under RA 6969, companies are required to register as hazardous waste generators. PD984 requires them to acquire a permit for establishment of effluent treatment facilities, and ECC certification is also necessary. The Regional Offices handle all of these procedures.

DAB (whose head office is EMB) is in charge of inspection of cases of violation of law. DAB consists of the DENR Secretary, two of the DENR Assistant Secretary, the EMB Director, and three persons appointed by the Secretary. There are three levels of

administrative disposition: cease and desist order, temporary lifting order and formal lifting order/case closed. In 2002, there were 11 cases of cease and desist order, 62 cases of temporary lifting order and 5 cases of formal lifting order/case closed[12].

d. Current Status of Factors Influencing Corporate Behavior Regarding Industrial Pollution Control

The current status of the factors regarding industrial pollution control by companies (as identified in Chapter 3) in the Philippines is summarized in the following table.

Table 5.2.3 Current Status of Factors in Corporate Behavior Regarding Industrial Pollution Control in the Philippines[13]

Contributing Factors	Items	Present situation
Factors Putting Pressure on Companies from Outside (Push Factors)		
Realization of Damages due to Industrial Pollution	Cases of damages of marine resources by water pollution.	A few cases
	Cases of health damages due to air and water pollution	No case (but regardless of industrial pollution, diseases caused by water pollution often occur[14])
Protest by victims and NGOs	Complaints	Existing but not perceptible
	Demonstrations of protest by victims	Existing but not perceptible
	Demonstrations of protest by NGOs	A few cases
Pressure by Mass Media	Report on industrial pollution problems	A few cases
	Report on environmental problems in general	Existing
Pressure by local governments	Democratization of local governments	Governors/mayors are elected
	Establishment of a special section dealing with environmental issues	No case
Revelation of environmental crime by police and its legal resolution	Revelation of environmental crimes related to industrial pollution	Not confirmed
	Damage suits against pollution sources	Not confirmed
Establishment and enforcement of legal system	Laws for industrial pollution control	Existing
	Establishment of administrative body dealing with environmental issues	Existing
	Establishment of regional offices of the above body	Existing
	Air monitoring network.	Very limited
	Plant registration requirement from an environmental view point	Existing (EIS)
	Plant operation permit from an environmental view point	Issuing of ECC
	Compliance monitoring of pollution sources	A few

[12] According to the statistics by DENR (no specifics about acts of violation mentioned)
[13] Based on the comments and interviews of persons involved in the Philippines during this study.
[14] National Statistical Coordination Board, Compendium of Philippine Environment Statistics 2002

Contributing Factors	Items	Present situation
	Preparation of annual reports on environmental administration	No case (one prepared by LLDA). Efforts being made.
Factors Driving Companies to Take Actions against Industrial Pollution (Pull Factors)		
Economic growth	Average annual GDP growth rate of 1990-2000. (the average for Middle Income Countries is 3.6%)	3.2% (lower than the average)
Measures regarding plant location	Zoning exclusive for industrial use	Existing
	Development of industrial complexes	Existing
	Guiding plants to relocate to industrial complexes	No case
Economic incentives	Public soft loans for environmental measures	Existing
	Preferential tax treatment for environmental investments	Existing
Leading companies in environmental management	Existence of leading local companies	A few
Dissemination of information from the government	Network of information dissemination from the public to the private sectors	Existing, but very limited to small companies
Industrial pollution control measures by industry associations	Collaborative research on industrial pollution control	Existing but weak
	Information exchange	A few
	Organization	Existing but weak
Industrial technology center	Guidance on industrial pollution control	Existing for wastewater control but not in local areas
Manufactures of Pollution control devices	Local manufacturers of air pollution control devices	No case
	Local manufacturers of wastewater treatment facilities	A few but small
	Local manufacturers of waste treatment facilities	No case
Internal Factors within Companies		
Characteristics of local companies	Communication between business owner and plant manager	Managers' interests in production technology are low.
Awareness of top management of local companies	Drive to expand the business	Generally low although export-oriented companies have.
	Environmental consideration in management concept	Existing, but not many
	Executives in charge of environmental matters	A few cases
Business management in local companies	Management for productivity improvement	Middle level
	Quality Control system (QC)	Middle level

Contributing Factors	Items	Present situation
Environmental management in local companies	Introduction of environmental management system.	Some cases in large companies
Technology innovation, etc	Innovation of production technology	Low
	Research and development	Low
Status of engineers in local companies	Status of top engineers within a company	Generally low
	Status of engineers in charge of environmental matters within a company	Generally low

With respect to the factors putting pressure on companies (push factors), many Philippine stakeholders recognize that the legal system has been fairly established while its enforcement is weak. However, it appears that the pressures of the mass media or local governments on companies are generally not very strong.

Among the factors encouraging companies to take measures (pull factors), the fact that the level of economic growth, which is most important to companies, is not so high seems to have had a negative impact on environmental investments by industry. Although there are economic incentives for environmental investments, they seem not strong enough to actually induce the investments. There is no fund to encourage investments in and research and development on pollution control measures by individual companies such as the Environmental Fund or the Energy Saving Fund in Thailand. However, NGOs and industry associations have shown a strong interest in industrial environment management; and many actions are being taken. Some aspects of industrial environmental management have been advanced in the Philippines such as development of an information platform by an NGO with the support of JICA[15].

With respect to internal factors at companies, although awareness of top management toward the importance of environmental management seems to have increased significantly, only a limited number of companies have reflected such awareness in their business management.

It is clear that the companies actively practicing environmental management are those rich in entrepreneurship. Companies intending to respond to the changes and promote business development are highly motivated toward environmental management. However, it seems that such companies are still relatively few in the Philippines as a whole, especially at small and medium enterprises (SMEs).

e. Current Status of Policies

This section describes and analyzes some examples of unique policy cases, such as the levy system on effluent discharges by LLDA, public soft loans, incentives for environmental investments and the PCO system.

e.1 Levy system on effluent discharges by LLDA

1) History of Laguna Lake Development Authority (LLDA)

The Laguna Lake Development Authority (LLDA) was established in order to manage Laguna Lake watershed for the balanced development of the lake and its watershed in 1966 by virtue of Republic Act 4850 as a government-owned and controlled corporation under the office of the President. In 1993, under EO 149, “Further Streamlining the Office of the President”, the

[15] Philippine Business for the Environment (PBE), “The Industrial Environmental Management (IEM) Knowledge Network”, http://www.pbe.org.ph/

administrative supervision over LLDA was transferred to the DENR from the Office of the President.

The main aim of the LLDA is to lead, promote and accelerate the development and balanced growth of the Laguna de Bay basin within the context of national and regional plans and policies for social and economic development and to carry out the development of the basin with due regard and adequate provision for environmental management and control, preservation of the quality of human life and ecological systems, and the prevention of undue ecological disturbances, deterioration and pollution.

Laguna Lake is the biggest lake in the Philippines and covers an area of 90,000ha, with an average of 2.8m in depth. It has a catchment area of 283,000ha, population of about 11.3 million[16], and 3,897 business establishments[17] around the basin.

2) Structure of the LLDA

The Pollution Control Division and Environmental Quality Management Division are in charge of environmental management in LLDA. The Lake Management Division and the Integrated Water Resource Management Division deal with lake utilization. For planning, the LLDA has the Plan and Project Development Division, Community Development Division, Engineering and Construction Division etc. The Finance Division, the Administrative Division, the Legal Division and the Human Resource Development Divisions (and a few others) are the management divisions of the agency.

3) Levy system on effluent discharges

Background of the levy system and its outline

The World Bank proposed to the LLDA the introduction of economic instruments for pollution control, to supplement direct regulations, in 1993. In the mid 1990s, the Bank proposed the introduction of a levy system on effluent discharges in the research conducted under the MEIP (Metropolitan Environmental Improvement Program).

Responding to this proposal, the LLDA introduced this system by Board Resolution No.26 in 1996 and defined the implementing arrangements in Resolution No. 33. These decisions were based on the authority rights for Lake Laguna, given to the LLDA by Republic Act No.4850, especially the license for lake utilization and the authority for collection of user fees. The original Republic Act No.4850 defines the authority for lake utilization and basin development. Discharging effluent to Laguna Lake was also recognized as an activity to use the lake, which become managed by the discharge permit and levy system on effluent discharges.

The details of the levy system are prescribed in Resolution No. 33 and mainly consist of the following: discharge permits and monitoring, user fees, prohibited acts, and penal provisions. The outline of Resolution No.33 is as follows.

Discharge Permit: Any person who shall discharge, in any manner, liquid waste into the Laguna de Bay Region shall secure a discharge permit from the Authority. (1500 pesos for application fee, should be judged within 30 days after applied) (Section 5) Validity period is one year and update every year. (Section 18)

Assessment of User Fees: LLDA assesses based on the data provided by the applicant in the application form and previous year's self-monitoring reports. (Section 8)

Surcharges and Credits on Annual User Fees: When actual discharge loadings are greater than those allowed, the Authority shall impose surcharges upon renewal of the discharge permit equivalent to the excess loading times the applicable user

[16] As of May 2002, according to the LLDA website
[17] As of October 2002, according to the LLDA website

fee rates plus 5 percent of this amount per month. If the actual discharge loadings are less than those allowed, the permit holder shall be entitled to a refund or credit of a portion of the variable fee corresponding to the reduced loading. (Section 9)

Payment Scheme: The user fee may be paid in full or in equal quarterly installments. Full payment shall be entitled to a 20 percent discount. (Section 10)

Grounds for Suspension/Revocation of Permits: The Authority may suspend or revoke any permit issued under these rules on any of the following grounds: a) Non-compliance with, or violation of regulations particularly the water quality standards, b) False or inaccurate information stated in the application for permit, c) Refusal to allow lawful inspections, d) Non-payment of user fees due in accordance with the schedule of fees and payment scheme, e) Other lawful and valid causes as provided for in these rules and regulations. (Section 14)

Self-Monitoring Reports: The permit holder or discharger must submit a quarterly self-monitoring report. (Section 19)

User Fees for Liquid Waste Discharges: It shall be comprised of the fixed fee and the variable fee. The number at 2002 is below.

The fixed fee (in case not include heavy metals)

Effluent Standard: Effluent standard for Biochemical Oxygen Demand (BOD) of 50 mg/L, regardless of strength of the raw wastewater. (Section 38)

Penalty: Any person found failing to comply with regulation shall pay a fine not exceeding five thousand pesos (P5,000) per day. The Authority shall hereby be authorized and empowered to impose the fine after due notice and hearing. (Section 31)

Annual user fees for liquid waste discharges are calculated by the following formula:

Annual user fees = the fixed fee + (the variable fee * annual BOD_5 load (kg))

where annual BOD_5 load = CBODm * Qm * d * 10^{-3}
CBODm = average concentration BOD_5 (mg/l)
Qm = daily wastewater discharge (m^3/day)
d = number of operational days per year
10^{-3} = exchange rate (m^3/l/kg/mg)

Table 5.2.4 Volumetric Rate of Discharge Fixed Fee

unit: Peso/year

	1997	2002
Within 30 m^3/day	5,000	6,800
More than 30 but less than 150 m^3/day	10,000	12,000
More than 150 m^3/day	15,000	18,000

Table 5.2.5 Effluent Concentration Variable Fee

Within 50mg/L BOD	5.00 Peso /kg BOD
Above 50mg/L BOD	30.00 Peso /kg BOD

Wastewater concentration, daily wastewater discharge quantity and the number of operational days per year are based on the submitted data in self-monitoring reports, but the LLDA sets the fee schedule. When practices are found to be different from those submitted in the report, penalties such as cancellation of discharge permit will be imposed.

Actual application of the levy system on effluent discharges

Issuing of discharge permits has not been implemented for all of the business establishments around the lake, but in 2002, 1,976 business establishments were given the permit (total sum since 1997), and of these, 914 are covered by the levy system.

Table 5.2.6 shows the changing actualities of the application of the BOD load and the levy system.

Table 5.2.6 Changes in the BOD Load in Businesses Using the Levy System on Effluent Discharges

Executed Year	# of Businesses	1997	1998	1999	2000	2001	2002
Feb. 1997	222	5403*	4102	1200	1241	941	202
Ratio to base year		1.00	0.76	0.22	0.23	0.17	0.04
Feb. 1998	255		4432*	1516	1279	963	223
Ratio to base year			1.00	0.34	0.29	0.22	0.05
Increment	33		330*	316	38	22	21
Ratio to base year			1.00	0.96	0.12	0.07	0.06
Feb. 1999	429			1790*	1448	1062	282
Ratio to base year				1.00	0.81	0.59	0.15
Increment	174			274*	169	99	59
Ratio to base year				1.00	0.62	0.36	0.22
Feb. 2000	628				2309*	1371	488
Ratio to base year					1.00	0.59	0.21
Increment	199				861*	309	206
Ratio to base year					1.00	0.36	0.24
Feb. 2001	738					1687*	653
Ratio to base year						1.00	0.39
Increment	110					316*	165
Ratio to base year						1.00	0.52
Feb. 2002	914						791
Increment	176						138

*: Base year
Unit: BOD_5 load is t/year BOD_5
Source: LLDA document

Regarding violations of the effluent standard, the LLDA charges a fine to violators based on Resolution 33. The fine is 5,000 pesos for a day and is set so that it will culminate to be a large amount if violation is continued.

Impact of the levy system on industrial pollution control by companies[18]

The behavior pattern of the factories in the Laguna area that reduced discharge amounts and environmental loads is extremely simple. Every plant installed effluent treatment facilities within 4 to 5 years after the introduction of the levy system on effluent discharges. This is because a fine of 1,000 peso per day (5,000 peso at present) is imposed on a violation of effluent standards if effluent treatment facility is not installed. If improvements cannot be made, the accumulated fine continues to grow. At the beginning, factories thought that the levy on effluent discharges was not a big burden.

[18] Based on interviews with local enterprises under this study.

The implications of the levy system are clear. The merits of avoiding a penalty and merits of a reduction in the levy due to a sharp reduction in BOD load by installing effluent treatment facility are greater than the burden of investment in effluent treatment facilities.

On the other hand, many companies use groundwater as a water source, and their water cost consists of only electricity charges for well pumps. Consequently, the water costs do not work as incentives to rationalize their water use. Since factories have to pay a large amount of the levy if their discharge amount is large, the incentive to lower volume and concentration of effluent is supposed to work. However, from the interviews conducted during the study such awareness was rare. In fact, efforts to reduce the effluent were not being made.

Although the investment cost for water treatment equipment varies from company to company, most of it is for concrete pits, which means construction costs are not large. Consequently, it has often been decided that it is profitable to construct a pit instead of paying the fine. In addition, if a pit is constructed, it is not considered to be a problem although the construction increases the production cost. Most of the factories do not borrow from financial institutions to fund construction of treatment facilities, and all companies pay for them from their normal cash flow.

Installing effluent treatment facilities clearly implies progress. However, all treatment facilities do not have sludge treatment facilities (dehydrators) so there is no place to store sludge. This suggests that sludge treatment is not being appropriately implemented. In addition, in many cases treated water is not being discharged continuously so that effluent volume is not accurately measured.

4) Effects and Analysis of Levy System on Effluent Discharges

By introducing a levy system on effluent discharges (effluent surcharge system), the Laguna Lake Development Authority (LLDA) began plant monitoring activities. Consequently, due to the fear of being penalized and the desire to reduce payments of the levy, companies began to introduce effluent treatment facilities. As a result, many companies that were monitored by the LLDA installed effluent treatment equipment at an early stage, which is estimated to have had a significant effect on the reduction of environmental loads.

Since the introduction of the levy system on effluent discharges was also an opportunity for LLDA personnel to obtain allowances, it became an incentive for them to take forward-looking action[19]. Securing budgets for monitoring ensures that the LLDA personnel can perform their operations. The levy on effluent discharges is appropriated in the LLDA's budget, which has created a favorable circulation leading to more positive monitoring.

Due to this circulation, the number of business establishments registered with the LLDA is nearly 1,000. On the other hand, the environmental loads declared by the establishments fell to 800 tons (BOD) in 2002. This is a sharp decrease compared to 5,400 tons of BOD loads from 222 registered business establishments at the beginning of the levy system, which may lead to sharp decrease in revenue from the levy.

The reduction in BOD load is due to the introduction of effluent treatment equipment, and not many companies have taken steps to reduce discharge by reducing water consumption. In addition, since not all effluent treatment facilities are equipped for sludge disposal, there is a possibility that sludge is not being disposed of appropriately.

In line with the increase in the number of registered pollution sources to approximately 1,000, a new problem has arisen; it is almost impossible to monitor all of them. Since monitoring cannot be completed, appropriate effluent treatment by the registered sources becomes a question. Because ditches accepting the discharges of treated wastewater are very

[19] Factories visited during the Study and employee of Japanese companies in the Philippines criticized the LLDA's unfair penalty impose and corruption. Luzon Bulletin, Dec.9, 2003

contaminated due to household wastewater, inappropriate effluent treatment at the pollution source cannot be publicly monitored either.

There is also the problem that the water quality of Laguna Lake itself has not improved. For example, since 2001 fish catches have fallen dramatically.

Yet, the levy system is an opportunity for administrative agencies to take actions to enforce the law and urge company management to take necessary measures for effluent treatment. Therefore, the development of effluent treatment facilities has progressed, which has produced some very significant results. However, future tasks to be addressed such as the problem of appropriate sludge disposal and measures for household wastewater have become clear.

e.2 Public Financing by DBP

The Development Bank of the Philippines has a two-step-loan system, consisting of the Environmental Infrastructure Support Credit Program II (EISCP-II) supported by OECF (currently JBIC) and the Industrial Pollution Control Loan Project supported by the German Development Bank (KfW) funds.

The eligibility conditions and qualifying requirements of each loan are as listed below.[20]

Environmental Infrastructure Support Credit Program II (EISCP-II)

Objectives:
The program aims to support investments in projects improving the quality of the environment through reduction or prevention of pollution.
Eligible borrowers:
Filipino citizens or corporations with at least 70% Filipino capital.
Eligible investment projects:

- Pollution control projects, e.g. pollution treatment/abatement, pollution prevention, waste minimization and/or cleaner technology.
- Projects that improve occupational health and safety.
- Projects that promote efficient use and/or management of natural resources.
- Establishment of an Environmental Management System and acquisition of ISO 14001 certification.
- Investments in equipment to monitor emission or effluent.
- Environmental Infrastructure Projects under Build-Operate-Transfer arrangement.
- Common waste treatment/disposal projects.
- Projects of or for SME environmental requirement.
- Installation and/or upgrading of environmental facilities for existing plants.

Eligible expenditures:

- Installation, improvement, replacement and/or relocation of plant and facilities.
- Consulting services, training of staff and other technical assistance requirements.
- Procurement of equipment and instruments for environmental monitoring.
- Initial working capital for operation of pollution control facilities.

Repayment term: 3 to 15 years with a maximum 5 years grace period.

Industrial Pollution Control Loan Project II (IPCLP)

Policy statement:

- To support investment in efficient production and environmentally sound technologies
- To promote environmental protection and occupational health and safety

[20] From pamphlets on EISCP-II and IPCLP II prepared by DBP.

- Eligible borrowers:
- Existing small and medium sized enterprises with minimum one year of operation prior to approval of loan.
- New companies with concerned investments that comprise of common treatment plants or environmental laboratories.
- Eligible projects:
- Investments in pollution reduction including improvement in occupational health and safety and/or reduction of raw material inputs for production to cover waste minimization/clean technology in industrial processes.
- Installation of cost-effective end-of-pipe (EOP) treatment facilities and other waste disposal options.
- Investments in equipment to monitor emissions or effluents.

Eligible investments:
Equipment procured locally and internationally and initial working capital.
Priority sectors:

Metalworking, Food production, Leather tanning, Fabricated metal, Veneer Plywood, Meat, fish, fruit and vegetable processing, Chocolate, cocoa, confectionery, Furniture, Carageenan and seaweed, Shrimp and prawns, Piggery, Slaughterhouses

Technical support:

For specific problems, DBP is supporting borrowers with the advisory service of international environmental technology experts.

Repayment term: Up to 10 years with up to two years grace period.

Not many small and medium enterprises utilize the DRP's low interest loans for environmental investment. According to the Assessment of Fiscal Incentives for Environmental Projects[21] (USAID, 2001, conducted as a part of IISE), the following reasons for this were discovered.

- The Bank has low technical support abilities for small and medium-sized companies and does not put emphasis on cleaner production or cost reduction.
- The evaluation of applications does not include items like environmental profit and cost reduction effects.
- Collateral conditions are strict (concerning this point, DBP does accept joint mortgage.).
- Borrowers' concern for environment is low.

In addition, based on the statement of a person responsible for financing at DBP and LBP in the EMPOWER[22], utilization at SMEs did not proceed for the following reasons.

- It costs a great deal to conduct a survey on the feasibility of capital investments and apply for financing (with respect to the survey on the feasibility of capital investments. Although it is possible to receive technical aid from the DBP, the budget for technical assistance is limited so that all SMEs cannot always receive assistance.)
- They cannot satisfy profit conditions. (Even if an environmental facility is introduced profit does not increase, so an application for financing is rejected due to low profit margin. On this point, the DBP has been examining the case for relaxation of profit conditions.)
- It takes time to obtain necessary approval for introducing a facility.

[21] USAID, "An Assessment of Fiscal Incentives for Environmental Project", 2001
[22] EX Corporation, "Study on Environmental Management with Public and Private Sector Ownership (EMPOWER) in the Republic of the Philippines", 2003 (commissioned by JICA)

- SMEs do not recognize the advantage of cost reduction through cleaner production.

For financial incentives to function, the mainstreaming of financial institutions sensitive to the environment by removing the above-mentioned impediments, improvement in financing requirements for environmental investments, enforcement of competency in technical assistance on the financing side, and better awareness on the borrower's side are all considered to be essential.

As described above, because the balance sheets of Philippine companies are not very good and because they lack adequate collateral, the DBP intends to provide financing but in actuality cannot. To address this problem, the DBP feels that a guarantee system in place of collateral should be created[23].

According to the interviews with the Philippine companies, although they target effluent treatment facilities as required environmental investments for the time being, the investment cost for the facility is not very large and represents an extension or improvement construction instead of the new installation of equipment. Therefore, they have decided that it is better not to utilize the loan considering the trouble of negotiations. The companies use profits obtained from cash flow and the manager's own resources for the extension and construction of the facility. SMEs in the Philippines rarely borrow investment capital from a bank, and moreover in many cases[24] they do not borrow operating capital from a bank.

e.3 Tax Privileges based on BOI Investment Priority Plan

According to the latest Investment Priority Plan (IPP) of the Philippines in 2002, some tax incentives became available for the following environmental projects:

- Development or conversion of industrial ecosystems

  An industrial cluster where waste/pollution minimization or materials and energy cycle maximization is practiced through conversion of waste materials into raw materials or feedstock for another industry. This may include supply of excess hot/chilled water or heat from power generation activities of an industry to nearby communities, institutions and establishments at affordable rates.

  Projects that will utilize waste materials as source of power/energy for the production of any product provided that it is for the exclusive use of the producer's plant/ facilities.

- Self-regulation at the plant/firm level

  Activities leading to environmental management systems certification: ISO 14000 refers to the first set of generic standards being developed by the International Organization for Standardization (ISO) that provides business management with a structure for managing environmental impacts. The standards include a broad range of environmental disciplines, including basic environmental management systems (EMS), auditing, environmental performance evaluations (EPE), labeling, life cycle assessment (LCA), and environmental aspects in product standards (EAPS).

  Activities in compliance with Multilateral Agreements, (e.g., Montreal Protocol Prescriptions on Ozone Depleting Substances) and International Framework Convention on Climate Change.

[23] Based on the interview with DBP.
[24] Four Star, "Case Study on Industrial Pollution Control in the Philippines", 2003, and interviews with enterprises.

Activities for environmental quality improvements as provided for under R.A. 9003 (Ecological Solid Waste Management Act) and future environmental laws.

- Establishment of Toxic and Hazardous Waste (THW) Merchant Facilities

  Merchant facilities refer to integrated and self-contained facilities capable of handling a wide range of toxic and hazardous waste (THW) for processing that involves treatment, storage and disposal (TSD).

- Establishment of waste handling facilities/sewerage systems for industrial/ municipal wastes (modernization may include rehabilitation)

- Testing/measuring services for emission and effluent and other related environmental parameters (for industrial and vehicular engines preferably with rehabilitation facility)

In addition to the above activities, the following energy conservation activities are also eligible for tax incentives if they comply with the specific requirement provided in the IPP. Energy conservation activities, in this case, include those which cover the establishment, operation, and business of providing services in accordance with practical and viable application of energy conservation concepts in order to contribute to the nationwide effort to save energy, including, but not limited to the following activities:

- New equipment or modernization of existing energy using equipment leading to improvements in their efficiency;

- Equipment and materials to improve energy utilization in buildings;

- Insulation materials on industrial and distribution systems;

- New manufacturing plant or processes, or modernization of existing manufacturing plant or processes, resulting in more efficient utilization of energy than currently achieved;

- New equipment or conversion of existing equipment to enable replacement of one form or sources of energy to another for the purpose of energy conservation

- Building Energy Management Systems (BEMS) composed of micro-processor-based devices that control and optimize the energy utilization efficiency of a building or facility;

- Variable Speed Motor Drives (VSMD) which involve installation of specially designed electric motors, the speed of which could be varied to match the load requirements of motor-driven equipment in a building or facility;

- Highly Energy Efficient Motors (HEEM) which involves the installation of specially engineered electric motors in which iron and copper loss has been reduced by twenty percent (20%) to thirty percent (30%); and,

- Waste Heat Recovery Systems (WHRS), which involve the installation of heat exchanges that recover energy which is otherwise wasted and putting to use the same or its by-product to produce energy.

As indicated above, BOI has preferential tax treatment for investments in environmental projects (waste minimization in industrial estates, securing electricity for industry generated from wastes, attainment of ISO14001, activities in compliance with multilateral environmental agreements, activities on environmental quality improvements as provided for under RA9003, construction of toxic and hazardous waste merchant facilities, establishment of waste handling facilities, testing/measuring services for emission and effluent, and energy saving activities)

listed in the Priority Investment Plan. BOI consider that the low usage of these tax incentives for investment is caused by lack of recognition by companies, and it has started to hold workshops and other activities to spread information.

Information about the actual usage and effects of this tax incentive is not disclosed, and it can be estimated that the number of cases of usage is not very high, due to the lack of advertising of the effects.

According to the evaluation of fiscal incentives for environmental projects conducted as a part of the IISE project supported by USAID [25], the fiscal incentives provide little assistance to firms undertaking environmental projects. For example, only firms that conduct waste management and disposal as their business can claim income tax breaks, and exemption from duty is only applicable to the import component of environmental equipment, but not for equipment per se, which is very expensive. The said report also points out that weak enforcement of environmental laws and regulations and penalties that are lower than the cost of investment to comply with the laws and regulations have resulted in a small number of cases of utilization of the fiscal incentives.

e.4 Pollution Control Officer System

A PCO system that is like the Japanese PCO exists. Letter of Instruction (LI) No. 588, August 19, 1997 by DENR, provides rules regarding PCO. LI No. 588 obliges facilities that discharge or treat polluted substances to appoint a pollution control officer (PCO).

After some revisions, the present PCO system was built by DAO92-26 (of DENR) in 1992. In DAO92-26, the system of LI No.588 facilities naming PCOs is continued, but now they are required to get certification from DENR, and the industries that need PCOs are specified. Also, unnamed industries -the machine industry, for example- are also involved. If a facility is recognized as a potential polluter, then it is required to set up a PCO system, even if it does not belong to the specified industries.

Eligibility requirements of PCOs in the water pollution control area are persons registered by the government as engineers in the fields of chemistry, machinery, mines, sanitation or environment. For air, chemical and mechanical engineers are eligible; in toxic waste treatment, chemical engineers and registered chemists are eligible.

If the person has graduated from a university with Bachelor of engineering, he/she can get a license. There are three levels of PCOs, according to the person's experience.

Everyday work

- Monitoring of emission sources of air pollutants for which the DENR set standards
- Monitoring of discharging sources of water pollutants for which the DENR set standards
- Monitoring of operation efficiency of air /water pollution abatement facilities
- Monitoring of effluent before it is discharged into the public waster body
- Establishment of programs and a team for safety and environmental protection
- Establishment of an emergency program
- Periodical work
- Submittal of PCO reports to DENR monthly, quarterly and annually
- Research and proposals on installations of pollution control facilities

As stated above, PCOs have a great responsibility for the environment, but in the interview conducted for this report, they said that their role as PCOs was one of many. The companies with facilities larger than the certain scale must hire full time PCOs, but the other companies, almost all small and medium enterprises in this category, are allowed to hire part time PCOs.

[25] USAID, "An Assessment of Fiscal Incentives for Environmental Project", 2001

Part time PCOs can belong to several companies at the same time. Although PCOs have great responsibility and their activities have a large influence, they are placed in a general duties post in many companies, and frequently their PCO positions are just on paper. DENR has already recognized this PCO status problem and have shown their intention to amend DAO26.

According to the survey conducted by JICA[26], PCOs attend various seminars about industrial pollution control and might have general knowledge, but in many cases, they were evaluated as not having specialized knowledge.

Although it is difficult to evaluate the effectiveness of the PCO system, there is no doubt that PCOs contributed to establish pollution control systems inside factories despite the PCO status problem. PCOs have an obligation to submit a quarterly report to DENR required by DAO26, in which they have to show their companies comply with the emission/effluent standards. Since PCOs are responsible for the contents of the report, they can put pressure on the companies.

e.5 The Philippine Environmental Partnership Programme (PEPP)

The Philippine Environmental Partnership Program (DAO03 - PEPP) to support the private sector for industrial environmental management was established on May 22, 2003. Commencement of the Program indicates a shift from environmental administration focusing on command and control to that encouraging individual companies to conduct environmental management activities.

The objectives of the PEPP can be summarized as follows.

- To comply with legal requirements through conducting activities to improve environmental performance by themselves and to promote monitoring of environmental compliance.
- To provide comprehensive “support packages” so that SMEs can prevent environmental pollution and promote cleaner production.
- To promote the capacity development of individual companies and industrial associations for voluntary environmental management activities and to establish a support system of governmental agencies, mainly the DENR, to this end.

The government is expected to provide various incentives and technical support to companies that participate in the PEPP. Companies receiving such incentives and support are to satisfy the following requirements.

- Implementation of the Philippine environmental management system (PEMAS): The existing EMS (environmental management system) is planned to be modified based on conditions of Philippine domestic industries through revision and simplification so that Philippine companies can easily adopt the system. This is the Philippine version of EMAS.
- To submit an environmental performance report prepared by themselves
- To participate in the Philippine Business Agenda 21

The Philippines Environmental Partnership Program (PEPP) is a policy implemented under the collaboration of the DENR and the BOI. The DOST, the DBP and the LBP, etc.[27] have already expressed their cooperation in the Program. As new means in place of existing control, the PEPP also includes application of Japan’s “agreement on industrial pollution

[26] EX Corporation, “Study on Environmental Management with Public and Private Sector Ownership (EMPOWER) in the Republic of the Philippines”, 2003
[27] DOST: Department of Science and Technology, DBP: Development Bunk of the Philippines, LBP: Land Bunk of the Philippines

control between a local government and a private company" to Philippine SMEs; a new trial is being put forward in the enforcement of environmental laws and regulations.

e.6 Other

Although the projects necessary to obtain ECC were fairly limited in the original EIS, all plants deemed to have an impact on the environment (this standard is not clarified) are subject to the acquisition of ECC. Therefore, most of the existing plants should also acquire ECC[28]. Since there were insufficient human resources at DENR regional offices who can deal with the ECC procedures, there was some confusion about the procedures. Private companies have been under pressure to acquire ECC.

5.2.3 Case Study on Industrial Pollution Control in Thailand

a. Economic Conditions

In 2001, the national land area of Thailand and population were 514,000 square meters (approximately 1.4 times that of Japan) and approximately 62.31 million respectively. The basic indexes of the Thai economy based on the *World Development Report* compiled by the World Bank are as follows.

- GNI per capita (2002): 1,943 US$ (105th ranking)
- Growth rate of gross national product (1990 to 2000): 4.2%
- Growth rate of gross national product per capita (1990 to 2000): 1.5%
- Population growth rate (1990 to 2000): 0.9%
- Industrial structure (the ratio of added value against GDP, Agriculture: Industry: Service) (2001): 8 : 36.4 : 55

Despite the most serious damage during the Asian monetary crisis in 1998, the Thai economy over the past 10 years has achieved a high growth rate of 4.2%. Although the current growth rate has not recovered to the level of about 10% recorded during the rapid growth period between 1985 and 1997, that in 2002 was 5.4% and continues to grow. GDP per capita did not recover to the level of 2,500 US$ in 1996, but did recover to 1,993 US$ in 2002 and 2,236 US$ in 2003. GDP per capita is approximately one seventeenth (1/17) that of Japan.

The economic growth rate per capita remains low due to the high population growth rate. In industry, the weight of the agriculture sector fell to 8% in 2001. On the other hand, the manufacturing industry has been growing.

[28] Procedural Manual of DENR Administrative Order No. 96-37

Table 5.2.7 Thai Industrial Structure

million Baht

Year	1991		2001*	
Item	Amount	Composition Rate (%)	Amount	Composition Rate (%)
Manufacturing	707,901	28.2	1,706,695	33.5
Commerce	426,957	17	875,850	17.2
Agriculture	317,085	12.6	436,160	8.6
Transportation Telecommunications	177,239	7.1	410,701	8.1
Other	877,453	35	1,670,236	32.8
GDP	2,506,635	100	5,099,642	100

Note: for the year of 2001, provisional value
Source: ASEAN – Japan Center, "GDP by Economic Activity (market value),"
http://www.asean.or.jp/general/statistics/01basic/05-04.html#09

Energy consumption sharply increased from 22.808 million tons (oil conversion) in 1980 to 73.618 million tons in 2002. Energy consumption per capita also increased from 488kg to 1,212kg, which is twice of that in the Philippines.

The number of registered automobiles (except for motorcycles, buses and trucks, etc.) increased from 4.4 million units in 1996 to 6.3 million units in 2001. The automobile ownership ratio (per 1,000 persons) reached a level of approximately 100 units.

The enrollment rate in primary education in 2000 was 99%. The enrollment rates in secondary education and higher education were 82% and 35% respectively. In particular, those in secondary education and higher education increased sharply in comparison with those of 29% and 15% in 1980 respectively.

Life expectancy increased from 63 years of age in 1980 to 69 years of age in 2001; whereas, the under-5 infant mortality rate decreased from 46% in 1980 to 24% in 2001, which indicates an extreme improvement in the social indexes.

As for trade policy and customs tariffs, 94.5% of the 9,111 items subject to the ASEAN Free Trade Agreement (AFTA) are applicable to 5% or less customs duty. The duty for all items is going to be reduced to zero by 2010.

b. Status of the Environment

b.1 Air

Regarding air pollution, huge improvements have been seen in the past 10 years, and concentrations of sulfur oxides, nitrogen oxides and lead mostly comply with the air quality standards. However, the particulate matter (PM_{10}) concentration in the Bangkok urban area in 2001 did not satisfy the environmental standard, which is the central issue in air quality management[29].

Energy demand is increasing significantly in the power and industry sectors. Demands in the manufacturing industry grew from 9.3Mtoe in 1991 to 16.7Mtoe in 2000. As fuel for electric power generation, natural gas accounts for 62.9% and coal and lignite 18.5% in 2000. A thermal power plant using lignite is operating in Lampang province. Lignite includes 2-3% of sulfur content. It is said that the shift of energy source contributed to environmental

[29] World Bank, "Thailand Environment Monitor 2002"

improvement, but newspaper reports that there were damages to human health and agricultural products.

Other main sources of air pollution are cement, glasses, ceramics, petrochemical, and food processing industries, but environmental impacts of large companies are restrained by implementing air pollution control measures. Improvement of air pollution is not major issue in Thailand because of the small accumulation of heavy and chemical industries and advanced measures, which are equivalent to the international standard, implemented by the heavy and chemical industries.

b.2 Water

The impact of high economic growth has been most serious on water pollution, especially in Bangkok and the central and east regions. In these areas, surface water is best suited just for transportation. Only 30% of household effluent is treated. Because of polluted rivers and coastal areas, water utilization for such as fisheries resources has also been affected negatively. In 1999, the Pollution Control Department (PCD) monitored the quality of 50 rivers and lakes. Fifty-two percent of Thailand's surface waters were found to be "poor" to "very poor" quality[30].

Industrial pollution was high on the lower reaches of the Chao Phraya river and medium in the middle lower Tha Chin river. Household effluent contributes significantly to water pollution in both rivers. Other pollution sources are food products, dying, metal products and machine related industries. Water pollution control measures by small and medium enterprises around the river are not sufficient.

Most foreign enterprises that branched out to Thailand during the 1990s are located at the industrial complexes developed by IEAT, and as these enterprises have been taking necessary measures under the IEAT direction, there are no serious problems. However, there is a case of groundwater pollution by organic solvents at one industrial complex; and this might become serious in the future.

b.3 Hazardous Industrial Wastes

Generation of hazardous wastes has been increasing steadily. According to DIW, 1.2million tons of hazardous wastes were generated in 2000, of which 0.7million tons were treated and the remaining 0.5 million ton untreated.

It is estimated that generation of hazardous wastes from component plants for electric equipment and transport machinery has been increasing. Therefore, proper management of hazardous wastes is still an important issue in Thailand.

b.4 Legal and Institutional Measures

1) Current Status of Laws and Regulations

The environmental law system related to industrial pollution control is mainly composed of the following[31].

1. Enhancement and Conservation of National Environmental Quality Act
2. Factory Act
3. Standards for air and water quality and automobile noise, etc.

[30] World Bank, "Thailand Environment Monitor 2001"

[31] OGANO Shoichi, "Thai no Kankyo to Gyosei Seido", *Hatten Tojokoku no Kankyoho – Tonan & Minami Asia*, Institute of Developing Economies, 1994; JICA, "Kunibetu Kankyo Joho Seibi Chosa (Thailand)", 2002; Global Environmental Forum, "Nikkei Kigyo no Kaigai Katsudo ni atatte no Kankyo Taisaku (Thailand)", 2001

The Enhancement and Conservation of National Environmental Quality Act was promulgated in 1992, which is generally regarded as the basic act on the environment. The Act provides a framework for industrial pollution control. The Ministry of Natural Resources and Environment has the authority to set environmental standards and effluent standards and to conduct environmental monitoring. All polluters are required to install necessary treatment equipment in accordance with provisions prescribed by a pollution controller stipulated in the said Act. However, with respect to approval for the installation of pollution control equipment at a pollution source and administrative order for the improvement, the official designated by the Factory Act is regarded to be a pollution controller.

The Thai industrial pollution control system is unique in that enforcement of environmental laws and regulations on factories is mainly based on the Factory Act. In the case of industrial parks designated by the Industrial Estate Act, approval for the installation of pollution control equipment is made in accordance with the said Act.

The following economic incentives are provided.

- Financing to companies from the Environmental Fund prescribed by the Enhancement and Conservation of National Environmental Quality Act (also provided by the Fuel Oil Fund) (MONRE: Ministry of Natural Resources and Environment, OEPP: Office of Environmental Policy and Planning, Environmental Fund Secretariat)
- Energy Tax and Energy Conservation Promotion Fund (Ministry of Energy)
- Public financing: Environmental Conservation Promotion Program of the Industrial Corporation of Thailand (IFCT)

Since it is difficult for only 400 inspectors to monitor factories, as of August 2003 the Ministry of Industry has submitted a draft entitled the "Economic Instrument Act" for the purpose of promoting environmental management through economic instruments. The draft Act contains provisions about a waste disposal tax and a product refund system which are scheduled to be deliberated in the national assembly.

With respect to industrial pollution control organization, a "pollution controller" may appoint a manager of the treatment facility in accordance with the Enhancement and Conservation of National Environmental Quality Act. Through cooperation with Japan, a certification system for pollution control officers is to be established. The Pollution Control Department (PCD), the Ministry of Industry (MOI), and the Department of Intellectual Property (DIP) provide companies with information on CP and the like. In addition, the Industrial Estate Authority of Thailand (IEAT) regulates and instructs companies within the industrial estates.

2) Organization

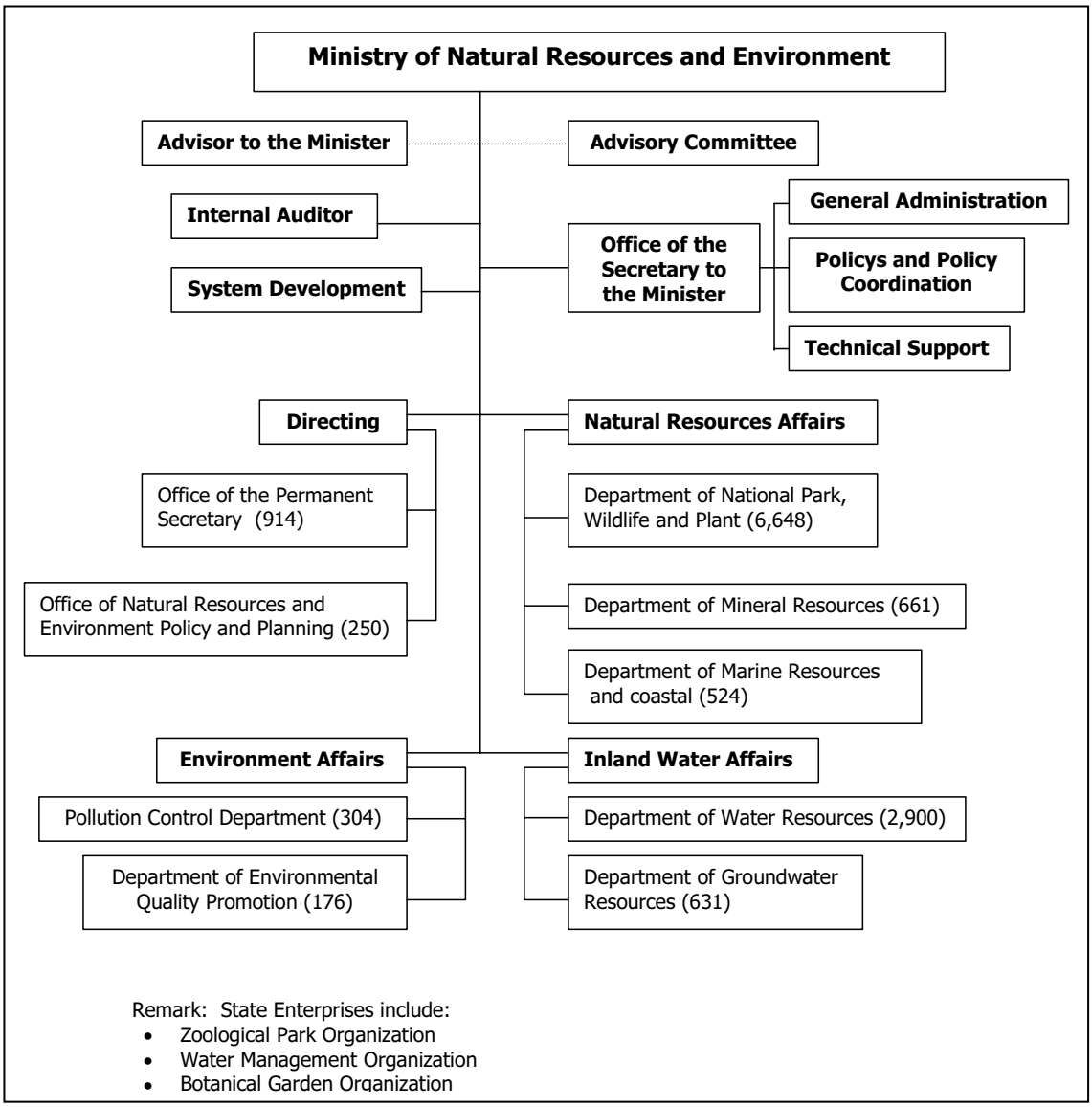
Thailand has undergone a bureaucratic reform in accordance with the Act Amending Ministry, Sub-Ministry and Department B.E. 2545 on 3 October 2002. The objectives of the reform are enhancing capacity and effectiveness of government agencies and officers, creating trust for Thai people in public administration. The structural reform has divided the ministries into three groups, including:

1) Ministries responsible for fundamental policies (6 Ministries)
2) Ministries for national development strategies (10 Ministries)
3) Small-sized ministries for urgent matters according to social situations (four Ministries)

Both Ministry of Natural Resources and Environment (MONRE) and Ministry of Industry (MOI) are categorized as those for national development strategies.

MONRE has responsibilities related to the conservation and restoration of natural resources and environment. The Ministry is divided into the following four groups: the Directing group, the

National Resource Affairs group, the Environmental group and the Inland Water Affairs group. The Department of Environmental Quality Promotion and the Pollution Control Department belong to the Environment Affairs Group. MONRE is a huge ministry which employs more than 10,000 staff, and there are approximately 480 staff members in the Environmental group in charge of environmental administration. Of these, PCD has the jurisdiction over the industrial pollution control. The structure of MONRE is shown in Figure 5.2.4.

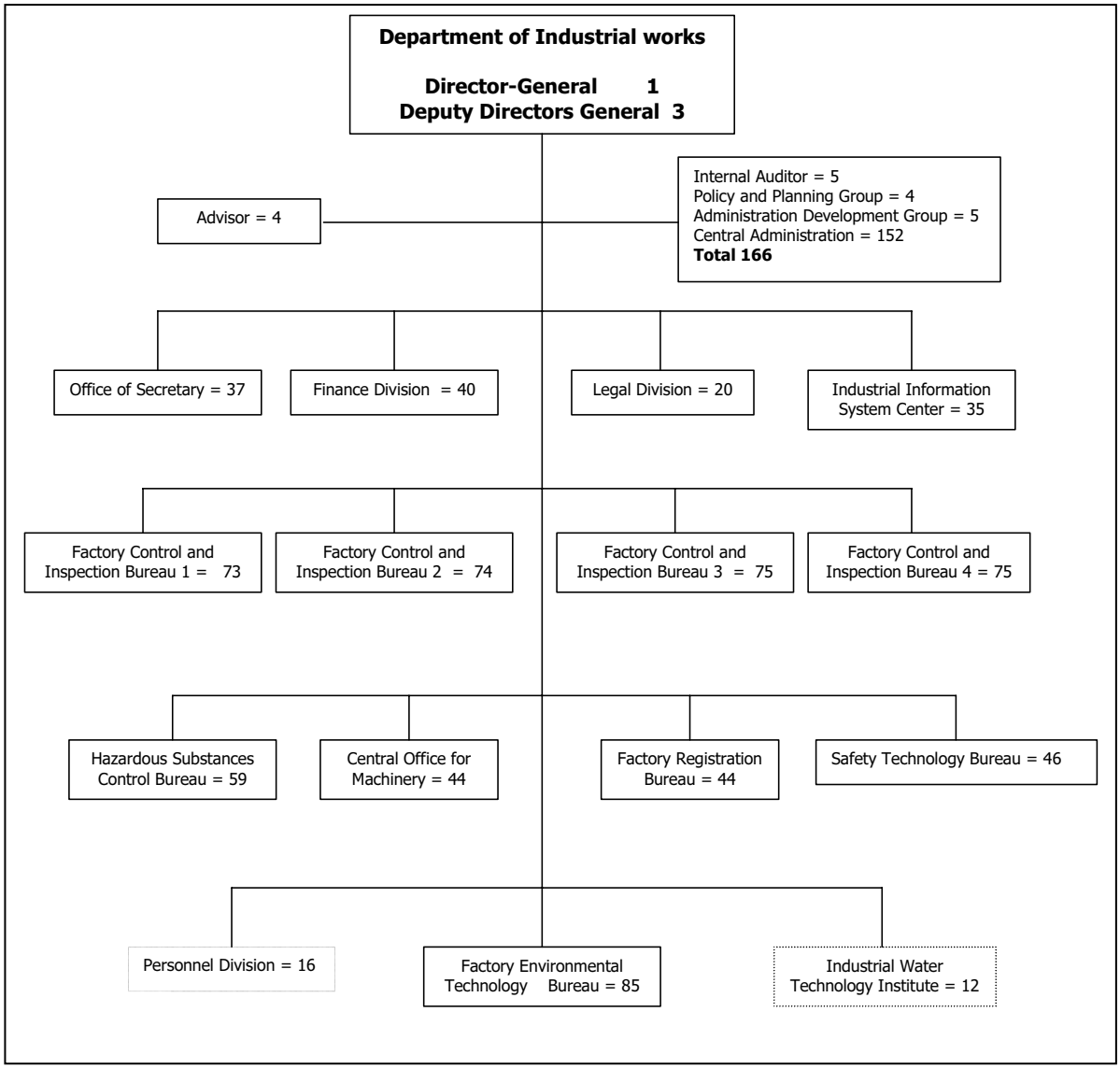


Source: Ministry of Natural Resource and Environment, "Structure of Ministry of Natural Resources and Environment", http://www.monre.go.th/mnreorg_t.html

Figure 5.2.4 Organization Structure of the MONRE

The Department of Industrial Works (DIW) under the Ministry of Industry is in charge of areas concerning industrial pollution control. DIW regulates and promotes the sustainable development of industries and the operation of business with emphases on environment, safety and international acceptance. The setting up and monitoring of factories, enforcements against industrial pollution and enforcement of environmental quality standards have largely rested with DIW.

The DIW controls industrial operation mainly through mandatory factory licensing which is required at three-year intervals. The licenses can be revoked if factories violate standards. DIW is required to coordinate its environmental activities with the Pollution Control Department (PCD) and with other agencies. Organizational structure of the DIW consists of 4 groups, 10 bureaus, and 3 divisions with no more than 1,000 staff altogether. The Factory Environmental Technology Bureau deals with CP. Four divisions set in the regions monitor factories.



Source: Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand", 2003

Figure 5.2.1 Organizational Structure and Staff Placement in the DIW

3) Environmental Administration System

The Ministry of Natural Resources and Environment establishes policy functions and environmental standards and conducts environmental monitoring, environmental impact statements (EIS) and environmental fund management; whereas the Department of Industrial Works (DIW) is responsible for monitoring pollution sources, and so is the IEAT over the factories within industrial estates developed by them. Environmental administration is not unified, similar to the Japanese system prior to 1970.

Although the MONRE has the authority to monitor, since they do not have the power to control pollution sources at individual factories, they only conducts activities mainly focused on awareness-raising. The MONRE has the Environmental Research and Training Center, which does not provide training for issues related to industrial pollution control and for factory staff but for monitoring and planning skills such as municipal environmental planning.

While many nations have consolidated their environmental administration into one organization, the Government of Thailand disperses authorities. The DIW of the Ministry of Industry has the authority over the industrial sector to control factory location, to permit factory operations, to set emission and effluent standards and to carry out hazardous waste disposal control and monitoring pollution sources. They also control a telemeter system for air pollution sources. The DIW central office takes charge over policies, while the regional offices implement actual monitoring operations. However, the regional offices have not been sufficiently staffed for monitoring and equipped with laboratories; strict monitoring including revelation of violators is not being done. The Industrial Water Technology Research Institute was established under the supervision of the DIW for industrial effluent discharges.

In addition to the project for the diffusion of cleaner production, the DIW has prepared and developed a system of pollution control officers and legislation pertaining to economic instruments and has constructed model hazardous waste disposal facilities.

The IEAT has developed industrial parks as part of its environmental measures and has been conducting procedures and management regarding environmental aspects for companies in accordance with the Factory Act on behalf of the DIW.

c. Current Status of Factors Influencing Corporate Behavior Regarding Industrial Pollution

The current status of the factors regarding industrial pollution control by companies (as identified in Chapter 3) in Thailand is summarized in the following table.

Table 5.2.1 Current Status of Factors Corporate Behavior Regarding Industrial Pollution Control in Thailand[32]

Factors	Items	Current Condition
Factors Putting Pressure on Companies from Outside (Push Factors)		
Realization of Damages due to Industrial Pollution	Cases of damage of marine resources by water pollution.	It is said that there were damages.
	Cases of health damage due to air and water pollution	Cases due to air pollution from coal-fired power plant

[32] Based on interviews with involved parties under this study and comments on the draft final report.

Factors	Items	Current Condition
Protest by victims and NGOs	Complaints	Reported to relevant authorities
	Demonstrations of protest by victims	Cases of residents attacking a chemical plant and campaigns against the construction of waste and wastewater treatment facilities.
	Demonstrations of protest by NGOs	Some
Pressure by Mass Media	Report on industrial pollution problems	A lot
	Report on environmental problems in general	A lot
Pressure by local governments	Democratization of local governments	Mayors elected by residents
	Establishment of a special section dealing with environmental issues	Existing
Revelation of environmental crime by police and its legal resolution	Revelation of environmental crimes related to industrial pollution	Existing
	Damage suits against pollution sources	Existing
Establishment and enforcement of legal system	Laws for industrial pollution control	Existing
	Establishment of administrative body dealing with environmental issues	Established, but DIW/MOI regulates pollution sources
	Establishment of regional offices of the above body	Established (by both DWI and MONRE)
	Environmental research and training center	Existing
	Environmental monitoring network	Fairly well established for both air and water
	Plant registration requirement from an environmental view point	Required by the Factory Act
	Plant operation permit from an environmental view point	Permitted based on the Factory Act
	Compliance monitoring of pollution sources	Monitoring of large pollution sources by telemeter. Routine monitoring for individual companies.
	Preparation of annual reports on environmental administration	Annual report by MONRE
Factors Driving Companies to Take Actions against Industrial Pollution (Pull Factors)		
Economic growth	Average annual GDP growth rate of 1990-2000. (the average for Middle Income Countries is 3.6%)	4.2% (higher than average)
Measures regarding plant location	Zoning exclusive for industrial use	Introduced
	Development of industrial complexes	Well developed
	Guiding plants to relocate to industrial complexes	Existing

Factors	Items	Current Condition
Economic incentives	Public soft loans for environmental measures	Existing
	Preferential tax treatment for environmental investments	Existing
Leading companies in environmental management	Existence of leading local companies	Existing (Siam Cement Group)
Dissemination of information from the government	Network of information dissemination from the public to the private sectors	Existing, but little dissemination to smaller companies.
Industrial pollution control measures by industry associations	Collaborative research on industrial pollution control	Low
	Information exchange	Low
	Organization	Low
Industrial technology center	Guidance on industrial pollution control	Guidance for wastewater, waste, exhaust gas treatment (no window at local level)
Manufacturers of pollution control devices	Local manufacturers of air pollution control devices	None
	Local manufacturers of wastewater treatment facilities	Existing, but small
	Local manufacturers of waste treatment facilities	None
Internal Factors within Companies		
Characteristics of local companies	Communication between business owner and plant manager	Owners have low interest in production technology
Awareness of top management of local companies	Drive to expand the business	Exist among export-oriented companies but low in general
	Environmental considerations in management concept	Developing
	Executives in charge of environmental matters	Developing
Business management in local companies	Management for productivity improvement	Developing
	Quality Control system (QC)	Developing
Technology innovation, etc	Innovation of production technology	Being introduced
	Research and development	Being introduced
Status of engineers in local companies	Status of top engineers within a company	Not so high in general
Technology innovation, etc	Status of engineers in charge of environmental matters within a company	Regarded as not so important in general

As described above, the current status of Thai industrial environment management is outlined as follows.

The manufacturing sector has expanded to the heavy chemical industry, and machinery-related industry has been also increasing due to direct foreign investment. The agricultural sector has become below 10% of GDP and the industrial and construction sector accounts for 37%.

The shift in industrial structure is advancing. Thailand is on the verge of becoming a middle-income nation and is in the mid-development stage in the industrial sector. The potential for industrial pollution has thus increased.

Although the push factors surrounding companies are on an increasing trend, the push has not reached the level of severe social problems. The environmental NGOs have shown a remarkable rate of development over the past 10 years. Although the legal system and the monitoring system have been developed, enforcement of laws and regulations has a become a bottleneck, which has resulted from insufficient management of individual companies for their environmental performance due to the small number of staff in charge.

Although a legal system has been developed and environmental monitoring has also improved, officials who can control entire companies do not exist at the legal level so there is a skills shortage in this area.

Although a certain level has been reached in the push factors surrounding companies, due to the lack of urgency that environmental measures should be taken, the level is not so strong. It is necessary to strengthen the pull factors in order to encourage local companies to take environmental measures.

With respect to factors to encourage companies to take measures (pull factors), the measures regarding location and economic incentives have progressed remarkably and have been in place since the 1990s. This point is related to economic growth in Thailand. However, measures taken by industry associations of local companies are still at a low level.

With respect to the internal factors at companies, the awareness of top management of companies has changed significantly in recent years; many of them have come to recognize the need for environmental measures and in particular the Polluter Pays Principle (PPP). With respect to environmental measures taken by companies, levels vary by type of corporate activities. Companies competent in the global market take more active action than those that play in the domestic market. The former type of companies sets a high value on corporate image and considers the implementation of environmental measures in transactions with other countries.

d. Current Status of Policies

This section describes some unique cases and analyzes their current situations and effects.

d.1 The Environmental Fund[33]

Section 22 of the Enhancement and Conservation of National Environment Quality Act provides for an Environmental Fund to be established under the Ministry of Finance. The Fund was established in 1992 and will provide resources to the following (Section 23):

a. Subsidies to central and local governments for investments in and operation of central wastewater treatment plants or facilities.
b. Loans to local governments or public corporations for development/establishment of air pollution prevention systems or wastewater or waste treatment facilities.
c. Loans to private enterprises to construct on-site facilities of their own for exhaust gas, effluent, or waste treatment, or permitted treaters of wastewater and solid waste.

The Fund was initially established with the following resources and increased later on.

- 5 billion Baht: 0.5 billion Baht from the Thai government and 4.5 billion Baht from the Oil Fund

[33] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand", 2003

- 1.25 billion Baht: government subsidy during 1993-1995
- 3.4 billion Baht: from OECF (current JBIC) in 1994

The Environmental Fund is available for both local governments and industry but mainly used for sewage and solid waste management by local governments. There are few cases in which it is used for the private sector which has generated strong discontent.

Energy Tax System and Energy Conservation Fund

1) Energy Tax System

There are four different types of tax levied on energy products in Thailand. These include:

- Import duty on imported petroleum and petroleum products;
- Excise tax for manufacturer and importers[34];
- Municipal tax on manufactures located in that specific area, and;
- Value-added tax for manufacturers on the sale of goods.

Table 5.2.8 Taxes on Petroleum Products in Thailand

Product	Import duty (Bahts/kg)	Excise tax (Bahts/kg)	Municipal tax	Value added tax (VAT)
Gasoline	0.010	3.685	10% of Excise Tax	7% - 10%
Kerosene	0.010	3.055		
Diesel	0.010	2.305		
Fuel oil	0.010	4.545% value		
LPG	0.001*	2.17		

Note: From 25 February 1998 to 5 October 1999, the import duty on LPG was at 0.010 Baht/kg.

A proportion of levied taxes has been allocated to the Oil Fund since 1979. The Energy Conservation Fund is administered by the Energy Policy and Planning Office (EPPO).

2) Oil Fund and Energy Conservation Promotion Fund

Oil Fund

The Thai Government raised the domestic retail prices for oil, but the rate was proportionally less than the increased global prices. To subsidize the difference, the Government decided to reduce taxes levied for oil producers in proportion to the costs of crude oil. However, the amount of taxes reduced from kerosene was not enough to compensate for the balance. The Government then decided to reduce taxes levied on benzene oil for an amount greater than that of increased costs. Oil suppliers, refineries and importers were required to provide financial support to the Oil Sales Fund. The fund was used to subsidize the kerosene suppliers.

In 1978, the Thai Government revalued the Baht currency by 1 per cent, which was of benefit to oil importers. The Government established a petroleum price stability fund (foreign currency) and required oil importers to transfer the surplus to the fund, which would be used to subsidize the differences when global crude oil prices soar.

In 1979, when the oil prices quadrupled, the Government merged the two existing funds for stabilizing domestic retail prices of oil and established the Oil Fund.

[34] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand", 2003

In 1991 the prices of gasoline, kerosene, diesel and fuel oil became deregulated. The only petroleum product type that is still being regulated today (up until 31 December 2000) is Liquid Petroleum Gas (LPG).

Resources of the subsidy for stabilizing LPG retail prices are the Oil Fund receiving regular income from the Oil Fund tax levied on importers and domestic producers.

The National Energy Policy Office (NEPO) is Secretariat of the Oil Fund.

The Oil Fund was used for providing subsidies to lower the retail price of unleaded gasoline in order to discourage use of leaded gasoline and promote use of unleaded gasoline. As a result, leaded gasoline was eradicated in 1996.

A proportion of the total revenues received from the Oil Fund is transferred to the Energy Conservation Promotion (ENCON) Fund at 0.04 Baht per liter. This transferred amount is used as a revolving fund and to support or subsidize energy conservation. In 2002, an amount of 1,292 million Baht was transferred from the Oil Fund to the ENCON Fund. It is estimated that the transfer will amount to 1,340 and 1,389 million Baht in 2003 and 2004, respectively.

Energy Conservation Promotion (ENCON) Fund

The ENCON Fund has been established under the Energy Conservation Promotion Act, B.E. 2535 (1992). The capital and assets of the ENCON Fund are from the following sources:

- Money transferred from the Petroleum Fund at an amount determined by the Prime Minister
- Levies imposed on petroleum product producers and importers at a rate determined by the National Energy Policy Council (NEPC)
- Surcharges on power consumption
- Government subsidies at times

In addition, the NEPC imposed a remittance rate of 7 satangs/liter on domestic gasoline, kerosene, diesel and heavy fuel oil to raise revenue for the Oil Fund from November 1992.

In August 1994, the NEPC gave consent to the establishment of the Energy Conservation Program (ENCON Program) and set guidelines, criteria, conditions and priorities on the ENCON Fund allocation to be in line with Article 25 of the ENCON Act.

The Energy Conservation Promotion Fund Committee (ENCON Fund Committee) is charged with management of the Fund allocation. During the fiscal year period 1995-1999, the total allocation from the ENCON Fund was 19,286 million Baht.

The ENCON Program during the fiscal year period 1995-1999 is comprised of three sub-programs and ten main projects.

In order to assist the work of the ENCON Fund Committee, three Sub-Committees have been appointed to implement each respective sub-program. In addition, two government agencies, the National Energy Policy Office (NEPO) and the Department of Energy Development and Promotion (DEDP) have been given the task of the ENCON Program implementation.

The ENCON Fund revenue decreased when the premium rate was reduced to 1 satang/liter for diesel and kerosene between August 1997 and September 1998. Since October 1998, the premium rate has been adjusted to 4 satangs/liter and imposed on gasoline, diesel, kerosene, and fuel oil. During the fiscal period of 2000-2004, the ENCON Fund has been allocated to implement the following programs:

- Energy conservation in government and private sector buildings, as well as on public information programs of the Department of Energy Development and Promotion (59%).

- Support and collaboration with public agencies and the private sector to promote efficient use of energy, as well as to support research and development programs (22%).
- Other complementary programs (19%).

The main objective of the Energy Conservation Promotion Fund (ENCON Fund) is to provide financial support to designated factories and buildings for investment in and operations of energy conservation programs. At the same time, the ENCON Fund can also be used to support other agencies that wish to undertake energy conservation, including activities on renewable energy projects, energy-related research and development, human resource development and training, and public awareness campaigns.

3) Laws and Regulations Related to Energy Tax and Energy Conservation

Excise Tax Act of 1984: The tax is collected from manufacturers and importers on oils and petroleum products shipped from the factories. The tax rates are calculated from either the quantity or the value of each shipment.

Customs Act of 1926: Levied on importers of coal and oil products. The tax rates are calculated at 25-30 % of the manufacturer's price, or based on the goods condition calculated in Baht per kilogram or liter.

Local tax on land and property: The rate is equal to 10 % of the excise tax.

Revenue Code: Value-added tax. The normal tax rate is set at 7 % of each transaction.

Following are the laws and regulations related to energy conservation.

- Emergency Decree on Remedy and Prevention of Shortage of Fuel Oils (B.E. 2516,1973)
- The Energy Conservation Promotion Act (B.E.2535, 1992): energy conservation measures in factories
- The Royal Decree on Designated Buildings (B.E.2538, 1995): energy conservation measures for designated buildings.
- Ministerial Regulation No.1 (B.E.2538) Issued under the ENCON Act: energy conservation measures for new and existing buildings.
- Ministerial Regulation No.2 (B.E.2538) Issued under the ENCON Act: energy conservation information for new and existing buildings.
- Ministerial Regulation No.3 (B.E.2538) Issued under the ENCON Act: establishment of energy conservation plan for new and existing buildings.
- Ministerial Regulation No.5 (B.E.2540) Issued under the ENCON Act: energy conservation plan management for new and existing buildings.
- Ministerial Regulation No.6 (B.E.2540) Issued under the ENCON Act: energy conservation plan management for new and existing buildings.
- Prime Minister's Order No. 1/2003: establishing the National Energy Policy Council and the Oil Fund

4) Structure and Mobilization of the Energy Conservation Fund

Thailand is in Phase 2 of the ENCON Program (the fiscal period 2000-2004) and has been engaged in an effort to increase the role of the market mechanism and to reduce financial assistance from the ENCON Fund. Development of human resources, establishment of information centers, promotion of demonstration projects, and acceleration of the establishment of energy-efficiency standards are planned.

Fund Components

The ENCON Fund is allocated to energy conservation programs classified into three categories, namely the compulsory program, the voluntary program, and the complementary program. Management and administration of the Fund is overseen by the ENCON Fund Committee and Sub-committee for each program.

The Energy Policy and Planning Office (formerly National Energy Policy Office) and the Department of Alternative Energy Development and Efficiency (former Department of Energy Development and Promotion) are responsible for proposing to the National Energy Policy Council guidelines, criteria, conditions, and priorities for the disbursement of funds and for allocating funds in accordance with the prescribed guidelines.

Estimation of the required budget to be allocated from ENCON Fund to the implementation of ENCON Program during the fiscal period 2000-2004 can be classified according to the sub-programs and main projects as follows:

Outcomes of the ENCON Program Phase 1

During the fiscal period 1995-1999, overall implementation can be summarized as follows:

(Compulsory Program)

- Project on Government Buildings

  Hired Implementing Agencies (IA) to manage the improvement of energy conservation in 573 government buildings nationwide, carry out energy audits, supervise the installation of energy-efficient equipment, and become more energy-efficient. The improvement of energy conservation was completed in 413 government buildings, accounting for total funding of 1,215 million Baht, which was 387 million Baht below the estimated budget.

- Project on Existing Designated Factories and Buildings

  There are 1,378 existing designated buildings where implementation of energy conservation measures is required according to the Royal Decree on Designated Buildings. An energy manager had to be appointed, and report to the DEDP. Reports from 1,045 buildings, or 76% of the total designated buildings, have been received, involving 1,726 energy managers. So far, the appointment of 1,139 energy managers for 711 designated facilities has been approved by the DEDP. The DEDP has approved registration of 70 consultants to implement energy conservation in designated buildings.

  A total of 2,557 designated factories will have to comply with the legislation. To date, 1,151 facilities have been designated according to designated years of their energy consumption capacity. An energy manager had to be appointed and report to the DEDP. Reports from 600 factories, or 52% of the total designated factories, have been received, involving 1,175 energy managers. So far, the appointment of 799 energy managers for 432 designated facilities has been approved by the DEDP. The DEDP has approved registration of 47 consultants to undertake energy conservation implementation in designated factories.

- Project on Non-Designated Factories and Buildings

  In 1999, 40 facilities were targeted.

(Voluntary Program)

- Renewable Energy and Rural Industry Project

The ENCON Fund Committee assigned 2,781 million Baht as a general budget during the fiscal period 1995 to 1999. For example, targeted programs were promotion of biogas generation from pig excreta, energy conservation at tobacco plants, landfill gas collection and power generation, promotion of energy efficiency of incinerators, introduction of solar batteries at schools in non-electrified areas etc.

- Industrial Liaison Project

Demonstration projects and technology dissemination were promoted. About 482 million Baht was allocated from the ENCON Fund to support 23 projects such as pilot projects for solar energy utilization, demonstration of energy utilization from reuse and recycling of waste, and demonstration of energy-efficient technologies.

- Research and Development Project

The ENCON Fund aims to support policy studies for enhancing efficiency of renewable energy technologies, technology transfer, promotion of wider use of technologies recognized in other countries, dissemination of research data and findings, as well as small-scale demonstration projects. The ENCON Fund provided grants to 59 R&D projects, accounting for 525 million Baht.

(Complementary Program)

The Program supported the development of curricula for energy conservation training for human resources development and a total amount of 594.89 million Baht was allocated to support this program from the ENCON Fund during the fiscal period 1995-1999. Also, during the fiscal period 1995-1999, a total budget of 785.1 million Baht was allocated from the ENCON Fund to carry out various public awareness activities.

5) Benefits of Energy Saving Practices

In implementing the ENCON Program under the support and assistance from the ENCON Fund during the fiscal period 1995-1999, a total of 6,237 million Baht was spent. The following table shows the expected outcome on energy conservation, efficient utilization of energy, and replacement of non-renewable energy.

Table 5.2.2 Benefits Obtained from Project Implementation

	Compulsory Program	Voluntary Program	Complementary Program	Total
1. Approved budget from the Fund.(million Baht)	2,124	1,605	2,508	6,237
2. Energy Conservation Potential			**	
2.1 *Electricity*				
- Replace electrical energy				
Per year (million kWh/year)	88	51		139
Throughout project life* (million kWh)	1,320	298		1,618
Money saved (M. Baht/year)	177	128		305
Money saved throughout project life (M. Baht)	2,655	745		3,400

	Compulsory Program	Voluntary Program	Complementary Program	Total
- Reduce capacity demand				
MW	33	14		47
Investment capital (M. Baht)	1,485	630		2,115
2.2 Fuel				
- Replace fuel				
Per year (million liters of crude oil/year)	-	26		26
Throughout project life (million liters of crude oil)	-	357		357
Money saved (million Baht/year)	-	220		220
Money saved throughout project life (million Baht)	-	2,231		2,231
Total Energy Conservation Potential				
Money saved (million Baht/year)	177	348		525
Money saved throughout project life (million Baht)	2,655	2,976		5,631
Reduce capacity demand				
Investment capital (million Baht)	1,485	630		2,115

Note: * Project lifetime estimates are for 5 years, 15 years, and 25 years depending on the type of equipment or technology used.

** Energy conservation potential under the Complementary Program cannot be valued in terms of money.

6) Evaluation

As described above, major energy taxes in Thailand include excise taxes from import duties on imported petroleum and petroleum products. Other local taxes and value added taxes are relatively small (10% and 7% respectively) which do not have a serious impact on the price of petroleum and petroleum products.

An analysis of energy consumption in Thailand demonstrates that the impact of general economic conditions is much greater than that of energy taxes. Consequently, changes in taxation rates do not have a major impact on energy consumption.

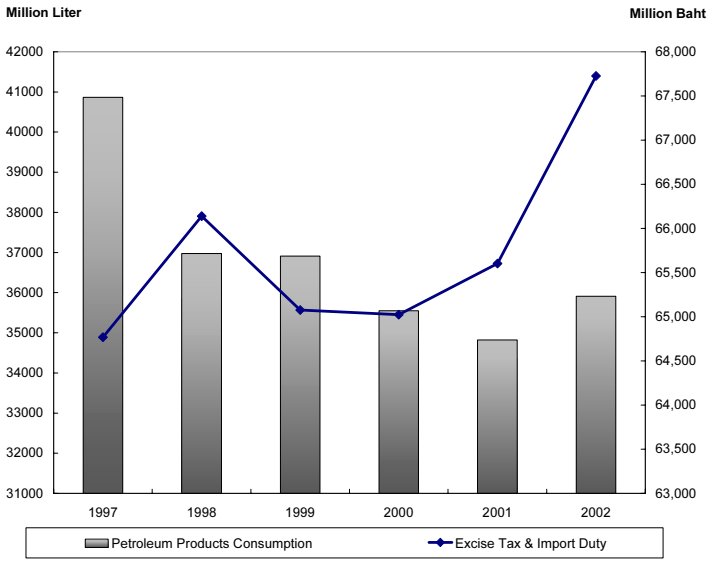


Figure 5.2.6 Petroleum Products Consumption and Import Tax Change (1997-2002)

During 1997 to 2000, there was no correlation between revenues from commodity taxes and custom duties and energy consumption, but there was a positive correlation between petroleum consumption and the economic growth rate.

In the analysis and evaluation carried out by the Thailand Environment Institute[35], the following negative evaluations are pointed out with respect to the ENCON Fund; budget appropriated to the projects is not appropriate; procedures have fallen behind and are complicated; the objectives and direction proposed are sometimes unclear; the development of training curricula has fallen behind schedule; the implementing competence of the governmental agencies is insufficient; and PR activities are inadequate.

However, despite the above, the ECON Fund linked to energy taxes was established, as was a system for utilizing subsidies for the introduction of energy saving and new energy sources. In addition, unleaded gasoline consumption was promoted through the policy and some accomplishments have been made.

Although energy taxation has not had a direct influence in restraining energy consumption or promoting the introduction of new energy so far, the Thai Government in the process of refining this policy to possibly increase reliance upon economic instruments in the future.

d.2 Economic Instruments for Industrial Pollution Control

1) Economic Incentives for Industrial Pollution Control

Economic incentives for industrial pollution control in Thailand aim at achieving environmental protection, improving the process of industrial production control, and upgrading the industrial zoning process.

Economic incentives are applied to Group 2 and Group 3 factories that are required to register with the Department of Industrial Works (DIW). This is because they can be systematically planned, tested and controlled.

[35] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand," 2003

Group 1 factories[36] are not required to register with DIW, which makes it more difficult for the authorities to control and verify. DIW statistics show that there were 43,892 factories in Group 1 in 2002, which accounted for 35 % of the total industrial factories in Thailand[37]. In any case, there are limited opportunities for economic incentives to be used to encourage investment in pollution control by this group in view of their small scale.

Tax Exemption and Incentives for Investment

Tax breaks as incentives for investment in the purchase of pollution control machinery, tools, equipment, appliances, or materials that are not available in the country allow industrial entrepreneurs to apply for import duty reduction. Exemptions from personal income taxes are available for foreign experts and consultants who provide services to install, manage, or run waste treatment systems. The DPC decides if facilities qualify.

It should be noted that most of machinery and equipment eligible for import duty reduction are end-of-pipe technologies for pollution management, and cleaner production technologies are not targeted[38].

Incentives for Environmental Protection and Conservation Operation and Services[39]

The Board of Investment (BOI) has announced the Types, Sizes and Conditions of Activities Eligible for Promotion issued by the Investment Promotion Act B.E.2520. A list of activities includes environmental protection and conservation such as wastewater treatment, and disposal of refuse, industrial waste or toxic chemicals. To be eligible for BOI privileges and support, the service must involve an investment of not less than 10 million Baht (US$ 0.25 million), but the cost of land and operating costs are excluded. Conditions include the requirement that promoters of the project must have not less than 51 per cent Thai shareholders.

Soft Loans[40]

There are five soft loan programs.

i. The Environmental Fund[41]: established under the Enhancement and Conservation of National Environmental Quality Act (B.E2523, 1992). The maximum lending period is 3 years, and the amount of loan does not exceed 5 million Baht per project.
ii. The Industrial Finance Corporation of Thailand (IFCT):
   - Credits for investment in environmental and energy conservation and pollution control. The maximum lending period is 7 years.
   - Japan's financial support on pollution control and environmental conservation (supported by former OECF, current JBIC): The maximum lending period is 15 years, and the amount of loan does not exceed 300 million Baht per project.
   - Credits for purchasing of industrial machines made in Sweden: The maximum loan period is 5-8 years, and the amount of loan does not exceed 4 million Baht per project.
iii. The Bank of Thailand: A credit program to support effective environmental problem-solving initiatives or industrial R&D projects. There is no limit on the amount of loan, and the loan period should not exceed 10 years.

Subsidies

[36] Group 1 factories refer to factories of which category, type, and size can start the operation whenever the industrial entrepreneurs wish. Group 2 factories refer to factories of which category, type, and size require approval from the regulators. Group 3 factories refer to factories of which category, type, and size require a permit to operate.
[37] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand," 2003
[38] Ibid.
[39] Ibid.
[40] Ibid.
[41] Ibid.

Subsidy programs in Thailand focus on research and educational development. Some major domestic sources of funding are as follows:

- Environmental and energy research and educational development.[42]
  DPC: research grants on pollution control
  DIP: research grants on productivity enhancement technologies
  TPD/MOSTE: supports research in the field of innovative technology for rural development, emphasizing the actual application of invented technologies in agricultural and industrial production
  Toyota Thailand Foundation: research grants in the field of environment for actual application in environmental conservation and issue-solving
  Thailand Toray Science Foundation: promotes the advancement of science, technology and environment
  ONEP: research grants on community environment and pollution
  EPPO: research grants on energy
  National Science and Technology Development Agency (NSTDA): support grants to promote capacity development in the fields of science policy and technology
- Environmental- and energy-related productivity enhancement grants
  Energy Conservation Promotion Fund

Environmental Fund: financial assistance for natural resource and environmental conservation promotion activities. The maximum amount of support is 5 million Baht per project.

Levies

A levy is a type of incentive which uses tax measures to convince industrial entrepreneurs to choose environment-friendly raw materials, or to relocate their factories to designated industrial estates where environmental conditions are controllable. The following list provides for Thailand's levy typology[43].

- Differentiation of tax rates between leaded and unleaded benzenes, and between low sulfur and high sulfur diesels. Currently, this form of incentive is not applicable due to the fact that all benzenes and diesels in the market are unleaded and low-sulfur types
- Differentiation of excise duties levied on new and old batteries (10 per cent on new batteries and 5 per cent on old batteries using recycled lead).
- Income tax exemption for factories to be relocated in the government's designated zones.

Other Economic Instruments

Volume of water: license for drilling for groundwater, license to infiltrate wastewater underground, charges for use of groundwater.

Other existing licenses: usage of fisheries resources, forest resources, wildlife, mineral resources etc.

Concerning wastewater management, involved organizations such as DIW, BMA (Bangkok Metropolitan Administration, the Bangkok city hall), ONEP and PCD carried out a survey on effective ways to impose the responsibilities of wastewater management on industries and communities. Also, DIW carried out surveys on charges for industrial pollution control and the application of financial measures for air pollution management.

[42] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand", 2003
[43] Ibid.

2) Current Situation of Economic Incentive System

Although a draft Act on economic instruments for industrial pollution control has been prepared, it has not passed the parliament. Many of the economic instruments currently in effect have been adopted through provisions under the existing laws, such as the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992) and the Factory Act B.E. 2535 (1992).

Several types of economic instruments including waste disposal charges and waste treatment fees are still being studied by DIW. Some instruments such as charges for substances depleting the ozone layer are currently in effect, but the level of actual implementation and enforcement has been low.

A survey of stakeholder attitudes and opinions about the use of economic instruments for industrial pollution control showed a majority (accounted for 89.3 per cent) of the surveyed entrepreneurs empathize with the Polluter Pays Principle (PPP). About 56.7 per cent of those who responded agreed that they should take a moderate responsible for the environment. The majority of industrial entrepreneurs were in favor of enforcement incentives.

3) Prospect

In Thailand, although many of the economic incentives are similar to those in Japan, there are subsidies from the Oil Fund to unleaded gasoline and charges on substances depleting the ozone layer that are unique in Thailand. The DIW is sufficiently active to prepare a bill on economic instruments. Examining the introduction of economic instruments is also expected to continue, and the Thai Government seems to have been making steady progress.

Since the command and control method is not very efficient, introducing economic instruments has been highlighted. The Thai Environment Institute claims that the effective utilization of economic instruments requires that they be used along with command and control methods in which polluters must conform to environmental standards[44]. Consequently, it appears that a company will choose to either conduct environmental management by voluntarily reducing pollutants or to accept penalties by discharging pollution which does not comply with the standards. At the time, polluters should consider investment to develop future business and its preparation.

The revision of laws can require a long period of time. Political and social constraints mean that it may take time to introduce the instruments in a full-scale manner.

d.3 Provision of Information on Cleaner Production

1) Outline

Thailand has introduced the concept of cleaner production into industry since 1990. The concept of cleaner production is applicable to a wide range of businesses such as hospitality business, school and communities. Presently, more than 1,000 organizations are adapting this concept.

Thailand has entered into the UNEP International Declaration on Cleaner Production in September 1998 during the UNEP the Fifth International High-Level Seminar on Cleaner Production at the Republic of Korea.

In February 1999, the Thai Cabinet's resolution entrusted the Ministry of Science, Technology and Environment (at that time) to be a core agency responsible for cleaner production.

The Pollution Control Department has prepared the National Master Plan on Cleaner Production, which was approved by the Pollution Control Committee in December 2001 and by

[44] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand", 2003

the National Environmental Board in January 2002. The Ministry of Science, Technology and Environment is responsible for delivering the National Master Plan on Cleaner Production to other agencies for implementation. There is a monitoring and evaluation activity and report to National Environmental Board every six months.

Information from 1990-1998 shows that public organizations carried out research and development of cleaner technology in approximately 54 projects.

2) Organizations to Promote Cleaner Production

Agencies responsible for application of cleaner technology in Thailand include:

- Industrial Water Technology Institute, (DIW/MOI): 4 persons, 500,000 Baht for one project
- Cleaner Technology Unit (DIW/MOI): 9 persons, 12 Million Baht for 2003
- Industrial Environment Institute (the Federation of Thai Industries): 3 persons
- Industry Division and Public Welfare Division (the Thailand Research Fund: TRF): 12 persons
- Bureau of Eco-Industrial Estate Development (IEAT): 2 persons, 200,000 Baht
- Division of Appropriate Technology Promotion, Department of Environmental Quality Promotion (MONRE): 12persons, 1.4 million Baht
- Bureau of Industrial Business Development and Entrepreneur and Bureau of Industrial Sector Development (Department of Industrial Promotion: DIP/MOI): 8 persons, 10 million Baht
- Business and Environment Program (Thailand Environment Institute): 5 persons

3) Current Projects and Achievement of Action Plan

Followings are the main projects.

Project's Name	Responsible Agency	Objectives	Time frame	Supporting institutes
Promotion of Cleaner Technology in SMEs	DIP	To promote Cleaner Technology in Small and Medium enterprises. The pilot industries selected are dyeing industry and textile decoration industry	3 years 2000-2003	JETRO, JODC, AOTS, Financial support through GAP
Project Supporting Improvement of Environmental Supervision Institution in Thailand	DIW	To improve environmental management and pollution control systems in Thailand.	4 years 1999-2003	JETRO, JODC, AOTS
Joint Research on the Development of Environmentally Friendly Industrial Wastewater Reuse Technology	DIW, DIP, Thailand Institute for Scientific and Technological Research	Development of environmentally friendly industrial wastewater reuse technology for dyeing industry and food industry.	5 years 2001-2006	with funding from NEDO
Model Project on Energy and Water Conservation in Textile Industry	DIP		2001-present	Support by NEDO

Project's Name	Responsible Agency	Objectives	Time frame	Supporting institutes
Green Manufacturing Technical Assistance Program	National Metal and Materials Technology Center (MTEC)	To develop skills and expertise for personnel who then transfer knowledge to factories.	2002-2004	
Cleaner Technology for Fish Pier Program	DPC	To promote cleaner technology to approximately 700 fish piers in Thailand.	2 years 2004-2006	
Program on Establishment of Suitable System in Recycling of Waste Electrical and Electronic Equipment (WEEE)	DPC	To publish technical guideline on WEEE and to design the law relating with the recycling.	2 years 2002-2004	
Program on Establishment of System for Environmental Management, Collection and Monitory of Pollution in Industrial Estates	IEAT	To establish complete monitoring and environmental management system in Maptaphut Industrial Estate.	1 year 2003-2004	

Note: JETRO: Japan External Trade Organization, JODC: Japan Overseas Development Corporation, AOTS: Association for Overseas Technical Scholarship

4) Achievement

The Cleaner Technology Policy was proposed and considered by the Department of Industrial Works, various representatives from government agencies, experts from several institutions, and foreign consultants and advisors. The Danish Cooperation for Environment and Development (DANCED) has been supporting the policy since August 1998[45]. The action plans for cleaner technology consists of

- Industrial sector approach and participation of the industry:
  - -Establishment of Industrial Sectors Committee
  - -Establishment of Technology Verification Committee
- Financing cleaner technology projects
- Human resource development in cleaner technology
  - -Register of cleaner technology auditors and cleaner technology advisors
  - -Training programs in cleaner technology
  - -Training of staff in the Department of Industrial Works
- Cleaner technology information activities

5) Survey of Enterprises Promoting Cleaner Production

A survey was conducted of the application of cleaner technology in Thailand; 10 factories were selected as pilot. Five of them completed applications for cleaner technology factories, and 5 on-going factories.

1. Completed application of cleaner technology (5 factories): food Industry (3), pulp and paper industry (1), and dyeing Industry (1).
2. On-going industries (5 factories): textile industry (4), and dyeing industry (1).

According to the survey on results of introduction of cleaner technology at these factories, motivations of the business owners participating in the program were minimization of their production costs and full utilization of natural resources. Participating companies showed their recognition of the need to implement systematic CP promotion programs. It was clear that forms of cleaner technology can be used vary from one industry to another.. They also adopted the ISO 14001 as well.

Problems and impediments found in the implementation of cleaner production programs are:

- Lack of enthusiasm of factory staff;
- High investment value in cleaner production in some cases and long time for the investment to yield a return;
- Lack of technical support and appropriate equipment;
- Lack of funding for some programs (40% of all factories interviewed)

6) Issues to Improve Cleaner Production Program

- Promotion of knowledge in cleaner technology to business owners
- Promotion of low-cost cleaner production
- Improvement of data collection
- Presentation of best practice from cleaner production program
- Behavioral changes of factory workers
- Development of domestic production technology

[45] Thai Environment Institute, "Case Study on Industrial Pollution Control in Thailand", 2003

7) Potential Role of Japanese Experience in Promoting Cleaner Production

Thai Environment Institute summarized ways in which Japan could cooperate with Thailand in promotion of cleaner production technology as follows:

1. Provide knowledge of cleaner technology to business owners.
2. Study and develop fundamental reuse technology, recycling technology and cleaner technology.
3. Study and analyze the needs and market conditions for these technologies and study the capacity of local manufacturing related to technological development and investment.
4. Study the procedures and channels to exchange waste between factories.
5. Study motivating and controlling measures to increase participation of the private sector and factories on how to use these technologies.
6. Prioritize research and development areas for these technologies.
7. Acceptance of aid should consider the appropriateness in transfer of that technology. The previous programs show once the project is completed, the technology then is often not used any longer.
8. In practice, it is found that most business organizations have slow response to cleaner production. Public and private organizations can assist them in funding, human resource development, and expertise.
9. Establish standard practices for cleaner technology for all industrial sectors.
10. Determine motivating and controlling measures to stimulate and support the private sector and factories to upgrade the level of their technologies for better production, service and waste minimization thereby leading to greater competition in the national market.
11. Determine promotional and motivational measures to support and assist the private sector in investing in the production of technology on a commercial basis.
12. Management of factories should seriously support and willingly apply the concept of cleaner production.
13. Establish financial support for small and medium enterprises to participate in the cleaner production program. This is because 90% of the industrial sector in Thailand consists of SMEs.
14. In order to develop a successful cleaner production program, coordination between the public sector, the private sector, business owners, and organizations must be established.
15. Exchange of experiences among countries about the process and channel in trading of waste between factories.

5.2.4 Industrial Environmental Issues in the Philippines and Thailand

a. Push Factors

a.1 Industry Scale and Pollution Potential

Although the industrial sectors in the Philippines and Thailand have developed in recent years, it is important to consider that their scale is smaller than that of Japan when she faced the severe environmental problems in the 1960s. In particular, the heavy and chemical industry sector which is the primary source of pollution is not very large.

Factories in the heavy and chemical industry (such as petrochemicals, fertilizer, fundamental chemical products manufacturing, synthetic fiber, cement, iron and steel and non-ferrous refining) and thermal power plants, which are major pollution sources, were built quite recently. Most of these factories and plants have incorporated efficient pollution control

measures in the process by obtaining latecomer's advantage. Some companies have technical support or related capital from companies in advanced nations and also compete on the global market, so they are sensitive to their environmental performance. These types of companies are striving to meet the global standards and bear comparisons with companies in advanced nations, and in some cases, their level is even higher.

In addition, direct investment from advanced nations has grown extensively since 1990, which locate many companies in the industrial parks. These companies are very sensitive to environmental issues in general, and they have no major problems.

The majority of companies in food stuffs, fiber and dyes, pulp and paper industries, which are classified as so-called light industries, are local-capital companies. These companies utilize mainly water and energy, and their effluent discharge loads are large. The number of companies providing metal and plastic parts to the factories with foreign capital is growing in Thailand, whereas, such an influence is not evident in the Philippines.

In both nations, there are companies in the heavy and chemical industry, electric and electronic machinery and transportation machinery at the leading-edge of industrial pollution control and a group of small and medium enterprises in light industries with local capital that are not so forward-looking with regard to industrial pollution control.

a.2 Actual Conditions and Influence of Industrial Pollution

With regard to air pollution, the most severely polluted areas are Bangkok and Manila. Concentrations of sulfur dioxides whose major pollution sources are the industry and power generation sectors satisfy the environmental standards, so the actual conditions are not so bad. The concentration of suspended particulate matters (SPMs) from automobiles has become a major problem. Compared to SOx and NOx, smoke and soot are like to be a problem at exhaust gas emission facilities.

Water pollution in urban rivers and coastal zones has become a problem in both nations. It is clear that industrial wastewater contributes to water pollution, which has an adverse effect on marine life, water utilization and environmental resources. Since domestic wastewater is also a contributing factor to water pollution, demonstration of protests specifying an individual plant as a pollution source has not occurred.

There is an extremely high possibility that soil and groundwater is contaminated by organocholorine solvent at the sites where machinery-related plants were located prior to 1995. In fact, such pollution was detected in a Thailand's industrial estate.

Hazardous waste disposal is also a major problem because both countries lack proper facilities for waste treatment and disposal.

Nonetheless, in both nations no pollution from a specific source has caused health damages.

a.3 Legal System and Enforcement

Laws and regulations in both nations are regarded to attain certain standards. However, it has been pointed out that the level of law enforcement is insufficient. In particular, compared with the number of factories, law enforcement personnel and budget is not enough.

Strengthening the capacity of the law enforcement personnel does not simply solve the above-mentioned problem. The capacity comes with the national power that enables recruiting capable personnel and sufficient budget for law enforcement. If we compare the Philippines and Thailand in the 1990s, Thailand appears to have enhanced their capacity of the law enforcement, which might be due to an economic growth higher than that of the Philippines.

When a company causes industrial pollution, the local governments or regional offices of the central government should detect it and take necessary measures. However, both nations are weak at this. The enhancement of environmental management capacity of local governments and/or regional offices of the central government is regarded to be a future challenge.

a.4 Economic Instruments

Since only depending on the law enforcement cannot realize sufficient environmental control, the World Bank recommended introduction of economic instruments such as environmental user fees. In response to this, the Philippines introduced a levy system on effluent discharges as a pilot project in the areas under the jurisdiction of the LLDA that controls the Laguna Lake basin. Through this, EOP measures have improved drastically and environmental loads based on the reports submitted to the LLDA decreased sharply, which has produced a positive outcome. However, the number of registered pollution sources has also increased, which makes it difficult to control individual pollution sources. The LLDA faces a challenge how to secure proper treatment of effluent from the large number of the individual pollution sources.

In either case, both nations recognize that a combination of command-and-control measures and economic instruments is necessary. The Philippine Department of the Environment and Natural Resources decided to expand the levy system on effluent discharges nationwide. In addition, the DIW in Thailand also proposed a bill on the economic instruments. A levy system on effluent discharges and waste disposal are to be introduced by this bill.

a.5 Other Push Factors

Both nations have established a democratic system; for example, local government leaders are elected thus broadening their experience in the democratic system. Public awareness has improved and college enrollment increased. Citizens have the power to conduct demonstrations on environmental issues, and the number of NGOs who can organize the demonstrations is also growing.

Since there is no existing antagonized axis between the left and right wings, environmental issues are suitable material for criticizing the government, which is common to both nations. In addition, criticism against the governments by the mass media for the reason that environmental measures are falling behind advanced nations can also be observed.

In such a manner, the pressure related to environmental issues by NGOs and the mass media has increased; however, industrial pollution is still not a major social problem. The large-scale heavy and chemical industry or companies from developed countries have responded sensitively to these pressures while local companies are regarded to be less sensitive to such pressures.

b. Pull Factors

b.1 Location Policy

Industrial estate development with regard to industrial location policy in both nations is deemed to have had a major effect on industrial pollution control.

b.2 Financing System

In both nations, a special environmental financing system has been established through JBIC funds. However, in reality the number of companies utilizing this financing system is very limited. There may be various causes of that situation, but first of all, most industrial pollution control at many existing factories is just effluent control. In such cases, most of the factories need not construct new wastewater treatment facilities but improvement or expansion of existing facilities. In addition, well-established firms are able to deal with this without

utilizing troublesome bank financing to cover the investment cost. Conversely, companies intending to obtain bank financing do not afford to by their cash or security; therefore, they are unable to do so.

For example in Japan, although it is clear that financing of the Pollution Control Corporation (presently Japan Environment Corporation) carries significant weight, when a company secures loans from a bank to invest in business expansion, in many cases it is said that banks forced companies to borrow loans from the Pollution Control Corporation for a portion of anti-pollution investments for diversification of risks. At such time, the bank does not demand a service charge. There are few examples of independent financing by the Pollution Control Corporation.

b.3 Network of Industry Associations

Chambers of commerce are located in both countries as are management associations. There are also local chambers of commerce. Although industry associations do exist, few of them have permanent offices or secretariats.

Some industry associations in the Philippines have prepared an environmental action plan, but their achievements have not been evaluated; the preparation of the action plans just ended as an event. An organization for industrial environmental management at industry associations has not developed, which is a weak area in both nations.

b.4 Research and Development, Instructions by Public Agencies

National science and technology research institutes and industry-specific research institutes exist in both nations. They focus on state-of-the-art technologies and are not active with the industrial pollution control of individual companies unlike the Japanese local testing laboratory of industrial technology (institution of industrial technology). In both nations, it is important to have local research institutions and their counseling function.

b.5 Institutional Pull Factors

The “Philippine Environmental Partnership Program (DAO03)” was established in May 22, 2003 in the Philippines, whose effective utilization is important. By linking the voluntary actions of companies with simplification of the procedures provided by various laws, a mechanism to induce such actions will be an important task.

b.6 Service Providers

Environmental control equipment and technical service providers in both nations are overseas companies in many cases, and local companies are to be developed from this time forth. Even if we request such companies to provide information, it is often a product catalogue, which cannot help but be one-sided.

In addition, it is in fact very difficult to identify the existence of service providers. To address such problems, the Philippine Business for the Environment (PBE) has established a knowledge network system to develop an information platform.

c. Corporate Internal Factors

Awareness of top management towards the environment has increased dramatically in both nations; if we look at corporate management it is still limited to a few progressive companies.

At local small and medium enterprises, in particular, it appears that a gap in awareness between executive officers and plant managers exists in many cases. Executive officers often entirely rely on their plant manager to carry out manufacturing who tend to have a negative view about

environmental measures due to the added cost burden. It is said that many executive officers in both nations are like this.

Furthermore, when viewing the Philippine case, when secondhand equipment is purchased for a manufacturing facility, it is utilized until it ceases to function, so most companies prefer not to make an investment halfway. In this type of case, cost of fixing equipment at the facility is small so the company is not enthusiastic about the concept of productivity improvement.

Despite various problems, the importance of environmental measures becomes to reach executive officers in both nations. In the future, it is important to make them understand how environmental measures can be effective towards improving productivity at their company.

A good sign of this is the fact that there are some companies in both nations that are leading the way for industrial environmental management and that there is also a movement of international firms introducing green purchasing. Local progressive firms and foreign companies are laying the foundation for sound industrial environmental management in the country; the issue here is how to extend this more widely.

5.3 Aid Agencies' Approaches to Assist Industrial Pollution Control in Developing Countries

There is no existing uniform principle for aid agencies to assist industrial pollution control in developing countries. This section focuses on the actualities of the assistance for industrial pollution control given to the target countries, the Philippines and Thailand, by each agency, to identify trends of their approaches.

USAID, World Bank, UNDP and Asian Development Bank are the main aid agencies in both Thailand and the Philippines. In Thailand, German and Danish aid agencies provide support in the field of industrial pollution control.

5.3.1 Cases in the Philippines

a. USAID[46]

USAID focuses its environmental support on improved environmental policies, institution building and environmental advocacy.

USAID support covers not only industrial pollution but also general environmental issues. USAID helps key national and local governments in their efforts to identify, improve and implement priority environmental policies and laws. USAID also supports training of government personnel to improve the management of hazardous wastes and reduce industrial pollution as a part of institution building and supports the development of informational activities to help inform the public on key policy issues, and to build the political will to improve environmental management and enforcement.

The approaches taken in the USAID support system are as follows: the reinforcement of the policies mentioned above, capacity building in involved governmental personnel, and the enlightenment of the population. As the main counterpart, it has selected DENR/EMB, and supports its operations. The results of these activities are reflected in the Clean Air Act and the Philippine Environmental Partnership Program (DAO03 - PEPP) announced in May 2003.

In regard to measures for industrial pollution control, USAID has several operations underway. The main results so far are as follows[47]:

a. Philippine Environmental and Natural Resources Accounting Project (ENRAP): 1991-1998
b. Industrial Environmental Management Project (IEMP): 1992-1998
c. Industrial Initiatives for a Sustainable Environment (IISE): 2001-2002

In these USAID projects, the basic data were organized, and then ENRAP was carried out in order to reflect the data on governmental policies, and IEMP, launched on a parallel with the ENRAP, designed programs to induce voluntary environmental management by companies, based on the idea that voluntary pollution prevention is more beneficial than governmental regulations and legal enforcement. This philosophy was inherited as the initiative for the industry's efforts to sustainable environment in IISE, and is still in effect today.

IEMP consists of the "Environmental Risk Ranking System," "Recruitment of Volunteer Firms" and "Waste Minimization Database." "Environmental Risk Ranking System" aims to establish an environmental risk ranking system called the National/Regional Industry Prioritization Strategy (NRIPS). The purpose was to identify and rank industry sub-sectors

[46] Based on the website of The United States-Asia Environmental Partnership (US-AEP) [http://www.usaep.org/] and that of USAID/Philippines [http://www.usaid-ph.gov/]
[47] EX Corporation, "Study on Environmental Management with Public and Private Sector Ownership (EMPOWER) in the Republic of the Philippines", 2003

and individual firms presenting the greatest relative potential risk to public health. Research teams reviewed 3,328 industry records representing 156 industrial categories in order to rank these firms using NRIPS methodology. This ranking enabled the DENR regional offices to prioritize and target compliance monitoring for those industry sub-sectors and firms having the greatest relative potential risk to the environment and public health. The survey identified 867 facilities and 28 industrial categories that presented the greatest risk to the surrounding environment.

"Recruitment of Volunteer Firms" is a strategy to recruit volunteer firms for IEMP demonstration to convince firms that pollution prevention pays. The marketing approach is the use of pollution management appraisal (PMA) and the savings that can be realized from using less raw materials and energy in the production process. The project spread the concept through 22 PMA workshops which 400 companies participated. Incentives for and obligations of PMA volunteer firms were established by DAO 17 in February 1993. A total of 143 agro-industrial firms volunteered for IEMP pollution management appraisals.

DAO 17, as a guideline governing voluntary participation in pollution management appraisals of the industrial environmental management project, includes the following: (a) moratorium on compliance to effluent and emission standards, (b) financing for investment outlays for waste management, (c) confidential business reports that would not result in DENR regulatory action and distribution to commercial competitors and other government agencies, and (d) regulatory actions of sanctions to motivate polluting firms to join IEMP.

"Pollution Management Appraisal" is a multi-phased, systematic procedure for identifying, selecting, and implementing waste minimization and improved waste management with targeting individual companies. It consists of four phases: planning and organization, assessment, feasibility analysis, and implementation. Organized experts team diagnosed each enterprise and led to the implementation of improvement. "Waste Minimization Database" is the result of these activities.

The succeeding IISE project consists of the PEPP (the Philippine Environmental Partnership Program) and the financial incentive analysis on environment project. The former aimed to help industries establish EMS and acquire ISO14001, thereby reducing environmental load in these industries. There are 232 companies implementing EMS, and 25 companies/organizations acquired an ISO14001 certification by December 2001. With the assistance of USAID, The Philippine DENR established the Philippine Environmental Partnership Program (PEPP) in June 2000 which facilitates conclusion of agreements among governments, financial institutions, politicians and training organizations for promoting EMS/CP.

USAID conducted the first comprehensive review and assessment of the existing fiscal and financial incentives available in the Philippines as a part of IISE and provided DENR with the result. It found that high interest rate, lack of banks' capacity of evaluating environmental cost/benefit of the project, high collateral requirement, and the like are the reasons for low utilization of public soft loans.

b. World Bank

The World Bank not only supports reduction in industrial environmental pollution by providing loans, but also provides technical assistance. The World Bank develops an environmental strategy and then carries out procedures based on said strategy.

In its environmental strategy for the East Asia and Pacific region, the World Bank will support environmentally sustainable growth in the region by:

- Working with clients to build environmental assessment and regulatory capacities,
- Supporting efforts to increase public participation and environmental awareness,
- Effectively implementing the Bank's own environmental safeguard policies, and

- Promoting macroeconomic and sector-wide policy reform[48].

In this strategy, the World Bank attaches great importance to institution building and continuously provides support for environmental assessment and law enforcement capability in the entire region. The World Bank also takes up "disclosure of environmental information to people" through dialogue in financing and non-financing as a new approach in environmental control. In addition, the implementation of an environmental management plan in important areas is also emphasized.

In this context, the World Bank supported the introduction of the levy system on effluent discharges in the Laguna Lake basin in the Philippines, and for Manila air pollution improvement, the development of environmental information, improvement in environmental indexes and an evaluation system[49].

The "Laguna Lake Environmental Study (LLES)" was implemented in 1993 through assistance of the World Bank, in response to the outcome, which led to the creation of a levy system on effluent discharges. While creating this levy system, at the same time the organization of the Laguna Lake Development Authority (LLDA) was strengthened. On the other hand, the competency of local governments in the basin to deal with the environment is being addressed. Since the economic instrument of the levy system on effluent discharges has been successful, it will be expanded nationwide with the establishing of a new water law.

The DENR carried out a comprehensive and quantitative study on air pollution through the assistance of the World Bank in 1994. This study clarifies the weight of pollution associated with industries. The study also assesses the impact of air pollution on human health and the economy and recommends a policy.

The World Bank carried out a study on the current state of natural resources and pollution in the Philippines, "hot spots" and recent environmental change, and then through its "Eco-Watch Program" disclosed information to the public. Although this disclosure promotes pollution control and removal only indirectly, it is considered to be an effective measure.

In such manner, although the approach of the World Bank on industrial pollution control in the Philippines is not always regarded to be comprehensive, we can see that the approach places an emphasis on the institutionalization of economic instruments, an assessment of the environmental impact of industrial activities, and public awareness through disclosure.

c. UNDP

The United Nations Development Program (UNDP) supports the Philippines based on the Country Cooperation Framework (CCF, the 2nd version 2002-2004) agreed on by the President of the Philippines and the UNDP. Following the UN Millennium Summit of September 2002, it focuses on developing a sustainable environment in the country. Special focus is on capacity development of the governments, the civil society and the private sector, which sets conditions for improvement of governance.

UNDP aims at strengthening the environmental management capacity to support the country's sustained economic growth. This is through the; (1) evolution and refinement of the legislative, institutional, and regulatory framework; (2) use of market-based mechanisms and adoption of environmentally sustainable technologies to encourage private sector participation in environmental protection; and (3) establishment of a more effective system of environmental governance and delivery of environmental services, including monitoring and enforcement.[50]

[48] World Bank, "Regional Strategy - East Asia and Pacific (Annex to "Environment Strategy")"
[49] EX Corporation, "The Study on Environmental Management with Public and Private Sector Ownership (EMPOWER) in the Republic of the Philippines," 2003
[50] See UNDP Philippine web-site [http://www.undp.org.ph/]

The field of industrial environmental management is only a part of the UNDP's activities, but it is given priority in the Philippines. The PRIME[51] project for the promotion of environmental initiative in the industrial field was implemented from 1999 to 2001.

The strategy of PRIME is to promote environmental management as a competitive business strategy. Its industrial pollution control measures are not EOP measures but mainly focused on cleaner production and aim to improve the level of environmental management in companies. The concept is to lessen the pressure on the environment by carrying out CP, and improving the productivity and corporate competitiveness. It was carried out on the following five themes[52]: (1) preparation of a voluntary action plan by industrial organizations (embodied in Business Agenda 21), (2) making industries ecology-friendly and exchanging waste in the industrial complex, (3) the speeding up of the introduction of a environmental management system in small and medium-sized companies (ISO 14001), (4) the ecolabelling of products, and (5) encouraging investments in the environmental service and equipment industries.

Two private organizations and 3 governmental organizations (BOI, BPS, DENR) joined this project. The financial assistance for the project from UNDP for 3 years is 1,400,000 US Dollars.

As a successor to this program, Environmental Management for Industry Competitiveness has been implemented from 2002 to 2004. The budget of the program is 800,000 US Dollars. The program consists of the following five components.[53]

1. Promotion and Institutionalization of Environmental Management Systems and Tools in SMEs
1.1 Establishment/ Strengthening of Industry-Government Facilitation Mechanism(s) on Industry-Environment and Sustainable Development Issues
1.2 Institutionalization of Accreditation Support Services for SMEs on ISO14000 and other Related Standards
1.3 Institutionalization of EMS implementation in SMEs
1.4 Indicator Establishment and Monitoring of SMEs' Industrial Competitiveness
2. Eco-Industrial Development
3. Environmental Entrepreneurship and Finance
4. Policy Development and Program Support
5. Capacity Building and Advocacy
5.1 Strengthening Database and Management Information Systems
5.2 Awareness Raising Events, Seminars, Trainings, Workshops, Conferences
5.3 Advocacy and IEC: Information Education Campaigns
5.4 Networking: By-Product Exchange (BPX), Industrial Ecology networking activities aimed at the academe

The following organizations are participated in the project:

From the private sector

Philippine Business for the Environment (PBE)
The Philippine Association of Environmental Assessment Professionals (PAEAP)
Clean & Green foundation, Inc. (CGFI)
Philippine Institute of Certified Public Accountants (PICPA)

From the public sector

[51] Private Sector Initiatives in Environmental Management
[52] Amihan Gorospe, "PRIME Project: Encouraging Private Sector Initiatives in Environmental Management"
EX Corporation, "Study on Environmental Management with Public and Private Sector Ownership (EMPOWER) in the Republic of the Philippines", 2003
[53] UNDP, "Project Document PHI/02/005 Environmental Management for Industrial Competitiveness"

BOI (as the Secretariat)
DTI-Bureau of Product Standards (BPS)
National Economic Development Authority (NEDA)
Environmental Management Bureau (EMB)

As can be seen above, the UNDP projects involve many organizations and are characterized by the way it is operated by local personnel. It is also characterized by the way it focuses on not enhancement of legal enforcement but such areas as promoting voluntary activities by companies, enhancing corporate competitiveness through the implementation of environmental measures, and developing a governmental support system for these activities.

d. ADB

ADB conducted an "Evaluation of Environmental Standards for Selected Industrial Sub-Sectors (EESSIS)" in 1997. The industrial sub-sectors covered include power generation and the cement and sugar industries. ADB also conducted a feasibility study on various market-based instruments (MBIs) in the Philippines in 1997. It estimated that introduction of MBIs could reduce environmental control costs by US 300 million per year and yield US$ 77-115 million per year from BOD discharges, compared to the costs of implementing regulatory standards[54].

Currently, ADB focuses support on CAA (Clean Air Act), providing DENR with financial assistance for implementing projects on transportation.

ADB has a plan to promote CP based on the recognition that introduction of CP is valuable because CP can reduce costs of direct regulation by the government and of EOP measures in the private sector as well as environmental loads[55]. In the Philippines, ADB has been providing technical support to DOST/ITDI, focusing on EMS and ISO1400 of companies.

ADB express its fear that existence of too many donors in the Philippines might result in confusion. However, ADB intends to lend more and more for CP activities in Philippines.[56]

5.3.2 Cases in Thailand

a. USAID

USAID set up the environmental management program of the Thai government during 1990-1998 in the textile, dyeing, paper and pulp, food and chemical industries. After the bilateral cooperation finished, USAID is providing support through the US-AEP at present. The US-AEP center is located in Bangkok, Thailand and sets its objectives as follows[57].

- Employ country-driven programming to ensure all activities are based on an in-country desire for change driven by a local partner
- Link counterpart organizations to build project-specific and broad-based partnerships to deliver valuable, cost-effective technical support
- Capitalize on drivers of change to match resources with opportunities on the ground
- Engage senior decision-makers who are taking a leadership role in reforms and are well positioned to affect change
- Develop long-lasting strategic engagements in which all partners share a common, well-defined objective

[54] EX Corporation, "Study on Environmental Management with Public and Private Sector Ownership (EMPOWER) in the Republic of the Philippines", 2003
[55] ADB, Asian Environmental Outlook, 2001
ADB, Guidelines: Policy Integration and Strategic and Action Planning for the Achievement of Cleaner Production, 2002
[56] Based on interviews conducted in this study.
[57] http://www.usaep.org/countries/thailand/index.html

- Apply targeted resources to make a measurable difference in the context of larger initiatives
- Define results and impacts before committing resources so that all activities have clear targets for specific results

With these goals in mind, the following projects are planned/put into operation.

Projects underway in the Policy area include:

- Promoting Improved Environmental Enforcement and Compliance
- Strengthening Public Involvement in Environmental Decision-Making
- Improving Management of Tha Chin River Basin through Community Involvement
- Supporting Reorganization of Environmental Institutions

Projects underway in the Urban area include:

- Urban Environmental Improvement Projects in Secondary Cities
- Reducing Pollution from Bangkok Bus Fleets
- Improving Municipal Environmental Management

Projects underway in the Industry area include:

- Greening the Supply Chain
- Industrial Energy Efficiency
- Sustainability Curriculum for Thai Business Schools

b. World Bank

The World Bank, so far, only has an energy saving project for buildings in the field of industrial environmental management in Thailand.

However, its environmental project, CDP-E is proceeding as a sub-project of Country Development Partnership (CDPs) launched in 2000.[58] CDPs is an agreement between the Thai Government and the World Bank to tackle important development issues in cooperation with other partners.

The CDP is a three-year integrated framework that addresses activities, participants, sources of financial and other resources, and measures to evaluate program outcomes. This program targeted five sectors; governance and public sector reform, finance and enterprise competition, poverty and monitoring, social protection and environment. Financial resources come from Administered trust funds including the Japan Policy and Human Resources Development Fund, ASEM trust foundation and the Institutional Development Fund (IDF:WB).

The CDP-E is a program aiming to improve the quality of the environment in Thailand. It is being put into practice through policy dialogues between the World Bank and partners such as the public and private sectors, international and bilateral aid organizations, community-based organizations and academe.

As a part of this program, a series of "Environmental Monitor" has been published since the year 2000, which is being used effectively for identifying priorities in the projects. The information is also expected to be useful in examining governmental policies.

[58] World Bank Thai Office, "Country Development Partnership (CDPs)" http://www.worldbank.or.th/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/THAILANDEXTN/0,,contentMDK:20169221~menuPK:372449~pagePK:141137~piPK:217854~theSitePK:333296,00.html

Also, basic surveys on decentralization, environmental funds, the Environmental Impact Assessment (EIA), economic instruments and information disclosure (carried out by the partners are expected to be useful in solving the problems in policy reforms in MONRE.

The objective of CDP-E is to improve the quality of the environment through capacity enhancement, technical assistance and promotion of investments for solving the problems identified by "Environmental Monitor." It focuses mainly on sections dealing with the issues of air quality, water quality and solid hazardous waste.

MONRE, DIW, JBIC, UNDP and USAEP/USAID are involved as partner organizations for this program.

c. UNDP

UNDP is planning a comprehensive approach based on a partnership program with the Thai government. However, the focus is mainly on biodiversity, recyclable energy and operations at the community level, and importance is not placed on the field of industrial pollution control.

d. ADB

ADB supports the promotion of CP in Thailand. It evaluates Thailand's CP as most successful, compared to Indonesia and the Philippines, citing the enthusiastic leadership of the operating authorities and the legalization of measures - after being approved by congress - as the main factors behind the success.

e. Other

CP/CT has been promoted in Thailand primarily through the support of international and bilateral development agencies. Donors who have supported CT/CP include:

- The Carl Duisberg Gesellschaft of Germany assisted SMEs in the textile, electro-plating and food industries with a number of training and industrial audit activities, in collaboration with AIT and local universities
- GTZ provides long-term environmental advisory assistance for the Thai industry in co-operation with DIW. The project was started in 1994 and was extended to 2001. It aims at demonstrating waste management in selected industrial sectors.
- The European Union has been implementing a project with TEI to encourage 'Public Participation in Environmental Management in Samut Prakarn' (SES is assisted by this EU project, which includes the introduction of CT approaches.
- The 'Promotion of CT in Thai Industry' project, supported by DANCED, attempted to strengthen Thai environmental auditing and CT expertise at the advisory and implementation levels from 1996-98 with TEI and FTI. The project established CT advisory services in the food, electroplating and textile sectors. Also a CT Information Center was set up at TEI, to disseminate national and international information on CT. The project was extended from 1998 –01
- The CP concept has been integrated in the Five Year Industrial Restructuring Plan (1998-02), and the Energy Conservation Promotion Act of 1992 is also relevant.

Receiving such support, DIW has developed itself from an EOP administrative organization to a leading organization in the CP area and is planning to train its staff. However, coordinating abilities amongst the donors are weak, and their support has not been provided to those other than the central government. Moreover, support from donors is of an intermittent nature, and continuous capacity building and support are hampered. The central government does not have enough budget, and it is perceived that continuous financial support to local governments is necessary. If taxes on resource consumption and industrial pollution are introduced, part of the tax revenue should be allocated to monitoring and research for industrial pollution control.

5.3.3 Points of Philippine & Thailand

When viewing practices of international aid organizations' support with respect to industrial pollution control, US - AEP, UNDP and the World Bank place an emphasis on the subjectivity (independence of will) of a field (local) office, depending on the interests of responsible personnel, which makes a difference in their practices. However, those organizations' assistance in the area of industrial pollution control seems to be moving in the same direction.

a. From Enhancement of Pollution Control Systems and Capacity to Introduction of Economic Instruments and Partnership between the Public and the Private Sectors

Although a legal system pertaining to industrial pollution control has developed in both nations, law enforcement capacity is recognized as insufficient in general. Aid agencies do not provide much technical cooperation and assistance for the enhancement of such capacity targeting governmental agencies. Instead of promoting the enhancement of a system and competency of direct regulation, international aid organizations are prioritizing measures to increase awareness of the target companies themselves.

In relation to this, at the policy level of the central government, international aid agencies recommend the introduction of economic instruments such as environmental user fees and the promotion of a partnership between the private and the public sectors inducing voluntary actions taken by the private sector. Cooperation between the agencies and the nations is being promoted to realize such recommendation.

b. Improvement in Information Disclosure and Public Awareness toward the Environment and Enhancement of Environmental Management by Local Governments

The World Bank, UNDP and US – AEP put a great importance on promotion of public awareness and local governments' competency in dealing with environmental problems because the former is affected by industrial pollution and the degradation of natural resources and because the latter is required to tackle the problems. The development of environmental information and its disclosure by the central government is emphasized, and in particular, the enhancement of environment management of local governments, enlightenment on the environment for residents and information disclosure.

c. From EOP to CP Measures

Foreign companies in the two countries are not the big source of industrial pollution problems. Nor are the local large firms, because they have introduced the latest production facilities and practice international standards of environmental management. Both nations recognize that local small and medium size enterprises are not environmentally sensitive.

The organizations concerned attach great importance to the introduction of cleaner production (CP) which is more advantageous to local small and medium-sized enterprises than EOP measures through direct regulation. When small and medium-sized enterprises are targeted, they provide technical support focusing on convincing business owners or top management by demonstrating the advantages of CP because it is most important to reform their awareness.

On the other hand, since the organizations concerned also recognize the importance of involvement by governments through policy making, they provide support to the governments by holding seminars to disseminate the concept of and other information about CP and introduction of economic incentives.

d. Local Initiatives and Capacity Building

The approach of aid organizations in the Philippines and Thailand is to post specialists at local offices and implement programs that effectively utilize local human resources in order to emphasize the initiative of local offices. To secure local sustainability, through the implementation of this program, training for leaders or personnel engaged in environmental services is also provided.

e. Comprehensive Approach

International organizations such as the World Bank and the UNDP conclude comprehensive agreements in various fields with target nations and implement environmental programs under the agreements. Among bilateral aid organizations, the US – AEP takes a similar approach. The agreements give official recognition to the environmental programs in the target nations, which makes the programs easy to be integrated into national policy.

Bilateral aid organizations such as the GTZ or the DANCED do not take the above-mentioned comprehensive approach. At present, with CP is a theme, they dispatch long-term experts, create CP-related policies and provide technical support and advice over an extended period, in a way similar to that of JICA. In particular, the DANCED dispatches long-term experts in the DIW taking initiatives in policy-making in order to contribute to the formulation of CP policies.

5.4 Characteristics and Issues Related to Japanese Technical Cooperation in the Field of Industrial Pollution Control

5.4.1 Characteristics of Japanese Technical Cooperation in the Field of Industrial Pollution Control

Japan conducts various types of cooperation with developing countries in the field of industrial pollution control. This section describes characteristics of Japanese technical cooperation in terms of the opportunity to effectively utilize Japanese experience.

Japanese technical cooperation projects related to industrial pollution control have been mainly conducted by the following organizations.

1. Cooperation related to industrial pollution control including cleaner production by the JICA (such as development studies and project-type technical cooperation)
2. Assistance through the Green Aid Plan by the Ministry of Economy, Trade and Industry (implemented by JETRO and the NEDO, etc.)

The above-mentioned projects are designed for the purpose of improving administrative competence and include training engineers to control environmental pollution, mainly at the level of central and local governments. Targeted fields include air pollution control, water contamination control, industrial waste management, energy saving and industrial water control, and improvement in the competence of industrial environment management at the individual company level.

Based on reports and observations by persons related to technology transfer, the following sections summarize the characteristics of Japan's technical cooperation in the past.

a. Establishment of Centers for Environmental Management

JICA has established centers for environmental management aiming at strengthening organizational systems for comprehensive environmental management. In concrete terms, environmental center projects mainly covering the development of human resources and equipment at environmental laboratories have been implemented. JICA has carried out technical cooperation for environmental monitoring and emission/effluent monitoring since the most important matters in the formulation or execution of environmental management policies are to scientifically identify the current environmental conditions and factors causing pollution and the degree that each pollution factor contributes to the deterioration of the environment[59].

From the view of a social environmental management system, evolution of this system may be divided into 1) the system-making stage with the timing of the establishment of environmental administration organizations in conjunction with the enactment of environmental laws, 2) system-working stage with the development of information required for environmental policy planning, and 3) self-management stages. The environmental center projects commenced at the final phase of the system-making stage or the system-working stage[60].

JICA has been conducting development of human resources to support the establishment of a basic system such as the enactment and amendment of environmental laws and their enforcement (e.g., application of penal provisions), which are regarded as matters to be undertaken by the recipient country.

[59] Institute for International Cooperation of JICA, "The Second Study on Development Assistance for the Environment", 2001

[60] Environment ODA Evaluation Group, The Japan Society for International Development (commissioned by JICA), "Thematic Evaluation (Environment) by External Party: Environmental Center Approach: Development and Social Capacity for Environmental Management in Developing Countries and Japan's Environmental Cooperation", 2003, pp.69-73

b. Cooperation with Japanese Governmental Agencies

Technical cooperation implemented by the JICA is closely associated with Japanese governmental agencies at each stage of identification, formation, design and implementation of the cooperation project. Based on the historical background, discussions are carried out between the central government and the JICA in the preparation and implementation of technical cooperation, which is reflected in the contents of the project. Engineers and experts in each ministry or those recommended by each ministry joined the project team or were dispatched as JICA experts, and various projects have been implemented while maintaining a close relationship with the central government. In addition, since local governments have adequate technologies in some fields, JICA has cooperation from local governments through the central government[61].

c. Human Resources Development Related to Industrial Pollution Control Technologies

Japan has been conducting human resources development and providing knowledge through technical guidance and joint research and development with counterpart agencies in a recipient country. In addition, appropriate technologies are developed and examined through model projects and the like.

For example, a specific industry is selected for technical guidance, then a model factory in the said industry is diagnosed, and guidance on the improvement of their environmental performance is provided. If possible, a pilot project for the improvement is implemented so that the model factory is encouraged to take actions. At the same time, the model factory`s experience is disseminated to other companies in the same industry through seminars (targeting engineers or business owners/top management), which is the approach usually taken. In the case of individual companies, for example, an engineer who has received training is expected to propose actual improvement plans to his employer with the hope that it will be put into practice.

5.4.2 Problems Faced by Organizations Involved in Technical Cooperation in Developing Countries

Problems faced by organizations in developing countries involved in technical cooperation with Japan, from the viewpoint of government and company decision-making processes related to industrial environmental management, are listed as follows.

a. Working on Policy Planners

a.1 Bottleneck of Policy Design on Industrial Pollution Control and Working on Policy Planners

In every country, the state (government) has a responsibility for policy with respect to industrial pollution control. Laws and regulations elaborate on the policy. The Japanese technical cooperation approach assumes that the government's policy intentions are established and that environmental laws and regulations are appropriately enforced in many cases. However, it is also well understood that in practice governmental budget and staff necessary for environmental monitoring and law enforcement are insufficient.

Consequently, critical issue for enhancement of capacity to control environmental pollution is monitoring technology and training for environmental specialists, and has therefore developed technical cooperation programs for such capacity development. In such programs, the key persons concerned on both sides, namely the person for whom technical cooperation is

[61] Institute for International Cooperation, Japan International Cooperation Agency, "The Second Study on Development Assistance for the Environment", 2001

provided and the person who provides the cooperation, are environmental specialists and engineers.

What is important in such an approach is that whether or not the engineers in an environmental management agency of the recipient country can effectively function depends on the top management of the agency. If the top management is smart and provides appropriate instruction, in particular, if a mid-ranking manager does not fulfill his mission with confidence, the front-line will never commit himself to his mission.

Many government engineers in recipient countries are very enthusiastic and brilliant, so it is very meaningful for them to improve their skills through Japanese technical cooperation. When this is so, Japanese technical cooperation appears to be extremely successful. However, one problem with this is that often there is not sufficient working environment to effectively display their acquired capabilities.

In every case, engineers responsible for practical business do not work adequately unless their superior gives concrete instruction or a certain assignment. Although the concrete assignment is different between the central and local governments, in either case, the contents of the assignment are extremely limited. The contents of the assignment are entirely focused on various office formalities, and there are a few cases where on-the-spot measures, for example, how to address a problem of actual environmental pollution, are routinized. In particular, it is essential to routinize on-the-spot measures for compliance monitoring and law enforcement. The on-the-spot measures, activities outside the office, require equipment and material (such as cars and analyzers) or costs associated with traveling to the spot. The on-the-spot measures also require the government staff in charge to be tough enough to conduct on-site inspection.

With regard to these operations, even though top management gives instructions, subordinate staff may make excuses that operations cannot be implemented due to a lack of necessary equipment and materials or budget; whereas, the top management also makes excuses that budget cannot be secured due to financial restrictions, then suspension can happen.

It is necessary to make efforts to specify and analyze causes hampering the development of industrial pollution control and find strategies to overcome the causes, and then to recommend policy makers to implement the strategies.

a.2 Lack of Understanding of Regulators toward Corporate Activities

Officials in government organizations are likely to implement measures for industrial pollution control without sufficient understanding of what companies are interested because most of them have never worked with private companies. Since the most important concern of a company is to increase productivity and profits, it is natural that they show their interests in the governmental measures associated with their concern.

Accordingly, it is important to increase the understanding of the concerned government officials about the above-mentioned point as well as the necessity of a policy approach considering incentives to a company. The incentives include environmental measures that can increase corporate profits by improving productivity and simplification of troublesome procedures associated with environmental regulations if they take voluntary environmental measures.

a.3 Difficulties in Collaborating with Related Agencies

Competent agencies in environmental control, industrial development and finance are often divided so they do not know about each other's activities or they do not make an attempt to know. It is therefore difficult to take cooperative pollution control measures. For example, it is difficult to provide an economic incentive for industries to strengthen environmental regulations without cooperation with ministry in charge of finance.

For future technical cooperation, it is important to work on these relevant agencies in order to encourage collaboration.

b. Approaching Business Owners/Top Management

In a similar manner as governmental agencies, it is extremely difficult for industrial pollution control to achieve an effective outcome if the top management of a company does not have a clear view with regard to industrial pollution control. Technical cooperation often assumes that top management is positive toward environmental measures.

Although the technical cooperation side understands that it is essential for a business owner to change his/her awareness toward the development of industrial pollution control, it is not so easy to do so.

On the company side, not a few business owners are not interested in the production process at the plant level. Plant management is entrusted to a plant manager and it is sufficient enough for the business owner to achieve certain profits, so he/she tends to avoid new investment whenever possible.

On the technical cooperation side, they are mainly engineers so in many cases they do not necessarily understand business management. Accordingly, they do not have sufficient techniques to convince the business owners based on the special features of business management. In order for business owners to change their views on pollution control, it is indispensable for the benefits of industrial pollution control to be demonstrated in a concrete manner and for necessary actions taken by business owners to be recommended.

In addition to the technical aspect, management consultation is included in this recommendation. Previous technical cooperation has not touched on the topic of business management. Moreover, after establishing a confidential relationship with a business owner, it is essential to make a careful diagnosis at the plant. Since it is difficult for only environmental specialists to carry out this diagnosis, it is vital that specialists in business management, production and quality control also become involved.

In other words, unless environmental control is recommended together with business improvement, changing the viewpoint of business owners seems to be difficult.

c. Overcoming Difficulties in Identifying the Current Situation

One hindrance to promoting various types of technical cooperation is the fact that basic data on the current situation of the environment or pollutant discharges from pollution sources are insufficient. Although it is fundamental for environmental administration to formulate its policy based on such basic data, this is not usually a case in developing countries. In due consideration of this importance, Thailand has been developing basic environmental data and the mechanism to formulate environmental policy based on the data with assistance from the World Bank.

As the development of environmental statistical information is extremely important for future policy formulation for industrial environmental management, it is necessary to encourage environment-related organizations in developing countries to develop the statistics and information.

On the other hand, in the case of promoting industrial pollution control at the company level, although it is necessary to provide site (field) instruction at companies, generally speaking every company is opposed to the idea of allowing outsiders to view confidential information on operations and exposing the company mechanism. In order to implement substantial technical cooperation, it is important to overcome such barriers. Accordingly, it is important to take the approach of preparing a contract or written consent including the benefits to the company and a guarantee of confidentiality with regards to the information.

d. Institution

d.1 Gap between Institution and Its Enforcement

If technical cooperation focuses on training and capacity enhancement of engineers, it does not step into an area to change the prerequisites of their posting (position in a company, business concept of business owners/top management, laws and regulation and policies of the state).

It is natural for Japanese to assume based on their past experience that environmental laws and regulations are enforced and that companies try to comply with the legal requirement in developing countries. However, it is quite difficult to strictly enforce laws in developing countries. Accordingly, such an assumption itself should be questioned. Insufficient legal enforcement could lead to the cause of lower outcome of technical cooperation.

Some development studies examine causes of insufficient enforcement of environmental laws and regulations; they point out that emission/effluent standards are unrealistic or that there is a lack of analyzers and analysts for monitoring discharges. They do not attempt to make laws and regulations applicable to the reality or to examine ways to overcome budgetary constraints and insufficient equipment and human resources, and then make recommendations.

Workshops are conducted with the expectation of enhancement of counterpart's ability to enforce legislation based on the assumption that knowledge and skills learned at the workshops will be always reflected in daily operations pertaining to legal enforcement. In addition, in many cases it is assumed that counterpart personnel are involved in the technical cooperation projects full-time. These assumptions are not always valid.

d.2 Gap between Institution and Corporate Awareness

In the case of technical guidance to target companies selected in specific industries in technical cooperation, Japanese experts provide guidance to a plant manager or chief engineer. In these cases, although some technical cooperation projects try to change awareness of business owners/top management of the target companies, the project counterpart is usually a plant manager or a chief engineer. After the guidance is completed, it is expected that the counterpart will implement what was guided. However, in particular, measures associated with investment are not always put into practice.

Based on interviews with relevant parties, the reason why the technical guidance is not realized is because many business owners of small and medium enterprises leave production and environmental management within their factory entirely to a plant manager and generally tend to be negative about new investments.

For example, in many cases, they start businesses by purchasing inexpensive plants. They often belong to the import substitution industry, and their products are mainly for the domestic market, which is relatively protected. They are not always confident about the future outlook of their companies. Consequently, existing manufacturing equipment is utilized until it breaks down, and their willingness to invest in new equipment is extremely low. The biggest incentive for them is to maximize current profits instead of developing their businesses. They sell their companies very quickly when financial difficulties arise.

Due to the above-mentioned characteristics, in the case of providing plant managers or engineers with technical guidance, even if there is a clear merit of investment projects proposed through the technical guidance, business owners will not show much intention to invest because they insist on profits for the immediate future.

Improvements at a model plant require active involvement of the plant as a prerequisite, but it is not easy to make it happen during the implementation period of a technical cooperation project. Improvements always necessitate a change in traditional practices and a small investment. Business owners feel the risk of changing the present conditions, so they are

reluctant to agree. A strong confidential relationship should be created for realizing the improvements during the technical cooperation project period. Even the installation of water volume meters or the improvement of the manufacturing processes does not easily happen. In addition, there is a problem that only Japanese experts who are plant engineers can provide on-the-spot guidance, which is becomes very detailed if improvements are not associated with investment.

Even if business owners are invited to seminars for dissemination of experiences of model companies to other companies in the same industry, it is the plant manager who often participates in the seminars. Even if industry associations are encouraged to take measures, it becomes difficult to share information on environmental management within the industry.

e. Finance

When Japan provides environmental two-step loans in a developing country, the main issue is who can carry out technical appraisal of investment projects. In the case of the Indonesian environmental two-step loan, although the governmental agency responsible for the environment is in charge of the technical appraisal, it is difficult for them to fulfill the responsibility due to lack of technical and staff capacity. In reality, consultants hired by part of the loans usually conduct technical appraisal for most loans. In Japan, the Japan Development Bank did not have technical capacity, but engineers from responsible governmental agencies or applicants (large-scale firm) had. However, since some banks providing the environmental two-step loan in developing countries have excellent engineers, strengthening capacity of technical appraisal at banks might be better option. An examination of which agency plays what role is important[62].

Public financing accounted for 30 to 40% of the total loans for anti-pollution investments at peak in Japan. Since the ratio of the environmental two-step loans to the total loans for anti-pollution investments is estimated to be much smaller than that, public financing may not become the major catalyst for private banks in developing countries for financing anti-pollution investment. As for the Thai environment two-step loans, there is a problem of utilization of funds was slow. This means that incentives other than preferential interest rates should be taken in order to promote loan utilization. In addition, if a bank in a developing country finances a project that will not produce a profit, dead loans may be created. From these viewpoints, in addition to technical appraisal, financial appraisal of environmental investment projects is also considered to be important[62].

5.4.3 Issues in the Implementation of Technology Transfer of Japanese Experience in Industrial Pollution Control

Measures for industrial pollution control taken in Japan can be divided into two groups: those focusing on pollution control from the late 1960s to 1985 and those focusing on environmental management thereafter. Industrial pollution control in the fields of exhaust gases and wastewater discharged from plants was mostly completed during the period of pollution control. However, the issue of industrial waste disposal has not reached a complete settlement at the present time, and risk management of hazardous chemical substances is also in the development stage.

It is necessary to understand that the level of economic growth was very high when pollution control administration started in Japan. In 1964, before the pollution administration was established, Japan shifted to a nation applicable to the provisions of Article 8 of the IMF Agreement and joined in the OECD. In 1969, Japan's GNP became the 2nd largest in the world. Furthermore, nominal GNP per capita reached approximately $2,000 (approximately

[62] KONISHI Aya, "Nihon ni okeru Kogai Boshi no tameno Koteki Yushi Seido ni tsuite", *Kaihatsu Enjo Kenkyu*, Overseas Economic Cooperation Fund, Vol.3 No.1, 1996, pp.168-187

$5,000 substantially) in 1970. The nominal economic growth rate in the 1970s also exceeded 10%.

Since Japan reached a certain level of economic growth, it distinguished itself from other developing countries in that it could create the conditions to independently develop industrial pollution control. At the present time, many developing countries are taking preventive policy measures on environmental pollution before or during they have experienced high economic growth.

In a sense, it is important for developing countries to take preventive measures against severe pollution while they are faced with a challenging environment due to a lack of experiences to take serious action. With understanding this point, it is important to push ahead with effective technical cooperation in due consideration of the current "push" and "pull" factors in industrial pollution control for companies and the current company potential.

In order to increase the level of industrial pollution control in developing countries, it is important to improve the administrative competency of the central and local governments and the execution ability at companies and industry associations. Accordingly, the following sections summarize the issues of technical cooperation and those of a phased approach to cover the framework for industrial pollution control.

a. Support to Strengthen Administrative Capacity

For the strengthening of administrative capacity pertaining to industrial pollution control of central and local governments, it is necessary to identify different development stages. Generally speaking, the following stages are considered:

1. Stage for enacting laws and establishing organizations and systems for their enforcement;
2. Stage for strengthening the administrative system; and
3. Stage for implementing environmental policies independently.

Stage 1 is applicable to the least developed countries. Stage 3 is represents the administrative level of countries exceeding that of developing countries. Technical support for industrial pollution control is provided mainly to Stage 2 countries, which vary significantly in terms of development level.

In a nation in Stage 2, there are certain changes in industrial structure and increases in the weight of the industrial sector. Development stages of the industrial sector also include those of light industries, heavy and chemical industries and electric machinery industries. Development stages of economic growth include those of preparatory, growing, and autonomous development.

It appears that the stages of industrial development and economic growth are related to those of development of laws and administrative competence of central and local governments. This means that the stage of industrial pollution control does not solely exceed these stages. It is important to examine the development of administrative competence with due consideration of the economic growth stage.

Since the stage of economic growth in a nation falling under Stage 2 also varies significantly, gross national income (GNI) per capita is also spread over a wide range from $500 (Indonesia) to $4,000 (Malaysia). This difference in income levels is also linked to changes in industrial structure and development of the industrial sector.

In the Asian region, to some extent the differences in income levels are reflected in the administrative level of the state's industrial pollution control. In Thailand case, in line with economic growth, they develop environment-related organizations and secure human resources and the necessary budget for law enforcement. Such development leads to the development of

the administrative level. At the level of environmental administration falling under Stage 2, there are beginning, developmental and graduation stages, so technical cooperation activities corresponding to each level should be undertaken.

The factors comprising an administrative system in the field of industrial pollution control are described below.

- Laws & Regulations: Enactment of fundamental laws and individual laws, enactment of rules and regulations for law enforcement, enactment of organizational laws for agencies responsible for the environment.
- Administrative procedures: Registration of pollution sources, licenses for plant operations, licenses for the installation of facilities discharging pollutants, permits for wastewater treatment facilities and flue gas treatment facilities, permits for transportation of waste, permits for the installation of hazardous waste treatment facilities and environmental impact assessment, etc.
- Monitoring: Environmental monitoring and compliance monitoring of pollution sources.
- Policy making and information disclosure: Formulation of a basic plan such as environmental management or national strategy, preparation of annual reports, compilation and publication of environmental data.
- Measures for improving the environmental management ability at pollution sources: Training and institutionalization of pollution management engineers and periodical exchanges with industrial associations.
- Awareness-raising: Environmental education and seminars for business owners.

The factors comprising of organizations and institutions for administration in industrial pollution control are described below.

- Establishment of a central governmental agency specializing in the environment, arrangement of necessary functions.
- Establishment of local offices of the environmental agency for law enforcement.
- Establishment of an environmental section responsible for law enforcement in a local government through decentralization.
- Establishment of research and development institutions for technical development and diffusion of industrial pollution control.
- Establishment of environmental research institutions.
- Establishing training courses.
- Arranging necessary personnel
- Securing the budget.

With respect to the strengthening of administrative capacity, due to the limitation of human resources and budget, it is extremely difficult to suddenly shift to the next stage. Accordingly, it is important to fit the level of constituent factors at each stage and develop the contents of the level for rapid progress to the next step.

In order to strengthen industrial pollution control at the state level, each development level should be carefully evaluated, and then a national strategy and action plan for a phased development program should be prepared.

In the strategy or program, it is desirable to position economic instruments which work as push factors and the measures which work as pull factors for companies' industrial pollution control, evaluate the merits, demerits and effects of these measures, and show policy makers the importance of introduction of these measures. In order for policy makers to understand the significance of the measures, it is important to organize an industrial environment policy forum

and symposium with ministerial participation. Moreover, as for the push factors, it is also important to strengthen local governments and local organizations for environmental administration.

With respect to measures positioned as pull factor in the national strategy or the action plan, while implementing these as a pilot project or model project for the purpose of obtaining results, it is necessary to take an approach to develop the next step. The pull factor measures should be planned and implemented so that business owners/top management are encouraged to make efforts for business development and will understand the benefits and the necessity of industrial pollution control.

b. Capacity Enhancement of Private Companies

In every country, advanced and obsolete technologies co-exist in private-sector companies. Advanced technologies are represented by global firms having established plants/branches in developing countries and companies established as national projects in the heavy and chemical industry. The industrial pollution level in such companies is comparable in that of companies in developed countries.

Local firms that do not belong to the above-mentioned companies can be roughly divided into two categories. One is a group of companies established as an import substitution industry that has been introduced in many developing countries. Although this type of company may still be protected by customs duties, such policies are gradually eroding at the present time. The other is a group of export-oriented companies. These companies take a global market view so that they are also extremely enthusiastic in business management. With respect to the latter, top management monitors its own development in order to be compared alongside companies in developed countries, so they work vigorously in industrial pollution control.

Since local companies in the import substitution industries may be protected by customs duties and remain in an environment in which they are satisfied with the domestic market, they may be slow in responding to industrial pollution control requirements. In order to make them more aware of the necessity of industrial pollution control, separate measures to motivate them are necessary. If technical cooperation to enhance capacity of these companies is not accompanied with such measures, it will be difficult to achieve positive results.

Costs for environmental management are the cause for falling profits, which generally speaking business owners dislike. Nevertheless, the reason why industrial pollution control has progressed in Japan is because despite being encompassed by the above-mentioned push factors surrounding a company, it could not avoid taking such measures. These were prerequisites for Japanese companies in the 1970s. In addition, the external factors that encouraged companies to take measures for industrial pollution control should not be forgotten. The biggest factor is that the growth of a company could be forecasted due to the expansion of the market, which is extremely important. Every company that undertakes capital investment to increase its production capacity in order to respond to market expansion could improve its productivity due to economies of scale. Consequently, Japanese companies could easily absorb the cost increases due to industrial pollution control and continue business expansion.

In Japan from the late 1980s, companies took measures to increase productivity to lower production costs in order to cut costs increased by the yen appreciation, which resulted in a reduction in environmental pollutants. It becomes clear that corporate efforts to maintain their market competitiveness were effective in environmental management. Examples of such cases can be an extremely good guide for companies in developing countries. If it is clear that profits and environmental performance are improved by increasing productivity, even if there are no external conditions such as severe “push” factors, companies appear to take steps to introduce cleaner technology by understanding its merits. On the assumption of certain “push” requirements, if incentive measures to encourage an entrepreneur’s willingness for investment is combined, even local companies are expected to take positive steps.

Certain "push" factors can be listed as follows.

- Regulations for industrial pollution have been established.
- An organization pertaining to industrial pollution control has been established.
- A policy for adopting a free trade system has been taken.
- A policy to introduce cost-reflecting prices for fuel and water has been taken.

On the other hand, as for incentive measures, the following "pull" factors which are preconditions for industrial pollution control at Japanese firms can be a good guide. Although there were severe "push factors" that made it possible for the pull factors to effectively function, the most important point is that economic growth was large and the market was expanding and that the macro economy was extremely stable. This is the most essential point in the Japanese experience in industrial pollution control. Business owners/top management did not have a negative view of investments in industrial pollution control during the growing process of their business. This indicates that business owners/top management could foresee that their companies could absorb the increase in cost for industrial pollution control and even increase their profit by improving their productivity through capital investments in expansion of production facilities.

It is said that most of the anti-pollution investment financed by the Pollution Control Corporation in Japan during the 1970s was associated with capital investment[63]. It is important to note that Japanese companies promoted industrial pollution control in line with capital investments for the purpose of expanding production capacity.

On the other hand, the Japanese experience shows that, after entering a period of low growth, companies increased their value added to products by thorough productivity and quality control as well as a reduction in unit production cost. Accordingly, the rationalization of raw materials input in the production process and reduction in costs by restraining the generation of waste is being conducted.

Based on Japanese experience, the following approach may be a challenge.

- The strong intention of a business owner/top management to expand his/her company is a prerequisite. It is desirable to prioritize technology transfer in the field of industrial pollution control to the companies that challenge severe competition under a market environment that includes free trade and low custom duties.
- For technology transfers to above-mentioned companies, it is preferable to take an approach that will focus on business management, product development, and production and quality control, and strengthening environmental management in such context. In addition the approach should encourage industry associations to take industry-wide environmental measures.
- As for financial support and preferential treatment for corporate industrial pollution control, it is preferable to support the creation of a system in which companies can utilize loans for anti-pollution investment in conjunction with capital investment for expansion of production capacity.
- It is important to create a leading company in the field of industrial environmental management and to effectively utilize its influence on other companies. In addition, it is preferable to support international companies in promoting their influence of environmental management on local companies through supply chain management.

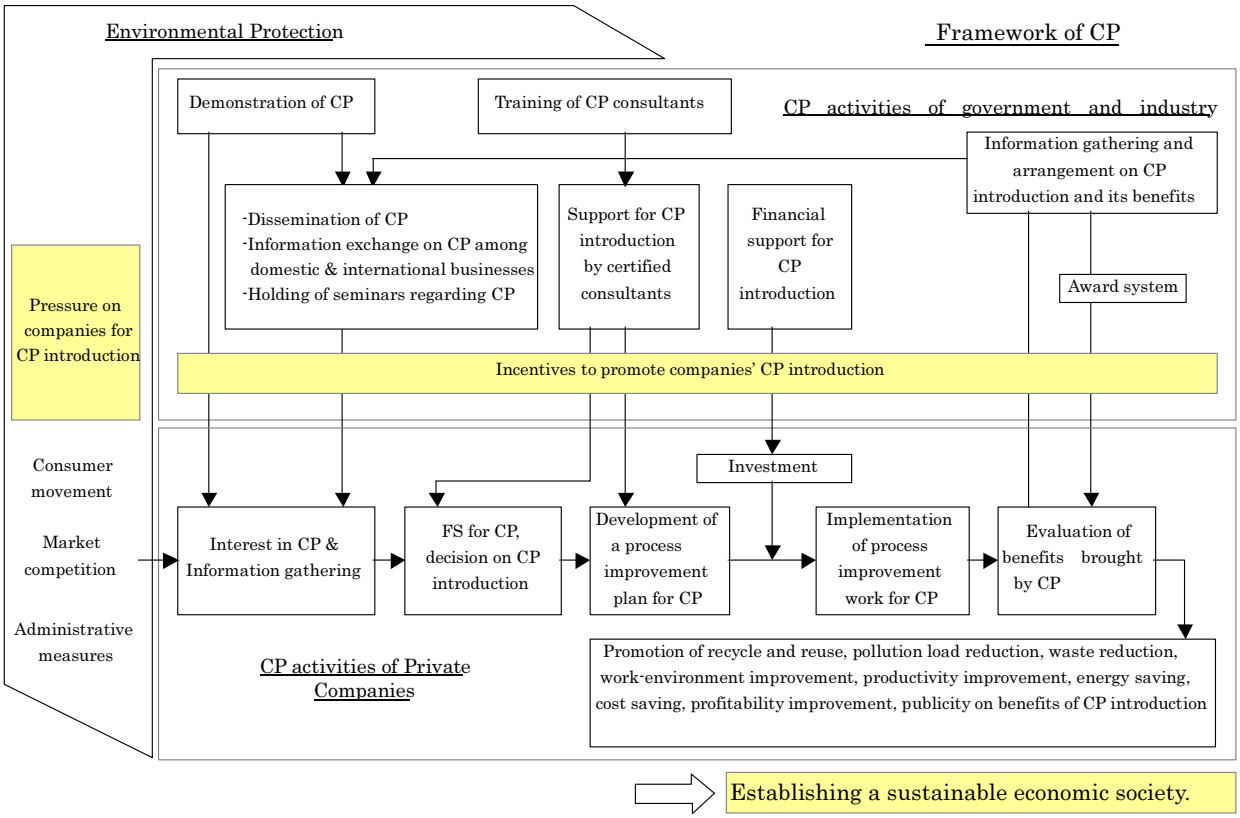
[63] MORISHIMA Akira noted that finance by the Pollution Control Corporation had a pumping priming effect on capital investment promotion in "Kankyo Jigyodan no Keii", Asia ni okeru Kankyo Seisaku no Keisei Jissi Katei Kenkyukai, Institute of Develoing Economies, "Nihon no Kogai Taisaku Keiken ni kansuru Hearing no Kiroku", 2002.

- It is important to create a network through which information related to institutions, technology and financing can flow to end companies. In this sense, it is preferable to support a policy that promotes organizational enhancement of industry associations and joint research and information exchange on pollution control by the associations. In addition, it is desirable to take an approach that will promote the establishment of an information center to provide an information platform on industrial environmental management and a network base for cooperation between parties concerned.
- It is preferable to support the development of experts in production and environmental management such as staff of national industrial technology centers and a mechanism to promote collaboration between companies and these experts.

c. Setting a Framework and Steps

The desirable approaches to enhance capacity of the government and the private sector in a recipient country have been discussed in the former sections. Also, the JICA has already published a report that discusses the above-mentioned matters comprehensively in the Collaborative Promotion Committee for Cleaner Production in 2001.

Hereinafter, the contents of the "Report on promoting cleaner production in developing countries" by JICA are summarized. The report examines how to design measures to encourage companies, who play a major role in CP promotion, to think about and decide the introduction of CP and to facilitate CP implementation, taking CP promotion policy as an example. In the report, a diagram illustrating the introduction of CP at a company level is shown in Figure 5.4.1.



Source: JICA Committee for the Promotion of Cooperation on Cleaner Production, "Report on Promoting Cleaner Production in Developing Countries", 2001

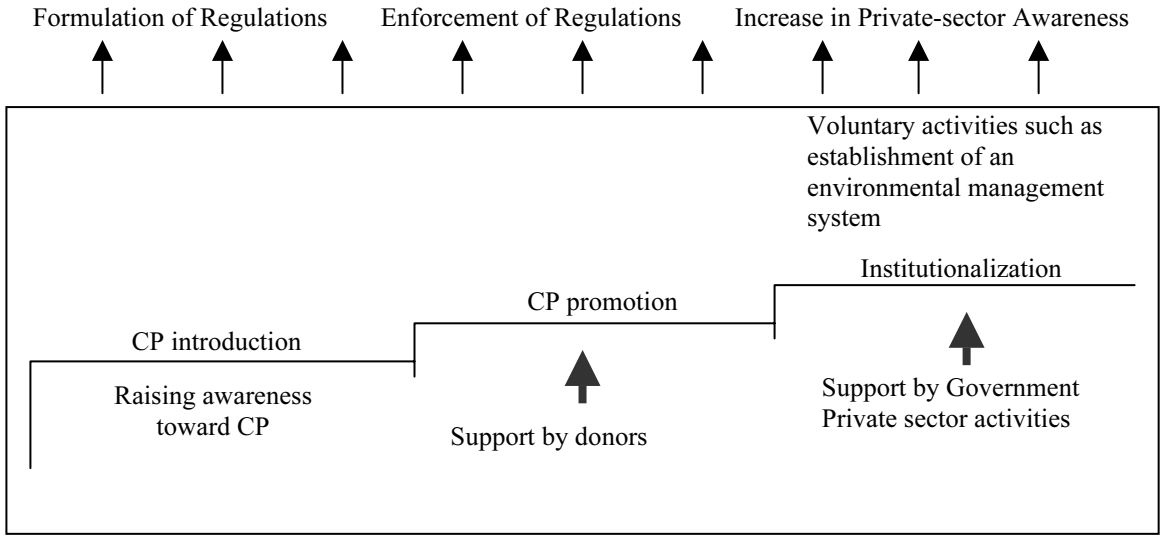
Figure 5.4.1 Framework of CP Introduction at a Company

The report points out that implementing measures for CP promotion requires design of measures based on conditions of a recipient country and that it is required to confirm priority sectors and constraints of the recipient country and examine measures considering the levels of environmental regulations and production control.

The report also lists Figure 5.4.2 as a model for introducing CP. In addition, it elaborated types of CP application in line with different levels of environmental regulations and production control as shown in Table 5.4.1.

Based on the above-mentioned points, the conclusion is described below.

- It is important to analyze the above-mentioned framework in the recipient country and then to identify effective measures and to set a development stage.
- Future issues would be to identify Japanese experience in industrial pollution control effectively applicable to developing countries and then to promote technology transfer while examining an approach for effective technology transfer to the recipient country.



Source: JICA Committee for the Promotion of Cooperation on Cleaner Production, "Report on promoting cleaner production in developing countries", 2001

Figure 5.4.2 Step for Introducing CP in Developing Countries

Table 5.4.1 CP Application Strategy according to Levels of Environmental Regulations and Corporate Production Control

Level of Environmental Regulations	CP Application Strategy
There is no environmental regulation, or even if it exists, it is equivalent to non-existent.	Without mentioning environmental protection, to make a company recognize that it can make profits by adopting CP instead of just discharging of waste or unused resources.
Monitoring of environmental control has been conducted to some extent; compliance with the regulations is required.	It is assumed that most of the items required by environmental regulations can be dealt with only through CP. In this case, it is possible to comply with environmental regulations while making a profit through CP instead of EOP measures. To make companies recognize that it is possible to achieve both environmental protection and strengthening of the corporate management base through the introduction of CP.
Taking measures to comply with regulations on items concerning the five senses (touch, taste, hearing, eyesight, and smell) or hazardous substances, or especially strict regulations imposed by the surrounding environment are necessary.	To encourage companies to comply with the regulations through EOP on addition to CP measures. In this case, through the introduction of CP, pollution load required to be treated by EOP facilities is minimized because of the introduction of CP. Consequently, capital and running costs for the EOP facilities become so small that the impact on profits of a company can be controlled.
Level of Corporate Production Control	**CP Application Strategy**
Production control has been rarely practiced.	Before drawing attention from companies to CP, to start with provision of information about the necessity of activities to improve productivity which generate profits for increasing their interests in the improvement of corporate production control level.
Production control has been practiced to some extent.	To start with providing companies with information to show that CP has a large positive effect on their environmental performance and profitability. Consequently, by widely providing CP information and recommending training for CP training services, it should be promoted in order to increase the desire to introduce CP.
Production control has been practiced, and there is a desire to improve.	This type of company has the desire and plays an important role in promoting CP activities. To promote awareness-raising through providing CP information, and encourage companies to utilize training services and consulting services for preparing a CP introduction plan.

Source: JICA Committee for the Promotion of Cooperation on Cleaner Production, "Report on Promoting Cleaner Production in Developing Countries", 2001

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Chapter 6

Implications of Japanese Experience in Industrial Pollution Control

6 Implications of Japanese Experience in Industrial Pollution Control

6.1 Implications for Developing Countries

Characteristics of Japanese experience in industrial pollution control have been discussed with the following keywords.

- Problem of "grow now, clean up later" strategy
- Preventive measures works in terms of cost-benefit
- Industrial Strategy: Reconciling Environment and Growth
- Economic Growth with Environmental Management
- Government Decentralization: Power and Competence of Local Governments
- Public Participation and Awareness
- Government-Industry Relationships
- Cleaner Production and Appropriate Technology
- Industrial Self-Reliance
- Financing Pollution Control

This chapter summarizes the stock of knowledge from Japanese experience in industrial pollution control considered as useful to developing countries as lessons learned by various actors and factors encouraging companies to take industrial pollution control measures, as well as relevant policy tools.

6.1.1 Lessons Learned by Actor

a. Public Sector

a.1 Local governments' capacity for industrial pollution control enabled effective enforcement of laws and regulations.

□ Local governments facing local residents suffering from industrial pollution regulated industrial pollution sources by enacting ordinances and concluding agreements with them prior to national law enactment. Governors/mayors of local governments directed such regulations; they felt it necessary to take account of residents' opposition against industrial pollution since they had to face election by the residents for their next term. In addition, they had power over staff assignment and budget allocation, which enabled them to change policy directions.

□ For enforcement of the local regulations regarding industrial pollution, technical staff at public health centers played an important role in on-site plant investigation and guidance. Technical staff of local governments learned and accumulated experience in industrial pollution control by visiting advanced ones. At the same time, each local government was motivated to compete in taking actions to control industrial pollution, trying not fall behind the advanced ones.

□ After the enactment of the laws and regulations related to industrial pollution control, there was enough experienced technical staff in local governments to enforce them, which made law enforcement effective. In Japan, employees of local governments were regarded as having high social standing; therefore, local governments could hire high-class personnel who graduated from the departments of science and engineering of universities as permanent staff. Local government staff with university degrees were trained through acquiring field experience such as on-site inspections. Such field experience was useful for them to prepare guidance on industrial pollution control for factories.

a.2 Industrial pollution control measures were integrated into industrial policy.

- While locating factories in existing urban areas became difficult due to land use regulation by zoning, the national and local governments developed special industrial estates and required locaters to comply with environmental laws and regulations. The industrial estates could absorb new demands for industrial expansion and prevent industrial pollution.
- The central government required factories to establish an organization for industrial pollution control within the factory, aiming at organizational response to the pollution.

a.3 Agreements on industrial pollution control between local governments and companies promoted companies' actions.

- Local governments developed a framework to require companies to control industrial pollution beyond the level required by the laws and regulations through conclusion of agreements on industrial pollution control between the local governments and the companies.

a.4 Public financing supported companies' pollution control investments.

- Substantial environmental contamination and damage created a need to make large pollution control investments nationwide within a very short time in order to rapidly promote industrial pollution control. To make such a large investment possible, it was necessary for the central government to strengthen legal enforcement and provide the private sector with enough economic incentives. This is because pollution control investments do not directly increase short-term productivity but pose pressure on companies' financial status. Even if legal enforcement is strengthened, companies cannot make pollution control investments when they are short on financial resources[1].
- The public soft loans (low-interest, long-term) for pollution control investments were an advantage for companies during the period of their business expansion (although collateral and guarantor were required, the loan mechanism allowed companies to get guarantees from the Credit Guarantee Association). To meet small and medium enterprises' (SMEs) financial needs, the national government provided public soft loans through financial institutions specializing in SMEs. The public soft loans were applied to not only pollution control investments but also requirements for relocation and change of business. The laws and regulations listed the types of pollution control facilities required and so firms did not have to go through a technical appraisal.

a.5 Utility price policies worked as unintended pressures on companies for rationalization of water and energy.

- Utility prices put pressure on companies to promote the rational use of the water and energy. Some examples are water costs accrued due to the switch from groundwater to more costly drinking or industrial water because of the regulation on pumping groundwater as a countermeasure to ground subsidence, and energy costs which increased due to the oil crises as well as taxation to finance energy policy implementation.

[1] TERAO Tadayhoshi, "Implication from Japanese Experience in Industrial Pollution Control," *Machinery Industry in Japan and Asia – toward Co-existence with Asian Countries* (in Japanese), Institute of Developing Economies, 2002

b. Private Sector

b.1 Cleaner production enhanced both competitiveness and industrial pollution control.

- During the high economic growth period, increasing market demands made it possible for companies to switch to cleaner production processes upon renewal of production processes or facility expansion.
- Companies were constantly required to improve productivity because market competition was severe in quality and price; they kept making efforts to improve and innovate production processes as measures to eliminate waste (increase yield rate). As a result, the companies achieved reductions in pollution loads.
- Companies established an internal structure for QC (quality control) and promoted company-wide productivity movements and data management for production control. They also constantly asked facility manufacturers for more efficient equipment; these manufacturers promoted technology development for cleaner production.

b.2 Information about industrial pollution control was disseminated through networking of companies.

- Industry associations, organized by industry sector, had opportunities to participate in policy development in the field of industry promotion and pollution control; the industry associations shared the same information with the government and disseminated it among the member companies. Although shareholders were competitors in the market, they shared information about industrial pollution control through study sessions and tours of companies with advanced practices.
- National level organizations worked in involving local industry associations and chambers of commerce and were influential; they disseminated information about improvement of business management, industrial policy, laws and regulations for industrial pollution control, and economic incentives for pollution control investments to local SMEs.

b.3 Pollution control investments and regulations on industrial pollution were not critical to companies.

- The high economic growth caused industrial pollution but at the same time made it possible for companies to accumulate capital, which allowed them to have the money to spare for intensive industrial pollution control in the following 10 years. Increasing market demands necessitated renewal and expansion of production facilities; companies could make investments including pollution control ones. Industrial pollution control at that time appeared to be too focused on end-of-pipe type measures. In other words, cost effectiveness of the industrial pollution control measures was not rigorously examined. This is because companies were obliged to choose the best technology over economic efficiency, because of the court decisions on industrial pollution cases and pressure by public opinion during the 1970s when intensive industrial pollution control was required.
- Increases in production costs due to pollution control investments did not matter to companies expanding their businesses. Especially to those making efforts to improve productivity through capital investments, the increased costs could be recovered from improved productivity.
- When a company established a new plant, pollution control investments in order to comply with environmental laws and regulations were a relatively small percentage of total capital investments. The pollution control investments did not become constraints to new plant development.

b.4 Companies established in-house organizations and developed human resources for industrial pollution control.

- Companies enhanced their internal capacity to control industrial pollution due to legal requirements to establish an organization to deal with pollution control and to designate pollution control managers; in effect, they established internal environmental management systems.
- It takes time for the private sector (like the public sector) to drastically change its policies, but there was a climate in which all company staff made the effort to achieve goals once they were set. Similarly, all member companies of the various industry associations tended to take the same actions once an industry-wide action plan had been adopted.

c. Citizens and Community

c.1 Citizen and community movements were the most powerful pressure on companies and local governments to take actions for industrial pollution control.

Citizens and local communities engaged in fierce campaigns against factories that caused industrial pollution problems and put pressure on polluters and governors and mayors of the local governments through civil actions and administrative litigation. Expansion of citizen and community movements greatly influenced politics.

c.2 Organized citizens expanded campaigns against industrial pollution.

Citizens formed organizations by themselves and enhanced their ability to run campaigns against pollution control. Formal public participation systems such as environmental impact assessment were not established at that time, but organized citizens made companies and local governments recognize the importance of public participation. The campaigns were carried out in each area of the nation through networking of citizen groups. Scholars, lawyers, and other experts participated in the campaigns and supported victims of industrial pollution through conducting verification of cause and effect relationships between the damages and industrial pollution and filing lawsuits.

d. Intermediation between Actors

d.1 Total social costs were not fully considered.

- As a result of insufficient countermeasures for industrial pollution control due to putting economic growth before environmental protection during the period of economic growth, economic activities caused large damages, which required enormous costs to recover and compensate victims. Society (both public and private sectors) was still burdened with costs even after private companies took necessary measures to control industrial pollution.
- It was obvious that preventive measures cost less than reactive measures after damages had been realized.
- Companies implemented measures to control industrial pollution as a response to governmental regulations and industrial accidents. Cost effectiveness of these measures was rarely estimated, and where it was done, effects of the measures were estimated as improvement in air and water quality (intermediate objective of the measures) rather than human health (ultimate objective of the measures). Since enormous health damages were caused by industrial pollution in Japan, an approach to economically evaluate improvement in human health or prevention of health damages as effects of the pollution control measures seems to be needed.

d.2 Legal resolution had a large impact on companies.

□ Victims' success in pollution lawsuits, especially the four major ones, had a large impact on companies. The legal resolution clarified conditions for damage compensation and how to prove cause and effect relationships, which indicated that companies may face damage and criminal liabilities.

d.3 Mass media played an important role in increasing public awareness.

□ Mass media reported on victims of industrial pollution and citizens' campaigns against industrial pollution, which increased public awareness towards industrial pollution as they felt that such pollution was not region-specific, and that problems might occur in their own vicinity.

d.4 Development of a proper industrial waste management market was problematic.

□ In contrast to the treatment of flue gas and wastewater, companies were allowed to treat and dispose industrial waste offsite. Since strict law enforcement in the industrial waste management sector was insufficient, many waste treaters including disqualified ones entered the market, which led to improper treatment/disposal of industrial wastes. To develop a proper treatment market, strict law enforcement is a prerequisite.

d.5 Mechanisms to rationalize production processes were developed by utility costs.

□ It was revealed that when increases in water and energy prices affected production costs, companies took actions to rationalize water and energy use in order to reduce utility costs. In fact, the two oil crises pushed companies to immediately take energy saving measures.

d.6 Service providers (pollution control facility market) were developed.

□ Demand for pollution control facilities which were needed due to laws and regulations created a market for the facilities, which created a large number of jobs. Fierce competition among facility manufactures stimulated efforts in product development and cost reduction as well as providing information about laws and regulations and economic incentives to their customers.

6.1.2 Factors Driving Company's Actions for Industrial Pollution Control

International market competition under the Japanese regulation on industrial pollution enhanced cost reduction consciousness of Japanese companies, and they increased market competitiveness and resource productivity through development and introduction of efficient production facilities and processes, which developed win-win mechanisms leading to reduction of environmental pollutants at sources.

- Factors putting pressure on companies from outside (push factors)
  - Protests by victims: There were demonstration of protests by victims of industrial pollution and civil actions claiming compensation for their damages, and most of the defendants lost the lawsuits.
  - Pressures by mass media: The mass media reported on the above cases as social problems.
  - Pressures by local governments: The local governments gave local pollution sources instructions to reduce pollution loads and concluded agreements with large enterprises in order to assure voluntary actions for industrial pollution control.
  - Revelation of environmental criminal cases by police: The police brought criminals of aggravated industrial pollution cases to trial.

- Legal control of industrial pollution: The central and local governments established systems to control industrial pollution and assured strict legal enforcement by the local governments.
- Utility costs: Accruing water costs due to the regulation of groundwater pumping and the obligation of sewer connection, and taxation of energy worked as cost pressures on companies.

➢ Factors driving companies to take actions against industrial pollution (pull factors)

- High economic growth and market expansion made it possible for companies to make investments including pollution control ones, especially during the 1970s.
- The central and local governments took measures to encourage relocation of factories.
- The central and local governments provided companies with public financing and preferential tax treatment for pollution control investments.
- Leading companies began to make positive efforts to control industrial pollution.
- The industry associations developed the networks through which information about systems, technology and financing regarding industrial pollution control was disseminated to small companies and the opportunity to exchange information among their member companies.
- Technical experts at the local industrial technology centers guided local companies regarding industrial pollution control.
- Many manufacturers of pollution control equipment realized business development.

➢ Internal factors within companies

- Many of the top managers of companies expressed their intention to tackle industrial pollution.
- Organized actions were carried out once the management decision was made.
- Companies were actively involved in production technology innovation and investment.
- Companies conducted improvement of production processes and cost analysis, which was effective in reducing pollution loads.
- Companies could foresee their capability to absorb increased costs due to industrial pollution control especially in the 1970s.
- Companies had highly capable in-house engineers.

6.2 Japanese Industrial Pollution Control Measures Useful to Developing Countries

6.2.1 Enhancing Capacity of Local Governments

- □ Secure human, material (equipment, etc.) and financial resources for implementation of measures required by laws and regulations (by local governments).
- □ Establish a window to accept complaints against industrial pollution problems and enhance capacity in holding a dialogue with the residents to solve the problems.
- □ Enhance capacity in identification and monitoring of pollution sources.
- □ As prerequisite for the above, it is desirable for countries to establish a decentralized system by which authority and responsibility for industrial pollution control are given to local governments who can relatively easily obtain information about pollution sources and the status of pollution.

6.2.2 Regulations

- □ Identify pollution sources and status of pollution. This requires introduction of a system to require possible pollution sources to register with local governments, implementation of on-site inspections, and development of monitoring and analysis capacity.
- □ Clarify rules of industrial pollution control such as analysis methods of pollutants so that those who are regulated by relevant laws and regulations can understand the contents of the control. In addition, make the control enforceable for regulators through issuing permits and conducting on-site inspections (e.g. there should be criteria for issuing permits).
- □ Put pressure on industrial polluters to improve their pollution control instead of legal penalty through dispatching experts to the pollution generators in order to give guidance on proper pollution control.

6.2.3 Development of Utility and Waste Management Market

- □ Eliminate subsidies and set utility prices that truly reflect costs of supplying such goods and services in order to enhance motivation for companies to reduce energy and water consumption.
- □ Develop a proper waste management market through clarification of rules on responsibilities of waste generators, entry and withdrawal of waste transporters/treaters, and responses to illegal waste dumping and the like.

6.2.4 Changing Corporate Attitudes by Information Dissemination

- □ Develop mechanisms to disseminate information relevant for industrial pollution control by utilizing industry associations and their federations.
- □ Train experts in SME management, increase awareness of corporate top management towards production control and business management through practical guidance on production and quality control by the experts; and integrate pollution control into production control and business management.

6.2.5 Financing and Credit Guarantee through Private Financial Institutions

- □ Arrange mechanisms by which private financial institutions can act as agents for public soft loans so that the private financial institutions can provide loans both for pollution control investments and other capital investments.
- □ Establish a credit guarantee system when collateral is lacking for loans for industrial pollution control facilities.
- □ Support private financial institutions to establish environmental assessment divisions, which is effective for appraisal.

6.2.6 Pressure on Corporate Behavior through Information Disclosure

- □ Conclude agreements on industrial pollution control between local governments and pollution sources and disclose information about the agreements and their implementation to the public.
- □ Local governments disclose names of the companies that constantly violate the emission/effluent standards in order to put pressure on pollution control managers and business owners/top executives.
- □ Require large pollution sources to conduct 24 hour monitoring and send the monitoring data to local governments having jurisdiction over the sources (local governments establish a system to manage the sent data).

6.2.7 Organizational Structure and Human Resource Development for Proper Industrial Pollution Control within Companies

- □ Develop a system to require large pollution sources to promote the establishment of an internal organization for industrial pollution control and an environmental management system.
- □ Disseminate improvement activities at point of production through introduction of CP and QC activities, and create opportunities to introduce cleaner production technologies through making production processes efficient.
- □ Develop a qualification and training system for personnel in charge of industrial pollution control in order to strengthen their capability.

6.2.8 Development of Planned Industrial Estates for Plant Relocation

- □ Develop industrial estates based on appropriate plans, require new locaters to the estates to comply with environmental laws and regulations, and guide pollution sources existing in residential and industrial mixed areas to relocate to the estates.
- □ Establish industrial pollution control facilities within the industrial estates with a partial involvement of the public sector.

6 IMPLICATIONS OF JAPANESE EXPERIENCE IN INDUSTRIAL POLLUTION CONTROL 6-1