Chapter 2

The Mechanism of Modern Capitalism and Environmental Destruction

Preface

This second chapter looks first at Karl Marx's analysis of how capitalist activities have disrupted nature, and goes on to ask if Marx's ideas, as expressed in his book *Das Capital: 'a critique of political economy'*, help us to think more critically about the relationship between the natural world and man's exploitation of that world. While Marxian economics is not the only tool that may be thought suitable for analyzing the environmental problems discussed in the present book, it is not without point to take lessons from this classic text. As the Chinese proverb says, "Study the classics and discover a new reality" (温故知新). Although the socialist-inspired economies of the Soviet bloc collapsed at the end of the 20th century and socialism was discredited, *Das Capital* still presents us with a powerful methodology for the analysis of capitalism.

We follow our discussion of *Das Capital* with an attempt to analyze certain contemporary issues that link modern capitalism to the disruption of the environment. If we set aside ideologies and look at the real world with open minds, we shall see that we are now entering a time of financial and economic crisis, a crisis that *Das Capital* predicted many years ago. *Das Capital* provides us with a tool to analyze this critical moment for global capitalism and the economic order as the crisis is expressed in growing poverty, unemployment, and a widening social gap between rich and poor, as well as the consequences of environmental devastation.

1 The metabolic relationship between humankind and nature

Fundamentally, the problems of how to reconcile the search for resources and the preservation of the environment can be reduced to what we might call "the metabolic relationship between humankind and the natural world": that is to say, the sum of the changes that occur when man and nature react to and interact with each other. In other words, human beings extract resources and raw materials from nature and make use of complex machinery to produce industrial goods; as a consequence of the production process we cannot avoid the generation of waste, what we may call "the wastes of production", and these wastes, when returned to or dumped upon the environment, bring about changes to the features and aspects of the natural world. Without the application of necessary pollution prevention methods and equipment, such wastes cause severe environmental pollution and are bound to be hazardous to human

beings.

Another type of waste is related to the consumption of products, a type that we might call "the wastes of consumption". These various wastes are processed as municipal solid waste or human waste and are thrown into a sewage system that may or may not be adequate for the purpose, whence they are discharged into the natural world (see Figure 2-1).

Das Capital sets out a systematic analysis of this "metabolic relationship between humankind and the natural world", and in this chapter we take up some important points from Marx's analysis with special regard to the disruption of the environment.

To begin with, we can summarize this "metabolic relationship" as a relationship between technology and technology's disruption of the natural world. Traditionally, human labor has been considered to "mediate", "regulate", or "control" the natural world by using machines as its instruments. Today, because human labor in our industrialized society depends on the use of computers, we need especially to focus on the environmental issues prompted by the progress of information technology and the changes that this has brought about in the industrial structure. It is particularly necessary to clarify both the plus and minus sides of information technology as these affect

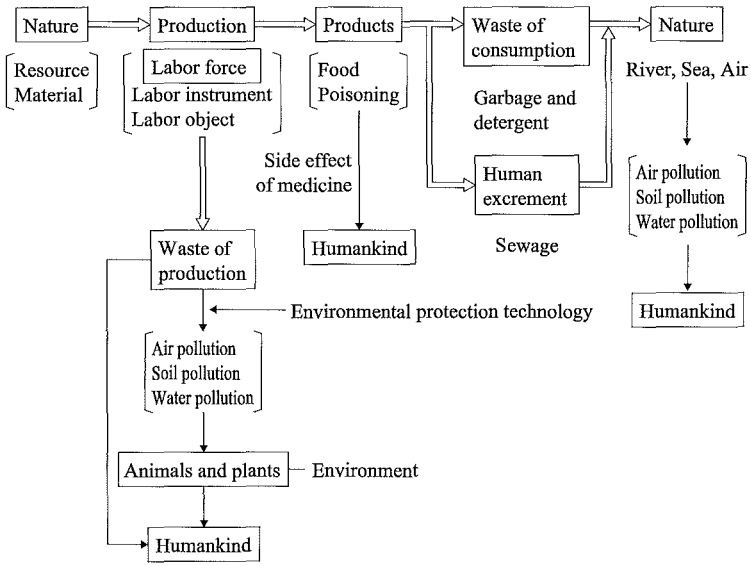

Figure 2-1 The disturbance of the metabolic relationship between humankind and nature.

environmental issues.

In the second place, this type of metabolism will often be the result of reactions, benign or adverse, between natural laws on the one hand and by social behavior on the other. In our industrialized society, for example, the water cycle and the earth's carbon cycle system are changing drastically as a result of man's interference, and consequently, this metabolic balance is determined not only by the "natural laws of life" but also artificially by the behavior of human beings.

Even so, this metabolic balance is not determined simply by man's behavior alone, and it becomes important to distinguish between those "metabolic effects" that are determined by natural laws and those determined by human activities.

Thirdly, we need to consider the precise problems that arise from disturbances to the "metabolic relationship that exists between humankind and the natural world". In *Das Capital*, Marx points out that human waste — i.e., excrement — does not flow back into the natural world in a cyclical way. Instead, the waste flows into rivers or the sea through the sewage system, thus giving rise to the problems of water pollution. At the same time, this leads to a shortage of compost in rural areas as well as contributing to the reduction of the land's fertility.

By taking up these points as they are discussed in *Das Capital*, we can direct our attention to the following four problems that affect the disruption of the environment:

[1] Problems relating to air pollution, land pollution and water pollution engendered by "the wastes of production", otherwise known as "producers' waste".
[2] Problems relating to the sewage system and the garbage that accumulates from "the wastes of consumption, otherwise known as "consumers' waste".
[3] Problem relating to the poor quality of the products themselves, food contamination caused by toxic substances, the harmful side-effects of medical practices, and the pollution generated by vehicular traffic.
[4] The handicaps that hinder the restoration of a proper "metabolic balance between humankind and the natural world".

These problems can all be seen as aspects of the deteriorating balance between humankind and nature, "a metabolic *im*balance", as it were.

It is necessary to include amongst the "wastes of production" such greenhouse gases as carbon dioxide and CFCs, and we need also to consider

industrial waste, hazardous waste and dangerous chemical substances, both independently and in terms of their relationship with each other. As for the "wastes of consumption", we need to examine "an eco-friendly design" for such durable consumer goods as automobiles or electronic devices. We should also seek to reduce the waste from packaging materials.

It is in this sense that we now need to explore the idea of "the governance of environmental flow" (Jänicke, 2004). This concept ranges from the problems of waste disposal to those of energy and global warming.

As Marx points out "... while upsetting the naturally grown conditions for the maintenance of that circulation of matter, it imperiously calls for its restoration as a system, as a regulating law of social production, and under a form appropriate to the full development of the human being ..." (*Das Capital*, Vol. 1 Chapter 13, "Machinery and Modern Industry", Section 10, "Modern Industry and Agriculture").

If we look at this demand in the light of today's environmental concerns, we have a glimpse of how we might maintain the global environment and keep control of the rates of "sustainable development" at one and the same time. In these terms, too, we have to find ways to achieve "eco-friendly reform" in industrialized countries, while solving some deep-rooted environmental problems in former "socialist countries", as well as those in emerging economies such as those of China and India.

2 An economic analysis of waste

Since, in theories of modern capitalism, any disturbance of the "metabolic balance between humankind and nature" is seen as strongly related to the problem of "the wastes of production", this section focuses on an economic analysis of waste.

In economic theory, we consider that a commodity has two aspects: its real "use value" and "its price". Although these terms may appear to have much the same meaning, economic theory distinguishes them. This distinction is especially useful when we analyze the problems of recycling and the reuse of the commodity.

"Use value" or "value in use" relates to the value of a commodity that is made by concrete, useful labor and is in itself useful. At the same time, "exchange value" or "value in exchange" is a rate of exchange, by which we can exchange a use value for another use value. This exchange value is the source of the "price".

For example, imagine that you purchase a watch. If the watch has an

"exchange value" of 10,000 JPY, then the "price" of the watch will be 10,000 JPY. At the same time, this watch has a "use value" that will tell you the time, and this function is not necessarily consistent with the "price".

The reader will understand that in the example of the watch the direction of commodity flow and currency flow move in opposite directions, and thus constitute a (legal) burden (what is called an "onerous contract"). In the case of waste, however, the direction of waste flow and currency flow move together in the same direction and the (legal) burden is equally divided (what is called "an inverse onerous contract").

One way to characterize types of waste is to distinguish whether the waste is exchanged by means of an "onerous contract" or an "inverse onerous contract". This notion is based on the "price" aspect of commodities. At the same time, however, we need to take a stand on the "use value" of commodities in order to characterize the type of waste: e.g., whether it requires to be detoxified or not.

This second criterion is especially effective when we have to deal with cases in which waste is exchanged in onerous contracts but requires detoxification. Under the first criterion, polluters often insist that because the waste is exchanged in onerous contracts what they handle is not waste. When transportation costs are considered, we can see that in most cases, this claim will not be true. If we apply the second criterion, we shall be able to uncover such cases of what is essentially a fraudulent claim.

The purpose of commodity production, which is the general basis of "the capitalist mode of production", is the unending search for profit. Two choices are open to those who seek to increase the rate of profit, the surplus value, that is, divided by the sum of constant capital and variable capital: the first is to increase the numerator, the surplus value, by extending working hours or intensifying labor density; the second is to reduce the denominator, the value of the constant capital tied up in the machinery or the raw materials. The latter choice is consistent with the idea of "economy in the application of constant capital" that we find in *Das Capital*.

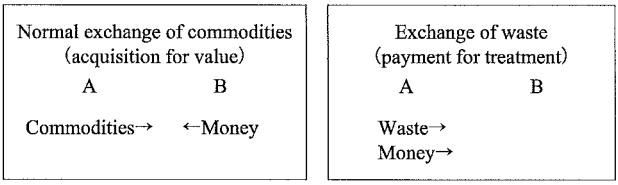

Figure 2-2 Exchange of commodities and exchange of wastes.

Let us now, in terms of this idea, examine the relationship between capital and waste matter. The major requirements for production are equipment, raw materials and labor. Economists call equipment and raw materials "Constant capital", while labor is known as "Variable capital", or, in other words, "Wages". We consider that the value of equipment is transferred to commodity depending on how long it can be put to work. The value of raw materials, as long as they are usable, can also to be transferred to the value awarded to commodity. We have to include waste matter from such raw materials in this category, although such material is not dedicated to the production process.

However, if the "yield rate" increases, so does the efficiency of labor as well, and it does so substantially. This increases the quantity of the products in the market and consequently lowers the prices. Since we need investments on constant capital in order to improve the yield rate, producers care about the quality, quantity and price of waste matter only when such waste leads to an increase in their profits ratio. In other words, producers invest, for example, in a closed system of production in which waste is minimized as long as it is dedicated to the economy of the raw materials.

On the other hand, economies sustained in the provision of pollution prevention equipment are not included in this calculation. These are classified instead as parts of the "economies in the employment of constant capital", and are similar to the "economies in the conditions of labor at the expense of the laborers" (*Das Capital*, Vol. 3, Chapter 5). Since these latter economies are those that producers make when they do not invest in what they ought to invest in, they differ from economies in constant capital in that producers invest so as to increase the yield rate, as for instance, in any investment given to a system of recycling.

Producers do not always have the incentives to promote such "economies in the conditions of labor at the expense of the laborers". Should there be, for example, any possibility of harm to their variable cost (labor) and constant cost (capital), then the producer will invest only to the necessary extent of preventing such harm. This is not the case, however, in costs incurred to prevent environmental disruption, such as the provision of pollution prevention equipment.

The reasons why producers are reluctant to invest in such prevention costs are as follows:

[1] Damage is concentrated upon the biologically weak.
[2] Damage is concentrated upon the socially weak.
[3] There will be an absolute irreversible loss.

[4] Most of the victims are not employees of the producers.

As Ken-ichi Miyamoto points out, producers do not therefore have the incentive to invest in pollution prevention equipment. This comment throws light on the present day consequences of the unsupervised use of Asbestos and the problems to which it has given rise (Miyamoto, 2007: 127).

BOX 2-1 Rate of surplus-value and profit ratio

An organization's capital is the entirety of its wealth, which is to be invested for the sake of making profit. Karl Marx took over a system of classical economics and on its basis extended his original theory. For example, he considered an entity's capital as a subject motivated by the expansion of value.

He also defined the transfer of surplus value from capitalist to workers as "exploitation" and the degree of such exploitation as "rate of exploitation". This rate of exploitation is defined by the ratio of surplus value and value of labor i.e. rate of surplus-value.

These ideas are especially useful when we try to analyze today's problems in the Japanese labor market, such as long working hours, the working poor, contingent workers, and the widening poverty-gap. Structural change in the global economy underlie the problems; workers in industrialized countries have to compete with their counterparts in the BRICs who have an abundant labor force and a surplus population as a "Reserve Army".

For the reader's information, the rate of surplus value and the profit ratio are shown as in the following formula:

Rate of surplus-value = surplus value M / variable capital (wage) V
Profit ratio = surplus value M/ (variable capital V + constant capital C)
Constant capital = fixed constant (e.g. machines) + floating constant capital (e.g. raw materials)

Under the Chinese "socialist market economy (early stage capitalism)", mining accidents caused by "economies in the conditions of labor at the expense of the laborers", which in this case means economizing on safety facilities, occur one after the other owing to the lack of regulations and the lack of pressure from civil society to improve safety conditions.

Microeconomic theory teaches that usually we assume we shall be able to calculate the optimal level of pollution. On the one hand, we can express the costs for pollution prevention equipment as Marginal Savings (MS), which, in terms of its more general meaning, corresponds with Marginal Abatement

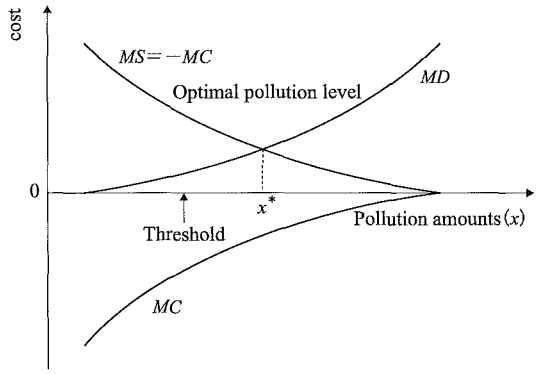

Figure 2-3 Optimal pollution level (Kolstad, 1999. Fig. 7.1 modified).

Costs (*MC*). On the other hand, we can express the sum of damages as Aggregated Marginal Damage (*MD*). If we do this, the optimal saving is determined as the cross of these curves (Kolstad, 1999: 119). However, this argument depends on the assumption that all the damages are transferable in monetary terms.

In Figure 2-3, *MC*(X) are the marginal abatement costs. These can be interpreted as the additional costs incurred for reducing one more unit of pollution, x. We consider that as pollution is reduced, so the marginal abatement costs decrease. The *MC*(X) curve therefore slopes upward. Notice that the value of *MC*(X) is negative in all X. *MS*(X) signifies marginal savings. This value can be interpreted as additional savings, allowing one more unit of pollution x. Notice that the curve is symmetric with *MC*(X) for the x-axis. Therefore, *MS*(X) = -*MC*(X).

We define the objective function of a business firm as the sum of abatement costs C(X) and the aggregated damage D(X). One objective of any firm is to minimize these total costs C(X) + D(X), and this aim can be characterized as Min{C(X) + D(X)}. The first order condition to minimize this {C(X) + D(X)}'= 0. Therefore, -*MC*(X) = *MD*(X). Because *MS*(X) = -*MC*(X), we then acquire a necessary condition *MS*(X) = *MD*(X). Consequently, the optimal level of pollution x* will be characterized by the intersection of these *MS* curve and *MD* curve, i.e. *MS*(x*) = *MD*(x*).

As for the basic criticism leveled against this idea of an optimal level of pollution, one answer given would be that the optimal level is irrelevant to the "threshold" below which pollution ceases to cause damage to the health of

human beings. Originally, a threshold is "the minimal value of a stimulus in causing the sensory receptor to stimulate an organism". Miyamoto has therefore criticized the notion that the "the level of pollution should be determined by the threshold" (Miyamoto, 2007: 191), but argues that it should be treated rather as issues directly related to human life, health and conservation of the environment.

Kazuhiro Ueta also argues that [1] the configuration of two curves is uncertain; [2] the victims and the polluters are different agencies; [3] the dynamic efficiency is questionable (Ueta, 1996: 100-102).

Since spending money on devices to prevent pollution means a reduction in the profit ratio, producers will not improve their anti-pollution apparatus unless they are forced to do so by society and the legal system.

The Nobel Prize laureate in Economics Joseph Stiglitz has said that without government regulation and pressure from civil society, corporations lack sufficient incentives to protect the environment. Indeed, they actually have an incentive to despoil it, if doing so saves them money (Stiglitz, 2006: 191).

When producers are obliged to abandon this saving, however, they are obliged to abandon the "economies in the employment of fixed constant capital", and, consequently, the profit ratio is reduced. To prevent this, the producers, in their turn, tend to pursue "economies in the employment of floating constant capital" by recycling and by the prevention of waste. In certain cases, such projects of recycling and waste prevention appear to have been successful in monetary terms.

In one case, for example, when environmental regulations required a company to attach a dust collector to its machinery, the company was able, after several years, to recoup its investment.

The reason why producers do not themselves initiate these projects is that their decision-making is always based on the rate of profit. It is for this reason that producers set up these projects only if they face a shortage of labor (variable capital) or if their constant capital is severely damaged.

Although neoclassical economists treat waste "as the joint products of output (Siebert, 2005: 27)", we still need to discuss carefully under what conditions waste can be considered as a commodity.

3 The disruption of nature caused by the plunder and abandonment of natural resources

In the past we have discussed the disruption of nature caused by the

emission of pollutants into the environment. Here, however, we shall discuss another type of disruption, i.e. the one caused by plunder and abandonment of such natural forces as land, minerals, and water.

When we think about land, we understand that the forces of nature have a "monopolizing" aspect. And these "monopolizing forces of nature" can be the natural source of surplus profit. In other words, such monopolizing forces of nature as waterfalls, richly stocked mines, rivers and the sea with an abundance of fish can all be counted as natural sources of "exceptionally productive labor". In the theory of differential rent, the marginal producer, such as the owner of the least productive land, will determine the market price. Consequently, the owner of such forces of nature will benefit from the monopoly.

Ground rent can thus be summarized under the following three conditions:

[1] Nature is monopolized, and there are superior and inferior natural conditions.
[2] The production price is not equalized.
[3] The market price is determined by the rent of the least productive land.

At the same time, "the land improves consistently if we handle it properly", but it will become dilapidated if we neglect to treat it well.

Das Capital suggests that mankind's employment of natural forces can be judged either as "artificial ignorance" or as "spontaneous ignorance". The former correlates to the plunder of natural forces while the latter correlates to the abandonment of natural forces when land is taken "out of cultivation". Most struggles to attain surplus value relate to these different forms of use.

The struggle to boost location rent, for example, leads both to the plunder of natural forces owing to overproduction and consequent infertility of the land and to the neglect of natural forces when the product price has fallen. A good example of the latter is the planting of cedar and cypress in Japan after WWII and their neglect and abandonment thereafter (Kurotaki, 2005: 110).

As we have just seen, "the monopolizing forces of Nature" make for various types of rent and the struggle for rent leads to the plunder of natural resources and their subsequent abandonment. An understanding of this practice is especially useful when we seek to analyze deforestation and the plunder of marine resources.

The pricing of resources has serious consequences for environmental and resource policy. In the developing countries, charges for public irrigation

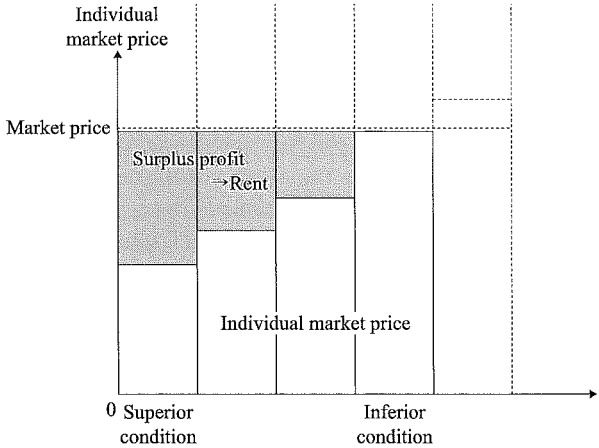

Figure 2-4 Image of differential rent (Yagi, 2006: 154).

water and land designated for public use are often set cheaply.

A government is paid rent when it has exclusive rights for distributing a specific local resource, and the price of the resource is less than the market price. "Rent" in this case is a surplus profit produced by the government's rights of enclosure where such rights to enclose property specify the ground rent. This becomes revenue for the government and some part of it will be distributed to interest groups and political supporters. This is one of the reasons why governments are guilty of wasting natural resources (Asher, 1999), something that we were able to observe in Russia during the transition from socialism to capitalism.

These days, overfishing is an extremely serious problem, and we can interpret it as the result of the struggle for location rent by "the monopolizing force of Nature". Ten kinds of fish constitute 30% of the world's total fish catch, and seven of them suffer from overfishing. Although fish are a typical "renewable resource" if fishing is well managed, the sustainability of marine resources is now in danger (Ishi, 2008: Chapter 3), and it is ironic that a renewable resource such as fish may dry up earlier than such nonrenewable resources as coal.

This surprising development has been called a "Regime Shift". According to this notion, the global environmental system comprises three elements, and over the past several decades these elements — the atmosphere, the ocean and ocean ecology — have changed in scale (Kawasaki, 2009). The notion of "Regime Shift" also suggests that two pressures, one from outside and one from

inside of the system, are the reasons for overfishing: i.e. global warming and an excessive demand for fish.

BOX 2-2 What is "The Tragedy of the Commons"?

Garrett Hardin's paper "The Tragedy of the Commons" has had a great impact on arguments concerned with environmental and resource policy. According to Hardin, the goods on which we cannot set any property rights, such as air, water or grazing lands, are likely to become exhausted (Hardin, 1968). He claims that the number of livestock browsed on a common always exceeds the common's capacity to feed them. This is because the benefit received and the costs from additional browsing are incompatible; on one hand, the individual reaps the benefit; on the other hand, the costs are shared with the public. Consequently, it makes sense for each individual to graze more cattle irrespective of the capacity of the common. In other words, what suits and profits an individual may damage the community as a whole. In the 1980s, however, arguments to Hardin appeared one after another. One of them contests his view of what constitutes a common. Although Hardin took the traditional view that 'a common' (common land) is characterized by "open access", others argued that in reality access to commons is usually limited. From a theoretical viewpoint, it is important to distinguish between "commons," i.e. property held in common by a community and property to which there is "open access". In other words, "commons" does not indicate "open access" property and vice versa (Sato, 2002). According to Makoto Inoue, "Commons is not only a resource itself, but also indicates the system of resource governance." Therefore, when we reconsider "the tragedy of the commons," we have to mention how to manage such common-pool resources (CPRs). Moreover, it is essential for achieving "Sustainable Development" to understand how communities manage CPRs. There are several ways of management: "private" governance, "public" governance and "collaborative" governance (Inoue, 2004). If commons are "open access" as Harding assumed, then the "tragedy" might be inevitable, because they are competitive but not excludable. It also means that public goods do not fall into commons due to their non competitive and non excludable properties.

Regarding to the management of commons, a study of Elinor Ostrom who is Nobel laureate in Economics in 2009 should be referred (Ostrom, 1990). As further topics, "Property Theory," "Environmental Governance Theory," and "Social Capital Theory" are advocated (Inoue, 2008).

4 The development of contemporary capitalism and the disruption of the environment

In this section, we shall examine in more detail our 'key terms': "the waste of production", "the waste of consumption", "human waste" and "the product itself". These terms enable us to analyze how the development of contemporary capitalism leads to environmental disruption.

4-1 The Wastes of Production

When the textile industry began to use chemical dyes, the capitalistic economy encouraged the mass use of the new resource, and this in turn promoted the mass production and transition of raw materials. (We may note in passing, however, that the discovery by von Baeyer in 1883 of the chemical structure of indigo eventually destroyed the livelihood of those, mostly in India, who cultivated the plants, principally *indigofera*, from which raw indigo had been traditionally produced.)

The price of a product is affected by the price of raw materials to a much greater degree than by the price of fixed capital, including machinery. The saving on the consumption of raw materials thus becomes the key to survival in competition.

The industrial complex is symbolic of such saving; it is the embodiment of "the accumulation and concentration of production" and, at the same time, a massive source of "production waste".

We may summarize the reasons that lie behind this as having three features. The first relates to "the production of waste". SOx (sulfur oxide), NOx (nitrogen oxide), soot dust, and other chemical toxic substances from the steel or petrochemical complex are discharged within a small, dense area. In this context, the "recycling of waste" falls into the "economies in the employment of constant capital", and, as we have said, the producer will pursue it in so as far as the economies effected reduce the production costs. Yet, ironically, the accumulation and concentration of production makes it easier to introduce the recycling system, especially in steel, non-ferrous metal, paper, and the cement industries. This is because these industries have built up their own infrastructures and technologies, and consequently have the resources to handle wastes.

In the second place, it is essential that the primary sector of such industries as the steel and petrochemical complexes supply products of high quality and low price. In performing "economies in the employment of constant capital",

such industries will increase capital turnover and raise the rate of profit, which will, in turn, lead to the introduction of "high pressure", "high temperature" and "high speed" technologies. Yet one result of the use of such technologies is an increase in "NOx" and "soot dust", and since the petrochemical complex in particular uses oil-related raw materials, both in its products and in its sub products, these technologies easily cause air pollution, water pollution, and fires.

The third important feature is that because today's production processes have become more automated and power consuming, the demand for electricity in the industrial complex is enormous. The thermal power stations in the industrial complex have become a major source of NOx, CO_2 and soot dust, and consequently, in modern Japan, stack gas desulfurization equipment for coal power stations plays a predominant part in attempts to control such emissions.

As the events of the 11th of March 2011 have so shockingly reminded us, the nuclear power plants, which supply one-third of Japan's modern electric power, also need to take urgent steps to ensure adequate "safety measures", solid "earthquake resistance" techniques and the proper "decommissioning of nuclear reactors, while at the same time we recognize that they create new environmental hazards in the wake of the nuclear fuel cycle and the disposal of radioactive waste. Such waste retains its radioactivity for several thousand years.

The environmental problem is not peculiar to such industrial complexes, however, for the so-called "clean", "high-tech" industries have their own specific environmental problems, too. Computer industries such as IC, VLSI plants require massive quantities of ground water (as well as being engaged in the struggle for surplus profit by taking advantage of the monopolizing forces of Nature), and owing to their use of toxic chemical substances such as organic solvent, they pollute the very water resources that they originally draw on.

More than twenty years ago, the increasing severity of such pollution of ground water and soil caused by organic solvents became a serious problem in the U. S. (Silicon Valley), as well as in Japan and Taiwan (Yoshida, 1989). As we have said before, computer servers have become major consumers of electric power, and, generally speaking, any advance in the "automated production process" and the "information oriented society" increases the demand for raw materials such as high-grade metal for electric parts, as well as intensifying the demand for electricity from coal-fired or nuclear powered plants.

Since the Yokkaichi Judgment in 1972, the Japanese petrochemical indus-

trial complex has been brought to court for its responsibility as the source of air pollution in the regions of Chiba, Mizushima, Kawasaki, Amagasaki, Nishiyodogawa and Nagoya.

The impact of the "Law Concerning Pollution-Related Health Damage Compensation and other Measures" (1970) and the system of charges it has invoked for causing pollution has been enormous. These measures have provoked producers to reduce air pollution, to introduce desulphurization equipment and low-sulfur fuel, and to initiate energy conservation, yet while such actions have indeed drastically reduced the air pollution caused by SOx, air pollution caused by NOx and exhaust gas has grown relatively more severe. In Yokkaichi today, those early victims of air pollution are aging, and more than 500 patients are still suffering from its effects.

While the Japanese industrial structure has undergone many changes, the heavy and chemical industries have moved to other Asian countries and the remaining facilities in Japan are growing exhausted. The regeneration of hardware and software (amenities) has become a challenge that takes in the economy and culture of those areas that have already been cleared of pollution (see Chapter 7).

4-2 The waste of consumption

Just as archaeologists can deduce the life-style and produce of ancient peoples from their 'middens' (their garbage pits and barrows), so the waste that we generate today shows the mode of production and the life-style of our own society, and, in archeological terminology, we can call today's landfill sites "modern shell mounds".

Everything from kitchen refuse to plastic containers, empty cans, batteries and used electrical appliances counts as garbage, and non decomposable plastic containers used for packaging, the mercury in batteries and the PCB in used electrical appliances are especially harmful to the environment. Incinerators deposit these "disposable" raw materials in the ground, or disperse them in the sea and air. Although environmental standards denote such wastes as severe, the health of local residents is still endangered by polluted rivers, soil and atmosphere.

Plastic containers for packaging constitute the major element of waste material and this is the direct result of marketing strategies taken by the petrochemical complex. Its marketing strategy indeed promoted a revolution in the market and "modernized" the distribution structure; but, at the same time, this modernized distribution structure strengthened the industry's dependence on fossil fuel. When we think of environmental protection, we have to

reconsider the mode of production characterized by "mass production", "mass consumption" and "mass decommissioning".

This is not simply a domestic problem: for example, the sea-borne litter that fouls Japan's coastline consists partially of waste from China and Korea as well as Japan (Kojima and Shin, 2007).

4-3 Human waste (the issue of the city sewerage system)

In *Das Capital*, Marx points out that waste generated by the human consumption of food — i.e. excrement — does not, in urban areas, return to the earth, but flows through the sewage system into rivers or the sea, causing severe pollution-related problems. It also leads to a shortage of compost as well as reducing the land's fertility. This was a problem in Marx's time. Is it still a problem in the present day?

The answer is 'Yes', and the problem has grown much worse. One particular hazard these days is that owing to the inflow of factory wastewater containing heavy metals sewage sludge compost now contains such dangerous substances as heavy metals, and consequently two principles of regulation have been established to characterize water that is discharged from the sewerage system to nature: the "Concentration Regulation" and the "Total Emission Regulation". The former regulation is used in most cases to deal with the problem of heavy metals, while the latter is used in the case of eutrophication (that is, the process of making a body of water eutrophic: when artificial nutrients in water lead to depleted oxygen levels and an overabundance of water plants, and ultimately to the death of the water).

Aside from these problems, the sewage system itself has severe shortcomings that spring from its construction. Most modern sewage systems are planned as large-scale "public investments" and are sometimes *over*-invested. This over-investment leads to inefficiency in the working of the system and consequently burdens municipalities that suffer from a shrinking population.

As a result of pollution caused by both "wastes of production" and "wastes of consumption", the coastal areas of Japan have seen a decline in their fishery industries. Consequently, the Japanese fishery industry has shifted to deep-sea fishing and is limited to an "EEZ (exclusive economic zone)". In the face of an increasing demand for fish in the U.S. and Europe, it becomes necessary for the Japanese fishery industry to protect those marine resources under its management.

4-4 The product itself

Within the world of contemporary capitalism, the greening of "commod-

ity" and the commercialization of "green" are proceeding simultaneously. In other words, the desire to be eco-friendly and the need to make a profit do not necessarily contradict each other. As is often the case when certain innovations capture the public's attention, "eco-friendly products" and their imitations are inundating the market.

Although such "eco-friendly products" are precious, it is important to check whether they are hazardous to human beings. We can undoubtedly say that various chemical substances surround us on all sides, and some of these substances arouse serious concerns. Yet there has not been enough assessment of their long-term influence on human beings — e.g., their carcinogenicity (the generation of cancerous cells), teratogenesis (the production of congenital deformations), their reproductive toxicity (having a toxic effect on the reproductive organs) and their genotoxicity (having a toxic effect on genetic materials) — and consequently no regulations are in place to counteract these effects.

No matter how beneficial a chemical substance may be, it is necessary to regulate and control its production and usage. The present regulations are inadequate and the introduction of a system such as the Pollutant Release and Transfer Register (PRTR) has become inevitable, while the introduction of the REACH system in the EU is a significant indication that the legal burden of proof is now changing.

The issue of food safety is also becoming ever more important, and it is clear that we need to analyze what factors in the production of food threaten its safety: raw materials, manufacturing processes, or types of additives.

Japan has experienced several cases of serious food poisoning: in the 1950s, we had the Morinaga arsenic milk case, when arsenic was mixed in dibasic sodium phosphate as a stable emulsifier in powdered milk, an instance of the "hazardousness of the additive". Dibasic sodium phosphate is, incidentally, a by-product of aluminum refinery, and ought never to have been used. In China, dairy products contaminated by melamine offer another example of the "hazardousness of the additive". In this case, producers used melamine because it improved "cost performance", "superficial quality and taste". In 2000, an accidental blackout in a Snow Brand factory led to mass food poisoning, an instance of the "hazardousness of process".

Recently, the overuse as well as the diversification of food additives has become a serious problem. At present, approximately 1,500 kinds of additives are used in food. Tsukasa Abe, a former top sales manager in the promotion of food additives, is the author of *The Backside of Food*, in which he exposes many shocking examples of what might be thought of as the criminal use of

additives: meatballs have been made from offal alone and 30 kinds of "white powder (food additives)", while non-dairy cream is made from water, oil and food additives.

Abe classifies food additives into four groups. Only the first group is necessary for food production. Additives in this group have been used for a long time and people have trusted them.

Those in the second group are not necessary but are used to improve the color, taste, and quantity of products. It would not be difficult for a producer to give up the additives in this group.

The food additives that comprise the third group are also dedicated to improving the quality and quantity of products. It would be difficult for a producer to give up these additives, but not impossible. This being so, consumers have to understand the merits and demerits of the food additives that fall within this group.

The fourth group comprises additives that are toxic and artificial and strictly regulated, and consumers should, if possible, avoid products that contain these additives. Among them are artificial colorants, color fixatives, sugar substitutes, antioxidants, artificial preservatives, and agents designed to prevent mold.

Naturally, there are economic reasons for using food additives, and we may summarize them under the following four headings:

[1] To economize on material costs: e.g., by using sugar substitutes, pesticides, bleaching agents, adhesives, a chewing gum base, acidulants and emulsifiers.
[2] To improve the superficial quality and taste: e.g., adhesives, color fixatives, by reinforcement with raising and flavoring agents.
[3] To economize on distribution costs: e.g., through the use of preservatives, pesticides, bleaches and adhesives.
[4] To economize on production costs by automating and speeding-up the production process: e.g., by the use of lubricants such as liquid paraffin.

Aside from the food industry, approximately 10% of the total Japanese workforce is engaged in the auto industry and its related industries, while approximately 20% is employed in the business of capital investment and major export procedures. The auto industry is therefore a "key industry" amongst Japan's capitalist enterprises and it is a highly important player when we consider the relationship between modern capitalism and the problems that beset the environment.

The car industry is a major source of such social costs as waste of fossil fuel, air pollution, global warming, noise pollution and traffic accidents, while air pollution is a cause of acid rain; CO_2 emissions from 10 km of car mileage are the equivalent of 1200 liters of carton-packaged milk.

Nor are gaseous fumes from vehicle exhausts the sole source of air pollution: asphalt is used in the making of roads and the asphalt dust raised by vehicle tyres, especially if spiked, has long been recognized as a major source of air pollution and photochemical smog, while the dust created when old cars are shredded is another major problem.

In addition, "public investment" on such projects as highway networks and the consequent long-distance transportation by diesel trucks that such highways have made possible, as well as "Super Forest Highways", help to destroy precious forest resources and irreplaceable landscapes.

Although, from the viewpoint of energy efficiency and environmental friendliness, a public transportation network is much superior to car-related transportation, its benefits are frequently overlooked by those who favor the car. It is obvious that Japan's energy policy and environmental policy lack consistency (see Chapter 5).

5 The global problems of the environment

5-1 Multinational enterprise and environmental issues

As a consequence of the global development of the "concentration of production", multinational enterprises now internalize the global production process. For example, the total sales of Toyota exceed the budget for a middle scale nation such as Thailand.

Multinational enterprises are attracted to developing countries by low wage structures, low material and environmental costs, and lower facility investment costs. They are also attracted to developing countries as destinations for the "export of pollution".

Pollution can be "exported" in several ways. A typical example is the location of such hazardous facilities as those used for the pre-treatment of raw materials in a developing country (such as the iron ore sintering plant in Mindanao Island). The management of one particular chemical plant risked saving investment on safety measures, with disastrous results: the accident at the Union Carbide Corporation Works in Bhopal, India, in 1984. In many cases, producers have exported the making of products that are already prohibited or regulated in the original exporting country.

Jagdish Bhagwati has classified cases of the "export of pollution" under

two headings: "What is Bad Here and Good There" (the case where the product is noxious at home, but useful in the other countries) and "What is Good Here and Bad There" (the case where the product is useful at home, but noxious in other countries). An example of the former is DDT, and the latter is powdered milk (Bhagwati, 2004: 186–187).

At the same time we may notice what has been called "the pesticide boomerang", where agricultural chemicals prohibited in a developed country are exported back to that country through the pesticide residue in such farm products as bananas, lemons and coffee beans. So it is that the damage caused by "the export of pollution" affects not only the "importing countries" but extends to the "exporting countries" as well (Teranishi, 1992: Chapter 2). We can thus easily understand how the mechanism of "price destruction" interacts with "environmental destruction".

5-2 The environmental problem in developing countries

The issue of starvation in Asia, Africa, Central and South America is closely related to deforestation and the resulting desertification. In these regions the growth of industrialization occupies a problematic economic and political place in a traditional structure of plantation and "monoculture economics", as well as having to come to terms with local conflicts between tribes. These older structures of tribal life encourage the "surplus-population" to exploit the forests, and this exploitation results in three excessive activities: over-cultivation, over-browsing, and over-deforestation. In developing countries these three conditions result in the disruption of the rain forest and partial desertification, and thus lead to soil erosion, a familiar reason for famine and starvation (Ishi, 1988: Chapter 1 "The Disruption of the Ecosystem")

By encouraging resource development in the rain forests and by exporting armaments, the developed countries aggravate these environmental problems and promote starvation by allowing trade conditions to deteriorate and the market price to decline. The familiar mantra of "famine aid" is therefore not enough. What we need to do is to clarify the fundamental mechanism of the causes of famine itself.

We may note, too, that many types of famine aid from developed countries actually disrupt the efforts of the developing countries: in Africa, for example, gifts of used clothing have destroyed the local textile industry, while the overuse of antibiotics enables germs to develop a resistance to the drugs' effectiveness (Ishi, 2009: 220).

The history of deforestation is a prime example of the negative impact of

global capitalism. Around the world, forests of more than 180 million hectares, 6 times as large as the landmass of the Philippines, were lost from 1980 to 1995. It is perhaps a surprise to learn that it is in the developing countries that most of the forests have been lost (Ishi, 2008: Chapter 6).

Ironically, this deforestation in developing countries has rebounded and in turn threatens developed countries through various environmental problems that can now be felt at the global level, such as the growth of desertification and the rise in the density of CO_2. The richer East Asian countries — Japan, China, Taiwan and Korea — bear some responsibility for this, thanks to their insatiable need for wood imports and because of their overhunting of marine resource.

5-3 Environmental problems at the global level

As we have now belatedly come to realize, acid rain is a consequence of the emission of exhaust fumes from cars, households and factories; and since exhaust fumes "know no borders", they move freely through the upper air and carry acid rain with all its problems to the whole of Europe, to the former Soviet Union and to Central and Eastern Europe no less than to the countries of Western Europe.

Global warming, caused by an increase in the density of CO_2, is another typical example of environmental problems at the global level, while desertification and deforestation also affect climate change. We shall review this point more specifically in Chapter 9.

6 Environmental problems in former socialist countries

The purpose of socialism was to end the contradictions inherent in capitalism — such as exploitation, unemployment and the private ownership of capital — but socialism as practiced in the former socialist countries failed completely to achieve its goals. That failure has had a profound impact on the environment.

We will roughly sketch the environmental problems associated with those former socialist countries in terms of the following three conditions: [1] the Political System, [2] Technology and Economy, and [3] Recognition and Information.

It is estimated that Russia, the heart of the former Soviet Union, is probably the most polluted area in the world. This is because of the massive environmental problems that accumulated during the lifetime of the Soviet Union. Now, at the time of the transition to a market economy, these

problems are growing steadily worse. As well as the very obvious condition of air pollution, the ageing of urban water and sewage systems is an especially serious problem, while in rural areas the main problem is the deterioration in the fertility of the land. At the same time, the budget for forest fire protection has been cut and because of the felling of timber and the summer hazard of wild fires, the forests are shrinking.

The disruption of the forest ecosystem is proceeding unchecked: overhunting is frequent, and so is the plunder of natural resources. The problems of radioactive contamination due to the accident at Chernobyl and other poorly supervised nuclear experiments remain unresolved (Ishi, 2008: Chapter 10).

A drop in the average life expectancy in Russia reflects confusion in society and the prevalence of social dysfunction: in 2002 it stood at 58years for men and 72years for women. This tendency is prominent even amongst the high-income group. The reasons behind this are the high turnover rate in employment, the crime rate, as well as inequality of income and the high incidence of alcohol abuse (Walberg, 1998).

Masaaki Kuboniwa points out two reasons why pollution has become so much more serious in Russia than in capitalist countries: firstly, since Russian socialism lacked appropriate market mechanisms and a settled price system, nothing encouraged or inspired such innovations as energy saving technologies; secondly, in socialist Russia human rights were evaluated so poorly that the disclosure of information was never permitted, and no attempt was made to establish a parliamentary democracy (Kuboniwa, 1992: 2).

Some years ago, I analyzed the environmental problems in the former East Germany and discovered the following facts: production was always given priority, energy was priced cheaply, insufficient investment was provided for production plants, and citizens' rights were suppressed (Yoshida, 1998).

We may summarize the three reasons why environmental policies in the former Soviet Union and its satellites in East Europe failed to work effectively as constituting a lack of democracy and the concentration of power in the hands of an oligarchy, the lack of a price mechanism and insufficient levels of investment, the deliberate neglect of human rights and insufficient disclosure of information.

While research into the environmental problems that have affected the USSR has been relatively limited, we have learned a great deal about conditions in China. In China, environmental problems can be characterized as played out against the historical background of an exhausted economy after the Chinese Civil War, the foundation of a socialist country, the promulgation and execution of the Great Leap Forward, and the political turmoil that followed

the Cultural Revolution.

From the founding of present day China in 1949 up to 1973, no mechanism existed for environmental conservation and no law existed to ensure it. The officials who took charge of environmental problems in the '80s, had to deal with the negative legacy of the damaging conditions that socialist China had left unattended.

Although its effects have not yet become clear, China has introduced a pollution levy system as well as a legal system called "The Three Simultaneous Introductions (San-Tong-Shi) System", i.e. a system that requires planning, construction, and the operation of pollution prevention equipment. Since the amount of the pollution levy is now set low, it does not affect a company's decision making. Moreover, because collection of the levy is not applied consistently, it forms only a tiny part of the investment devoted to environmental protection.

China's pollution problems, which are caused not only by its production plants but also by the disruption of the ecosystem, are indeed serious, where deforestation, soil loss and the reclamation of lakes, for example, have led to large-scale flooding and the drying up of the Yellow River (Ueda, 2009).

China's fundamental environmental problem is that it has become "the factory of the world", supported by its "three low costs": i.e., low wages, low material costs, and low environmental costs. It has been estimated that a quarter of China's CO_2 emission is related to exports, and in 2008 China became the world biggest exporter of machinery, ending what till then had been the dominance of Germany.

My investigations of China's environmental problems suggest that three institutional issues constitute the core of the matter:

[1] The government's evaluation of a company's worth on the degree of its economic growth and the scale of employment,

[2] The existence of what is called a "Company Town",

[3] The difficulty of providing administrative relief owing to the insufficient separation of powers.

And because China has adopted the policy of the public ownership of land, the status of residents and farmers is highly vulnerable (see Chen, 2008: Chapter 4).

Economic policy must therefore set a fair price for resources and energy if it really intends its environmental conservation to be efficient. The present pollution levy system leads to misunderstanding, and many firms believe that the authorities actually permit the pollution that they cause.

China needs to adopt the following measures to deal with its environmen-

tal problems:

[1] Political measures: the enlargement of municipal autonomy and the correction of income disparity,
[2] Economic measures: reform of the price of Energy and Resources,
[3] Informational measures: the introduction of information disclosure and public education of environmental issues.

It will be no less difficult for China than for East Asia as a whole to achieve sustainable development without first solving the problem of social disparity and the need to protect the environment: hence the Chinese government's adoption of the slogan "a harmonious society".

Nor should we neglect the responsibilities of those developed countries that invest in China and import its cheap products. The world must change its habits to encourage China to change its own, too (Yoshida and Yoshida, 2008). The resolution of the problems that affect China's rural areas will increase the wage rate worldwide, while the enforcement of the reduction of China's CO_2 emission will be a major step in the fight against global warming.

Japanese-Chinese cooperation is indispensable if we hope to achieve environmental conservation in East Asia. China is responsible for air pollution and water pollution in both Japan and Korea, and joint actions between the countries are urgently required to deal with air pollution, the emission of carbon dioxide, and water pollution. Japan and China must abandon their export-oriented economies, and the two countries should cooperate through the expansion of their own domestic markets.

Summary

We have classified wastes into four groups: "the wastes of production", "the wastes of consumption", of "the sewage system" and "the product itself". This classification has enabled us to confirm that environmental disruption and the disruption of nature are not necessarily synonymous. This conclusion brings us nearer to understanding the crisis that human existence faces both locally and globally.

Marx's *Das Capital* surveyed the future of society in the following terms: "Freedom in this field can only consist in socialized man, the associated producers, rationally regulating their interchange with Nature, bringing it under their common control, instead of being ruled by it as by the blind forces of Nature; and achieving this with the least expenditure of energy and under

conditions most favourable to, and worthy of, their human nature." (Vol. 3, Chapter 48: "The Trinity Formula").

When we consider Marx's formula in the light of contemporary capitalism, we deduce that we need to reconsider the relationship between the natural world and human beings. The concept of sustainable development and the restoration of the presently disturbed "metabolism of humankind and nature" will be the key.