

# 14

## Mainland China Grows into the World's Largest Source of Environmental Pollution

*Reeitsu Kojima*

### I. INTRODUCTION

The last four decades have seen one East Asian country after another become a rapidly growing industrial economy as the region has become the world's center of production. In regards to consumption, East Asian countries and territories have assimilated the high standard of material life, or the so-called American way of life, developed in the United States in the 1950s. This rapid growth both in production and consumption has given rise to serious environmental disruption. The region has become the world's most serious source of pollution.

This is inevitable as the American way of life rests upon a trinity of mass production, mass consumption, and mass waste. In this setting, however, Japan has succeeded in at least preventing further environmental deterioration after much sacrifice and through great efforts in the 1960s and 1970s. Not only have other East Asian countries failed to reach a stopping point for environmental aggravation, but in fact the situation seems to be worsening. Particularly alarming is the outlook for mainland China, with its huge population and unusually rapid economic growth and rising consumption.

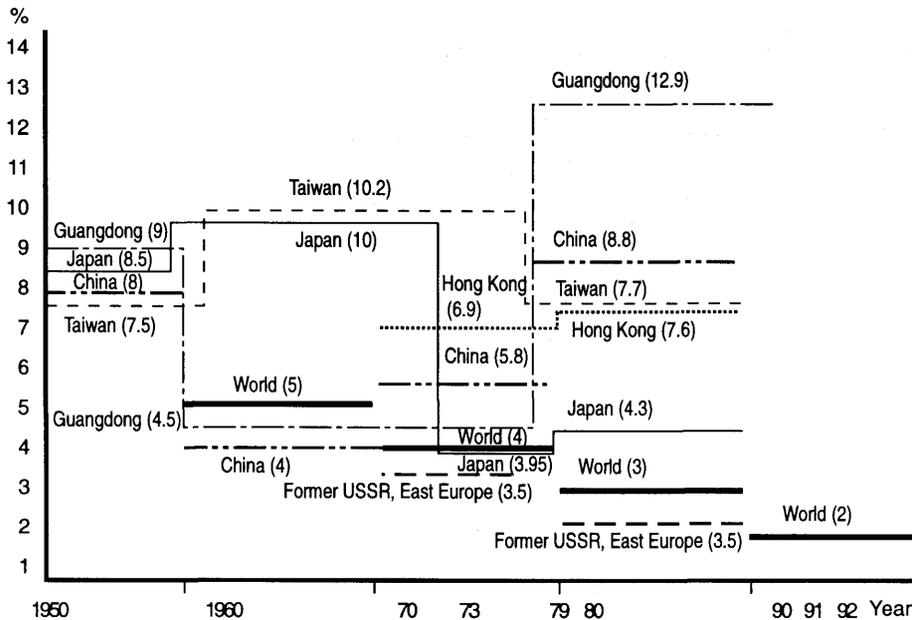
In this paper, I will describe the degree and nature of environmental destruction in China and will discuss some of the problems pertaining to pollution preventing policy measures taken in the country. I will base these observations on the Japanese experience of halting the process of environmental disruption.

### I. RAPID ECONOMIC GROWTH AND INDUSTRIAL STRUCTURES IN EAST ASIA

Over the past forty years the countries of East Asia have attained economic growth on a scale that no Western countries, and in fact very few countries in the world, have ever experienced. Figure 1 shows their growth rates.

Japan enjoyed annual real economic growth rates of 10% in real terms throughout the 18 years starting in 1955 and ending in 1973, the year of the first oil crisis. Taiwan, with a current population of 20 million, went through a similar process of fast economic growth,

**Figure 1** Comparison of Real Growth Rates for China, Taiwan, and Gaungdong Province

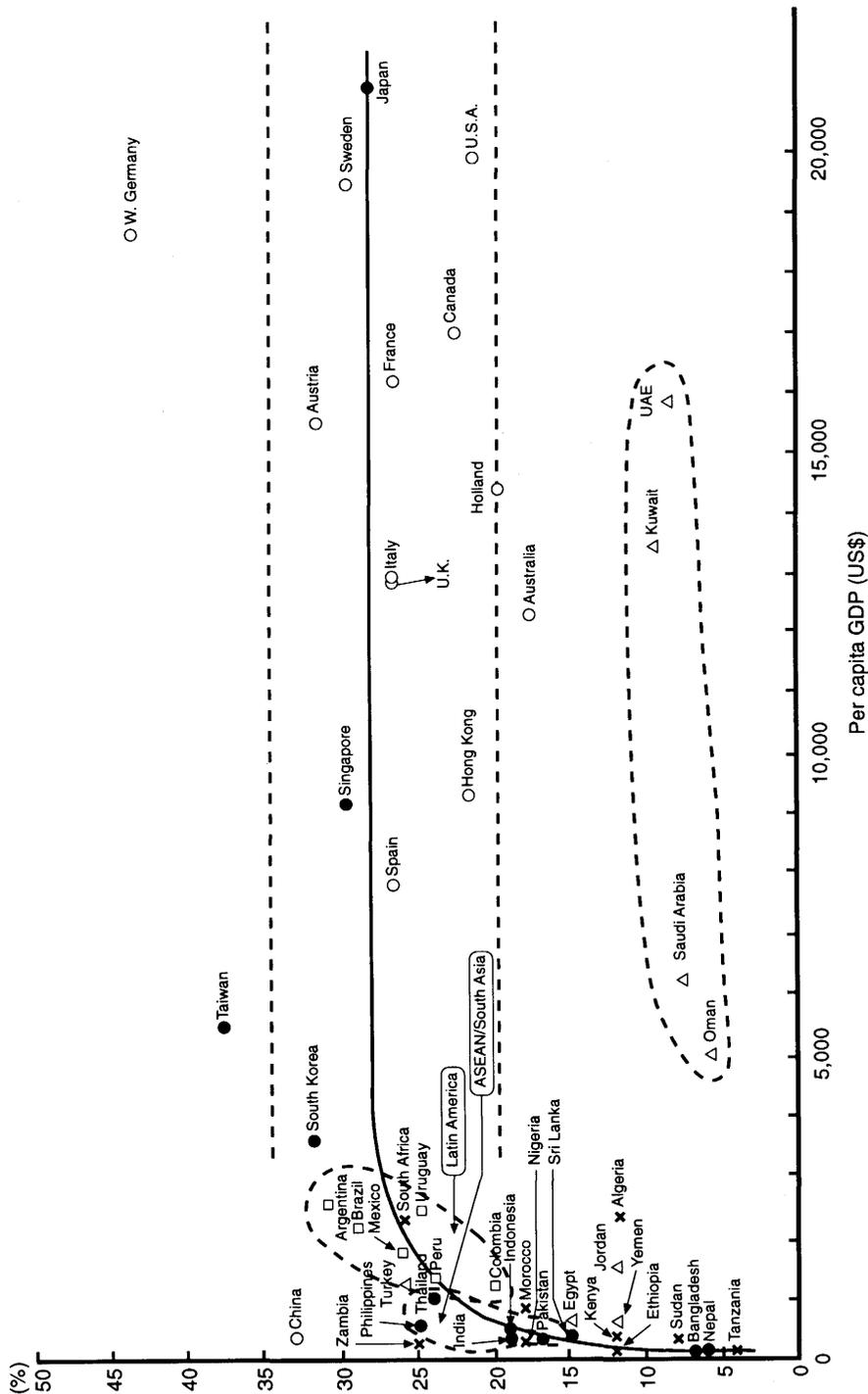


expanding its economic size 4.7 times in the 16 years starting in 1963. Since the second half of the 1960s, South Korea with its 45 million people has achieved a similar level of growth.

Mainland China, with its vast territory and immense population, entered a high growth phase in 1979 and has maintained this pace ever since. The country's period of super-growth has lasted for 15 years so far. Because China has a population of 1.16 billion people, in fact double the African population, its rapid economic growth does not compare in importance with that of a country of tens of millions of population. Guangdong Province, in particular, has maintained an unusually rapid annual growth rate of 12.9% over the past 15 years. This province alone holds 63 million people, approximately the same as the South Korean and Taiwanese populations put together. The size of the province's economy in 1993 was 6.2 times that in 1979. No society has ever sustained such growth over such a long period of time. In fact, Guangdong has set historical growth records. Though this rate is expected to slacken slightly in the future, it can be safely predicted that the provincial economy, with its large source of cheap labor in the hinterland, will continue to grow at an annual pace of 9-10% until the year 2000. If so, this province will have sustained a supergrowth pattern for two continuous decades. Its economic pie will be more than 12 times larger in 2000 than in 1978.

In Figure 1, China's economic growth is compared with the world average as well as with the rates of selected countries. In the 1960s, the world economy expanded at an annual rate of 5%, but the rate has declined decade after decade to 4% in the 1970s, 3% in the 1980s, and in the 1990s is expected to hover in the vicinity of 2%. This is accounted for largely by the stagnant U.S., Japanese, and German economies which represent 50% of the world's aggregate GDP.

Figure 2 Per Capita GDP and Share of Manufacturing in GDP (1988)



Sources: The World Bank, *World Development Report 1990*, pp. 178, 179, 182, 183; for Taiwan, *Taiwan Statistical Data Book*, 1989, p. 41.

It is necessary to point out that the East Asian economic growth has been made possible by industrial expansion centering on manufacturing industry. This is a particularly important point when discussing environmental issues, as indicated in Figure 2. The share of manufacturing in GDP ranged from 20-25% in 1990 for the advanced countries of Europe and America. The corresponding figures were 29% for Japan, 31% for South Korea, 34% for Taiwan, and 38% for China. For Germany the share is 31%, and it suffers more seriously from industrial pollution than any other advanced countries of Europe and America.<sup>1</sup> It should be noted that the figures for East Asian countries are by far larger than most European and North American countries. The shares for other large population countries are much smaller: 19% for India, 17% for Pakistan, and 20% for Indonesia.

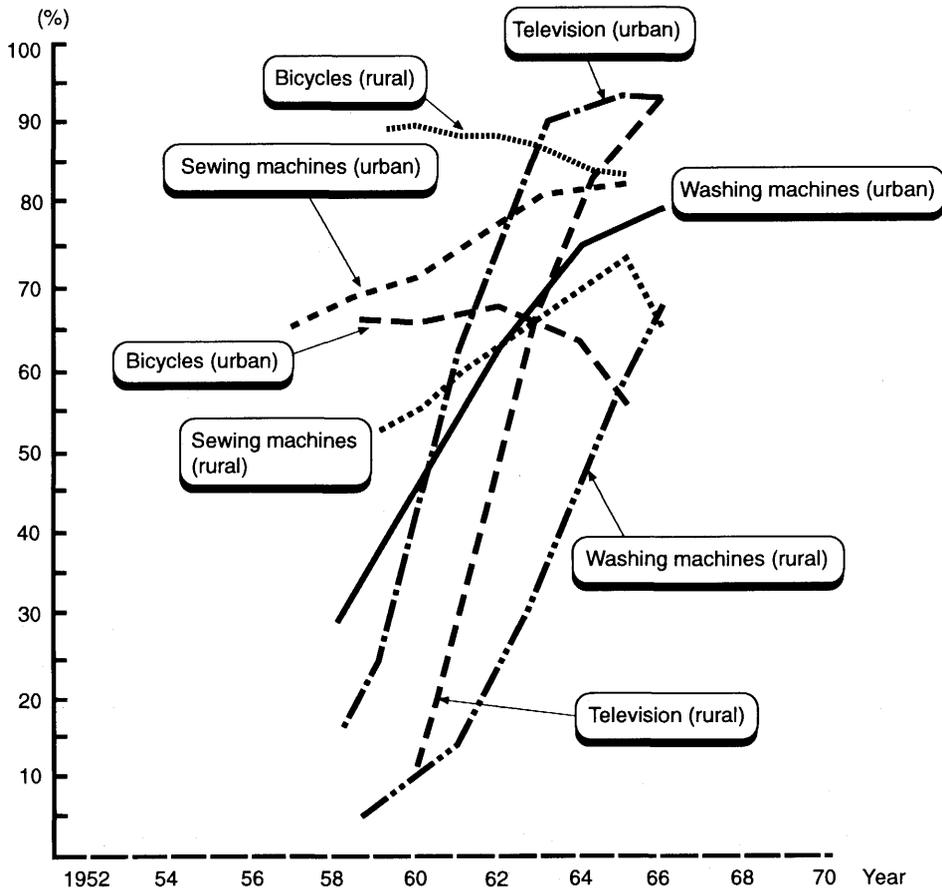
If we examine the breakdown by manufacturing sector branch, we find that heavy and chemicals, which is known as the major source of pollution, carries an extremely heavy weight in East Asian countries.<sup>2</sup> Its share in the manufacturing sector was 51% for China in 1991 and 56% for Taiwan in 1990, while the corresponding figures for advanced industrial countries were 53% for Japan in 1986, 51% for the United States in 1985, 55% for the United Kingdom in 1986, and 69% for West Germany in 1986. This comparison shows that in terms of heavy and chemical industrialization rate mainland China and Taiwan are already abreast of the advanced industrial countries, with the exception of West Germany, whose figure is unusually high.

## II. CONSUMPTION—THE RAPID SPREAD OF THE AMERICAN WAY OF LIFE

The American way of life represents a culture of a high material consumption, as symbolized by the personal ownership of passenger cars and TV sets. This lifestyle spread fast among American families in the 1940s and 1950s. Homes were equipped with electrical appliances which drastically reduced housewives' home work. Television not only created a uniform perception of social affairs among the people but also brought them in touch with the consumption patterns of people outside their communities. The effect of this was to universalize a certain consumption pattern throughout society. The demonstration effects of television are immense, particularly for those living in low income areas, and impell them to strive to catch up with higher levels of consumption in other areas. Personal automobiles also serve to expand individuals' geographical range of activity. While many people once spent their lives within a range of five kilometers or so from their domiciles, they now consider an area in the range of 20-30 kilometers to be their area of daily activities.

In Japan, this process began in the second half of the 1950s with the widespread use of transistor radio sets, followed by bicycles, television sets, electrical washing machines, refrigerators, and vacuum cleaners, which in 10 years' time came to be owned by 80% of Japanese households. In the 1970s, Japanese families began to obtain air conditioning equipment and passenger cars, and in 10 to 15 years these too spread to more than 80% of all households.

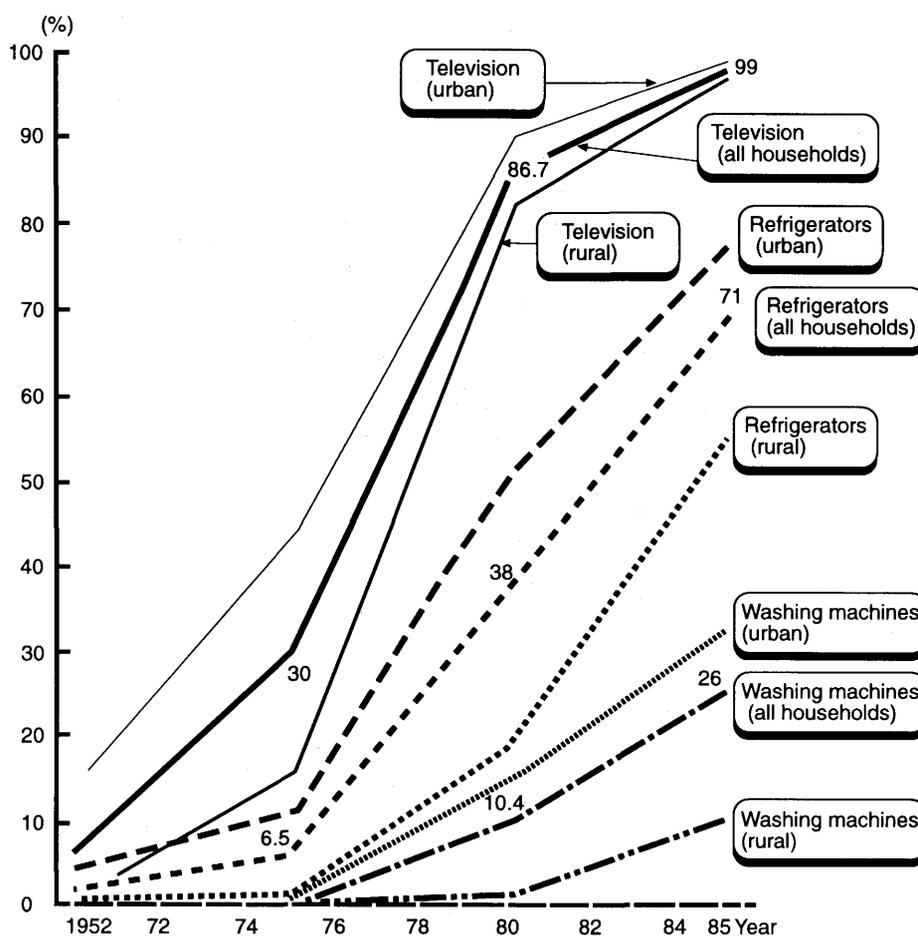
This consumption pattern was followed first by Hong Kong in the 1960s, then by Taiwan in the second half of the same decade, and finally by South Korea in the 1970s. In Taiwan, air conditioning equipment and personal cars spread quickly in the 1980s. South Korea entered a period of expensive consumer durables in the second half of the 1980s. This trend is gaining momentum with every passing year.

**Figure 3** Saturation Rates of Consumer Durables in Japan (per Households)

Source: Economic Planning Agency, "Consumption Trends Survey."

What about China? First, a yawning income gap exists between cities and countryside. China also is far larger in territory than Japan and its neighbors. For these reasons, it will certainly take a long time for consumer durables to saturate the whole country. Regional differentials within China are inevitable. The situation is sketched in Figure 5. TV sets began to be widely owned in the cities in 1979, the year economic reforms got under way. Ten years later, in 1988, TV saturation hit the 100% mark. By 1990 more than 10% of the urban households had more than one set, and the saturation rate reached 111%. Comparable rates for washing machines and refrigerators in urban areas are expected to climb to 100% around 1995. Thus, the first stage of consumer durables saturation, namely, the pre-car/air conditioner stage, will be fully reached around that year as far as the urban areas are concerned.

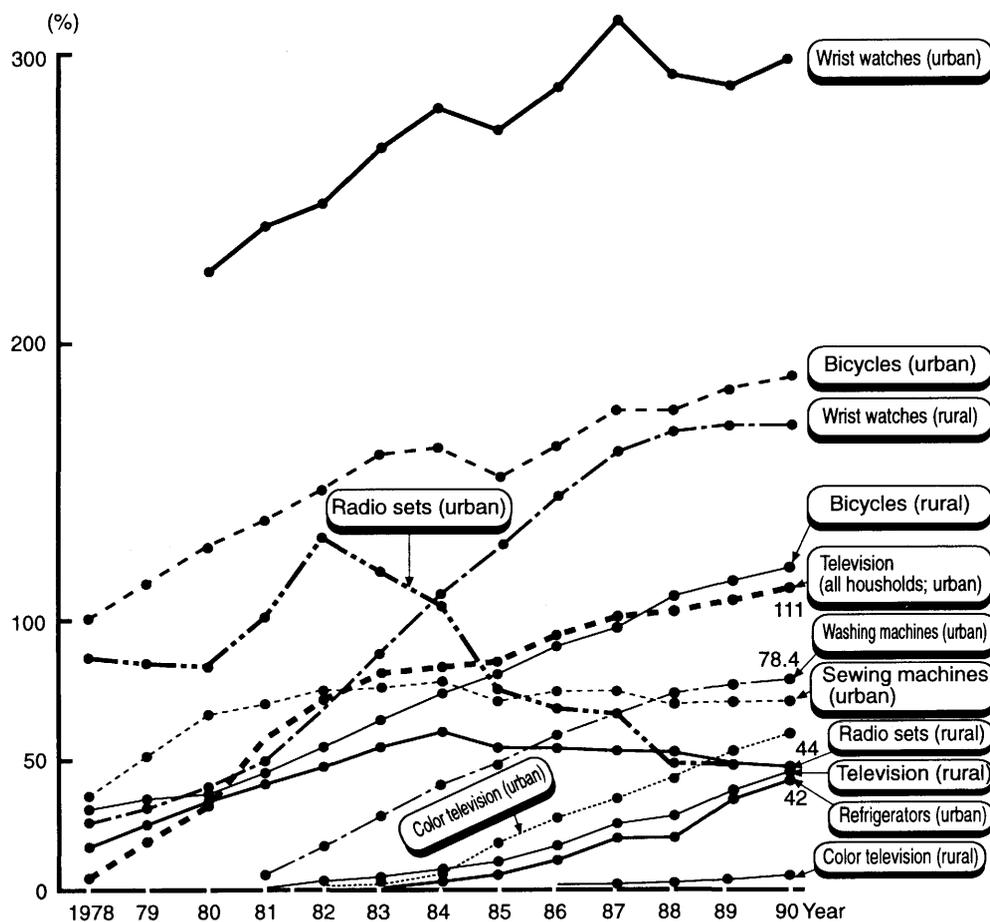
In contrast, the rural areas which hold 75% of the Chinese population (about 800 million people) lag behind. This rural population can be broken down into 250 million who live in relatively rich suburban villages, 250 million who earn average incomes, 250 million poor

**Figure 4** Saturation Rates of Consumer Durables in South Korea

Source: *Korean Social Indices*, 1991, p. 315.

farmers, and 60 million who are destitute. Television began to penetrate the first group around 1983. At present 60% of all rural households own TV sets. It is likely that 80% of the high income rural households will obtain refrigerators and washing machines by the year 2000. The rural population in the average income bracket will enter the first stage of mass consumption around 2006-2007, 20 years after they began to buy first consumer durables. For the poor areas, consumer durables began to penetrate in 1990. The first stage of mass consumption will arrive around 2010.

The second stage characterized by the spread of personal cars and air conditioners already began in Guangzhou City and its neighborhood, Shantou peninsula, and a series of suburban rural areas with prosperous village and township industries in Jiangsu, Anhui, and Zhejiang provinces. In these areas, motorcycles have become extremely popular as pre-passenger car consumer articles. In Shanghai, Beijing, and Tianjin, administrative ceilings have been set on the number of personal cars used in their jurisdictions, and as a result there has been no conspicuous increase, though government owned cars and taxi cabs have

**Figure 5** Saturation Rates of Consumer Durables in China (for 100 Households)

Source: Taken from *China Statistical Yearbook*.

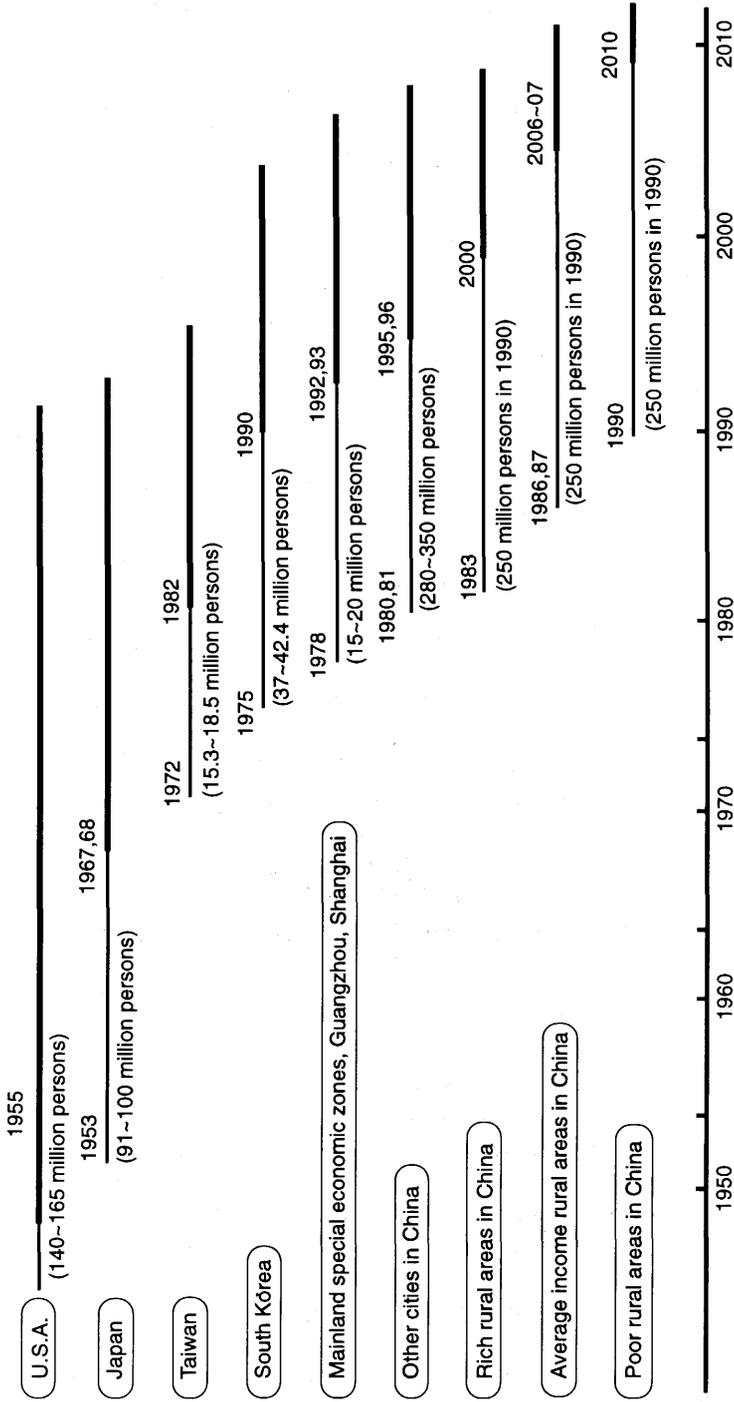
proliferated. But surveys now show that passenger cars are high on the list of urban dwellers' lists of future priority purchases.

From this analysis, the pattern of arrival of mass consumption in East Asia has been idealized in Figure 6. Japan started the trend in the 1950s, and the East Asian countries and territories have reached the mass consumption stage one after another at certain intervals.

Attention should be paid to the sheer sizes of the population groups indicated as "mainland and other cities" in the figure. These are huge groups, each comprising 250-300 million persons. They are successively entering into the mass consumption era in four stages.

One salient feature of the mass consumption period is the use of large quantities of disposable items. This is beginning in Chinese cities. The spread of foamed styrene for lunch boxes, containers for McDonalds, Kentucky Fried Chicken and other fast foods, and plastic containers for cosmetics and seasonings is symptomatic. Waste from family consumption will certainly increase along with industrial wastes.

**Figure 6** Arrival of the Era of Mass Consumption by National and Population Group



Note: Fine lines represent the stage of spread of the three durables (televisions, washing machines, and refrigerators); thick lines represent the stage of spread of other more expensive durables (typically personal cars).  
 Source: Compiled by the author.

The general use of washing machines also will increase consumption of synthetic chemical detergents, which naturally pollute river waters.

### III. CHINA'S INHERENTLY NEGATIVE ENVIRONMENTAL CONDITIONS

I have thus far described how the East Asian countries and territories have entered their high growth orbits with mass consumption patterns, and how in China mass consumption is overtaking one income group after another. Environmental disruption has invariably occurred in high growth periods characterized by mass consumption. From the environmental point of view, however, it should be pointed out that conditions that relate to environmental conservation differ significantly in China compared to Japan and other peripheries, for instance rapidly industrialized Asian NIEs. China is plagued by decisively negative environmental circumstances.

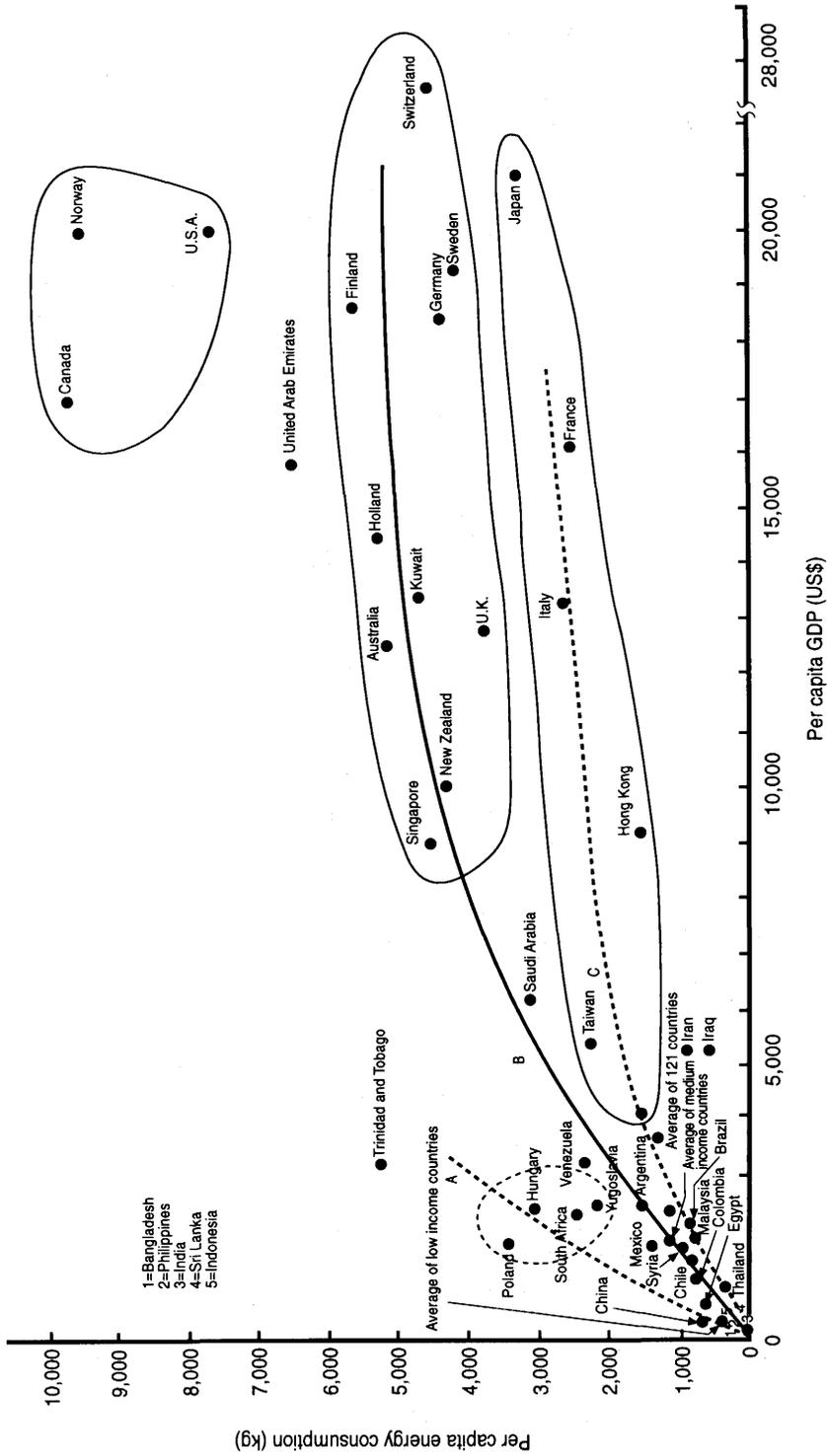
First, its natural conditions are more severe. In particular, precipitation is much lower than that in Japan and other peripheries. Tokyo enjoys an annual precipitation of 1,800 mm, compared to 500-700 mm for Beijing. The region north of a line drawn slightly north of the Yangtze River is a dry area with only 500-700 mm precipitation per year. In Shanxi, Gansu, and Xinjiang provinces, the figure is as low as 400-500 mm a year. If we look at the vast plains, we see that Chongqing in Sichuan Province is far inland, 2,500 kilometers from the mouth of the Yangtze River but that its altitude from sea level is a meager 230 meters. By contrast, Japan and the peripheries are characterized by steep mountainous terrains. The Japanese archipelago's coastal stretch reaches 30,000 kilometers, but China's by contrast is only 12,000. This means that the ocean's capacity to wash away pollutants is very weak. With these circumstances, China has located most of its industries in inland regions. This is a marked difference between China on the one hand and Japan and other peripheral areas on the other.

These facts point to China's decisively weak natural capacity to cleanse pollution compared to Japan and other peripheries.

Second, China depends on coal as its primary source of energy. It currently relies on coal for 86% of its commercial energy supply (excluding wood and plant stems). This composition will not change in the foreseeable future. This is another difference between mainland China and the peripheries including Japan. China's coal consumption is estimated to reach 1,800 million tons in 2000.

This dependence on coal has three negative impacts on the environment. First, coal has an extremely low thermal efficiency. Figure 7 shows a cross-section of per capita GDP (1988) and per capita energy consumption. China is located near the origin. Countries are generally subdivided into four groups with respect to this relationship. The least energy-efficient group consists of East European countries. Canada, the United States, and Norway form another group with both high incomes and high energy consumption. West European countries generally fall into a third category represented by line B. Taiwan, Hong Kong, South Korea, Italy, France, and Japan are located along another line C, which indicates high energy efficiency. 1988 GDP per capita per ton of standard oil was \$6,370 for Japan, \$2,144 for Hong Kong, \$2,432 for Taiwan and \$2,400 for South Korea as compared to a poor \$569 for China. China's figure was just one eleventh of Japan's. It is thus likely to follow the steps of East European countries in energy inefficiency.

Figure 7 Per Capita GDP and per Capita Energy Consumption (1988)



Sources: The World Bank, *World Development Report 1990*, pp. 178, 179, 186, 187; for Taiwan, *Taiwan Statistical Data Book, 1989*.

Dependency on coal increases environmental burdens. Coal has a larger sulfur content than either petroleum or natural gas. The sulfur content of the coal generally used in China is 1.7% but that from the southwestern regions has a 3% sulfur content.

Moreover, disposing coal cinder poses a serious problem. A 100,000-kw or larger coal-burning power plant located in an inland area produces such a large quantity of cinder that after a certain period of time no disposal facility can cope with it. At present, the cinder is being discarded into farmlands, lake coasts, and river banks.

Third, environmental disruption is caused by the lavish use of chemical fertilizers and agricultural chemicals. Generally, there are two ways of developing agriculture: the widening method by which cultivated land is increased, and the deepening method in which harvests per unit of area are increased. In most Asian countries all arable lands had been brought under cultivation before the onset of modernization. This was a reflection of the high level of civilization they had attained. In this sense Asia differed from America or the former Soviet Union, where in the course of modernization cultivated areas had to be doubled or trebled in order to cater to their burgeoning population, and in particular their urban populations. In China, population has about doubled since 1950 but cultivated land area has declined 6% since reaching a peak in 1957. China is in fact the only country in the world where the cultivated area has experienced minus growth in absolute terms in the process of modernization and attendant population explosion.

Under these circumstances, there is no way other than the profuse use of fertilizers to develop agriculture in China. The administration of large quantities of nitrogenous fertilizer will increase fertilizer residue in the earth, and the residue will eventually turn to nitric acid and pollute subterranean water. Pesticides and other agricultural chemicals used in large doses will spill into rivers and prevent the growth of aquatic plants. In particular, this destroys algae beds in shallow delta waters. Algae beds are where aquatic microbes and small fish proliferate. The decreasing reproductive capacity of small fish immediately affects the medium- and large-sized fish that feed on them. It is easily surmised that such negative phenomena are already occurring in many places in China.

Fourth, the development of township and village industries in rural areas needs to be examined.

Since 1958, when people's communes were established, China has implemented a policy of preventing the growing rural work force from flowing into cities. To facilitate this policy goal, the creation of industrial enterprises in rural areas was encouraged in order to absorb surplus rural labor. Under the impetus of the rural reform program which was launched in 1979, township and village enterprises have experienced spectacular growth. At present they provide jobs to 100 million people, about equivalent to the employees of state enterprises. Township and village enterprises mushroomed not only along the coasts but in inland areas as well. Already by 1990 these enterprises accounted for 25% both of China's total manufacturing output and total export value. It is true that medium and small enterprises played important roles in the economic development of Japan and Taiwan, but in the Japanese case these enterprises were located, until the early 1970s, in urban rather than rural areas.

Individually small enterprises discharge smaller amounts of industrial waste and pollute water than do large ones, but the cost of disposing such small quantities is much higher in relative terms than for the large quantities discharged by large enterprises. It should be remembered that in Japan the last application of anti-pollution laws was against medium and small firms. A thorough application of the PPP principle (polluter's responsibility) would have unduly raised the business costs involved and would have deprived the enterprises of

their market competitiveness. The same can certainly be said for China. The larger the number of medium- and small-sized township and village enterprises, the more serious is the danger that they will spread pollution all over the country.

Fifth, China's urbanization has been swift.

During their periods of economic development, the advanced countries of Europe and America saw their city populations grow by 2% or less per year. Even when cities expanded exceptionally rapidly, their annual population growth rate rarely exceeded 3%. Japan broke this precedent. Twice in its modern history, namely in 1930-40 and in 1950-60, the Japanese urban population exploded by an annual 6% and 6.6%, respectively. The corresponding figures for Taiwan and South Korea in their high growth periods were 4-5% and 5-6%. After the hectic growth phases ended in the 1980s, the increases slackened slightly.

Because China strictly controlled its process of urbanization, urban population growth grew at just 1.4% in the 1960s and 1970s. In the 1980s, however, urbanization asserted itself in spite of administrative regulations, leading to an annual rate of 5% throughout the decade. In light of the urban history of advanced industrial countries, it is all too clear that annual urban population growth rates of 4% are far beyond the capacity of any city. But this is exactly what is happening in China.

China has thus entered into a period of rapid urbanization and has seen a consequent leap in household waste and sewage.

#### **IV. DEVELOPMENT OVER TIME OF ENVIRONMENT MEASURES AND THEIR ACHIEVEMENTS IN CHINA**

I will now refer to three points: (1) environmental policies, (2) degree of environmental improvement, and (3) the current level of environmental investment.

##### **1. Development of Environmental Policies**

The development of environmental policies in China has followed a different pattern than that in Japan. In Japan, the motive force driving legislation was the anti-pollution struggle waged by the victims of mercury pollution at Minamata. Popular resistance forced the government and corporations to adopt environmental policies. The victories of popular resistance in four major pollution trials symbolized the pressure from below against the government that led to the introduction of environmental policies. In China, by contrast, environmental policies were introduced from above, by the government, as it learned from overseas sources about the seriousness of environmental destruction. This pattern basically remains unchanged.

It was at the 1972 Stockholm United Nations Conference on the Human Environment that the Chinese Communist Party leaders first learned about the environmental pollution resulting from industrial development. The country's environmental policies thus have but 20 or so years of history.

This history can be divided into three phases. The first started with the First National Conference on Environmental Protection, held in 1973, and ended with the 1984 Second Conference of the same title. In this period the government set up administrative structures to cope with environmental issues. An environment preservation guidance unit was set up at the central government level, followed by the creation of local administrative structures. In

December 1982, the State Environmental Protection Bureau was set up as a permanent organization.

The second phase began with the Second National Conference on Environmental Protection and lasted until the third conference in 1989. This period saw the formulation of environmental legislation and concrete environment protection programs. In Japan, most of the environmental laws were made between 1967 and 1974. In 1967 the Basic Law for Environmental Pollution was adopted, followed in November 1974 by the Law for the Preservation of the Seto Inland Sea. China's second period seems to correspond to these seven years. It was also in this period that local governments at different levels organized environment monitoring and research systems. From 1985 through 1987, China's first industrial pollution survey was conducted. This was presumably the largest scale survey ever carried out on Chinese state sector enterprises. The basic pollution situations of 168,000 out of the 400,000 enterprises were investigated and put on record.

The third phase ranges from the Third National Conference on Environmental Protection in April 1989 until today. This may be characterized as a period in which environmental laws have been encouraged to penetrate society. The efforts in this period have been based on a long-term program on environmental conservation covering the period up to the year 2000, which was adopted at the Third National Conference. It should be added, however, that the environmental legislation applies only to cities, and that the environmental situation in the vast countryside has been left untouched. It was only in 1990 that environmental surveys were initiated in the rural areas which comprise 15 million township and village enterprises. Pollution surveys in the countryside involve colossal funds and personnel. It took seven or eight years to complete the survey and monitoring systems for cities. In the countryside, 10 years seem to be the minimum period for creating functional systems. It will be close to the year 2000 before a general picture of rural environment situations becomes available.

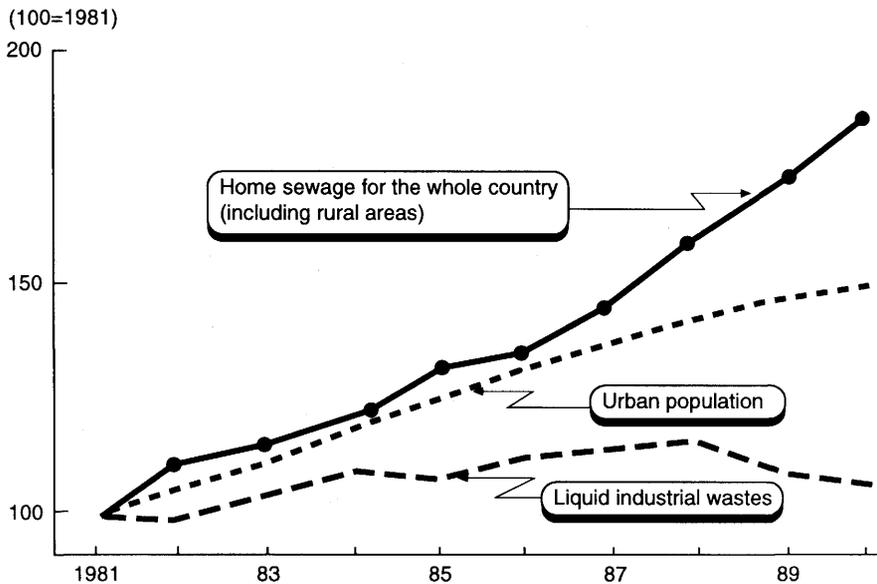
Three methods have been proposed as means to alleviate and prevent environmental pollution. The first is to use the government's administrative powers. The second is public monitoring. The third is market mechanisms. The first operates most effectively.

In 1979 the government introduced the so-called "three simultaneous" policies based on Article 6 of the Environmental Protection Law (tentative) of 1979. This means that factories should be equipped with anti-pollution facilities not only when they are built as new projects but when they are remodelled or enlarged. Obviously, existing large factories have thus been exempted from obligations under this law. This provision in fact applies mostly to major projects involving the remodelling of existing factories. The Law for the Collection of Fines on Discharge of Pollutants, which went into force in February 1982, set fines against enterprises that discharge pollutants of a density above a governmentally set level.

In regard to the enforcement of punitive measures, "environment administration offices" were established at the end of 1989 at different administrative levels: 18 at the provincial, 229 at the ward, and 758 at the county level. Since there are 30 provinces and 2,300 counties in China, only one third or so of these local administrative units have been equipped with environmental regulation enforcement units as of the end of 1989.

This implies that environment-friendly improvements of existing state-owned factories have yet to start. It is also clear from the above analysis that China's environmental policies are organized around the idea of monetary penalties.

It therefore follows that the most urgent tasks facing China's anti-pollution program pertain to how far urban state-enterprises carry out environment-sensitive improvements and

**Figure 8** Rapid Increase in Home Sewage Accompanying Urbanization

Source: Reetsu Kojima, "Tairiku Chugoku" (Mainland China), Fujizaki Shigeaki ed., *Kaihatsu to Kankyo (Development and Environment)*, Institute of Developing Economies, 1993, p. 99.

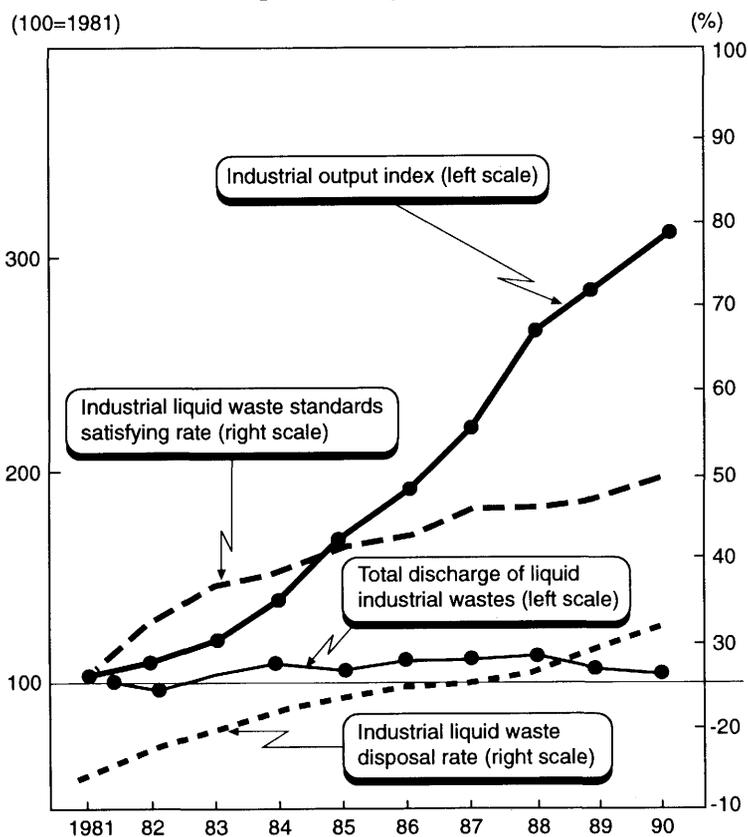
how thoroughly the "three simultaneous" policy coupled with the collection of fines is implemented toward medium and small enterprises in the countryside.

## 2. Achievements and the Present State of Affairs

Figures 8 and 9 illustrate the present state of affairs for liquid wastes. Both figures are confined to cities, and ignore the countryside. Figure 8 indicates that the volume of discharged industrial liquid waste began to diminish in 1988. This shows that intra-factory water recycling equipment has been introduced, albeit slowly. The volume of home sewage, however, shows no sign of decline, and this suggests that in cities household sewage is becoming a more serious problem than liquid industrial wastes. The total volume of liquid industrial wastes is declining in spite of a sharp rise in industrial output. Also improving steadily are the ratios of industrial liquid wastes disposed to the total volume of discharge of such wastes as well as the ratio of liquid waste satisfying the government environment standards to the total volume of such wastes. But the absolute levels are still low: roughly 30% for the former and 50% for the latter. It is clear that further efforts are necessary.

On the question of liquid wastes, the following conclusions may be drawn: nothing has yet been done in the countryside; though there are signs of improvements concerning industrial wastes, household sewage has emerged as the major pollution source, and yet no effective remedies have been implemented; improvement has been seen only with regard to liquid wastes from state-run factories in the cities, a tiny fraction of the national total.

**Figure 9** Industrial Output Growth Rates and Improvements in the Disposal of Liquid Industrial Wastes



Source: Same as Figure 8, p. 95.

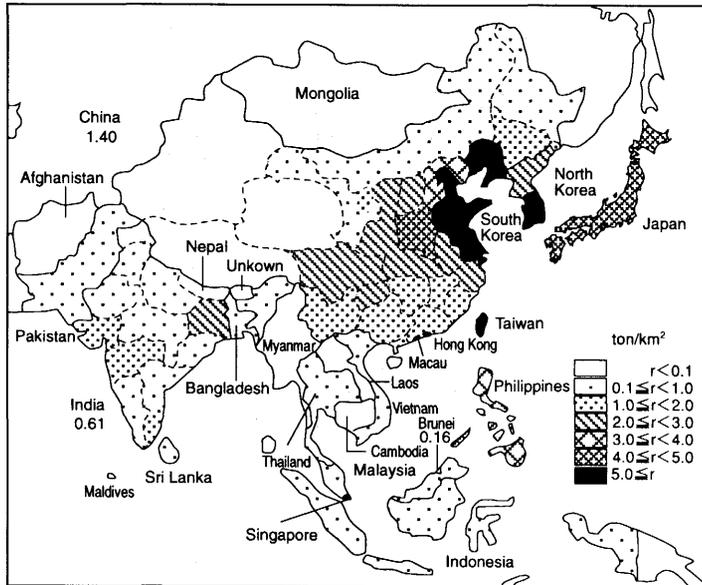
In terms of atmospheric pollution, data about SO<sub>x</sub> and NO<sub>x</sub> are shown in Figures 10 and 11, which includes two charts made by the Japanese Science and Technology Agency's Institute of Science and Technology Policy. The figures compare 1987 with 1980.

What they show is that there was great improvement in Japan concerning SO<sub>x</sub> in the period under review. In China, by contrast, areas with five or more tons of SO<sub>x</sub> emission per square kilometer have proliferated. Other areas which had very low figures in 1980 saw rapid deteriorations in subsequent periods. A similar tendency is observed for NO<sub>x</sub>. The deterioration has been particularly serious in economic centers, especially those in the North. Major cities have begun to undergo the process of motorization, though most cars are still taxi cabs and official cars. Air pollution in these cities will increasingly be a result of automobile exhaust in addition to industrial gaseous wastes and smoke from home heating.

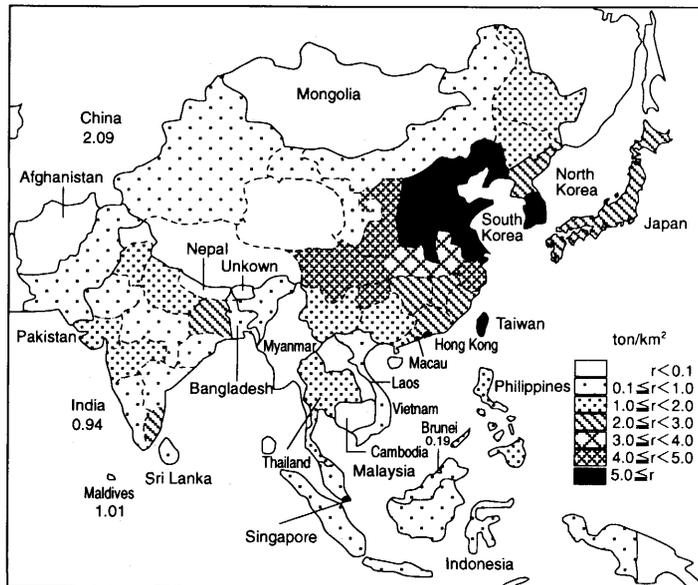
Unlike water pollution, there are no signs of improvement in atmospheric pollution.

**Figure 10** Geographical Distribution of SO<sub>x</sub> Emission in Asia per Unit Area

(1) 1980



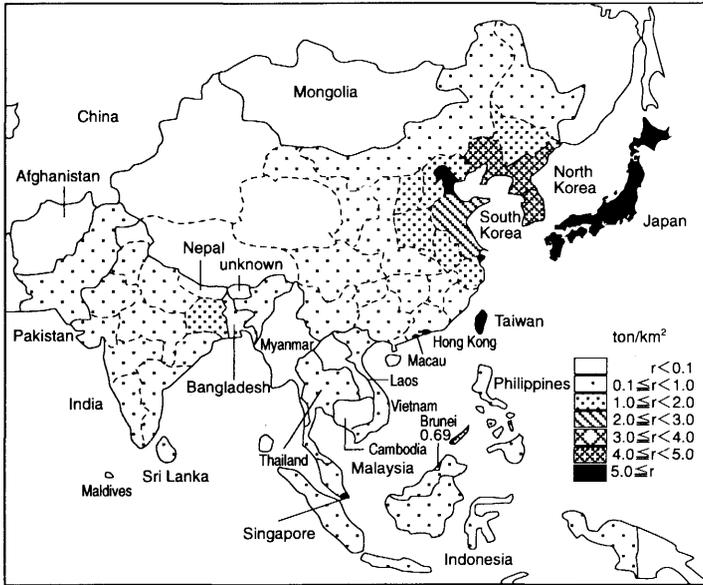
(2) 1987



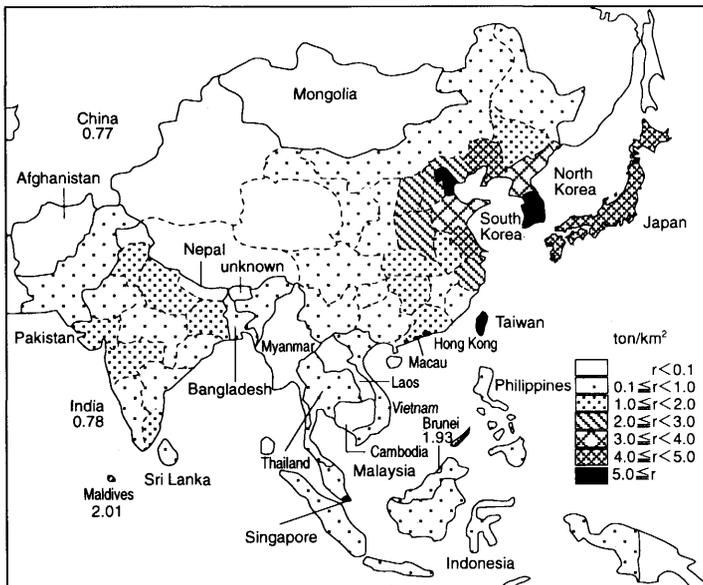
Source: Institute of Science and Technology Policies, STA, ed., *Asia no Energy Riyo to Chikyu Kankyo (Energy Utilization in Asia and the Global Environment)*, 1992, p. 193.

Figure 11 Geographical Distribution of NOx Emission in Asia per Unit Area

(1) 1980



(2) 1987



Source: Same as Figure 10, p. 217.

### 3. Investment in Environmental Protection

The environment is ultimately protected by investments into its improvement. No matter how many conferences the government and the Communist Party hold, pollution won't diminish unless investments are actually made. In the early 1980s the advanced industrial countries made relatively large investment into environmental protection. In that period, the share of environmental investment in GNP was estimated at 1.3% for Japan, 1.8% for the United States, 1.85% for West Germany, and 1.1% for France.<sup>3</sup> With these GNP fractions funneled into the environment, these countries more or less succeeded in stopping further environmental deterioration.

How about China? In 1990, government statistics claim that 0.7% of GNP was invested for the purpose. The Environment Protection Program adopted by the Third National Conference on Environmental Protection<sup>4</sup> projected that 1% of GNP invested in environmental protection would help only to prevent further environmental deterioration, 1.6% would improve the situation somewhat, and that 2.4% would suffice to basically overcome pollution problems.

But the stated Chinese environment investment/GNP ratio seems exaggerated, as GNP figures used in China are grossly underestimated. Though this is not the place to examine in detail the reasons for this underestimation, I will mention three factors in passing: first, administrative service costs, including military and police expenditures, are counted as part of GNP in European and North American countries, but are not counted in China; second, China's accounting units are very large, resulting in the exclusion from GNP figures of otherwise counted internal transactions; and third, various intra-enterprise services are not subject to independent accounting and so are not reflected in GNP calculations. Adjusting these aberrations lowers the Chinese environment investment/GNP ratio to an estimated meager 0.28%. China's real investment in this area in fact is certainly extremely small.

Earlier I mentioned the poor environmental conditions special to mainland China. Because of this situation, according to my revised calculation no improvement would actually take place unless the said ratio were raised to 2.5-3.0%. In this light, the actual figure, 0.28%, is inordinately low.

## V. IN LIGHT OF THE JAPANESE EXPERIENCE

From the late 1960s through the 1970s, Japan managed to prevent further aggravation of environmental problems through the following dynamic: first pollution victims and people's movements launched protest actions, which the media made into a major public issue; public opinion influenced local assemblies through elections, and these bodies became increasingly aware of the gravity of the issues; all of which created pressure to bear on the government and enterprises to take effective counter-pollution measures. In this process, three points should be singled out for emphasis.

First, the anti-pollution public opinion was steadily built through the activities of the pollution victims, support groups, and journalists. This was basic to the whole process. Without vociferous public opinion, local and central governments would not have taken action.

Second, the policies of the central and local governments worked. They adopted a series of tax, financial and other measures to induce enterprises to invest in pollution preven-

tion. The central and local governments played important roles as buyers and users of a whole range of equipment and machinery designed to dispose of industrial wastes as well as home garbage, used items, and other waste. If it had not been for this official demand, the counter-pollution equipment industry would not have developed.

Third, the government and a polluting company were defeated in the Minamata disease court case in March 1973. This dealt a decisive blow to the corporate world. Japanese companies learned from this trial that once they caused pollution they would incur enormous costs in settling and would suffer an immense loss in corporate image. They began to develop technologies to help cut wastes. The most typical technology was one which enabled industrial water to circulate inside a factory. Japanese companies learned then investment in pollution prevention technologies would lead to larger profits.

From this angle, the circumstances surrounding China's environment policies differ from the Japanese case. First, popular protest movements and media revelations of pollution incidents are both extremely weak in China. The Chinese political system explains why this is so. Second, Chinese policy centers on the "three simultaneous" policies and pecuniary penalties while fiscal and financial inducement measures are very weak. In 1983, the government spent 2,080 million yuan in subsidies and 1,150 million yuan in loans to support enterprises to take anti-pollution measures. Subsidies of this nature plummeted to 1,450 million yuan by 1987 while loans for this purpose were 1,730 million yuan in the same year.<sup>5</sup> The overall total fell.

In terms of the third point, in spite of progress of economic reform, state enterprises are basically oriented to fulfilling government-given production targets and not toward the market. There is little need for them to care about corporate images. Also, under the existing system, a polluting enterprise can continue operations simply by paying monetary penalties. Because of the lack of market criticism, no mechanism exists to persuade enterprises into pollution preventive investment for the simple reasons of profiting from it.

In summary, it is impossible not to conclude that the Chinese environment situation will further deteriorate in the future.

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#### Notes

1. In Figure 1, the West German manufacturing rate for 1989 takes an unusually high figure of 45%, but *The World Development Report 1992* puts the rate for Germany at 31%. This reflects the annexation of East Germany.
2. For Mainland China, State Statistical Bureau, *Chinese Statistic Yearbook 1992*, p. 416, China Statistics Publishing House, 1992; For Taiwan, Council for Finance and Statistics of State Administration, *Statistics Almanac of Republic of China*, Republic of China 80, 1991, p. 438; for others, Yano Kotaro Memorial Assn. ed., *1989 Nihon Kokusei Zukai*, Kokusei-sha, 1989, p. 229
3. Hidebumi Imura, "Kankyo Hozen Hiyo no Doko," (Trends in Environment Conservation Costs), *Kankyo Kenkyu*, No. 42, 1983, p. 88
4. *Environmental Yearbook of China 1990*, p. 39
5. *Ibid.*, p. 432