Invited Paper

Sustainable Development and Minamata Disease Some Lessons from Japan's High-Speed Economic Growth

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Chapter 1 Introduction

Because of the impact of economic growth on the earth's environmental capacity, various environmental problems, such as global warming, water pollution, large-scale waste accumulation, and so on, are increasing everywhere in the world and the future of our global life support system is threatened today (Meadows *et al*. 1992).

In East Asia, after the second half of 1980, economic growth saw a period of high-speed industrialization and urbanization, and the region's market share of world trade began increasing from 4.4% in 1974 to 17.4% in 1994. One result is that various pollution problems, including mercury poisoning, are being created in countries of the region such as China, Philippines, Vietnam, Thailand, and Indonesia (Harada 1995). The Chinese government officially recognized China- Minamata disease in 2000. And these countries can be said to consider the High-Speed Economic Growth of Japan as the development model.

In this context, especially after the "Earth Summit" in 1992, a search began for a new growth alternative, which could continue to develop permanently while keeping the global environment ecologically sound. With that in mind, investigations began on how to build a social system which would not be environmentally destructive. This new area of subject is known as the "integrated governance of environment and economic growth" (OECD 2002). Such research will inevitably need an interdisciplinary approach.

"Sustainable Development"[1] (or 'SD' for short) consists of regaining the ways in which genuine economic growth ought to be and maintaining the healthy cycles of natural assets (ecosystem) on which economic growth is dependent. The examination of this concept raises two issues.

(1) How is the rate of economic growth controlled within the range which maintains the soundness of natural assets? So to speak, this is a subject that can be termed the governance of the rate of growth.

(2) How can a social system be built that can minimize the stress which economic growth has on the soundness of natural assets? So to speak, this is a subject that can be termed the governance of the quality of growth.

That is, the SD concept calls on us to pur-

pursue both subjects, i.e. governance of the rate of growth and governance of the quality of economic growth.

Needless to say, Minamata disease was the benchmark pollution problem of the postwar period of Japan and did the most serious damage to the local residents. But its creation was firmly connected with the so-called high-speed economic growth policy of Japan. High-speed economic growth was evidenced by growth in GNP of 9.2% per annual over the 18 years from 1955 to the "Oil Shock" in 1973, resulting in the revival of the Japanese economy, the improvement in national income and in Japan's catching-up to the developed world. However, it also created various pollution problems, Minamata disease notable among them, sprinkled all over Japan. Furthermore, it destroyed rural communities and agriculture, and had a major negative influence on regional economies.

However, the view that evaluates the Minamata disease problem simply as a negative experience in postwar Japan is incomplete. During the long struggle for recognition of this environmental disaster, valuable precedents have been set, that have proved useful in a wide range of other pollution and public health problems. Formal recognition of Minamata disease came in 1956, and the cause scientifically demonstrated in 1959. Patients and their supporters began a long fight for recognition of corporate and governmental responsibility, gaining extended national support through many trial fights. In 1996, a political conclusion was finally reached, during a critical situation of the ruling conservative political party, 41 years after the formal recognition of Minamata disease. The tenacity and the national spread of the "Save Minamata Disease Patients Movement" are the pride of the citizens' movement of Japan, and contributed to the development of the private citizens in Japanese society, and thus to the development of Japanese democracy (National Liaison Conference for Minamata Disease Victims 1997, 1998).

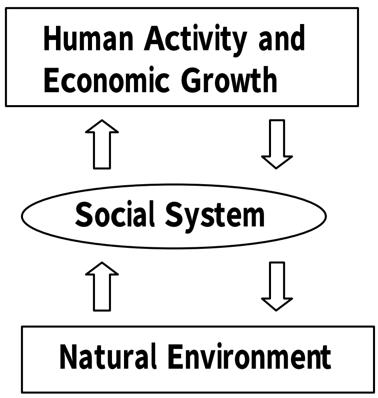
It can be said that Minamata disease is one of the most convincing examples of the need to seek the way to "Sustainable Development." In this paper I want to consider the social and economical causes of Minamata disease in relation to the period of Japanese high-speed economic growth, and, from the viewpoint of "Sustainable Development," to extract some lessons for our common future.

Chapter 2 Methodological Framework

Some key concepts used in this paper are explained here at the beginning.

Generally speaking, in human activity, especially industrial production, a certain amount of resources and energy of high quality are consumed, and, in addition to the products, some wastes, such as carbon dioxide, waste water, smoke, energy of low quality etc., are inevitably produced. In terms of the creation of various forms of waste, the same can be said of consumption, and other human activities.

Figure 1.



The exploitation of natural resources and these resulting wastes cause damage to the ecosystem. These effects on the environment, that accompany human activity, are collectively referred to as 'stress.' Economic growth has a trade-off relation to the environment, i.e., economic growth surely creates a certain amount of stress on the environment. However, even if GNP levels or energy consumption levels are the same, different societies do not inflict the same degree of stress on the environment. That is to say, given an increase of 1% in economic growth, the degree of stress on environmental assets differs greatly in different societies. In other words, we can have various types of trade-off patterns. For example, we can attain the same p.c. GDP by various industrial structures (See Table 1).

Table 1. Comparison of Status of World Economies and the Environment

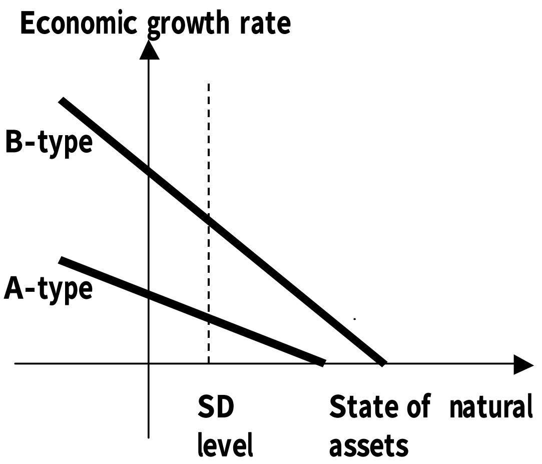
Title	World share of population	P.C. GDP, 1998	Annual rate of real economic growth, 1990-98	P.C. energy consumption, 1997	Annual rate of CO2 emission, 1990-97	P.C. CO2 emission	Energy efficiency per million US$, 1997	Ratio of primary industry employers to all employers, mid 1990s
Unit	‰	US$	%	Kilograms	%	Kilogram of carbon dioxide	Tons/million US$	%
Australia	2.99	20125	3.3	5511	2.7	-	-	4.9
Canada	4.83	19642	2.0	7832	1.7	18.35	0.615	3.7
China	194.05	777	10.0	692	5.6	2.89	0.928	47.4
France	9.47	24739	1.6	3853	0.8	7.29	0.081	5
Germany	13.72	26183	1.4	3984	-1.6	10.80	0.063	2.8
India	141.57	422	5.7	294	7.4	1.21	0.583	-
Italy	9.89	20659	1.3	2903	0.8	7.77	0.026	7.5
Japan	21.01	29956	1.8	3632	1.2	9.80	0.027	8.3
Korea, Rep. of	7.46	6956	5.8	3221	11.0	9.59	0.070	12.2
Netherlands	2.51	24956	2.8	5318	1.6	12.08	0.181	3.2
New Zealand	0.61	13985	2.1	4139	1.7	8.00	0.256	8.5
Russian Fed.	24.59	1936	-6.2	3945	-6.2	10.17	3.347	15.5
Sweden	1.44	26790	1.2	4540	0.3	6.63	0.103	2.6
Thailand	9.12	1890	5.6	1016	16.9	3.83	0.256	51.3
UK	9.43	23934	1.9	3810	-0.8	9.70	0.190	1.7
USA	41.60	31746	2.7	7756	1.4	22.03	0.192	2.7
World Monde	1000.00	5010	2.1	1427	-	-	-	-

(Source) UN Statistical Year Book [20]

Now, let's think of an axis of coordinates with the horizontal axis presenting the state of natural assets, and the vertical the economic growth rate (See Figure 2). We can identify two types of economy by the trade-off patterns between economic growth and environmental preservation. An A-type economy achieves lower economic growth rate if it keeps natural assets constant. On the other hand, a B-type economy can attain a higher economic growth rate than an A-type even while keeping natural assets constant. Moreover, even if the economic growth rate of an A-type economy were zero, the growth rate of natural assets is lower that a B-type. In a B-type, even if the economic growth rate is zero, the state of natural assets will be higher than in an A-type.

Assuming, for the sake of illustration, that the state of natural assets at a sustainable level, shown in Figure 2 as the SD level, is located lower than the level which will be attained when both economic growth rates become zero[2], the patterns of trade-off may differ as shown in Figure 2. A B-type economy will attain a much greater growth rate compared to an A-type, with the same level of environmental damage. Thus, even if the economic growth rate is the same, damage to the natural environment can be reduced, by changing from an A to a B-type economy. Or, if natural assets required to maintain at the SD level, then a higher economic growth rate can be attained by switching from an A to a B-type.

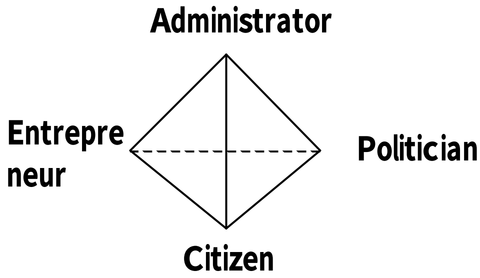
Figure 2.



In other words, an A-type economic growth is the one with greater environmental destruction, while a B-type will have less environmental destruction, or even environmental preservation. According to my personal impression, Japan and the United States are A-types, and Northern Europe and Germany are B-types.

The concepts of a social system and social cost are required to explain the difference in these patterns of trade-off relations between economic growth and environmental preservation. The concept of a social system expresses a certain whole that has regulated human activities and human relations in relation to the natural environment (See Figure 1). We can think of the social system like a shock absorber or an amplifier. It has three activity dimensions, political, economical and cultural. It also has four key players: first, commercial enterprises or industry; second, residents or citizens; third, the political establishment; and fourth, administrators. These relations are diagrammed as a regular tetrahedron (See Figure 3).

Figure 3.



For the purposes of this discussion, the role of citizens is the most crucial. Especially in a democratic society, the residents or citizens can influence politics, as sovereignty is ultimately vested in them, even though they are also dependent, in their daily lives, on commercial enterprise and administration. In particular, politically and/or environmentally aware citizens have the power of changing the social system in various ways. Especially, in non-profit or low profit areas of activity, in which commercial enterprises do not normally intervene, citizens can have a big influence on society, performing useful functions through the activities of various NGOs or NPOs. The following areas of activity can be mentioned as examples: social welfare, social justice and environmental preservation.

Private cost is the expenditure of private economic players to exclusively acquire the fruits of economic activities. But in their economic activities, including production, transportation, marketing, consumption and disposal process, all economic players will cause some damage and stress to the natural environment knowingly or not. Much expense would be required to remove such stress and to restore what was destroyed and exhausted to its original state, even if that were possible. Social cost reflects of entire expenses required in order to keep the natural environmental assets constant or healthy and includes the external expenses not paid by the market dealings of the private economic players. For example, the collection and processing expense of garbage or waste is one example of social cost, and so is the expense of a sewage disposal plant. In my opinion, the social infrastructure cost should be included in the social cost, especially in Japan (See Table 2).

Table 2 Example of Social Cost of Automobile in Japan

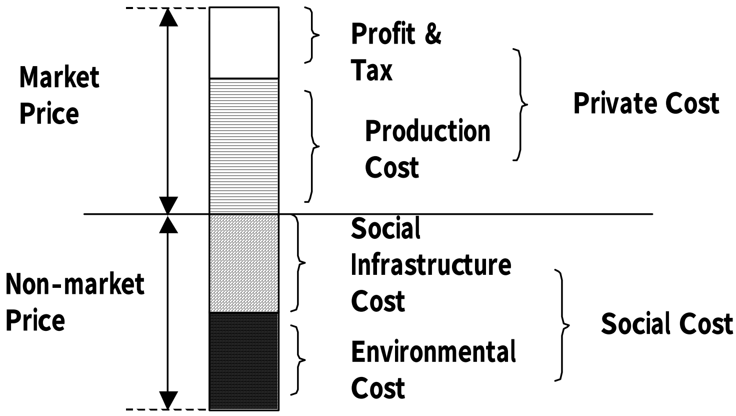
	Benefits	Costs
Private	・ Convenience ・ Time & labor saving	・ Purchase expense ・ Parking and operating expense
Social	・ Employment and income ・ Increasing tax ・ Acquisition of foreign currency	・ Road construction costs ・ Car disposal costs ・ Air pollution ・ Noise ・ Traffic accidents ・ Traffic jams ・ Depletion of fossil fuel ・ Global warming

The size of social cost may differ depending on the social systems, i.e. the degree of priority placed on industrialization by the national government; the speed of economic growth; the freedom of corporate activity; the use, if any, of environmental taxes; and citizens' level of environmental awareness and activity, etc.

The burden problem of social cost cannot be fully solved by the market mechanism alone. For example, a company will tend to avoid the burden of social cost often required to control pollution processing for profit maximization. Moreover, when a possibility of immediate profit presents itself, a company does not tend to consider the future risk but to act in the short term. Similarly, a household also becomes egocentric and a "free rider" of public goods easily. These are unavoidable problems in the market economy. That is, the market economy cannot pay the social cost automatically and willingly, and market prices fail to reflect socially desirable outcomes (See Figure 4). These problems are commonly known as "Market Failure."

It is clear that many national policies or national decision-making systems are influential in harmonizing the environment and social development. Furthermore, the political structures, including the judicial system, tax system, financial system and public works system can also have an effect on the level of stress on the environment. These policies and systems all have a certain rational basis. But

Figure 4.



the government's intervention in a market economy may also aggravate a problem and even delay the solution. For example, it is often the case that wasteful public works may be planned by alliance among leading politicians, senior bureaucrats, and the leaders of big business, and these may result in an increasing budget deficit. The special relation that has evolved among these three is called the "Iron Triangle" or "Sei-Kan-Zai Yuchaku" in Japanese. "Sei-Kan-Zai Yuchaku" distorts the problem of sharing the burden of social cost. This type of problem is known as "Government Failure"(Kondo, 2000).

Neither a company nor the government can solve the social cost burden allocation problem because of both "Market Failure" and "Government Failure." If democracy is immature in a society, the socially weak people within the community are, in general, made to pay a larger proportion of the social cost. The citizens' movements and environmental NGOs can compensate for both " Market Failure" and " Government Failure." And they can play an important role in the field of not only local autonomy but also environmental preservation as well as the social cost burden allocation problem. This is becoming a global trend.

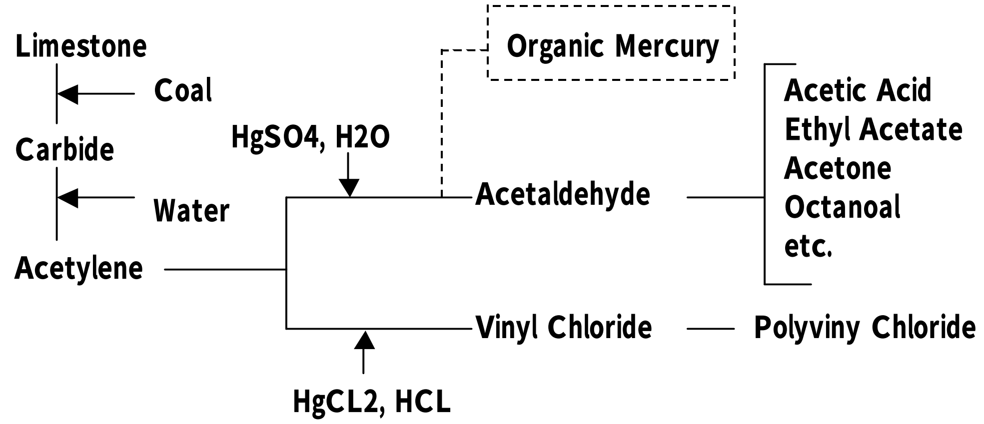
This general trend is described by Professor Friedman as a sort of "development of inclusive democracy asking for alternative development" (Friedman, 1995). Professor Salamon describes this same phenomenon as a "Global Associational Revolution" (Salamon, 1997). Also in Japan, when converting a social system from an environmentally destructive type into an environmental harmony type, it can be said that the efforts of environment NGO/NPOs are making an important contribution.

Chapter 3 Model Analysis of the "Tragedy of Minamata Disease"

Minamata disease collectively describes various pathological changes that arose in local residents who ate the fish and shellfish from the Shiranui Sea, in Kumamoto Prefecture. In those days, the Chisso Corporations Minamata plant used mercury as a catalyst when producing acetaldehyde, and its industrial waste water, containing the organic mercury (methylmercury), was released to the sea, where it was polluting fish and shellfish (See Figure 5).

Although formal recognition of Minamata disease as a medical condition was made in 1956, the cause was scientifically concluded to be organic mercury only in 1959. However, it took the government until 1968 to recognize Minamata disease as a pollution-caused illness, and the number of victims continued increasing in the meantime. Furthermore, the discovery of the "second Minamata disease" was announced in Niigata Prefecture in 1965. According to Table 3, the total victims of Minamata disease are presumed to be about 20,000 persons.

Figure 5. Illustrationf of Old System of Acetaldehyde (Acetylene Method)



(Source) Minamata-city [10]

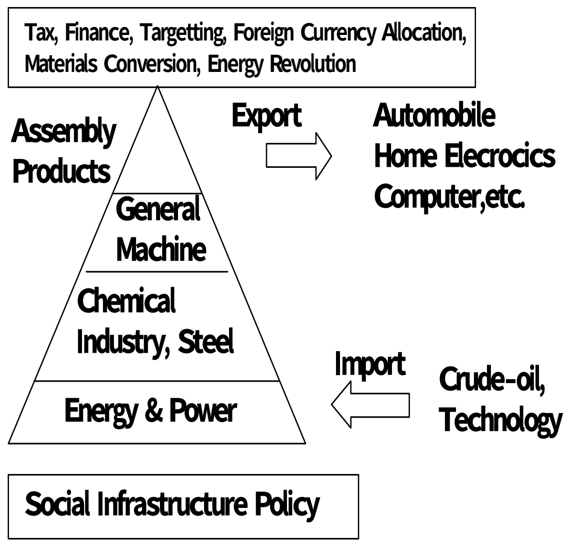
Table 3. Administrative Status of Patients (2000)

	Total Application Number	Certified Minamata Disease Patients	Partially Compensated Patients
Kumamoto Pref.	13142	1774	7989
Kagoshima Pref.	4269	489	2361
Niigata Pref.	2001	690	799
Total	19412	2953	11149

* Deceased patients included （Source）Minamata Kyoritsu Hospital Group [12]

Although the Chisso Minamata plant which produced acetaldehyde was a company with excellent technology, it did not pay necessary attention to industrial waste water, and the danger which it has on the environment, and did not willing to pay expense required for appropriate processing, simply because it hurried pursuit of profits and high speed growth. Furthermore, the petrochemical industry association of those days and the Ministry of International Trade and Industry (MITI) were aware of the necessity of minimizing the cost of export products in order to quickly promote the heavy and chemical industrialization of Japan[3].

Figure 6. MITI's Industrial Policy



This structural comprehensive policy system of MITI became known worldwide as Japan's "centralized industrial policy" (See Figure 6).

Therefore, MITI encouraged industry to abandon the comparatively high-priced system acetylene method of producing acetaldehyde, which used carbide and acetylene. MITI advocated a plan to build new factories to convert to the method (the Wacker method), new acetaldehyde production which used ethylene generated from cheap crude oil (See Tabel 4). The implementation of this plan consisted of using factory equipment employing the older method as much as possible without investing in proper maintenance, thus producing larger profits, the idea being that the profits so obtained would be applied to the introduction of new technology as soon as possible[4]. Actually, as is clearly apparent in Figure 7, acetaldehyde production using the old acetylene method at Chisso's Minamata plant was greatly increased, especially after an in-house experiment, the results of which were suppressed, revealed that the cause of Minamata disease was in the company's own industrial waste.

Table 4. Cost comparison of the old and new system of acetaldehyde

	Cost(yen/kg)	Method	Material	Price(yen/kg)	Production
New method	50.24	Wacker	Ethylene	50	60,000 t/year
Old method	56.30	Acetylene	Acetylene	70	12,000 t/year

(Source) Japan Petrochemical Industry Association [3], p.34.

Furthermore, in order to increase the competitive power of Japan in the international market, from around 1960 to 1965, MITI orchestrated the large-scale transition of the primary energy supply structure from coal-centered to oil-centered. This is known as the "Energy Revolution" in Japan, and as a result of this shift, various industrial processes involving coal-based materials were phased out, and processes employing petrochemicals adopted. At the Chisso Minamata plant acetaldehyde production was ended in 1968. Also in 1968, perhaps not coincidentally, the Ministry of Health and Welfare (MHW) at last officially recognized Minamata disease as a pollution-caused illness. This was 9 years after identification of the cause (in 1959) and 12 years after the official recognition of Minamata disease. Throughout that entire time, Minamata disease patients continued increasing in number, and a whole new locus of the disease, with an identical cause, emerged in Niigata. This is known in Japan as "Dai-ni Minamata Byo" or second Minamata disease. Thus, the outbreaks of Minamata disease were closely connected with the energy revolution for strengthening Japan's competitive power in the international market, and the victims of the disease sacrificed for that purpose.

In this context, it is necessary to understand the problem of Minamata disease not only as a one-company problem, but also as a problem arising from the nurturing of the petrochemical industry as one part of MITI's powerful comprehensive industrial policy of Japan.

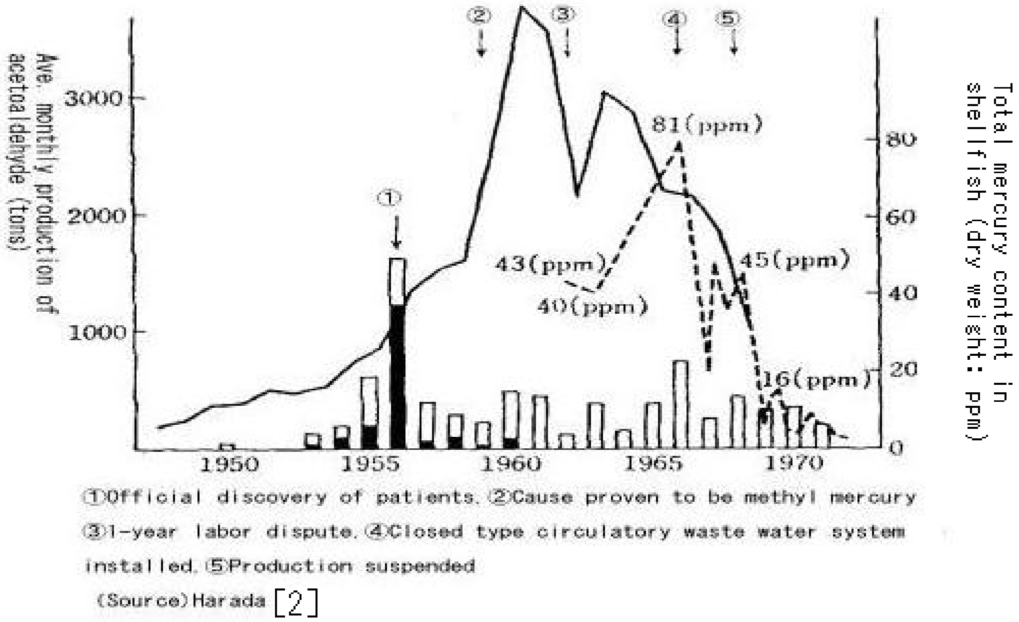
This brief historical explanation of the Minamata disease problem will have to suffice as, in this paper, I want to concentrate on the social and economic aspects of the tragedy of Minamata disease, elucidating the essential structure by using some model analysis.

The Model and Assumptions

(1) The sea is considered as a shared resource of an area.

(2) The quantity of production of a certain company (the Chisso Minamata plant) is set to *x*.

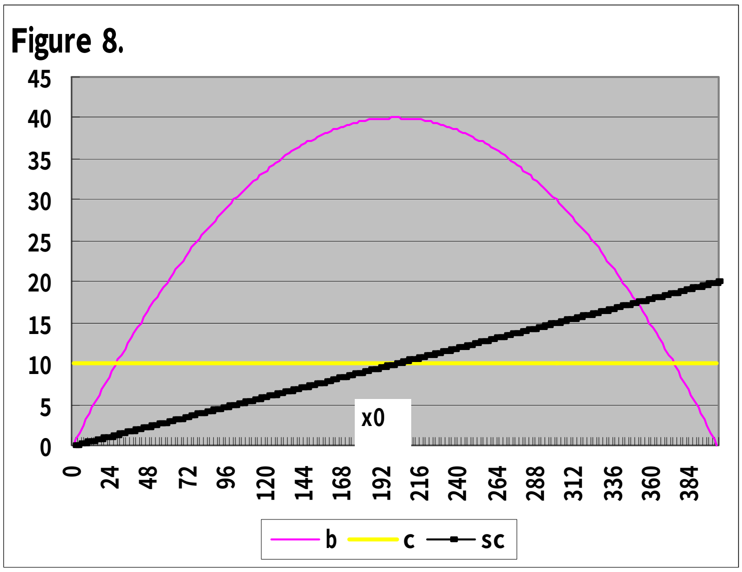
Figure 7. Chronological changes in acetaldehyde production, onset of Minamata Disease, and mercury content in the Shellfish of Minamata Bay



(3) Production cost per unit product is set to *c*. For simplicity, it is presupposed that *c* is constant.

(4) The revenue per unit product (=market price) is set to *b*. So, *b* · *x* means gross income. *b* is a function of *x*, and *b* is an increasing function until a certain production level, *x0*, and becomes a reducing function if *x* surpasses *x0*. That is, revenue increases if a company with monopolistic technology increases production up to the level of *x0*. However, if *x0* is exceeded and it produces superfluously, the price will fall because of superfluous supply and profits will decrease (See Figure 8).

(5) Social cost[5] per unit product is set to *sc*.



sc is the function of *x* and is taken as a monotonous increasing function. Therefore, social cost = *sc(x)* · *x* increases at an increasing tempo as production level increases.

A company acts so that its profits may be maximized.

Expressed as an equation,

Profit(1)=gross income – production cost

$= b(x) \cdot x - c \cdot x.$

The necessary condition for profit maximization is that the marginal revenue gained by an additional unit of production and the marginal cost of producing an additional unit become equal, and makes x^* the production level which fulfills this condition. On the other hand, seen from the viewpoint of social welfare, what does the optimum quantity of production become? Social cost is clearly increased by non-processed industrial waste water effluence which accompanies an increase of production. Thus, from the standpoint of social welfare, to maximize social net benefit, it is necessary to subtract both production cost and social cost from social benefit. For ease of analysis, we will assume that social benefit and private revenue are in agreement, and also suppose that the production cost is excluded from social cost. That is,

Social net benefit = social benefit – production cost – social cost

$= b(x) \cdot x - c \cdot x - sc(x) \cdot x.$

The necessary condition for maximization of social net benefit is that marginal social benefit and marginal private cost + marginal social cost which are gained by addition of production become equal, and makes x^{**} the production level which fulfills this condition. It is clear that $x^* > x^{**}$, and the production level determination by private enterprise can easily exceed a desirable production level, seen from the viewpoint of social welfare. That is, when private enterprise is allowed, untrammeled, to determine production level, resources and the environment will be destroyed beyond necessity. $x^* - x^{**}$ (the difference between the optimum production level for profit maximization and the optimum production level for social net benefit maximization) can be described as "Market Failure" because it is the overproduction portion of x^*. Or, in other words, if $b(x^*)$ is called "market price" and $b(x^{**})$ is called "social price", under the market economy, we can say that social price surely exceeds market price, i.e. $b(x^{**}) > b(x^*)$.

In order to avoid this, what measures are needed? Government subsidies covering outlays for pollution control are one possibility. Imposing an environmental tax and/or an industrial-waste-water tax is another option, one that could be described as a sort of "negative subsidy" for those firms that take the necessary measures to avoid such punitive taxes. A third approach is influencing production level decisions of private enterprise by regulations of water quality in industrial waste water, both in regard to concentration of pollutants in discharged waste water and total emissions (to prevent companies from simply diluting their waste before discharging it). Typically, a comprehensive approach would combine aspects of all three of these options. For example, if c is increased deliberately through an environmental tax, the optimum production level of a private enterprise can be guided to x^{**} from x^*.

Next, how can the influence of government industrial policy be expressed in mathematical terms?

Industrial policy in Japan promoted the shift in production materials for acetaldehyde to ethylene and the disposal of old equipment, thus giving Chisso the incentive, by maximizing profits at all costs, to invest in new equipment and technology. Consequently, Chisso depreciated old equipment as soon as possible.

When seen from the viewpoint of social welfare, increasing c was desirable to control pollution, but instead, Japanese industrial policy reduced the amortization cost of old equipment, and had the effect of reducing c. The result was the tragedy at Minamata.

Supposing a to be the fall in production cost per product unit as a result of industrial policy, Chisso maximized profits as follows: That is,

Profit(2) = gross income – revised production cost

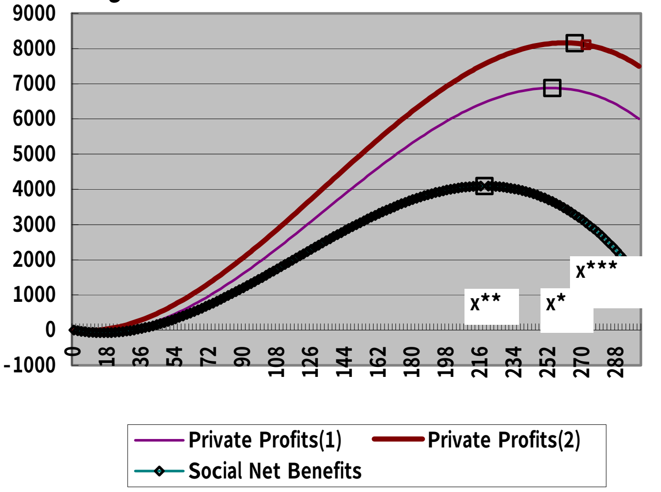
$= b(x) \cdot x - (c - a) \cdot x.$

It will become $x^{**} < x^{*} < x^{***}$ where the quantity of production which Chisso chose is x^{***}. Clearly, the quantity of production of Chisso exceeds x^{*} and the degree of excess was accelerated further by Japan's industrial policy. $x^{***} - x^{*}$ is the overproduction portion caused by "Government Failure" (See Figure 9).

As mentioned above, the cause of the pollution which brought about the tragedy of Minamata disease can be understood as compound problem of both "Market Failure" and "Government Failure."

In addition, I want to add a comment as to why the MITI of those days could have had such power and influence as to overwhelm other ministries in the government offices. It is one aspect of the structural alliance between MITI and politicians over a period of many years. Many upper-level bureaucrats of MITI, after leaving government office, became politicians in the governing party, a couple of them at least even becoming Prime Minister and Deputy Prime Minister. Others took up high-level positions in various industries, including petro-chemical industry. It is possible to state that the Minamata disease problem was one social symptom of "Sei-Kan-Zai Yuchaku" (Prestowitz 1988; Wolferen 1989; and see in Chapter 2 above).

Figure 9.



Chapter 4 Conclusions

Japanese Model from the viewpoint of "Sustainable Development"

The high-speed economic growth model of Japan was a controlled economy type model dominated by the government-business relationship, for a rapid heavy industry catch-up aiming at an import substitute and export promotion. By laying private cost on social cost, it succeeded in curtailment of cost and succeeded in the advancement of an energy revolution. On the other hand, Minamata disease was generated, Japan was changed into "Pollution Islands," and the regional economy, such as agriculture and fishery, decayed. High-speed economic growth of Japan was the growth which was connected with disregard of social cost, and disregard of local residents' life and health, and became possible rather just because of it. It was the result of "Market Failure" and "Government Failure" carrying out polymerization in the worst form.

It destroyed not only the natural environment but also the regional economy. Figure 10 shows how the population of Minamata-city was influenced by both high-speed economic growth and Minamata disease. The population which was at 45,532 persons in 1955 decreased at 31,789 persons in 2000. If there is neither Minamata disease nor high-speed economic growth, it would be estimated that the population of Minamata would have increased to 64,734 persons in 2000. Among these, it was estimated in 2000 that 20,074 persons were lost by depopulation and 12,871 persons were lost under the influence of Minamata disease. That is, no less than 51% of population was lost from Minamata-city, and the regional economy was destroyed.

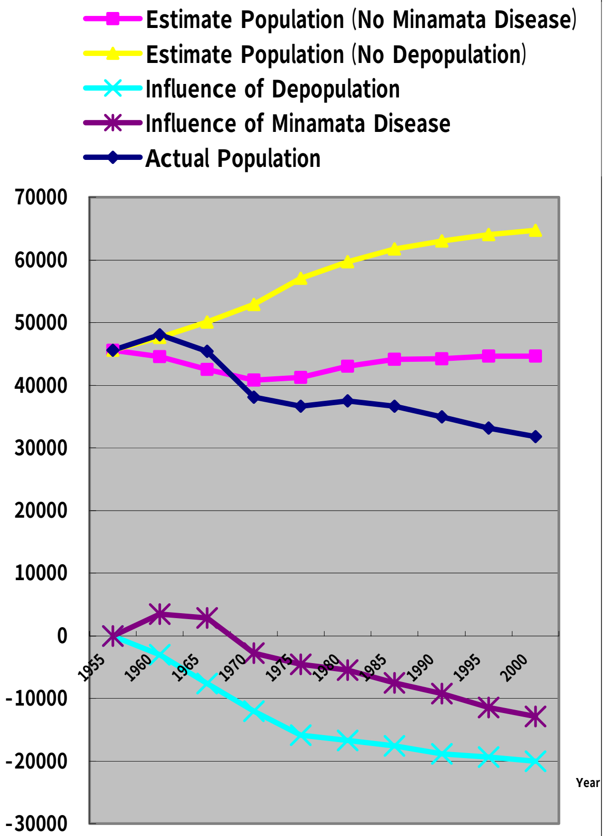
High-speed economic growth of Japan was the typical case of "non-sustainable development," and not only the side of the brilliant success but also the dark portion should be gazed at justly to pull out the right lessons.

Six Lessons from Minamata Disease

(1) (Stop the "Market Failure"): Although Chisso knew through animal experimentation in 1959 that the factory effluent was the cause of Minamata disease, it hid the cause, blocked cause investigation, extended the measure against waste water, and continued acetaldehyde production till 1968. It was the typical example of "market failure" which is going to avoid the burden of social cost for the profits of the near future of itself. It is necessary to incorporate environmental costs into private cost by economic means, such as an environmental tax, to correct the "Market Failure," and force companies through direct regulation to meet the social costs of their conduct.

(2) (Stop the "Government Failure"): In order that the Japanese government including the MITI might achieve high economic growth,

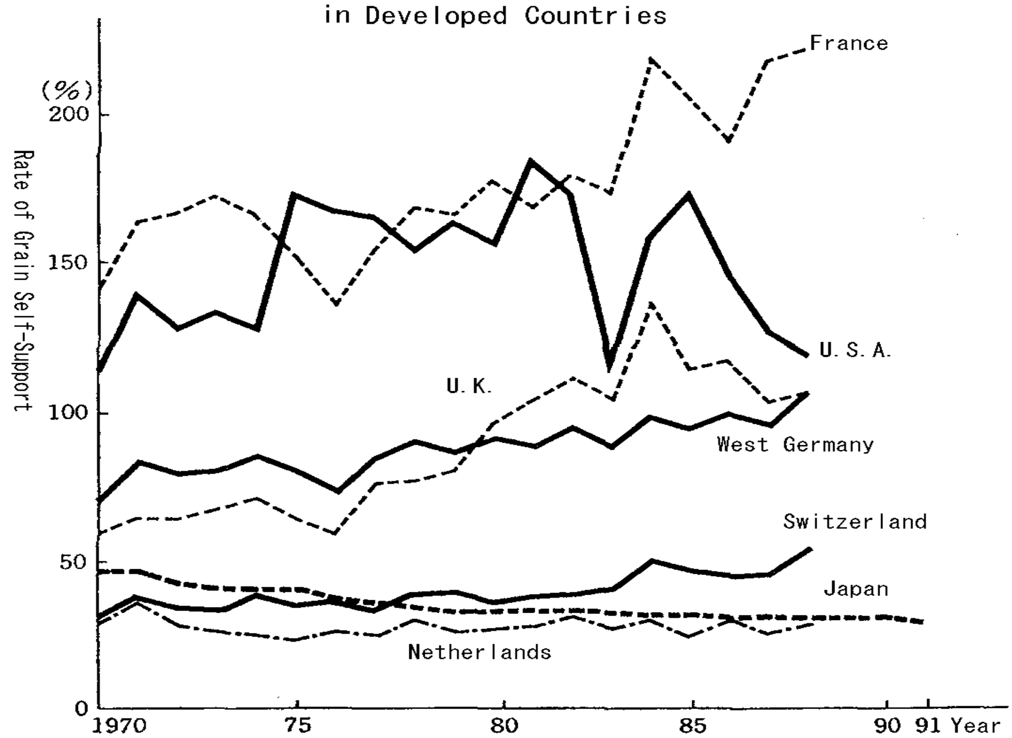
Figure 10. Influence of Minamata Disease and Depopulation to Minamata-city



and an import substitute and export promotion, it made the supreme proposition strengthening and materials conversion of competition in the international market, and gave priority to the profits of industry. Consequently, generation of the second, third, and fourth Minamata disease was not prevented. Furthermore, it did not consider how to accept the administrative responsibility itself, but the pain beyond necessity was given to the victim by the patient omission policy, and the trial fight was made to protract. This was a typical example of "Government Failure." High-speed economic growth also produced the problem involving the portion of growth. Only some of persons or companies should not monopolize economical abundance, but the fruits are universally distributed to people in the true economic growth. The room of people's life, a happy circle with a family, social welfare and independence of local economy must be secured. The main portion was utilized for the economical fruits which high-speed economic growth produced for accumulation of capital rather than for people. We have to grope for conversion of political/social structure called "Sei-Kan-Zai Yuchaku," for connecting economic growth to improving social welfare in a broad sense. For that purpose, reform of a political/administrative dimension is inevitable in Japan. Moreover, we should stress the importance of change of political power and parliamentary independence.

(3) (Converting the Decision-Making System and Strengthening Public Involvement): People have to know that economic policy and the political system are connected with their lives, and have to search for the democratic structure in which the demands of the community are reflected in decision making process of national government. The rigidity of a bureaucratic system, continuation of long-term one party rule, and the system of alliance of politician, bureaucrats, and industrial world delay and aggravate the solution of problems. Developing the freedom of information, residents' surveillance and citizens' participation in mu-

Figure 11 Transitions of the Rate of Grain SelfSupport in Developed Countries



(Source) MAFF, Syokuryo Jukyu Hyo.

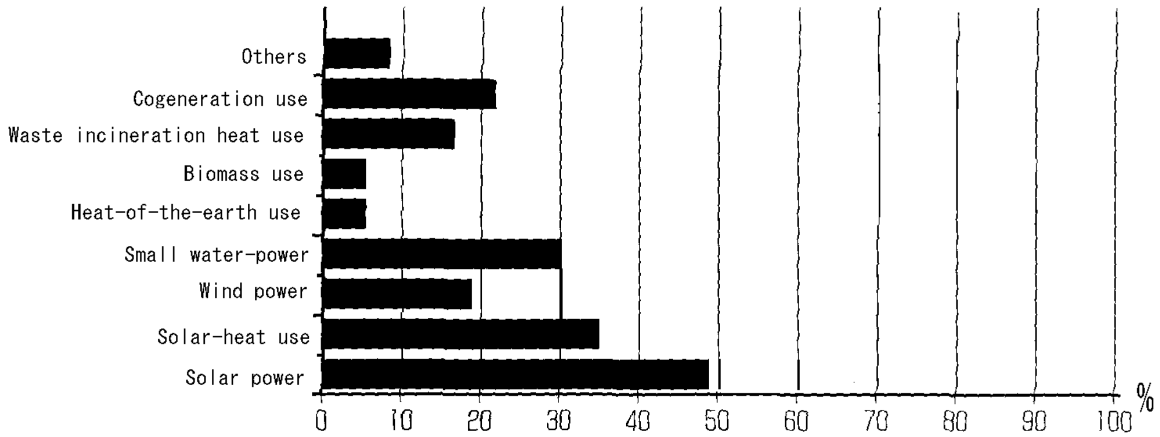
nicipal affairs must be strengthened. And the alternative economic development plan by residents should be submitted.

(4) (Promoting Local Economy, including Agriculture and Fishery, and Restoration of healthy Environment): High-speed economic growth destroyed both regional substance circulation, including regional economy circulation, and the environment. For example, the rate of Japanese self-sufficiency in food production became the worst in the developed countries (See Figure 11). We should perform natural substance circulation, environmental reproduction and promote the regional economy destroyed by development. The regional economies should utilize their resources and pursue industrialization, i.e. the local industrial policy with the balance containing agricultural reproduction. For that purpose, the role of the state and local government should be improved so that the regional economy can become relatively independent and a source of revenue should be decentralized, and development of local autonomy should be secured.

(5) (Strengthening of Human Right and Democracy): Fighting for 40 years of Minamata disease pulled up democracy of Japan and increased community participation certainly[6]. We have to connect the lessons of Minamata disease to the development of resident autonomy. We should know that ultimately the protection residents' safety and health is dependent on the community itself.

(6) (Improvement in the Rate of Energy Self-support and Promoting Technological Development of Natural Energy): The harmonization of a global intensified competition and achievement of SD is becoming the important problem. In order to protect economic independence to global intensified competition, we should aim at diversification of primary energy supply structure, and the improvement in the rate of energy self-support. Especially, for independence of the regional economy, practical use of natural energy is important. (See Figure 12) We should pursue independence of the regional economy by introduction of the natural energy by expansion of citizen participation and citizen possession. It will convert the existing system into the “Sustainable Society” simultaneously.

Figure 12. Rates of Various Natural Energy Use of Self-Governing Bodies (Prefecture Level) to the Whole in Japan, 1999



(Source) Wada[21]

NOTES

[1] According to the "Brundtland Commission," sustainable development is defined as the development that "meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). And also, in the preamble of "Agenda 21," it states that "integration of environment and development concerns and greater attention to them will lead to the fulfillment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future (http://www.unep.org)."

[2]. In this paper, the levels of natural assets in case the economic growth rates of both economies become zero assume that a B-type economy is at least higher than an A-type.

[3] In 1955, MITI determined the "Measure for promotion of the petrochemical industry." This was intended to import European and American technology and promote the growth of the petrochemical industry, whish was the start from nothing, as a national policy. The main points of this measure included

(1) Guaranteeing stable supplies of the raw material of synthetic resins, such as synthetic fibers (nylon and acetate, etc.), and phenol resin, and meta-acrylic resin,

(2) A changeover to domestic production of raw-material goods, such acetylene system products, that until then had totally relied on imported production.

(3) Supply price reduction of main chemical industry materials.

And through these policies, it was intended to promote the Japanese competitiveness in the international market and the advancement of Japan's industrial structure, the chemical industry and related industry. MITI framed a plan favoring a select few companies through enforcement of the quota system of foreign currency, special taxation measures, the loan system, etc., in order to achieve this purpose and to promote accelerated depreciation of old equipment, and new equipment investment. International Trade and Industry Minister Tanzan Ishibashi conducted, in 1955, the transfer to private industry of old army fuel depots in Yokkaichi, Tokuyama and Iwakuni. This was called the "Ishibashi Plan." This plan was a factor in the revival of the great pre-war "Zaibatsu" or business conglomerates. It also contributed to the petrochemical industry development in Japan, and domestic production of petrochemicals (Japanese Petrochemical Industry Association, 1981).

[4] A petrochemical company in West Germany developed the basic technology of ethylene direct oxidization in 1956, in response to this in 1960, the Hoechst=Wacker company of the same country completed a full-scale production facility of acetaldehyde employing the petrochemical system called the Wacker method. The predominancy of the Wacker method became clear gradually and the full-scale materials conversion progressed from 1964 and many new plants were built from 1964 to 1968 in Japan as well. At Goi in Chiba Pref., in July, 1964, Chisso also completed a new plant using the Wacker method with a yearly acetaldehyde production capacity of 48000t. Materials conversion of acetaldehyde was completed in Japan in 1969 and, by using the Wacker method mercury became unnecessary in acetaldehyde production (Japanese Petrochemical Industry Association, 1981).

[5].According to my simple estimation, the social cost of Minamata disease in Japan at 2000 present value is estimated at about 230 billion yen (1.92 billion US$).

[6]. The role played by the nation-wide citizens' movement calling for redress of Minamata disease victims in the development of democracy of Japan is not fully considered by this paper.

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