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Population, Development and Environment in Japan

— Asian Experience —

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The Asian Population and Development Association

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THE ASIAN POPULATION AND DEVELOPMENT ASSOCIATION, 1991
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Foreword

Population, environment and development are mutually intertwined. Their relationship is exceedingly complicated. The reciprocity that exists between population, environment and development is theoretically still not clear.

It was thought that population and development could continue to increase and to expand forever. Through progress of science and technology, economic development was activated and living standards of people rose. The rate of population increase dropped with the process of modernization due to industrialization and urbanization. This adaptive relationship between development and population continued up until the prewar era.

However, after the Second World War a complete change occured in the situation. Suddenly, world population began to increase at an extremely high rate. Since the dawn of history human population has never known such an increase, so-called population explosion. Recognition that the earth's natural resources have limits, and that the environment is being destroyed, constitutes an emergency that must be dealt with swiftly.

From a worldwide perspective, concern and measures to be taken from a collective standpoint are being initiated. A particularly important point is the influence of humans in the global warming trend on human survival and the changes it is causing in the earth's environment.

Human society cannot grow infinitely. It is necessary to find some kind of balance between the rate of population development, development and the environment. The idea that we need to create a "sustainable development" must be made acceptable. Mankind's immediate problem is to put this type of development into practice.

Focussing on Japan, her modern era problems of population, development and the environment will be discussed in this article. At this point we would also like to call for joint studies by researchers working in related fields in other Asian countries.

Lastly, I would like to express my profound gratitude to the Japan Shipbuilding Industry Foundation (Chairman: Ryoichi Sasakawa) as well as to the United Nations Population Fund (Executive Director: Nafis Sadik) for their valuable support in the preparation of this report.

February 1991

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Chairman, The Asian Population and Development Association

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Chapter 1

General Links Between Population, Development and the Environment

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1 Two Traps Inherent in Human Existence

Following the Second World War, mankind has experienced a growth in population totally unprecedented in the annals of human history. By the latter half of the 1960s the annual rate of growth of the world population reached 2.06 percent. With the prospect of food production not being able to meet demand and the danger of imminent catastrophe looming if the growth went unchecked, the world entered an age of population control. The term "population explosion" was coined to refer to the phenomenon, and it came to be viewed as a global issue in the sense that all mankind, in both the advanced and the developing countries, was seen to be facing the same fate.

With the advent of population control on a global scale the annual rate of world population growth dropped below 2 percent, reaching 1.74 percent in the period from 1975 - 1980. However, after this the population growth rate did not continue to drop as estimated and in fact remained at slower pace. The danger poised by the population explosion had seemed to be diminishing for a while, but then concern again began to increase. The new population projections of the United Nations (1988) revised the figures of the earlier version (1982) in the following ways. The projected world population for the year 2000 was raised from 6.127 billion to 6.251 billion, and the population for 2025 went up from 8.26 billion to 8.467 billion. This amounted to an extra 124 million persons in 2000, and an additional 261 million persons in 2025. Furthermore, the annual population increase in the 1990s (97 million) is estimated to be the highest in the 20th century. If it continues for ten years, the result will be an aggregate increase of one billion persons.

The high variant of these revised projections forecasts a world population of 9.423 billion in 2025. If we extrapolate the annual rate of increase for 2020 - 2025, this would mean that the world population will reach 10 billion by 2030.

The previous projections made in 1982 assumed that the population increase rate would decrease in all regions of the world except for Africa and parts of South Asia. It therefore predicted that the world population would stabilize around 10.2 billion around the end of the 21st century.

However, it now seems that the likelihood of things working out this way are slight. The fertility now appears to be dropping more slowly than anticipated, and the UN is again revising its population projections upward. The estimates which have been released early this year, 1990 speak of the world population reaching 6.26 billion before the end of the century, and eventually stabilizing not around 10 bil-

lion, but at approximately 11 billion.

If the birthrate continues to drop more slowly than predicted, the final, stable population total could be as high as 14 billion. This means that the human population will continue growing for some time to come.[1)]

Even more than before, the population explosion has become an issue which must be viewed from a global perspective and which demands expanded and more powerful countermeasures. Another serious issue demanding urgency concern along with this new stage of the population explosion is the global environmental situation, and particularly the problem of global warming. The effect of global warming is a truly global problem which affects all nations, both advanced and developing, equally.

2 The Development of the Environmental Problem

The environmental problem has come to be widely recognized as an issue affecting all of spaceship Earth as described in the preceding section only very recently, in the 1980s. The United Nations Conference on the Human Environment (Stockholm, 5 to 16 June, 1972) was held only 20 years ago. In those days, understanding of the relationship between the environmental and population problems was only in its formative stages. Calls for restraining the rate of population growth and implementation of family planning programs met strong opposition from the representatives of developing countries. Even the Declaration on the Human Environment hardly touched at all on the effects of population growth on the environment. The only references to population growth and population policies appeared in article 5 of the preamble to the Declaration and in "Principle" 16.[2)] For example, article 5 of the preamble reads: "The natural increase in the population inevitably leads to problems effecting the preservation of the environment. Therefore, appropriate policies should be adopted and measures taken to deal with these issues." Positive expressions such as "restraining population increase" are avoided. "Principle" 16 ends on a very passive note, stating that "Population policies which do not infringe on basic human rights, and which are considered appropriate by the government authorities, should be instituted in regions where the rate of population increase and the concentration of people are likely to have an adverse effect on the environment and on development, and in areas where improvement of the human environment is hampered and development is impeded by low population density."

It is not going too far to say that at that time in Japan that problems such as pollution generated by industry and urban areas were pigeonholed under the heading of "environmental issues," and that there

was no awareness at all of the connection between the environment and population related issued such as the population increase and family planning. Critics of the recommendations made by the conference noted that insufficient consideration has been given to overpopulation, malnutrition and the accumulation of population in urban places, and that these issues were not even addressed in the final recommendations.[3] Nevertheless, in the years following research and international conferences on the societal and economic repercussions of the population explosion have succeeded in raising awareness of the connection between population increase and resources, the environment and development. The alarm warning of the impending catastrophe of a drastic increase in mortality due to insufficient food and environmental deterioration caused by unchecked population increase and economic growth was sounded in its clear-cut form by the book The Limits to Growth [4], which was published in the same year as the UN conference mentioned above. Here the adverse effects of continued population increase and economic development on resources (food) in the form of shortages and on the environment were presented clearly, and the necessity for harmonious and balanced effort on the part of mankind in order to save our finite Earth was emphasized.

The next event to have a significant impact on world opinion was the publication by the U.S. government of a report entitled The Global 2000 Report to the President -- Entering the Twenty-First Century [5] in 1980. It presented a comprehensive analysis of the global environment through the end of the century from a wide range of viewpoints, including the issue of population growth. This report had a considerable influence the world over.

Further impetus was given to environmental awareness by the World Committee on Environment and Development (WCED) which was founded under the sponsorship of the Japanese government in 1984. The conclusions of the committee were published under the title Our Common Future [6] in 1987, concurrently with the committee's Tokyo Declaration. The notable features of this report are (1) that it considers the environment in terms of its relationship with development, (2) that ample consideration is given to the problem of population increase and the links between that increase and the environment and development are examined, and (3) that the concept of sustainable development is presented not as a concept conflicting with environmental preservation, but rather based on the basic premise that only through preservation of the environment does sustainable development over the long term become possible. These principles received worldwide support and were hailed as epoch-making ideas. Previously questions of the environment and resources were seen from opposing viewpoints by the countries of North and South. The developing countries maintained that the global environmental problem was the result of wasteful use of resources by the advanced countries. The developed countries countered by criticizing what they viewed as the blind development taking place in developing countries. The coun-

tries of the Eastern European Block argued that the environmental problem was the product of the contradictions of capitalism and that it did not exist in socialist countries.

In fact, the failure of policies aimed at producing rapid economic growth left many developing countries saddled with enormous foreign debt burdens. Reckless, ill planned development had ruined vast tracts of land and was contributing to desertification. This left them no choice finally but to recognize the importance of preservation of the environment and resources as a foundation for development. It also began to be acknowledged in the Eastern European countries that their pollution problem was worse than that in the West. The concept of "sustainable development" as proposed by the World Committee on Environment and Development has been widely accepted over the world as a guiding principle. The question for the future is what concrete measures to take to make this principle a reality.

3 Links Between Population, Development and the Environment

Sustainable development is receiving a great deal of attention as a completely new approach. But the idea of sustainable development is not an independent notion. To make it a reality, a sustainable population growth rate and a sustainable environment are prerequisites. In this sense, the above three factors are inextricably connected. All three must be "sustainable".

Nevertheless, before the Second World War the interrelations between population, development and the environment were hardly recognized at all. There was virtually limitless frontier in the world which could be developed, and even if the population increased, production could always be expanded to produce enough food to feed them. Even primitive tribes living hidden in mountain valleys had just enough room to continue cycles of slash and burn cultivation. Apparent destruction of the environment can be said to have had no effect whatsoever on the human population. However, in feudal times when very little land was under cultivation, putting an absolute limit on the population which could be fed with the volume of agricultural produce harvested, there were cases of infanticide, abandonment of elders too old to work and migration to other regions. In situations such as these there were so-called implicit societal norms and forms of "mutual coercion through mutual agreement". [7] In these ways destruction of resources and the environment was prevented. At present, on the other hand, the population is undergoing an explosive increase, and demand and consumption are accelerating at a tremendous pace. With depletion of resources and environmental destruction proceeding on a global scale, some sort of mutual coercion through mutual agreement is necessary. One step in this direction would be the setting of a binding limit on the level of carbon dioxide emissions.

At any rate, it is clear that population increase and the concentration of people in the cities is having an obvious impact on resources used in common and the environment. However, many points still remain unclear regarding the complex interrelationships between population, development and the environment. One of the most important priorities for the future of humankind is research, supported at the national or international level, aiming to make clear the dynamics of these links.

At this point, let us consider a few concrete examples which are widely observable.

First, there is the destruction of the resource base which can be seen in a number of developing countries. The poor populations of developing regions engage in indiscriminate deforestation, deplete water sources and allow their livestock to overgraze the land in their urge to obtain food, water, fuel and feed for their animals. Insufficient fuel already affects some 1.3 billion people in developing regions. And according to FAO calculations, the number will reach 3 billion by the year 2000.

Second, slash and burn cultivation is still practiced in the tropics. Due to factors such as increasing population and unequal land distribution, already meager forests are cleared to make plots for farming. Another cause of deforestation in tropical regions is the growing world timber trade. This primarily takes the form of exports of raw materials to industrially advanced countries and is leading to resource destruction. There is the danger that exports of lumber, minerals and agricultural produce from developing regions will go beyond the sustainable level.

Third, as demand for water for irrigation and industries has increased, so have requirements for household water grown with the population increase. Insufficient water is one of the reasons for migration from villages. This is also one of the major causes of sickness and premature death, particularly among infants, in both urban and rural areas. A high infant mortality rate in turn contributes to poverty, frequent pregnancies and the desire for large families.

Fourth, rural poverty is causing many small tenant farmers to flee to the cities. However, many cities in developing countries lack sufficient water, sewage treatment facilities, food, fuel, housing, education, medical services and job opportunities, and also lack capacity to respond to them.

Fifth, among the resources-versus-population problems faced by

by the productivity of a small area of land, life beyond the limits imposed by the volume of agricultural produce was impossible. So the population was kept within a fixed limit. In order to maintain this limit, excess population was dealt with by means such as infanticide, abandonment of the elderly or migration. Since the population increase is so pronounced today, villagers in developing regions are forced to use marginal land. Slash and burn cultivation is on the rise and deforestation due to indiscriminate cutting down of trees for fuel is occurring. Since developing countries generally have very little new land available for development, the size of farms per household, or per capita, is shrinking as the population grows. In the 30 years since the liberation in 1949, China's population has leapt from 500 million to 1 billion. As a result, the average area of agricultural land per farming family has decreased from 2.7 mu to 1.5 mu, and is becoming yet smaller. As the population grows, demand for housing land increases. On the other hand, industrialization and urbanization causes farmland to be converted into land for factories and public facilities. This in turn further decreases the agricultural land available. A rapidly growing population also leads to economic and social difficulties in the cities, while at the same time exacerbating environmental problems.

Now let us examine the effects of population increase on the environment by means of a few simple calculations. First we will assume a rate of annual population increase of 1 percent. This would have been considered quite high when the developed countries were still in the process of modernization. The yearly rate of world population increase was about 0.5 percent during the 19th century, and 1 percent is twice that. This rate of increase suddenly started to rise after 1950, but the 1 percent figure reached around 1950 was already quite high.

If this 1 percent annual rate of increase were maintained, the world population of 2.5 billion in 1950 would be expected to double about 70 years later, or in 2020. But the latest projections 1988, of the UN predict a world population of over 8 billion in 2020. This is 3 billion larger than the population which would have resulted from an assumed increase rate of 1 percent a year. It is estimated that world population passed the 5 billion mark much earlier in 1987. In other words the population hit 5 billion 33 years early. The 1 percent a year rate is in fact twice as high as the current rate of 0.5 percent annually for the advanced countries. But even with this very high rate of 1 percent increase there would have been probably more enough time to work out a solution.

There has never been an population growth on as explosive a scale as this in all of human history, and the lack of understanding of this fact prevents people from to appreciate that population constitutes the underlying factor of the most vexing problems facing us today. The accepted ideas that the best policy for dealing with the skyrocketing population increase is to encourage development and rapid economic

developing countries are the following. It is very difficult to change traditional farming practices overnight to deal with the increased demand. Techniques which may be effective in a small society which a population growing at a slow rate may not be able to meet great demands of a society with rapidly increasing population. Advanced technologies may be advantageous in the short term, but are frequently not appropriate for sustainable use of resources. Familial and social structures which have developed over many centuries cannot adapt to today's rapid changes. The international resources available for development are substantially shrinking, in spite of growing demand.

4 From Independence to Linkage

The relationship between population and development was a comparatively simple one up until the Second World War. Advancing development to the full extent possible made it possible for everyone's standard of living to rise. Increases in production far outstripped the growth in the population, allowing income per individual to continue growing. In those days, no one worried about what effects, if any, depletion of resources and environmental damage might have on people's health. There was a tacit consensus that resources were infinite and that the environment would not be harmed. The only goal was to have the standard of living continue to go up and up. Man was master of the Earth. There was no theoretical ground demanding balance. They were independent entities, respectively.

Now the situation is entirely changed. The abnormal increase in the human population and uncontrolled development are working together to cause ever more environmental destruction. It was thought so far that development in the form of economic growth and industrialization was the key factor to satisfying human needs, to eliminating hunger and poverty, and, finally, to alleviating population increase. This can be said to be the logic of the process of modernization in the West following the Industrial Revolution.

However, after the Second World War it became impossible to continue the modernization path described above. Development, which had made great contributions to a higher standard of living and increased prosperity, was now beginning to have adverse effects on people's lives. This is a contradiction inherent in industrialization itself. The increase in emissions of carbon dioxide, the destruction of the ozone layer, acid rain and global warming caused by the so-called "greenhouse effect" directly affect the lives of human beings. They are the harmful by-products of industrialization.

The effects of population increase on the environment are both direct and indirect. In feudal times when society had to be maintained

growth is in urgent need of revision due to the environmental damage caused by the negative side effects of economic growth and the abnormally high population growth rate. The environment, which used to be an issue outside of the realm of discussions of population and development, now has a powerful role to play.

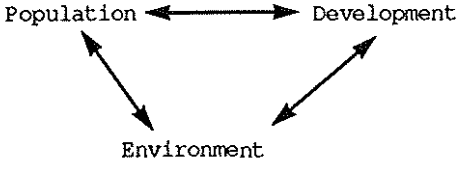
However, without development and without some degree of economic growth, it is not possible to raise people's living standards and quality of life. In other words, we need development which does not harm the environment, or development in balance with the environment. This is the "sustainable development" which was mentioned earlier. Environmentally safe development must be able to satisfy the "needs of future generations" without damaging their abilities, and it must also satisfy the needs of the present generation. [8]

5 New Links and Ecological Transition

The relationship between population and development is extremely complex. However, it is clear that they are intimately intertwined. Economic development raises living standards and provides a basis which contributes to improvements in education and health. These factors encourage shifts in demographic transition such as lowering birth and mortality rates. This in turn contributes to a reduction in the rate of population increase. However, a rapidly growing population uses up the resources which could make economic and social development possible. It therefore interferes with the improved living standards and advances in education and health care mentioned above. This makes it extremely difficult to break out of the pattern of high birthrates and mortality rates.

Amid these mutual associations between population and development, the environmental problem is now an added factor. The dimension of environmental degradation throws the vicious circle between the other two into stark relief.

Now that the environmental problem has been added to the mutual relationship between population and development, the links between it and the other two issues are coming into focus. The relationship can be summed up in the following diagram.



The relationships between the above three issues can be expressed more dynamically as the three stages of ecological transition. [9]

In the first stage of ecological transition, the demands of man (that is to say, the population) are within the biological support system's capacity. Population increase poses no problem in this case because it is within the limits of what can be sustained by the biological support system. Population growth therefore has no significant effects on the environment.

In the second stage of ecological transition, the demands of the population on the biological support system have surpassed the system's support capacity, and consumption of the biological resources themselves begins. In this case there is still room for the population to expand, but not indefinitely.

Human demand continues to expand in the third stage of ecological transition, and the biological support system itself begins to collapse. The ecological balance of the system has been destroyed by the rapid increase in the human population.

The above is an attempt to describe the relationship between population, development and the environment by analogy to transition in an ecological system.

Conclusion: Environmental Issues and Population

In 1975, Mrs. Ariyoshi wrote that "the beauties of nature, flower, birds, winds and moon are exposed to danger ... in the cities and villages strange diseases claim ever more victims."[10] It was when pollution, the other cutting edge of the sword of progress forged for us by modern science and technology, was on its peak. Three years before, in 1972, the United Nations Conference on the Human Environment was held in Stockholm. However, at that time awareness of the critical issue of the human environment degradation was spotty and localized, not only in Japan but all over the world. The problem was considered one which could be solved through continued scientific advances.

That the environmental problem crosses national borders and affects many countries, that then it is a global issue of concern to the whole of mankind finally has been realized only in 1980s,particularly after the mid 1980s. This was due to appearance of the problem of global warming termed the greenhouse effect. It was recognized as a danger threatening mankind itself, with no distinction in its effects between advanced and developing countries.

Mankind finally came face to face with the difficult issues of the population explosion and global environmental destruction. "We must never forget that the human population is in fact but one component of the environment. Therefore, in order to attack the population problem we must view the environment not only in physical, biological and chemical terms, but also from the sociocultural and socioeconomic standpoint. When we speak about population in this context, it becomes a very meaningful issue."[11]

The population lives within a biological and sociological environment. We must come to realize that we are in the process of destroying it.

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Chapter 2

Economic Expansion and Environmental Problem

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Introduction

With the accomplishment of the rapid expansion of the Japanese economy after World War II the environmental problem received major attention here only in the recent past. From the pre- to the post-war period the Japanese economy was quite backwards in comparison to the developed countries of Western Europe. This is clearly evident from factors like structure of production facilitites and individual living standard. Consequently, it became the national objective to catch up with these countries. Following the post-war reconstruction the Japanese economy entered a process of high grade economical growth in the fifties, realizing gradually the objective of catching up. On the other hand, this process of economic expansion caused damages to the environment and thus gave rise to a new problem. During the sixties more and more voices arose saying that economic and social development should progress simultaneously to solve the environmental problem. As a result economic expansion and environmental concerns were harmonized to a high extent. However, since the expansion of the Japanese economy consumed a large amount of raw materials from other countries, it caused also environmental destruction in these countries. For this reason the claim arose recently, that this economic expansion is cause for an international environmental problem which cannot be solved just on a domestic level.

Though the relationship between economic expansion and environmental problems is multi-faceted, this manuscript examines the relationship between economic expansion and environmental problem with special emphasis on the aspect of demographics.

1. Population and Environment

Population and environment were put into a relationship by the classic theory of Thomas Robert Malthus. To be more precise, his theory deals with the relationship between population and food or life essentials. By a wider interpretation his theory can also be applied to the environmental problem. Malthus' theory is based on the following juxtaposition: Population can grow in a geometrical progression, but the capacity of the supporting environment can only grow in an arithmetical progression. On the basis of this premise Malthus concludes, that population growth will not cause any environmental conflicts in the beginning, but with the progression of the population growth the environment will be put under increasing strain, until a point is reached where the population growth has to be restricted by some means. In this case three ways of population control can be distinguished. The first is the control of the birth rate, the second is a raise in the death rate, while migration constitutes the third way. If among these

three ways neither birth control nor migration can be realized, the only population control will be achieved by increased death rates due to disasters. As commonly known, Malthus emphasized these three possibilities of population control.

In the case of Japan, the first half of the Tokugawa period (from the end of the 16th century to the middle of the 19th century) registered a relatively smooth population growth while in the second half of the Tokugawa period the population numbers stagnated. Consequently, it can be deducted that during the first half of the Tokugawa period population and environment were in balance. In contrast, the environmental conditions of the second half of the Tokugawa reign prevented a population increase. In this latter period population growth was checked on one side by the comparatively high death rate and furthermore by artificial birth control. During this period no population control by migration overseas occured.

In the above case the basic premise of Mr. Malthus' theory applies: the speed of population growth exceeds the speed of the growth in capacity of the supporting environment. But if this premise is removed, we get a different picture. In 1868 with the Meiji Restauration a policy of industrialization was implemented which altered the conditions for the environment supporting the population to a vast extent. Actually, it can be said that the relationship or interdependence between population and environment entered a new phase with this development. After this the population of Japan registered a change in the growth rate and increased by 3 to 4 times within barely a century up to the present. Furthermore, the expansion of the modern economy after the Meiji Restauration brought also a vast increase in consumption per head. The course of economic expansion in the industrial era is not only coupled with a growing population but, as a specific characteristic, shows also a significant increase in productivity per head and per capita consumption. Due to this development in modern times the characteristics of the relationship between population and environment change and new problems arise. However, since the population dynamics in the industrial or modern society are influenced by new shifts, the relationship between population and environment becomes even more complicated.

2. Relationship Between Population and Environment in the Modern Society

Before the transition to the modern or industrial society the relationship between population and environment can be simply expressed by saying, that population growth depended on whether the relationship between population and environment was in harmony or in balance. On the other hand, with the onset of the modern society this relationship became

much more complex due to the following reasons:

First of all population dynamics do not only include population growth but also the occuring transitions of the population increase, called demographic transition. This demographic transition passes from a slow population increase in the beginning to accelerated growth in the intermediate phase, which slows down until the population gradually stagnates in the final phase. Malthus' demographic theory is based on the hypothesis of a geometrically progressing population increase, while the demographic transitions of modern society is different from this premise. The theory of demographic transistion conforms to Malthus' theory in the first phase, when a decreasing death rate translates into a population increase. However, a significant difference is the fact that the birth rate is declining as a result of the economic expansion during the intermediate phase. Then in the final phase the demographic transition shows at first a gradual slowing of the population increase until a stagnation occurs in the end. Within the framework of the economic expansion in the modern era we can state, that from the start to the intermediate phase the population increases, followed by stagnation in the final phase, when the influence of the economic expansion is absorbed or nullified.

As a second reason for the increasing complexity of this relationship between population and environment we have to consider the fact that the economic expansion of the modern era is linked with a steady increase of consumption or living standard per capita of labour force or population. Before the emergence of the modern society Malthus' theory applies, since the living standard was fixed to the subsistence or survival level. However, modern society registers a constantly increasing living standard. When methods of production were improved and upgraded with the beginning of the modern era, the energy demand or consumption of energy resources increased while capital and technology, as prerequisites for production, gained an overwhelming importance. Therefore, we can conclude that a constantly improving living standard will induce population growth. This explains why the population numbers after stagnating in the latter half of the Tokugawa period, increase with the onset of the Meiji era. Yet in contrast to the past the population increase during the modern era did not cause a decline in living standard, but actually contributed to the advance of the economic expansion. Indeed, this is a most significant feature of modern society. As stated above, the population of Japan registered a gradually accelerating increase in accordance with the demographic transition theory during the Meiji and Taisho eras (mid 19th century to 1926). Furthermore, this increase coincided with a doubling of productivity and consumption per capita. Therefore, we can say that economic expansion in the modern era led to a population increase coupled with an increase in per capita productivity and consumption, resulting in added pressure on

the environment by the combination of these two factors.

However, with the end of the intermediate phase of the modern economic expansion we are witnessing a slowdown in population growth. In the case of Japan the highest population increase was registered from the end of the Taisho era to the early Showa era. After that the population increase rate shows a declince. With regards to the economic expansion of modern society the population increases from the beginning to the intermediate phase and the environment is influenced by this aspect. With the end of the intermediate phase the influence of the population growth on the environment diminishes. On the other hand in this later phase the increased per capita productivity and consumption, as a consequence of the past population increase, constitutes a new aspect which influences the environment increasingly.

3. Urbanization and Environmental problems

Although big cities had already developed before the dawn of the industrial era, the economic expansion of the industrial age had a great influence on the urbanization of the population. In general, demographic transition theories take into account the changing relationship between birth and death rate. However, since modern society is affected comprehensively by demographic transition the population movements must be included in the overall framework.

The demographic transition theory asserts the environmental impact of modern society not only by the changes in birth and death rates but also by taking into account accompanying influences like the various socio-economic factors, the population movement in the modern society and the socio-economic expansion. Another influence on the environment, which cannot be neglected, is the urbanization of the population.

With the end of the Meiji era a gradual urbanization occured in Japan. Especially during the period of expansive industrialization, in other words after World War II, population migrated to the big cities. In the national census, taken in 1919 (year 9 of the Taisho era), the share of the urban population was found to be 18% of the overall population. By the year 1940 (year 15 of the Showa reign) the share of the urban population had risen to 38%, by the year 1955 (year 30 of the Showa reign) to 56%, by 1970 to 72% and by 1985 the share had climbed to 77%. The concentration of population in and around big cities following World War II can be seen by the population increases in and within a 50 km radius around Tokyo, Osaka and Nagoya. By the year 1960 already 33% of the populace lived in these areas, by 1970 their overall population share had risen to 41% and in the year 1985 it had reached 43%.

Generally speaking, we can distinguish two reasons for urbanization. First, there is the absorption power of the big city, attracting people from rural villages. Second, there is population pressure in the villages, forcing people to leave. Although these two factors work in concert to trigger migration, it is very difficult to determine the individual weight of these factors.

The migration caused by these reasons will not result in problems, as long as the accommodation capacity of the city is appropriate to the moving population and the number of people leaving does not strain the village. However, if these two conditions are not fulfilled, problems will occur on both sides, i.e. in the urban and the rural area. In prewar Japan the phenomenon of urbanization caused hardly any problems. During this period the economic expansion was accompanied by a rise in labour demand, which attracted the rural excess population and induced them to move to the cities. However, with the begin of the high growth period after the war, an increasing migration led to the loss of this balance, causing problems in the urban and rural areas simultaneously. Since the main effort was focussed on economic expansion itself, the creation of necessary facilities for the urban environment as well as the development of rural areas were delayed. Consequently, the urban accommodation capacity was exceeded by the influx of people while the rural areas on the other hand had difficulties to maintain the required labour force - a two-pronged problem resulted.

Urbanization must be understood under the terms of demographic dynamics in modern society, of which one aspect is the decline in birth and death rates and the accompanying inevitable phenomena. As explained above, the excessive migration will have a strong impact on the urban and the rural environment and leading to big problems. However, the urbanization problem has also other aspects. Since life patterns advance and living standard is rising in the urban environment, a strong influence on environment and resources will result. On the other hand the life style of the rural population still remains comparatively close to nature and the pressure on the natural environment actually recedes due to the urbanization. In contrast, the urban population leads a rather unnatural life. Furthermore, the remarkable rise in living standards demands more resources and raw materials which inevitably increases directly and indirectly the pressure on the environment.

It cannot be denied that the economic expansion with the increase in population and higher per capita productivity and consumption was accompanied by destruction of the environment. Though the extent of destruction differs according to the individual conditions, it can be put in a general context by the following guidelines. If the progress of economic expansion is assigned to the horizontal axis and the destruction

of the environment expressed by the vertical axis of a system of coordinates, the relationship between the two phenomena or factors results in a curve as shown in graph 1. In other words, during the initial phase of the economic expansion the destruction of the environment occured on a comparatively small scale, but with the progress of the economic expansion the scope of the destruction increased rapidly. On one hand, during the economic expansion the environmental destruction was due to the low level of technology with regards to environmental safety and damage restriction, while on the other hand industry, society and citizens still lacked environmental awareness. However, in the course of economic expansion the citizens become aware of the destruction of the environment, causing more and more voices to call for control. Consequently, the government, industry and also consumers are exploring ways to limit environmental destruction and implement those methods. As a result the negative relationship between economic expansion and environmental destruction is improved, so that despite a continuing economic expansion the scope of the destruction of the environment declines. This development becomes evident from the logistics curve in graph 1. Also, this graph does not assume that the environmental destruction will become zero. Even if technology progresses and the economic expansion comes to an end, a certain degree of environmental damage in all probability will not be avoidable. In order to avoid environmental destruction totally, any economic growth would have to be rejected - an unrealistic assumption, considering the generally prevailing attitude among people. In view of a 1987 per capita GNP of 19,553 U$ in Japan (compared to an average of 661 U$ in ASEAN countries) the problem comes up, whether the economic expansion should be sustained or not. However, this problem requires separate consideration.

The relationship between economic expansion and environmental destruction can be seen as interdependent whereby economic expansion will be inalterably linked to destruction of the environment. And since economic expansion is viewed as a national task by the modern society, it will not be opposed in itself. However, if in the course of economic expansion the destruction of the environment is gradually turning into a big problem, opposition will occur. Japan experienced this conflict in the latter half of sixties and the beginning seventies. It was solved according to the slogan "Harmony between Economic and Social Development" by balancing these two factors. The explanation of graph 1 above seems to implement already this formula as solution. However, the implementation and success of this solution formula are not always possible. This depends on whether the group, profiting from the economic expansion, and the group suffering damage from this expansion can meet on an equal level. Then the opposing claims must be judged fairly for reaching a solution and implementing it. The concrete solutions in the case of Japan

are explained in a later chapter.

If this problem is not solved by this formula, or in other words, if the voices for putting priority on economic expansion cast aside the opposing arguments, significant environmental destruction and sacrifices will be the consequence. It is well known, that after the war Japan put priority on economic growth and suffered environmental destruction in return.

Though the conflict between economic expansion and environment within one country can be solved by mutual consultation of the opposing parties concerned, we must not forget to search also for a solution of the global aspects of the environmental problem. Especially, in the case of the Japanese economy, which is closely linked to many countries abroad, this global aspect becomes very important, since the domestic economic expansion will influence the environment of other countries. Even if the environmental problem is solved domestically in Japan, this problem is not remedied from a global viewpoint. To say it simply, the environmental problem cannot be solved as a domestic problem, if it also affects other countries. Since economic expansion and the accompanying environmental conflict do not occur isolated in one country, but have to be seen in a context of global economic expansion and environmental problem, we have to think about this problem with a wide field of vison

5. Global Viewpoint

At present the world population has reached 5.3 billion. In comparison to 40 years ago (1950) the population jumped by 2.5 billion. After World War II a period of global peace followed, allowing a rapid growth of the world population. According to a UN projection the population will continue to grow and is expected to reach 6.3 billion in 2000, 8.5 billion in 2025. If the population growth equalled prosperity, this increase would be positive. However, under close examination unfortunatly this situation does not bide well. First of all, the world is divided in advanced areas and developing areas with a significant disparity in wealth, which cannot be ameliorated at a stroke. Of the present global population of 5.3 billion people 1.2 billion live in advanced countries, while the remaining 4.1 billion, with an overwhelming share of them in poverty, inhabit the underdeveloped areas. The discrepancy in population increase is becoming bigger, and as consequence the discrepancy in living standards or wealth will be magnified. In the year 2000 the population of the adavanced countries is expected to reach 1.3 billion, compared to 5.0 billion for developing countries. In the year 2025 the populations are presumed to reach 1.4 billion and 7.1 billion respectively.

The impact of this immense population growth on the global environment will be beyond imagination. Natural disasters and famine will be the consequence, demanding constant humanitarian assistance. It is easy to see, that population growth puts the environment under pressure and causes its destruction. Therefore, the call for restricting this excessive population growth finds wide-spread support. The United Nations, founded after World War II, started early to raise global awareness of the global population problem by conducting several "International Population Conferences". Especially the "International Population Conference", held in Bucharest in 1974, gained great significance by adopting the "World Population Plan of Action". Until then, population control constituted a sensitive question, which caused discord when called up at international conferences. However, with the Bucharest conference an important consensus with regards to population control was reached for the first time. Ten years later the effect became evident at the "International Population Conference", conducted in Mexico. There most countries expressed the same opinion concerning the overpopulation problem.

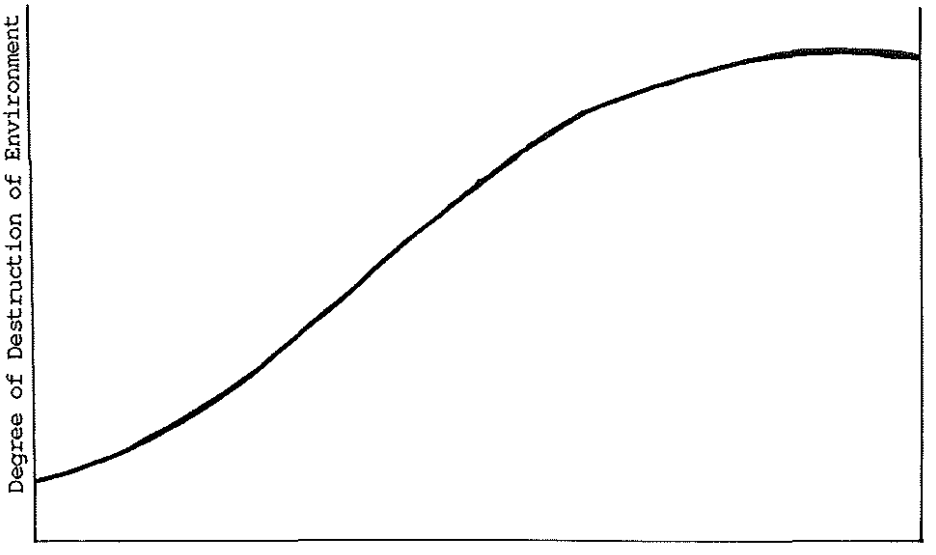
Due to its slow-taking effect, the result of population control will not show quickly. As explained above, the speed of the global population growth will slow down somehow, yet the increase will continue, and with it the destruction of the environment. Seen from the viewpoint of population and environmental protection one cannot help to avoid a feeling of near hopelessness. However, the problem is not so simple. The destruction or worsening of the environment can be classified in three types. The first is the excessive consumption by the wealthy, developed countries, the second is the priority given by newly industrializing countries to economic expansion without consideration for the environment and the third type is the exploitation of natural resources for the mere survival by developing countries (Hironobu Ishi "Global Environment Report", published by Iwanami, 1988). Judged by the aspect of the overpopulation problem the third type will increase strongly. As one remedy advanced countries like Japan have to cooperate internationally to contribute to a solution of the overpopulation problem in developing countries. At the same time the advanced nations must understand, that they contribute to the worsening of the global environment directly and indirectly by their wasteful lifestyle and therefore must strive for counter-measures.

Table 1: Population, GNP and per capita productivity (Annual average %)

Period	Population	GNP	Per capita productivity
1887 - 1913	0.97	2.47	1.49
1913 - 1940	1.24	3.65	2.38
1952 -1979	1.13	8.24	7.03

Sources: H. Obuchi, J. Morioka, Population and Economics, Shinpyoron, 1981, p. 199

Figure 1 Economic Expansion and Destruction of Environment



Economic Expansion on the basis of per capita GNP

Chapter 3

Environment and Population Composition

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1 Introduction

One striking feature of contemporary Japan is the high degree of regional variation in the age structure of the population. This disparity is largely due to the cumulative demographic effects of and repercussions from the drastic population movement which accompanied the process of rapid growth of the postwar Japanese economy. Regional variation in age structure means that the pattern of population distribution differs by age. The population of a given region (generally only the de jure population is considered) lives within the environmental conditions prevailing there. However, even though the population belonging to a particular age group is living in the same environment as the other age groups in the same region, when we look at the situation from a national perspective in order to see how one age group and regional distribution differs from the others, the environmental conditions under which that group is living begin to appear different from those of the other groups. This is the issue which is considered in this chapter. However, data on population by age, if used as the only basis for discussion, would limit us to a simple enumeration of figures on age and population. In this chapter, extensive use is made of data on population by age. But this is supplemented by simple comparisons of school populations at all levels, from kindergarten to university. Furthermore, we also take a comparative look at aspects other than population, such as the "four vital events" (birth, death, marriage and divorce) and statistics on interprefectural migration. In our consideration of the question of living environment, no strict general rules were followed. Quantitative indicators related to environment were selected rather arbitrarily. In this chapter, prefectural population size itself is used as an environmental indicator. We believe that rather than using data (which in fact was not used) such as rates of fertility and mortality by prefecture, the percentage of nuclear families, etc. as environmental indicators, using demographic indicators as environmental indicators will not necessarily yield insignificant or contradictory results. Finally, it should be noted that this chapter does not deal with issues related to the organic relationship between the environment and the population within the ecosystem which they comprise.

2 Methodology

In this chapter, data such as environmental indicators and figures for population, vital events and population movement are considered with the Japanese prefecture as the basic unit. Within each prefecture there are regional variations, and the environmental circumstances and the ways in which the local populace deals with them are multifarious and disparate. However, in this chapter we concern ourselves only with statistics on the prefectural level to simplify the handling of data.

For the time being, when we say "population" we will be referring to "population by age" in the interest of convenience. When we consider a given quantitative environmental indicator at the prefectural level together with a given population by age, we shall represent number "i" prefectural environmental indicator and number "i" prefectural population aged "a" years as:

$$F_i,\ P_i(a)$$

We can then obtain the mean related to Fi for all prefectures weighted for Pi(a) as follows:

$$_wM(a) = \Sigma_i\ [F_i \times P_i(a)]\ /\ \Sigma_i\ P_i(a) \qquad (1)$$

Then,

$$P_i(a)\ /\ \Sigma_i\ P_i(a) = p_i(a)$$

gives us the allotment of population aged "a" years for prefecture "i" as a portion of the population aged "a" years for all prefectures. Equation (1) then becomes:

$$_wM(a) = \Sigma_i\ [F_i \times P_i(a)] \qquad (2)$$

Furthermore, vital events and population movement were considered without consideration of divisions by age, so the calculations involved are a little simpler than in equation (1). In other words, the number of births, deaths and other vital events for prefecture "i" in the year in question, or the number of in- and out-migrants, can be represented as Vi. Then the mean for all prefectures is obtained using the following equation:

$$_wM = \Sigma_i\ [Fi \times Vi]\ /\ \Sigma_i\ V_i \qquad (3)$$

3 Population Size as an Environmental Indicator

(1) Population as Environment

Let us begin by assuming a single prefecture in which a total population of "P" persons lives. To each individual member of the total of "P"

persons living there, the fact that there is a total of "P" persons in the prefecture is one factor in the regional environment. Each individual possesses an environment which consists of the regional population of "P" persons. If we accept this, the total number of residents becomes "P x P" persons. The average per person is "P" persons. This "P" persons is the so-called objective population of the region. In contrast to this, the value "P x P" persons is the total "population environment" as experienced by all of the "P" persons living in the region. (This total sounds a little unrealistic based only on the discussion up to this point.)

Next, we assume that the region we are considering comprises "n" sub-regions. The total population for all these sub-regions is "P" persons. If the population of sub-region number "i" is "P_i," then the total population as environment for the population living in all "n" sub-regions will be as expressed in the following equation, because we are considering that "F_i" = "P_i":

$$\Sigma_i (F_i \times P_i) = \Sigma_i \ (P_i \times P_i)$$

which can be simplified to:

$$\Sigma_i \ P_i = P$$

The difference between "$\Sigma_i (P_i \times P_i)$" and "P x P" is therefore:

$$\Sigma_i \ (P_i \times P_i) - P \times P = \Sigma_i \ [P_i \ (P_i - P)] \quad (4)$$

In equation (4) above, "$P_i - P$" will be negative regardless of the value of "P_i." The population as environment per individual resident we are considering here will always be smaller when considered as a regional allotment of a larger whole than when considered for a single region in isolation.

(2) Population by Prefecture

Next we shall consider the total population size per prefecture as an environmental indicator for the people living in the prefecture, and attempt to determine the mean for all prefectures. We can calculate this using the following equation:

$$\Sigma_i \ (F_i \times P_i) \ / \ \Sigma_i \ P_i = \Sigma_i \ (P_i)^2 \ / \ P \qquad (5)$$

Then, if we further consider the prefectural population size as an environmental indicator related to the yearly vital events and in- and out-migration occurring in the prefecture, we can use the following equation:

$$\Sigma_i \ (P_i \times V_i) \ / \ \Sigma_i \ V_i \qquad (6)$$

If we calculate the total population size by prefecture using equation (5) and data from the 1985 Population Census of Japan, we arrive at a figure of 4,678,138. This is slightly lower than the actual population of Fukuoka prefecture, which is ranged ninth among the prefectures of Japan in terms of population size. The figure is also considerably higher than the simple mean population per prefecture of 2,575,509. We can consider this figure for simple mean population per prefecture as the objective population. In contrast to it, the population we are considering in this section is arrived at through the following process. We ask ourselves what the population size is of the prefectures in which residents live. This population size is the mean value per person for all of the prefectures in Japan. In turn, this mean value is weighted by the prefectural distribution. In other words, we can think of it as the national average per person of the total results we would obtain if we travelled around Japan and asked every individual member of the entire population what the population size of the prefecture they were living in was (considering these answers as uniformly published prefectural population sizes). Now it goes without saying that the greater the objective population of the prefecture, the larger the perceived population per person will be, so the weighted mean population mentioned above will naturally be far larger than the simple mean population.

If we use equation (6) and the 1985 statistics by prefecture for births, deaths, marriages and divorces, as well as in-migration to the prefecture and out-migration from it, to obtain weighted mean population figures in order to determine the prefectural population size in which these events occurred, we obtain the following results:

<Event>	<Weighted mean population per prefecture (persons)>
Birth	4,572,475
Death	4,244,550
Marriage	4,891,588
Divorce	4,962,395
In-Migration	5,343,388
Out-Migration	5,231,598

Of the six events considered above, the mean prefectural population size is lowest when weighted by deaths, and grows progressively larger for births, marriages, divorces, out-migration and in-migration. The inclination toward prefectures containing large cities is most pronounced for in-migration, and least so for deaths.

(3) Prefectural Population Size Considering Population by Age Group As an Environmental Indicator

Now we will continue our discussion by attempting to obtain weighted mean population figures for total population by prefecture, using population by age group as an environmental indicator. We will employ equation (2) from section 2 above for this purpose. In this case, "Fi" in equation (2) will be the total population for each prefecture. According to the results obtained using the population statistics for 1985 [Table 1, column (1)], there is significant variation between age groups. At the same time, characteristic age patterns are apparent. The 20 - 24 age group has the highest figure of 5,312,000 persons. The figure for the older 40 - 44 group is a slightly lower 4,902,000, but is still a significant peak. When higher age groups are considered, the figures begin to drop significantly, reaching a mere 4 million for persons in their eighties. The figures also drop when we move in the other direction toward the younger age groups, reaching 4 - 5 million for persons less than ten years of age. This means the larger the weighted mean population scale figure, the greater the share of persons of that age group to be found in the more heavily populated prefectures. In order to show prefectural distribution by age group or the like, it is normally necessary to present a comparison of the distributional composition by prefecture, or to concentrate on population as the only indicator. However, in our discussion here we have been able to use weighted mean figures to express distribution tendencies for prefectures with larger, or smaller, populations, using population size as an indicator.

If we now compare the results of taking weighting our results by events such as births, deaths, marriages, divorces, in-migration and out-migration, as described in (2) above, with the procedure of using population by age as an environmental indicator discussed above, a pattern begins to emerge. The population size shrinks progressively from a high of 4.75 million for the prefectural population size weighted for births, to 4.53 million for population 0 - 4 years of age, and finally to a low of 4.50 million for population 5 - 9 years of age. In addition, we can see that the prefectural population size of 5.20 - 5.30 million weighted for in- and out-migration corresponds with the figure of 5.31 million weighted for residents aged between 20 and 24.

4 Proportion of Population in Densely Inhabited Districts

The separate urban and rural population figures for administrative districts which were maintained through the 1950s provided a convenient quantitative indicator of the urbanization of units such as prefectures which contain both metropolitan and rural districts. Due to the rapid process of amalgamation of farming areas surrounding urban concentrations into metropolitan administrative districts, however, these statistics quickly begin to lose relevance from the 1960s onward. Then, beginning with the 1960 Population Census of Japan, collective statistics became available for the population of densely inhabited districts (DIDs). When considering individual prefectures, therefore, the portion of the total prefectural population living in DIDs presents a new and very handy indicator of urbanization.

The relation between population by age and proportion of population living in DIDs is something which should be elucidated. We have figures for the population of DIDs by age which were obtained by dividing the population for each age group for Japan as a whole into the portion living in DIDs and the portion residing in other districts [Table 1, column (3)]. It is presented in this chapter only for purposes of comparison. Our purpose here is after all to determine the weighted mean proportion of prefectural population living in DIDs based on the population for each age group weighted by prefectural distribution obtained using the data for each individual prefecture. Here again we will use equation (2) from section 2 above. This will produce a mean value for the proportion of the population of prefecture "i" living in DIDs (Fi) weighted by the proportion for prefecture "i" of the population for all prefectures in age group "a" [pi(a)]. The results of these calculations are presented in column (2) of Table 1. In this section, we used ratios for the environmental indicator "Fi," and obtained weighted mean figures based on them. However, if we tried to calculate mean figures weighted directly by the proportion of population living in DIDs by prefecture, the prefectural total for proportion of population living in DIDs would have to be divided by the total population of all prefectures (= total population of Japan), resulting in a "national statistic" for proportion of population living in DIDs. However, mean values weighted by prefectural population by age group as described above would not be "national statistics" by age group, but rather "prefectural mean values" for each ratio. Therefore, in this study we use these figures as comparative indicators of prefectural distribution of population by age group.

If we compare columns (2) and (3) of Table 1, the variation between age groups is less for the weighted mean values in column (2). This is because statistics for the proportion of population in DIDs for

all ages by prefecture (in other words, representing a population containing persons of all different ages) were used to obtain the weighted mean values listed in column (2). Consequently, these figures show less variation than those based on indicators for specific age groups. Nevertheless, in both columns we can see a peak in the 20 - 24 age group, and a secondary peak in the 40 - 44 group. The figures then drop as age increases, and also we move toward the younger age groups. It should be noted that this same tendency was already evident in column (1) of Table 1.

As an appendix we will take up the school population for the following six educational levels: kindergarten, primary school, junior high school, high school, junior college and university. Mean values by prefecture for proportion of population living in DIDs weighted by prefectural distribution and based on 1985 data are: kindergarten pupils - 61.8%, primary school students - 59.6%, junior high school students - 60.5%, high school students - 61.1%, junior college students - 68.4% and university students - 74.6%. These figures mean that as we progress from the primary school to the university level, the regional distribution of the school population becomes greater for prefectures with a higher proportion of the population living in DIDs -- exactly what we would expect to find. The average figure for kindergarten pupils is slightly higher than that for high school students.

The mean values for the proportion of the prefectural population living in DIDs, based on statistics for 1985 and weighted for births, deaths, marriages, divorces, in-migration and out-migration, follow in descending order: in-migration - 65.1%, out-migration - 64.2%, divorces - 62.9%, marriages - 62.0%, births - 59.9% and deaths - 57.5%. Here again, the relationship with age groups pointed out above can be observed.

5 Observations Based on Socioeconomic Environmental Indicators

For the discussion which follows, we selected the following five indicators (all statistics for 1985): ratio of new constructions of owned houses, cost of residential land and ratio of population covered by waste processing service from the prefectural statistical indicators listed under the category of "living environment" in "Social Indicators by Prefecture," published by the Statistical Bureau of the Management and Coordination Agency, per capita income for prefecture from "Annual Report of Prefectural Accounts" and ratio of land under cultivation, as calculated by the Ministry of Agriculture, Forestry and Fisheries, from "Japan Statistical Yearbook." The procedure described in the preceding sections was then used to calculate all-prefecture mean values for each indicator, weighted by prefectural distribution of population by age group (Table 2). Additionally listed in Table 2 is the proportion of population living in DIDs, which also appears in Table 1. This was done

because many of the other indicators appear to be interrelated with it. However, if we actually calculate the coefficients of correlation, no significant positive or negative correlations emerge. In addition, if we make comparisons with the indicators from the previous section, the correlation coefficients with the weighted mean values for the proportion of the population living in DIDs are as follows: population from Table 1: +0.610; directly calculated proportion of population living in DIDs from Table 1, column (3): +0.558; ratio of new constructions of owned houses from Table 2, column (2): -0.652; cost of residential land from column (3): +0.614; ratio of population covered by waste processing service from column (4): -0.625; per capita income for prefecture from column (5): +0.621; ratio of land under cultivation from column (6): -0.608. These figures are provided for the reader's reference. However, indicators yielding an age pattern with a positive correlation with the proportion of population living in DIDs tend to be analogous, as do indicators yielding an age pattern with a negative correlation. Table 2 lists mean values for the above indicators, as well as for births, deaths, marriages, divorces, in-migration and out-migration, weighted by prefectural distribution. However, we will omit a discussion of these figures due to space considerations.

6 Conclusion

In this chapter we have done little more than convert data on environmental indicators from prefectural statistics into figures based on age group in an attempt to establish a connection between environmental factors and population composition. Nevertheless we succeeded, using an admittedly extremely macroscopic approach, in showing how the environment people live in changes with the age group (through examining data no more detailed than the prefectural level) using simple quantitative indicators which are significant as both environmental and demographic indicators. The features of the age pattern painted by our results regarding the degree of urbanization indicated by the age composition of regional populations do not represent any new insights or exceed what we already know from experience, and in that sense it could be said that this chapter presents no new discoveries. Nevertheless, we can say that the distinguishing feature of this study lies in its attempt to use a variety of quantitative environmental indicators such as prefectural population size to make comparisons of population by age group, vital events, prefectural migration, etc.

The research summarized in this chapter in fact bears a certain relationship to mortality study. These days comparative tables of life spans broken down by prefecture, or even by municipality, are being published. Nevertheless, the comparative study of age-specific mortality in Japan is almost always carried out on the basis of countrywide data. When such an approach is taken, the fact that the environment differs depending on the age group cannot be given due consideration, resulting in a simple comparison of mortality rates for different ages.

However, as even research based on the meager materials used in this chapter shows clearly, quite distinct patterns exist in the variations between the environmental conditions of different age groups. Perhaps it can be argued that this is basically a question of whether the region in which the individual lives shows an overall tendency toward the urban, or toward the rural, extreme. But then the difficult problem remains of determining what effect differences in environment by age group have on age-specific mortality rates. However, attempts such as that presented in this chapter to compare environment by age group by weighting by regional distribution by age group hold the promise of providing a more logical comparison of age-specific mortality rates. Only a limited selection of environmental indicators was used for the present study and we were not able to plot the data over time. We therefore hope to present further verification and amplification of this study at a future opportunity.

Table 1: Mean prefectural populations and proportions of population in DIDs weighted by prefectural proportions of population by age group and all Japan propotions of population in DIDs by age group: 1985

Age group (in years)	Mean value weughted by prefectural proportions of population:		Proportion of population in DIDs for all Japan (%)
	Population scale average values (persons)	Proportion of population in DIDs (%)	
	(1)	(2)	(3)
0 - 4	4,531,264	59.7	59.9
5.- 9	4,499,249	59.6	58.7
10 - 14	4,629,373	60.5	60.1
15 - 19	4,886,789	62.2	64.0
20.- 24	5,312,262	64.8	69.2
25 - 29	4,886,924	61.8	64.3
30 - 34	4,725,787	60.9	61.8
35 - 39	4,797,530	61.6	62.6
40 - 44	4,901,799	62.3	63.9
45 - 49	4,816,933	61.6	62.5
50 - 54	4,622,609	60.1	59.7
55 - 59	4,397,871	58.4	55.9
60 - 64	4,298,135	57.6	54.1
65 - 69	4,256,345	57.4	53.3
70 - 74	4,226,863	57.3	52.9
75 - 79	4,156,312	56.8	51.6
80 - 84	4,099,871	56.4	49.4
85 +	3,999,298	55.8	46.3

Note: Source of raw data used for calculation for each column: Statistical Bureau, Management and Coordination Agency 1986. 1985 Population Census of Japan, Volume 2, Part 1 Japan. Tokyo.

Table 2 Prefectural means of selected environmental indicators weighted by the prefectural proportions of population by age group, vital events and interprefectural migrants: 1985

Age (in years), vital events and interprefectural migrants	Proportion of population in DIDs (%)	Ratio of new construction of owned houses (%)	Cost of residental land (3.3 m^2) (thousands of yen)	Ratio of population covered by waste processing service (%)	Per capita income for prefecture (thousands of yen)	Ratio of land under cultivation (%)
	(1)	(2)	(3)	(4)	(5)	(6)
0 - 4	59.7	39.7	332.5	42.2	2,098	15.3
5 - 9	59.6	39.9	330.7	42.3	2,100	15.4
10 - 14	60.5	39.4	340.7	41.5	2,110	15.4
15 - 19	62.2	38.4	358.6	40.3	2,122	15.1
20 - 24	64.8	36.9	389.6	38.4	2,138	14.6
25 - 29	61.8	38.6	358.3	40.7	2,111	14.9
30 - 34	60.9	39.1	345.9	41.4	2,106	15.2
35 - 39	61.6	38.9	352.9	40.8	2,120	15.2
40 - 44	62.3	38.5	360.6	40.2	2,130	15.1
45 - 49	61.6	38.9	353.7	40.9	2,117	15.0
50 - 54	60.1	39.7	341.1	42.4	2,098	14.9
55 - 59	58.4	40.6	326.7	43.6	2,081	14.8
60 - 64	57.6	40.9	320.3	44.2	2,071	14.8
65 - 69	57.4	41.1	318.2	44.4	2,069	14.8
70 - 74	57.3	41.2	317.8	44.4	2,069	14.8
75 - 79	56.8	41.4	314.3	44.8	2,062	14.7
80 - 84	56.4	41.5	311.5	45.0	2,056	14.7
85 +	55.8	41.6	305.7	45.3	2,045	14.7
Birth	59.9	39.6	335.3	42.0	2,099	15.3
Death	57.5	41.0	318.2	44.4	2,068	14.8
Marriage	62.0	38.5	357.7	40.6	2,116	14.9
Divorce	62.9	37.7	352.6	40.5	2,107	14.9
In-Migration	65.1	36.8	405.0	37.6	2,149	15.0
Out-Migration	64.2	37.2	393.2	38.8	2,124	14.6

Notes: Numerators and denominators of environmental indicators (all figures by prefecture):
Col. (1) Population of DIDs / total population
Col. (2) New constructions of owned houses / all new constructions
Col. (4) Population covered by waste processing service / (population registered in the Basic Resident Registers and registered foreign population)
Col. (6) Area of cultivated land / total area

Sources of raw data used for calculations for each column:
Col. (1) See Table 1.
Col. (2) - (4) Statistical Bureau, Management and Coordination Agency, 1989. Social Indicators by Prefecture, 1989. Tokyo.
Col. (5) Economic Research Institute, Economic Planning Agency, 1989. Annual Report of Prefectural Accounts, 1989. Tokyo.
Col. (6) Statistical Bureau, Management and Coordination Agency, 1986. Japan Statistical Yearbook, 1986. Tokyo.
Sources of additional raw data:
Birth, death marriage and divorce:
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Interprefectural migration:
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Chapter 4

Transition in Population Distribution and Environmental Problems

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Introduction

For maintaining a stable everyday life as a group, a secure supply of raw materials and people is necessary, namely reproduction population as well as production and consumption. In other words, a stable everyday life requires a natural environment, where production and consumption is harmonized with the environment.

Both population and environment have a tolerance range for absorbing slight changes. However, if a sudden and severe change occurs in one of them the other will consequently respond to this change and if its tolerance range is exceeded, in due course of time, a critical situation will follow, finally culminating in the collapse of both. Demographic transition, particularly the growth of young population, causes by nature socio-economic changes as well as changes in population distribution, which will reflect strongly on the environment.

In this report, the relationship of environment and urbanization, caused by demographic transition, are explained, with particular emphasis on Japan.

1. Demographic Transition and Changes in Distribution

(1) Demographic Transition and Growth of the Young Population

The population increased and decreased cyclically in response to the changes of the environment up to the 19th century and it grew slowly along with the increase in productivties. But with the Industrial Revolution the demographic situation changed from dynamics with a high level of deaths and births to dynamics with a low level of deaths and births, thanks to the enormous increase in production capacity and improvement of living standard.

With this demographic transition, especially with the onset of a declining death rate an increase in young population begins, which in turn will cause an increase in fecundable population. For instance, according to the estimates of United Nations in 1988, the population in the 20 - 24 years group in developing countries was 148 million in 1955. For 1975 a figure of 269 million was estimated, reaching 426 million by the year 2000. For the year 2025 the share of young population is presumed to become 594 million.

(2) Expansion of Farmland and Development of Rural Industries

In societies with agriculture as the main industry, most of the population reside in rural areas. Therefore, the growth in population results in the growth of cultivated areas. When the rural population starts increasing, the first step to be coped with will be to expand the cultivation area, by developing land or land reclamation. But these new regions offer poor farming conditions due to uneven terrain, flooding or lack of water, and there are limitations to production activities due to the low technological level.

Along with the growth of rural population, commercial activities and rural industries are also progressing. However, if the activities for the enhancement of agricultural production and the spreading of commercial industries do not create enough work, an accumulation of unemployed, particularly young, people, will result. Furthermore, the enhancement of labour productivity by an advancing agricultural technology, particularly mechanization, also results in a decrease of the number of young people required in rural regions.

(3) Migration to Large Cities and Urbanization of Population

Population growth accompanying the natural expansion of cultivation area has been causing some migration to the cities from old times. However, even with a demographic transition following the natural expansion of farming area, rural areas can only sustain a certain population growth rate. As a consequence a continuous large-scale migration of population from the rural areas to large cities or overseas is taking place. Consequently, the population growth rate of urban areas often becomes twice the population growth rate of the whole country.

If the production activity of urban areas does not afford to meet the needs of the population growth, unemployment becomes a major problem. Also, if housing supply and facilities are insufficient to cope with the population growth, then the living environment deteriorates rapidly, due to housing problems and spreading slums. Furthermore, as the new inhabitants will settle on the outskirts of the established cities, the metropolitan areas will expand. This expansion will cause serious traffic and transfer problems.

(4) The Three Types of Out-Migration Areas

Rural areas, in addition to the areas which are swallowed up by the expansion of metropolitan areas, may be classified into 3 types. The first has an population outflow due to natural growth only, the second type causes migration because population is growing, while the third type is an areas with declining population.

Since in type 1 migration is triggered only by natural growth, the society is stable for a long period of time. In areas as in type 2 where industry and commerce are developing population growth will cause few problems. However, if the population growth forces the expansion of cultivation area by swallowing up surrounding natural environment, e.g. by deforestation or grazing, to such an extent that the reproductive capability of the natural environment is damaged, the natural environment will be unable to sustain human life because of the devastation and these areas become areas of the third type. In area of type 3, where the population decreases, the maintenance of production activities and consumption activities requiring a certain population size is not possible, and the resiliency of population to resist the changes in environment drops. Areas with a drastic decrease in population, unable to sustain a continuous development, are called "depopulated" areas in Japan.

The main point is that with the onset of a continuous demographic transition, particularly the decrease in the death rate, a consequent progress of urbanization is historically more or less inevitable. This is because the decrease in death rate causes a growth in the population of young people in the rural areas, and at least, the population corresponding to the natural growth will start migrating to the cities. At the later stages migrants to the city will dwell on the outskirts of the established metropolitan areas, causing an expansion of the urban areas by swallowing up villages in the vicinity of the big cities. In this way, due to migration, natural growth and expansion of urban areas, the progress of urbanization of population will become rapid. On the other hand, the rural areas too can be classified according to the population growth rate into stabilized areas, areas with rapid increase in population and depopulated areas.

2 What is Environment?

Environment is everything that surrounds us. So environment consists of human-beings and non-human-beings. And the two elements influence and change each other.

Since environment is everything excluding "ourselves", environment or environmental problems can be described on the basis of various phenomena. The purpose of this report is not to clarify and expound on the definition and concept of environment but it is felt that some kind of consistency is required. Therefore, an attempt has been made here to classify the phenomena and definitions of environment and environmental problems, as indicated in Table 1, based on the classification of "Social Resources".

Starting with the environment, let us distinguish between

"Material Environment" and "Human Environment", which is the basis of human interaction. "Material Environment" can be classified into the natural environment which existed before the birth of mankind and the "Man-made" environment which man has created. And the environmental problems of the earth are mainly due to environmental changes on this level, which cross all national boundaries as they related to human life itself.

Man-made environment can also include social resources. Based on the classification of social resources, the contents can be broadly classified into a) Facilities which are closely connected with production activities b) Facilities related to human living c) Facilities related to territorial maintenance

"Human environment" refers to the indispensable human interaction for production, consumption and reproduction. This includes (d) Family of husband-wife, parents and children, brothers and sisters or family relations (e) human relationships between neighbors, organizations such as town block associations, ward associations and (f) production organizations of farmers or businessmen, administrators, etc. There are cases where uses and maintenance of human environment becomes difficult due to the sudden growth or sudden decrease in population.

3. Changes in Age Structure of the Population in Japan and Changes in Distribution of Population

What are the influences of changes in the age structure and changes in the population distribution in Japan?

Due to the extremely rapid demographic transition in Japan, the changes in age structure came suddenly. The age structure of the Japanese population, as indicated in Fig. 1, can be compared to a population pyramid in 1925, showing a society with a large number of births and deaths. But in the year 2000, this changes to an exclusive "bell type" distribution with a small number of births and deaths. That is to say, in 75 years the age structure has drastically changed. It can be deducted that this change has been brought about by the population under 25 years of age in 1950, who were born in the period between 1925 to 1950.

Let us verify the sudden changes in the age structure by the population ratio of 25-year-groups, or in other words, by the population ratio between generations. As indicated in Table 2, in 1925 and 1950 the ratio of the young parent generation (between 25 to 49 years old) to the generation of children under 25 years of age, is nearly two to one. Also, in comparison to the next-elder generation, namely the par-

ent generation between 50 to 74 years of age, the ratio between the young parent generation (25 to 49 years) and the preceding generation (50 to 74 years) is also about two to one. As a result, before 1950 each succeeding generation doubled the preceding in numbers.

Yet in 1975 the population under 25 years, i.e. the generation born after 1950, is 44 million, constituting almost the same population size as the parent generation with 25 to 49 years of age. Furthermore, in the year 2000 the population under 25 years will be 40 million, resulting in a generation ratio of nearly one to one. In other words, the generation born after 1950 is a "two children generation" or "few births, few deaths generation", and from this generation, the age distribution of the population will level out. Consequently, the aging of the Japanese population will continue up to the year 2015, when the persons born between 1925 to 1950 or the "large births, large deaths generation" will all be more than 65 years of age. After this, the percentage of the aged is presumed to stabilize at about 20 percent resulting in an "aged society".

From 1950 to 1975, the young children-producing population between 25 to 49 years of age has doubled. This has caused the following changes in Japanese society. Namely, from the latter half of 1950 a high-grade economic expansion took place, causing a profound change in the employment structure, which in turn brought about a nation-wide, rapid concentration of industry and population in cities. Since the migration to cities progressed with dramatic speed, excessive concentration in the large metropolitan areas was on the result on one hand, while the out-migration areas became depopulated.

Why has the change in age structure brought about such a drastic change in society, economy and urbanization of population? Let us first observe the changes in regional distribution of the Japanese population between 1925 and 1950. The 47 prefectures were divided into the 3 large metropolitan areas of Tokyo, Nagoya and Osaka (Tokyo Metropolitan Area, Tokyo-to, Chiba-ken, Saitama-ken. Nagoya Metropolitan Area; Aichi-ken, Gifu-ken, Mie-ken. Keihanshin Metropolitan Area; Kyoto-hu, Osaka-hu, Hyogo-ken and other non-metropolitan areas. According to Table 3, the population of non-metropolitan areas was 40 million in 1925, constituting 66 percent of the population of the whole country. From 1925 to 1950, the population grew by 24 million and 66 percent of this growth in population occurred in the non-metropolitan areas. Though the Japanese population increased by a further 27 million from 1950 to 1975, the population growth of non-metropolitan areas was only 4 million, while the population growth of large metropolitan areas was 24 million. As a result the population of metropolitan areas reached 52 million, 47 percent of the total population.

Why was there a growth in metropolitan population after 1950 even though the overall population growth in 1950 was according to the population density of 1925? The key to this is in the age structure. Fig. 2 and Fig. 3 indicate the transition of the population pyramids for large metropolitan areas and non-metropolitan areas.

Between 1925 and 1950, non-metropolitan areas showed a population growth for all ages with the younger groups registering a higher increase. In other words, the major part of the population growth up to 1950 was due to the growth in population of children. But between 1950 to 1975, it was difficult to allot working places for all these children. This lack of employment opportunities led to migration from the non-metropolitan areas to the three large metropolitan areas from the latter half of the fifties to the first half of the seventies. Consequently, the population between 25 and 49 years of age in the three large metropolitan areas increased from 9 million in 1950 to 22 million in 1975, which is more than a twofold increase.

As the children born in the "two children generation" after 1950 came to reach the age of 25 in the second half of seventies, the migration to metropolitan areas diminished significantly with the stabilization of the generation ratio in the non-metropolitan areas. With the reduced the migration from non-metropolitan to metropolitan areas a balance in migration was reached between the non-metropolitan areas and the metropolitan areas.

Furthermore, the never-ending change in the population growth trends of metropolitan areas, within the context of the overall national population growth trend, is also caused by the shift from a socially induced population growth to a naturally induced population growth. This trend is likely to become more noticeable in the future, with the reproduction base of the population shifting from rural to urban areas

Generally speaking, the population of Japan can be classified into 3 generations, namely the "large births, large deaths" generations born before 1925, the "large births, small deaths" generations born between 1925 and 1950 and the "small births, small deaths" generations born after 1950. Most of the persons born in the "large births, small deaths" generation were born and brought up in non-metropolitan areas but started to migrate to the metropolitan areas between the second half of the fifties to the first half of the seventies when they reached the reproductive age. As a result, this period registered an extremely rapid urbanization.

Next, we shall examine how the change in the distribution of the population reflected in the economic planning at the beginning of the seventies.

4. Environmental Problems in Areas with Rapid Population Growth

After World War II until the onset of the sixties Japanese economic plans were focused on balancing international revenue and expenditure by export, on economic expansion as far as possible to cope with the predicted rapid increase in working age population and a steady improvements in the living standards of the people. For the realization of these targets these plans promoted the expansion growth of manufacturing industries, especially the export industries, heavy industry and chemical industry.

According to these plans production facilities for these industries were created with the focus on the three large metropolitan areas, heavy and chemical industries were promoted, and people from rural areas were recruited. The rapid pace of economic growth which exceeded predictions by far, increased the living standards by raising the income levels. On the other hand, the accompanying urbanization and the expansion of production structure lead to inadequate housing, difficulties in commuting to work, unsuitable living environment and worsening pollution problems. Actually, we can say that the delay in providing the facilities for proper living conditions greatly diminished the effects of the increased income level.

In the "New Economic Society Plan" announced in 1970, one of the main policies was the improvement of housing and residential environments in large cities. Specifically, these policies aimed at an increase in the supply of good quality housing, provision of transportation systems, particularly high speed railway networks to expand commuter areas and a land price policy, to enhance these effects.

Why did the improvement of living environment become such an important policy matter? The only reason to explain this is that the growth in the number of households in large metropolitan areas became more noticeable than the population growth in the other areas. Between 1950 and 1975, the number of households in the whole country increased twice but the number of households in large metropolitan areas increased 2.6 times. As evident from table 4, showing the transition of households in large metropolitan areas and non-metropolitan areas, the number of households in the large metropolitan areas and non-metropolitan areas increased both with the same tempo before the war. But in the period between 1950 and 1975, the number of households increased from 6 million to 15 million in the large metropolitan areas, which is an increase of 9 million in a 25-year period, while the number of households in non-metropolitan areas increased from 11 million to 17 million, translating into an increase of 6 million households.

In conclusion we can see that in areas with an increase in young,

fertile population during that period, the provision of living and housing facilities required immediate attention.

5. Trends of Population and Environmental Problems in Out-Migration Areas [3]

The rural areas other than the areas that have been swallowed up by the expansion of metropolitan areas, can be classified into 3 types of areas, as mentioned above. The first describes areas with a population outflow due to natural growth only, the second type is an area of unsustainable population growth and the third type is characteristic of a population decrease. Next, we examine this third area type with population decreases and study the population trends and environmental relations.

(1) What is a "depopulated area"?

The problem of a rapidly decreasing population in rural areas, especially mountain villages in Japan happened around 1960, when the high level growth of the economy became substantial. Then with the publication of the results of national population census in 1965, this problem came to be regarded as a major social problem.

Due to the rapidly decreasing population it became very difficult for these regions to maintain their living standard. With the decrease in population, the population density declined and the remaining population had a predominant share of old people. Therefore the maintenance of fundamental social services, such as fire-fighting, education, health facilities, etc. began to be problematic. In addition, the optimum exploitation of resources also became difficult, leading to a drastic decline in production capacity. This development continued and the areas where the conventional living pattern could only be maintained under difficulties increased steadily.

For this reason, the Government selected cities, towns and villages meeting the following conditions of "Depopulated Areas" and framed different countermeasures. First according to the laws in 1970, "Depopulated areas" were cities, towns or villages where the population decreased by more than 10 percent in the last five years, and the financial index was less than 0.4. But around 1980, the conditions were changed. According to the new guideline cities, towns and villages where the population decreased by more than 20 percent from the population in 1960 were earmarked as "depopulated areas". And finally, the latest government guideline in 1990 designated depopulated areas where (1) the population in 1985 had decreased by more than 25 percent from the population in 1960, or (2) where the population reduction is more

than 20 percent but the percentage of population above 65 years of age in 1985 constitutes more than 16 percent of the overall population or the percentage of population between 15 to 29 years is less than 16 percent and the financial index is less than 0.44.

Up to 1980, a percentage based on population decline was used as index for depopulated areas but thereafter the ratio of age groups came into use as index. This is because the population likely to emigrate from depopulated areas had already diminished totally, and because the percentage of reduction in population, as determined in the national population census had become too small.

(2) Size of Depopulated Areas

What is the size of the depopulated areas with respect to the total area of Japan? Fig. 4 indicates the number of local self governing bodies, areas and other basic figures.

The number of cities, towns and villages specified as depopulated areas was 775 in April 1970 (Showa 45) (25 cities, 88 towns, 282 villages) but in 1988 (Showa 63) 1,557 cities, towns and villages were specified as depopulated areas, which is 35.6 percent of the total number of cities, towns and villages in the whole country. The cities, towns and villages specified as depopulated areas, cover a considerably wide area as indicated in Fig. 5. If the area of the depopulated regions is measured, it adds up to 170,000 square kilometers, which is 46.6% of the total area of the country. A considerable area of mountainous regions is included in this figure. Forests of 140,000 square kilometers, constituting is 55 percent of the total area of 250,000 square kilometers of the whole country, are also included in the depopulated area.

(3) Population Trends in Depopulated Areas

As indicated in Table 5, the population in depopulated areas was 8.18 million in 1985, which is only 6.7 percent of the total population. In 1960, just after the high-level economic expansion started, 12.75 million people, occupying 13.5 percent of the total population lived there. However, within a five year period in the sixities, the population declined by more than 10 percent. After entering the seventies, the population reduction rate has dropped and at present it is about 3 percent.

The zero population out-migration from the depopulated areas can be easily understood from the population pyramid of the depopulated

areas. Fig. 6 indicates present depopulated areas and the population growths by age separately for men and women 25 years ago, in 1960. From this figure, it can be seen that there is no major change in the population above 40 years of age in this 25 year period. But the population group below 40 years of age, shows a decrease of about 1/3 to 1/2 of the population.

Most of the population between 40 to 64 years of age are the heads of the households, who are playing the most important role in society or the dependents (Mainstay Generation). The population between 15 to 39 years of age may be said to be the next succeeding generation. Therefore the required population figure for continuance of the generations is broadly the population between 40 to 64 years of age, any population in excess of this figure, as long as the status of economic activities in the depopulated areas does not indicate further expansion, is the "Surplus Population" or the "Potential Out-Migrants" who have to leave the areas. Also, the population under 15 years of age, is also spaced at 25 year intervals with the 15-39 and 40-64 years of age population, therefore 60 percent of this population can be considered as the required population figure for continuance of the generations. It is felt that out of the population of inhabitants above 65 years of age, the percentage of people who are involved in economic activities in the depopulated areas is rather high but this population is likely to have the large influences of the increased life expectancy.

If considered in this way, the population of the "mainstay generation" of 40 - 64 years of age in the depopulated areas was 2.9 million and there has not been a major change in this figure from 1960 to 1985. But the succeeding generation was 4.4 million in 1960 and had a considerable number of "potential out-migrants". But due to the subsequent out-migration, this figure dropped to 2.3 million in 1985, - 0.6 million people less than the required population for a stable continuance of generations. Also, the population of 15 years of age and under, declined from 4.6 million to 1.6 million, in other words, a reduction of 3 million in a 25 year period. And the ratio compared to the population between 15 to 39 years of age is 68 percent, which exceeds the figure required for continuance of generation by 8 percent. However, how many of this age group will remain in the depopulated areas in the future?

How will the population of depopulated develop in the future? Let us see the future estimates projected by the Cohort Change Method. This estimate is based on the assumption that in the future, too, there will not be any change in the population growth rate for different age groups between 1980 and 1985, and then the estimate of population after 1990 is calculated.

The result shows a population decrease by 3 percent until 1990, which is the same as in the eighties. After 1995 when the present mainstay generation with a high life expectancy becomes aged, once again the rate of decrease in population will grow, reducing the population share to 6 million in 2005, that this will be less than 5 percent of the total population.

(4) Policy for Depopulated Areas and Environmental Problems

The following policies are being made. The first is the provision of living facilities and services for areas where living has become difficult because of the decrease in population. In other words, this encompasses the provision of transportation and communication facilities within the sphere of living activities, particularly roads. Especially in areas with much snowfall, the policy takes into account the considerations for eliminating damage by snow. Also, shifting of villages and reconstruction is being carried out for villages where the required number of households and population is inadequate.

But, the biggest problem of the population decline is linked to the lack of employment opportunities in these regions. Therefore, promotion of local industries has been given high priority to create opportunities. The second problem is the large scale development of leisure facilities, particularly in depopulated areas. Since the population, living in metropolitan areas with a poor natural environment, is growing and the income level of this population is growing at the same time, lifestyle changes can be observed. For instance, there is a demand for increased leisure time and an increase in personal consumption expenditure along with outdoor recreation activities.

But since the main leisure activity is the development of golf links at present, large scale changes in topography and road construction projects are being executed. However, when considerations for topography and vegetation are lacking, there are many dangers of destroying the environment by soil erosion and fertilizers polluting rivers and underground water. [4]

References

1) Planning Bureau, Economic Planning Agency " Complete Particulars of New Economic Society Development Plan", (1970, Economic Planning Association), pp. 550-552.
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2) This section is mainly according to reference 1. Economic Planning Agency, "Annual Report related to Status of Pollution, 1989." (1989)
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National Land Agency, 1989.
4) Yasuo Shimadzu, "Environment Assessment" (NHK books no. 527, 1987)

Table 1. Ciassification of Environment and Main Environment Problems

Classification of Environment	Details	Main Environmental Problems
I. "Material Environment" 1. Natural environment	Atmosphere (Nature) Topography/Soil quality Underground water, rivers, seas Plants, animals, vegetation	Ozone destruction, rise in earth's temperature Soil erosion, desert formation, water pollution, sea pollution Acid rain Destruction of tropical rain forests and wildlife
2. Man-made Environment a. Facilites related to production Seconday,Tertiary Production Related Primary Production Related Facilities Transportation and Communfcation Facilites	(Social Resource Infrastructure) Industrial land, water facilities Electricity, gas facilities, etc. Agricultural foundation, water facilities, Forest roads, fishing harbor facilities, etc. Roads, railways, ports, Electrical communication facilities, etc.	Population growth regions a. Inadequate provision of facilities Atmospheric pollution, traffic pollution, noise pollution, water pollution, undergrounc water /soil pollution, dust/ industrial wastes.
b. Facilites Related to Daily Living Housing Related Facilites	Housing, housing land, underground and above water facilities Parks, cleaning facilities, etc. (Roads, railways, ports, electrical communication facilitues, etc.)	b. Deterioration of housing/ residential conditions
Education and Cultural Facilities Health and Wwlfare Facilites	Schools, social education/cultural facilities, etc.Health centers, hospitals, social welfare facilities, etc.	
c. Facilities Related to National Land Conservation	River and forestry conservation facilities,seashore conservation facilities, etc.	Population Reduction Regions c. Maintenance of facilities related to living is difficult
		d. Destruction of natural environment Reclamation/ Golf links
II. Human Environment d. Relationships of family, relatives e. Neighborship relationships f. Producer relationships	Relationships between persons Husband/Wife, Parent/Child, Brother/Sister, relatives Local governing organizations of town-block assocations, ward associations, neighbor associations (including fire-fighting groups) Producer groups of agricultural cooperatives, business associations and administrative groups	Regions with rapid increase in population Deterioration of mutual assistance Deterioration of pudlic peace and order Regions with decrease in population Deterioration of mutual assistance

Source) Planning Bureau, Econmic Planing Agency, "Complete Particulars of New Economic Society Development Plan", (1970, Economic Planning Association) Economic Planning Agency, "Annual Report related to Status of Pollution, 1989" (1989), etc.

Table 2. Transition of Population by Age and Population Ratio between Generations : Whole Country, 1925−2000

Age Group	1925	1950	1975	2000
Population (1,000)				
Total Number	59,737	84,115	111,940	131,192
0−24	32,870	46,260	44,241	39,519
25−49	17,836	25,164	44,048	43,580
50−74	8,224	11,617	20,764	39,641
Above 75 years	808	1,069	2,841	8,452
Population Ration between generations				
(0−24) ／ (25−49)	1.84	1.84	1.00	0.91
(25−49) ／ (50−74)	2.17	2.17	2.12	1.10

Source) Statistical Bureau, Management and Coordination Agency, "National Population Census Results" and Institute of Population Problems, "Population Projections for Japan 1985−2085"

Table 3. Transition of Population in Large Metropolitan Areas and Non-Metropolitan Areas

Year	Country	3 Large Metropolitan Areas	Non-Metropolitan Areas
Population (×1,000)			
1925	59,737	20,176	39,561
1950	84,115	28,447	55,668
1975	111,094	52,155	59,784
Population growth(×1,000)			
1925−50	24,378	8,271	16,107
1950−75	26,979	23,708	4,116

Source) Statistical Bureau, Management and Coordination Agency, "National Population Results".

Table 4. Transition of Number of Households by Large Metropolitan Areas /Non-Metropolitan Areas

Year	Country	3 Large Metropolitan Areas	Non-Metropolitan Areas
Number of Households (×1,000 Households)			
1925	11,903	4,024	7,879
1950	16,425	5,727	10,699
1975	31,271	14,755	16,515
Growth (×1,000 households)			
1925−50	4,523	1,703	2,820
1950−75	14,845	9,028	5,817

Source) Statistical Bureau, Management and Coordination Agency, "National Population Census Results".

Table 5. Transition of Population in Depopulated Areas, 1960−2005

Year	Total Population (×10,000persons)	Reduction rate in a 5 yesr period (percent)	Total Population Ratio (percent)
National Population Census			
1960	1,275	−	13.5
65	1,110	12.9	11.2
70	959	13.6	9.2
75	875	8.8	7.8
80	843	3.7	7.2
85	817	3.1	6.7
Future Estimates			
1990	786	3.8	6.3
95	747	5.0	5.9
2000	703	5.9	5.4
05	657	6.6	4.9

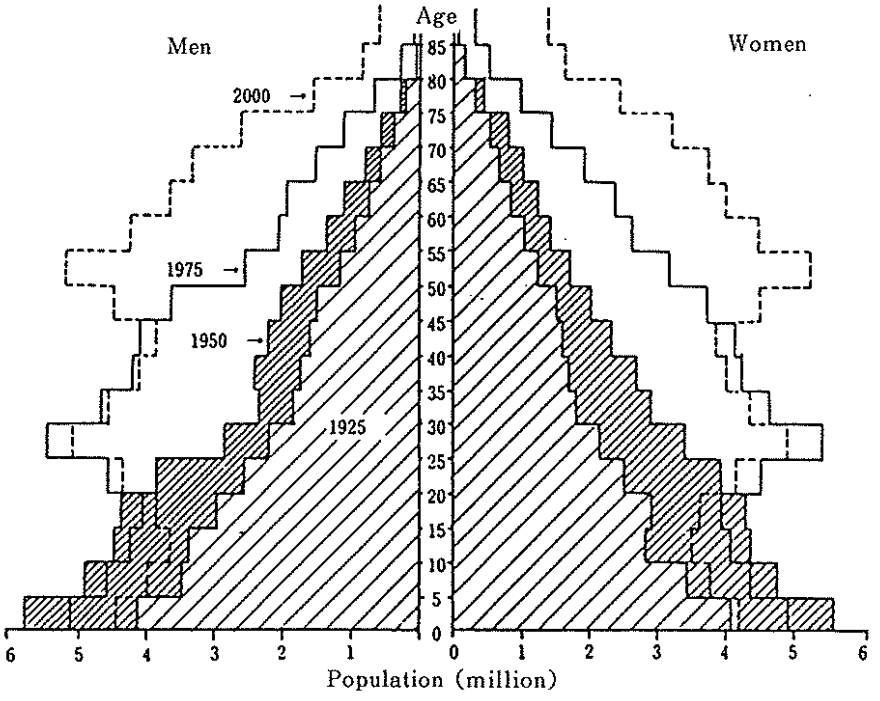
Source) "Status of Depopulation Policy", Depopulation Policy Room, Regional Development Bureau, National Land Agency, 1989.

Table 6. Changes in Population Composition by Age in Depopulated Areas : 1960, 1985.

Age	Population (×1,000)		Population percentage(percent)	
	1960	1985	1960	1985
Total	12,748	8,167	100.0	100.0
0−14	4,590	1,586	36.0	19.4
15−39	4,421	2,325	34.7	28.5
40−64	2,861	2,871	22.4	35.1
Above 65 years	876	1,385	6.9	17.0

Source) Same as in Table 5.

Fig. 1 Transition of Population by Age, Men and Women (1925−2000)



Source) Statistical Bureau, Management and Coordination Agency, "National, Population Census Report" and Institute of Population Problems, "Population Projections for Japan:1985−2085".

Fig. 2 Transition of Population by Age, Men, Women, in Non-Metropolitan Areas

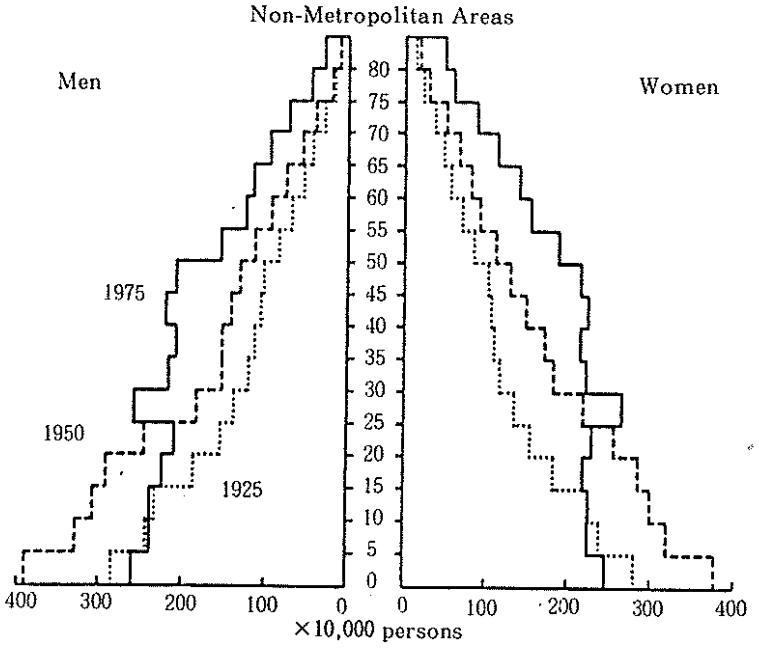


Fig. 3 Transition of Population by Age, Men, Women in Large Metropolitan Areas

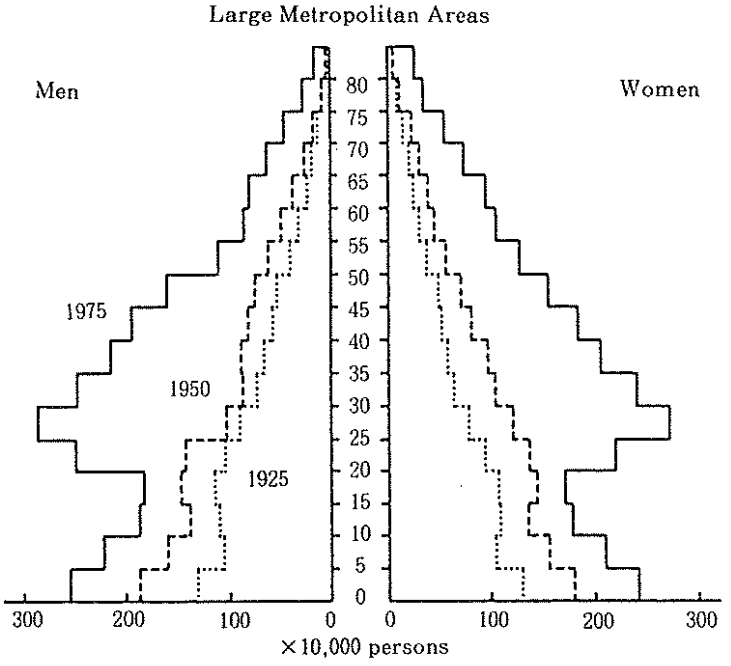
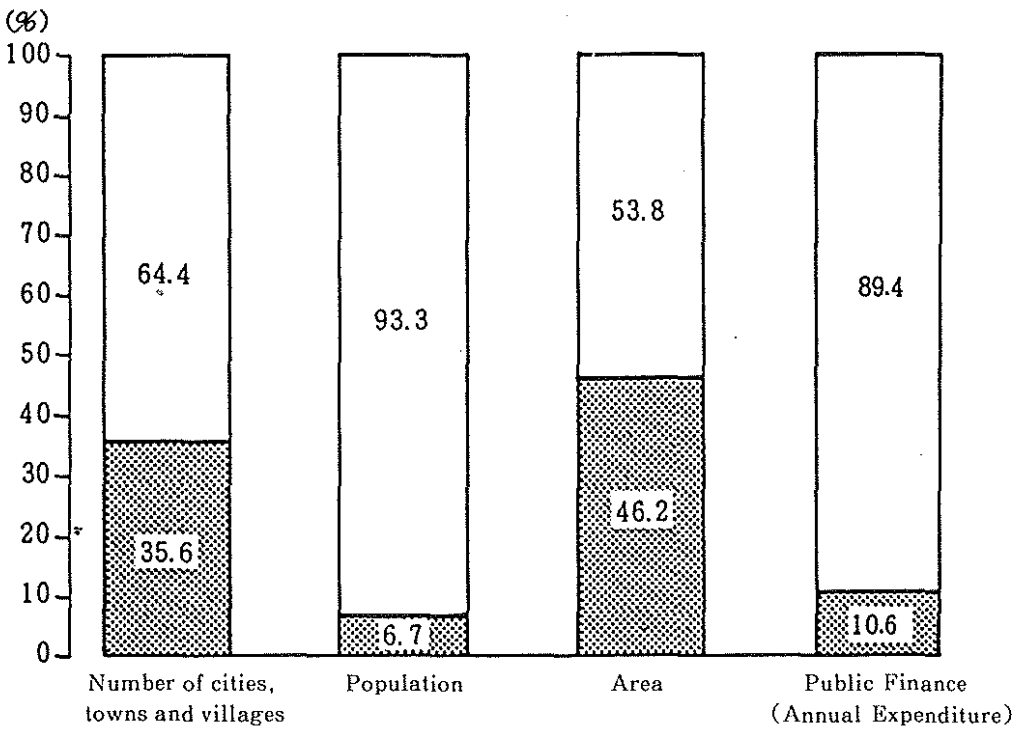
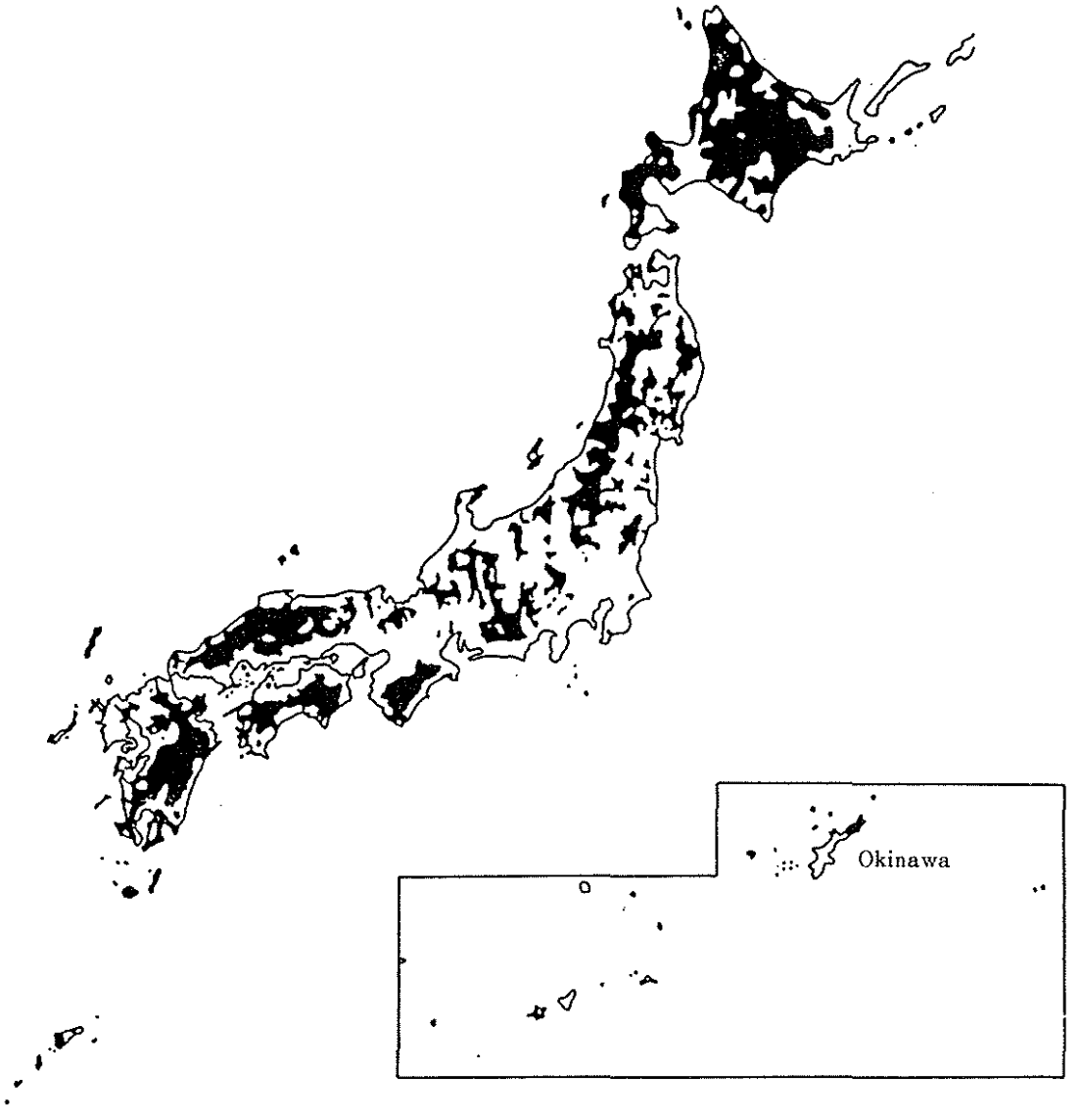


Fig. 4 Depopulated Areas as a Percentage of the Whole Country



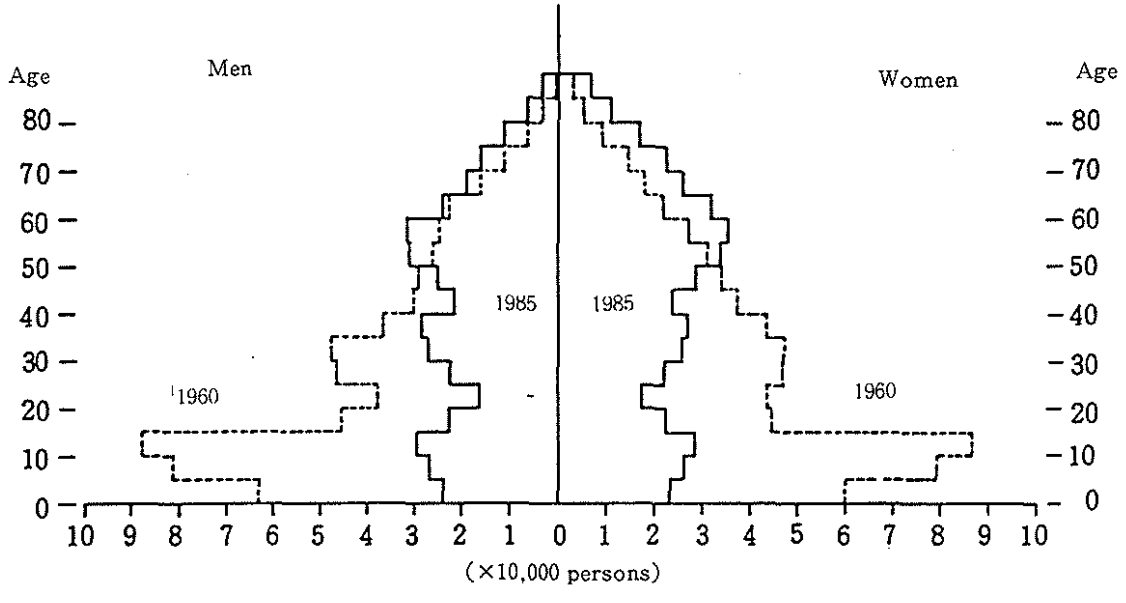
Note) Public finance is according to the survey of Ministry of Home Affairs (1987 Closing of Accounts, Cities, Towns and Villages)

Fig. 5 Distribution of Depopulated Areas (as on April 1, 1988)



Note) The black dots indicate depopulated cities, towns and villages.

Fig. 6 Composition of Population of Depopulated Areas



Chapter 5

Changes in Environmental Problems

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1. Introduction

We have worked hard to provide a better living environment. Prosperity by industrialization and urbanization is one of these factors which have contributed to a comfortable lifestyle.

With the growth of cities and progress in industrialization, it seems as though we had fulfilled our long cherished dream. But it is ironic that this progress has resulted in adverse side effects such as destruction of our living environment.

In this report, we hope to clearly explain how the progress of urbanization, industrialization has damaged our living environment and led to health problems, by relating these to the changes in environmental problems.

2. What are the Environmental Problems?

The awareness of environmental problem in our country is said to have arisen in part due to environmental pollution. Let us first define environmental pollution.

According to Mr. Hikaru Shoji and Mr. Kenichi Miyamoto "Environmental pollution is a social disaster which has resulted in serious health disorders and hardships in life. Pollution and destruction of natural and living environment are caused by industries, saving on expenses for environmental protection and safety in pursuit of profits. Further losses are due to generation and accumulation of large quantities of pollutants, which are by-products of urbanization and industrialization, aggravated by a consumer lifestyle, popularized by mass production industries. All these occured because the Government (including local self governing bodies) has been remiss in framing preventive policies against environmental pollution, and because it has not earmarked adequate expenditure for environmental protection".

1) What then is the environmental problem? It was the common belief that the pollution causing party is industry and that people are the victims. But as we shall see later, the status of environmental problems such as pollution today, is due not only to industry but is being caused by the common people at large.

This change in the conditions, is also apparent from the transition from the usage of the word 'pollution' to 'environment'. Therefore, the environmental problem can be defined as follows: "with the changes in

lifestyle, along with the progress of urbanization and industrialization, not only industries but common people too are damaging nature and the living environment, which has led to serious health disorders and hardships in life, confronting the entire society and this is the social calamity which people recognize today."

In any case, if the environmental problem is defined in this way, then environmental pollution is also included in this definition.

3. Transition of Environmental Problem - From Pollution to Environment

If the transition of environmental problems of our country is examined from the terminology itself, up to the first half of the seventies, the words 'pollution problem' was often used but from the latter half of the seventies, the usage changed over to 'environmental problem'. In this way, the change in terminology can be considered as indicator of the change in the social and economic phenomena, which is apparent from 'environmental problem'.

Here, we shall discuss the transition of environmental problems in our country with the help of results of research related to the history of pollution.

According to Ms. Nobuko Iijima, the history of environmental pollution can be divided into five periods. (Refer to Table 1)

If these time divisions are broadly divided into two groups and its characteristics observed, up to 1970, environmental pollution can be seen as pollution resulting in diseases such as Minamata, Itai-itai and Yokkaichi asthma. These diseases were due to industrial wastes, but if observed regionally, the areas where these diseases occurred were locally concentrated. And they had the characteristics of heavy pollution with health disorders of a serious nature also. However, after the second half of 1970, environmental pollution and environmental destruction problems due to effluents and discharges in daily life such as automobile exhaust or pollutants in water, appeared. If these are observed according to the regions, with respect to the level of pollution for the whole country, there is a transition from low pollution to compound pollution, and a transition from health disorders of a light nature to atypical health disorders.

2). The change in conditions in this way, is thought to be the prime factor for the change in the words from 'pollution' to 'environment', adopted in the human environment declaration made in the United

Nations Human Environment Conference held in June, 1972 and also became the motivation for changing the universal awareness with respect to the status of the problem.

What are the results brought about by the differences before the first half of 1970 and after? Let us examine these from the view point of sources of environmental pollution.

Ms. Nobuko Iijima explains the differences observed in these two periods in relation to the 'polluters' and the 'polluted' (victims). Ms. Iijima comments on the sources of environmental pollution prior to the first half of 1970 : "the prime sources of pollution were the mining industries and sometimes industries associated with public undertakings. The result of disposal of different types of harmful effluents and developments which were incompatible with the surroundings created a condition leading to destruction of the natural environment, damaging primary industries such as agriculture, forestry and fisheries, health of the people and the culture, which has been built up by humans and local societies. In this case, the relation between the mining industry or public enterprises on one hand and natural environment, primary industries, lifestyle and culture on the other hand, was of a one-sided nature with damage caused by the former to the latter". (Refer to Fig. 1)

However, after the second half of 1970, "the types of sources of pollution increased, and a total of four types, including carrier pollution, accessory pollution A and accessory pollution B" could be defined. Accessory pollution sources do not have such a tremendous damaging nature as the main pollution source but ranking them as a damaging source, implies them as a source which causes excessive destruction to the environment. Relevant to this is the direct introduction of exploitative industrial methods by the primary industries followed by the high level of industrialization and growth of civilization on which the consumer life is built upon, which forms the main threat to the environment. Accessory pollution sources are also ranked in the same level as the main pollution sources, therefore even if there is a difference in the degree, there is no deviating from the fact that this is also a damaging source." 5) On the other hand, "Carrier sources which are ranked between main sources / accessory sources and damaging sources, are those which may have received damage from main pollution sources or accessory pollution sources and in turn, get converted to pollution sources. When the natural and physical environment of atmosphere, water, soil, plants, animals, rain, wind, fog, buildings, structural materials, etc. are polluted due to the harmful waste and effluents of industry or human lifestyle, there are various instances, where these by themselves have changed and become new pollution sources after being polluted. The occurrence of the same possibilities exists in the primary industries too. Particularly, there is a considerable change in status from the conventional type of environmental problem.

change in status from the conventional type of environmental problem.

Compared to the fact that the main pollution sources and accessory pollution sources are "originators" of environmental destruction or pollution, carrier sources are "damagers" and at the same time "originators", having a double-sided characteristic." [6] (Refer to Fig. 2)

At any rate, if the results of research up to now are summarized, the environmental problems of our country are changing from health disorders due to localized, heavy pollution with industry as the main source of pollution, to health disorders which are caused by pollution of a light nature on a country-wide scale, which are due not only to industries but also to people.

4. Awareness of Environmental Problems and Actions

Let us see what sort of awareness the people of our country have with regard to environmental problems and what actions they have been taking against these problems.

In 1988, the Prime Minister's Office carried out a "Public Opinion Poll Related to Environmental Protection Activities". Let us relate the results of this poll to the topics mentioned above.

First, was the question "At present, what sort of an environmental problem is of concern to you? Select one of the three problems mentioned below", to find out the environmental problem which the people were acutely aware of. If the results the responses are observed, "atmospheric pollution and water pollution due to factories" accounted for 43.5%, "daily life problems such as noise and water drainage" accounted for 37.5% and "environmental pollution due to harmful chemical substances" accounted for 31.5%.

Next was the question "Has your awareness regarding environmental problems changed from the awareness of the controversy 15 years ago, when the Minamata disease and Yokkaichi asthama were caused by environmental pollution? " The responses to this question were as follows : "Awareness has increased" was 27.8%, "Awareness 15 years ago and now also is high" was 24.5%, "Not much awareness 15 years ago and now too" was 17.5%.

Observing these results, the percentage of "awareness has increased" ("greater awareness than 15 years ago + awareness 15 years ago and now also is high") was 52.3%, "Not much awareness" ("Not much

awareness 15 years ago and now too" and "Awareness has decreased compared 15 years ago") was more than 40.6%, which indicates that the number of people whose "awareness is high" is not all that large.

Furthermore, there was a question "Have you ever participated in voluntary environmental protection activities such as symposiums related to environment or river cleaning activities, greenification activities, etc.", regarding individual activities related to environmental problems. If the results of the responses are observed, the percentage of persons who responded "Have participated" was 27.2%. As against this, the percentage of persons who responded "Have not participated" amounted to 69.3%.

From these results, it is concluded that more than 50% of the people have interest in environmental problems but the percentage of persons who are striving to tackle the environmental problem does not even reach 30%.

If these results are observed, it may be said that the people of our country have a strong interest in the environmental problems but it cannot be said that they are making efforts to tackle these problems.

5. Environmental Problem and Population in the Context of Death Rate and Life Expectancy

Could it be that results, as indicated above, have been derived because the environment, which surrounds us, is in an extremely satisfactory condition? Topics such as these are considered here in relation to population, particularly death rate and life expectancy, with investigations on topics which are hurled on us by environmental problems.

In other words, the death rate and life expectancy are indices which reflect on the status of hygiene and health of a particular region. Consequently, by investigating the trends based on these indices, we should be able to conclude on the emergence of environmental problems.

Regarding disasters and death rate / life expectancy, Mr. Haruo Mizushima says "The fact that the average life span of terribly polluted Tokyo is the highest in Japan is very strange. Environmental pollution is harmful to health and it is illogical to believe that it is unrelated to life expectancy. Environmental pollution shortens the life expectancy. The effects of pollution do not appear when young, but appear only after the persons have become middle-aged. The birth rate amongst young people is very low, and the number of healthy per-

sons shifting from farming villages to the city is considerable, therefore the influence of death rate due to environmental pollution is concealed, and the death rate in the city appears to be smaller than the death rate in the suburbs.

The effects of environmental pollution on the health are hidden and chronic. For young people, the harmful effect is still in its infancy, and the good health of young people restrains the harmful effects to some extent, and death is rather uncommon. But the damage is transferred to people in their thirties and forties, their resistance to diseases is reduced and there are many cases where these people have succumbed to diseases."

With these results of research borne in mind, let us first see the overall situation of our country.

According to "Annual Report Related to the Status of Environmental Pollution - 1987" of the Environmental Agency, the death rate of patients who have been recognized as suffering from Minamata disease, Itai-itai disease and chronic arsenic poisoning is between 28% to 85%. Consequently, it can be said that the effects of environmental pollution on health are still not very clear. (Refer to Table 2).

With this as the overall status, let us introduce the results of research related to specific regions.

Mr. Yuichi Minagawa has been carrying out research on the population trends and employment structure of Kawasaki city, but he has also touched upon the relation between environmental pollution and the death rate. A part of the results of research is as follows: "if the life expectancy of each ward in 1977 is observed, there is a difference of more than 5 years between the life expectancy of Tama Ku, which has the highest value and Kawasaki Ku which has the lowest value amongst men. For women, the lowest value of life expectancy is for Takatsu Ku, but this still exceeds the value for Kawasaki Ku. The difference between these two Kus (wards) and Tama Ku is 1.5 years and 1.3 years respectively, and indicates the lowest value for males, which catches one's attention." (Refer to Table 3)

Furthermore, if the death rate for people in the 20 - 64 age category is observed, a large difference between Tama Ku and Kawasaki Ku is indicated. (Refer to Table 4)

Mr. Shunichi Kawano and Mr. Hideaki Nakagawa, with their observa-

tions of patients suffering from Itai-itai and those not suffering from the disease, have verified that the average life expectancy of patients suffering from Itai-itai is much shorter than those not suffering from it. [9]

6. In Conclusion

The above was a general survey of the transition of environmental problems, with a glimpse on the effects of environment on the health of the people, with particular reference to the death rate and life expectancy. The result is the verification that the problem of environmental destruction in our country has been undermining the health of the people. But, as in all diseases due to environmental pollution, the damage does not appear within a short period of time, therefore the interest and awareness of the people of our country with regard to environmental problems is rather thin, and we ourselves are not aware of the fact that we are assisting in the destruction of the environment. Consequently, the present status is that we have not yet reached the stage of taking positive steps for resolving the environmental problems.

Is it not necessary that the population researchers while progressing with positive research activities in environmental problems and investigating aspects such as death rate, life expectancy and population disposition, should also officially announce the results of their research? This is because, I feel that glimpses of reports of this type and abundant research activities will heighten the awareness of the people of our country with respect to environment and health, leading to deepening the understanding and interest in environmental problems.

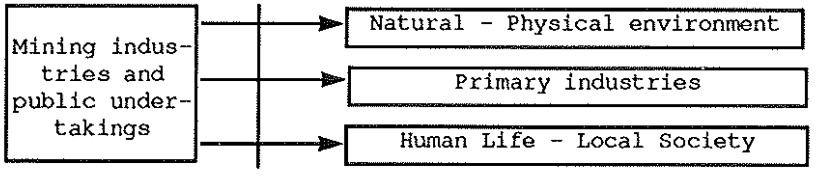
(Note) 1) Hikaru Shoji, Kenichi Miyamoto - "Environmental Pollution of Japan" (Iwanami Shinsho), Iwanami Book Store, 1975, p. 24. 2) Masazumi Harada "Industrialization, Urbanization and Humans" Edited by Takehisa Awaji, "Development and Environment - Regarding Environmental Pollution of Primary Industries", Nihon Hyoronsha, 1986, p.67. 3) Nobuko Iijima, (Regarding the Relations between Polluter and Polluted), Edited by Takehisa Awaji, "Aforecited", p5.4) Nobuko Iijima, "Aforecited Paper", p10.5) Nobuko Iijima, "Aforecited Paper", p10.6) Nobuko Iijima, "Aforecited Paper", p10 - p11.7) Haruo Mizushima, "Life Strength of Osaka City Residents - Life Table and Population Reproduction Rate", Life Insurance Cultural Research Institute, "Annual Report", No. 13, 1966, p81. 8) Yuichi Minagawa, "Population Analysis of Kawasaki City after the War - Investigation of Population Trends and Changes in the Employment Structure", "Chiba University Education Department Research Proceedings", No. 35, February 1987, p91-92.9) Shunichi Kawano, Hideaki Nakagawa, "Investigation of Status of Death Rate of Patients suffering from Itai-itai Disease", "Public Health", No. 53 Supplement, November 1987, p.74-75.

Table 1: History of Environmental Pollution

Time Period	Characteristics
First Period (From Meiji Era to the First World War)	Period when environmental pollution became a problem in areas with mines, and in cities like Osaka and Tokyo, due to the progress of industrilization and urbanisation.
Second Period (From the First World War to the Second World War)	Environmental pollution occurred due to mining industries, but pollution due to factories too occurred in each region, particularly the chemical industries which were developed in this period, gave rise to a new type of industrial pollution.
Third Period (From the end of the Second World War to the 1950s)	Capitalism, which had progressed in our country suffered a setback, due to the Second World War, and environmental pollution showed a decrease because of this.
Fourth Period (From the sixties to the first half of 1970s)	High level of economic growth in the sixties, leading to diversified environmental problrms, which became extremly serious
Fifth period (After the second half of 1970s)	A slowdown in economic growth but no decrease in environmental pollution as in the period after losing the war, rather, it remained dormant, and assumed a serious aspect. Locally and superficially, the measures against environmental pollution sems to be effective but pollution and destruction of the environment on a larger and more deeper scale has been progressing.

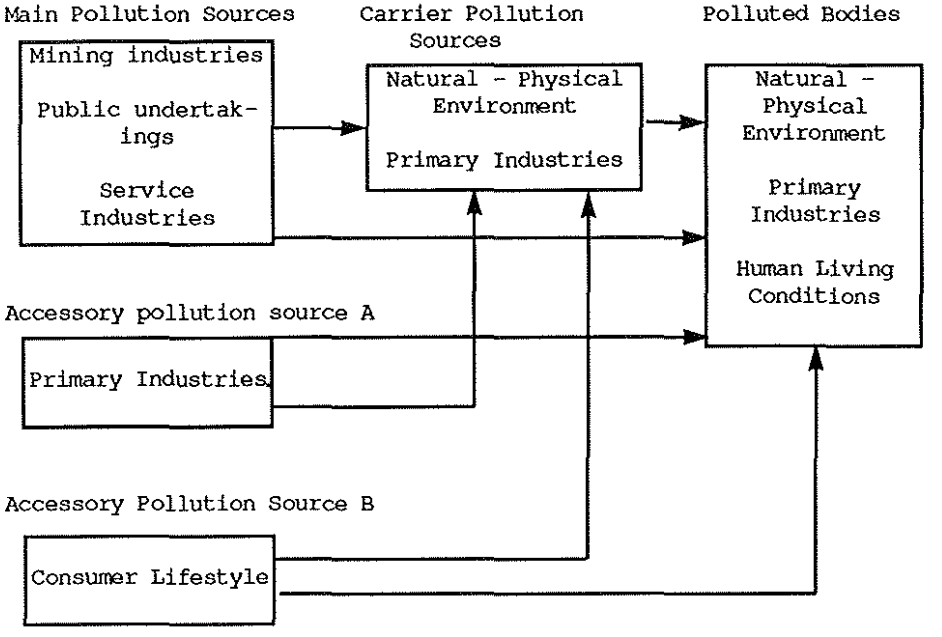
(Source) Nobuko Iijima, History of Environmental Pollution, Edited by Japan Environmental Conference Committee, Door to Environmental Science, Yukihaku, 1984, pp. 15 - 34

Fig.1 Figure indicating relation between polluter and polluted in the conventional environmental problems.



(Source) Takehisa Awaji, Development and Environment - Regarding the Environmental Pollution of Primary Industries, Nihon Hyoronsha, 1986, p.6

Fig. 2 Figure indicating the new relations betweeen polluter and polluted in environmental problems.



(Source) Compiled by Takehisa Awaji, Development and Environment - Regarding the Environmental Pollution of Primary Industries, Nihon Hyoronsha, 1986, p. 11

Table 2: Number of recognized patients of environmental pollution and number of deaths

(Unit : Persons)

Disorder	Number of recognized patients	Number of deaths
Atmospheric pollution	101,778	-
Minamata Disease (Kumamoto Prefecture)	1,038	663
Minamata Disease (Kagoshima Prefecture	314	121
Niigata Minamata Disease	489	196
Itai Itai Disease	* 123	105
Chronic Arsenic Poisoning	* 158	58

Note to table 2: These are figures at the end of December 1987. Numbers of persons who died are not included in the number of patients, indicated by the mark * the number of persons who died is also included.
(Data) Environmental Agency, Annual Report Related to Status of Environmental Pollution - 1987.

Table 3 Life expectancy in Each Ku (Ward)

(Unit : Years)

Year	Kawasaki City	Kawasaki Ku	Saiwai Ku	Nakahara Ku	Takatsu Ku	Tama Ku
Men						
1971	71.41	70.01	71.89	72.63	71.92	72.12
1976	73.68	70.99	73.60	75.04	73.66	76.88
1977	74.08	72.04	72.92	75.23	73.37	77.09
1978	73.37	71.78	73.40	74.26	73.19	74.48
1979	75.42	73.45	75.83	76.40	77.10	76.93
1978-82		72.44	74.29	75.21	75.05	76.02
Women						
1971	76.86	75.67	77.66	77.38	77.01	77.16
1976	79.11	78.02	78,76	80.81	78.32	80.25
1977	79.55	78.83	79.07	80.78	78.62	80.10
1978	79.82	77.58	78.41	79.91	81.56	81.01
1979	80.20	79.23	81.24	80.84	80.45	80.88
1978-82		78.65	79.06	80.11	79.84	80.72

Note: (1) is according to the life table for 1980.
(2) are estimated figures based on the same data as the previous table.
(Source) Yuichi Minagawa, (Aforecited paper), p.93

Table 4 Comparison of death rate for each age group in different areas

(1) Death rate for men in 1980 as an indicator for the whole country.

(2) Death rate for each age group based on the number of deaths for the age groups between the years 1978 - 1982: Comparison between Kawasaki-ku and Tama-ku

Age group	Tokyo City Ward	Kawasaki City	Okinawa Prefecture	Men			Women		
				Kawasaki-ku	Tama-ku	Index of Kawasaki-ku compared to Tama-ku	Kawasaki-ku	Tama-ku	Index of Kawasaki-ku compared to Tama-ku
0	86.9	94.2	105.2						
1	88.6	106.1	100						
2	55.7	97.1	85.7	0.01245	0.01032	120.7	0.00977	0.00679	143.9
3	78.0	49.2	86.4						
4	89.4	93.6	87.2						
5 - 9	85.7	76.8	103.0	0.00175	0.00089	196.6	0.00028	0.00113	25.0
10 - 14	89.7	87.2	99.1	0.00071	0.00078	90.8	0.00059	0.00023	254.9
15 - 19	65.9	83.4	176.8	0.00350	0.00380	92.0	0.00205	0.00109	187.3
20 - 24	59.4	65.7	127.9	0.00581	0.00243	239.1	0.00159	0.00123	129.2
25 - 29	77.5	89.9	146.7	0.00477	0.00331	144.2	0.00208	0.00251	82.8
30 - 34	88.3	75.9	134.7	0.00697	0.00351	198.3	0.00365	0.00244	149.8
35 - 39	99.9	82.6	126.2	0.01071	0.00525	204.3	0.00707	0.00311	229.2
40 - 44	99.0	100	92.4	0.02070	0.00923	224.2	0.00894	0.00526	170.2
45 - 49	101.7	93.6	90.4	0.03021	0.01346	224.4	0.01495	0.00905	165.1
50 - 54	101.7	112.4	97.2	0.04307	0.02571	167.5	0.01887	0.01134	166.5
55 - 59	99.5	89.5	97.5	0.04551	0.03179	143.1	0.02433	0.02300	105.8
60 - 64	98.4	94.6	95.6	0.07881	0.05125	153.8	0.03989	0.03088	129.2
65 - 69	96.0	90.7	89.5	0.11999	0.09940	120.7	0.06529	0.04987	130.9
70 - 74	94.5	96.0	80.7	0.19395	0.15158	128.0	0.10691	0.10116	105.7
75 - 79	94.6	92.8	83.5	0.29680	0.27089	109.6	0.20508	0.17174	119.4
80 - 84	95.1	99.0	81.0	0.45662	0.45793	99.7	0.35885	0.30751	116.7
85 - 89	96.2	93.5	79.2	0.62353	0.51629	120.8	0.51874	0.54452	95.3
Average remainder of one's life.									
Age 0	74.31	74.41	74.52	72.44	76.02		78.65	80.72	
Age 20	55.31	55.51	55.93	53.70	57.17		59.62	61.46	
Age 40	36.11	36.27	37.25	34.92	37.84		40.30	41.93	
Age 65	15.21	15.29	16.36	14.89	15.94		18.12	19.06	

Note: (1) is according to the regional life table for 1980.
(2) are estimated figures based on the same data of the previous table.
(Source) Yuichi Minagawa, (Aforecited paper), p. 93

Chapter 6

Economic Development and the Environment of East Asian Countries

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Introduction

As a result of their outstanding economic performances in the recent past, East Asian Countries (Asian NIES and ASEAN countries) are reputed as the "growth center" of world economy. It is widely recognized that the secret of their outstanding economic success is export-led industrialization and that these countries, especially NIES, provide a model of how export-led industrialization works. East Asian countries, however, are encountering severe environmental disruption and natural resource depletion as a result of their economic success. In this paper we discuss the "cost and benefit" of economic development of East Asian countries. In the first section, we try an overview of three decades of development. Strong emphasis is placed on thee increased interdependence of world economy. The cost of economic development are examined in the second section in detail.

1. Three Decades of Development - A Retrospect

(1) Performances of World Economy

It was only since the turn of the 1960s that industrialization in most of the developing countries started in earnest. It is in fact the case with East Asian countries. In this part, we try an overview of past 30 years of world economy focusing on the performance of developing world, especially East Asian countries.

During the period the most significant incidents affecting world economy were the following: oil crises in the 1970s, severe recession in the early '80s and the "Plaza Agreement" followed by rapid exchange rate adjustment. This thirty-year-period, therefore, seems to be divided into four subperiods by the above mentioned incidents.

The first subperiod (1960 - 1973)

Until the first oil crisis in 1973 world economy on the whole had grown steadily. During the period 1965 - 1973, the economies of advanced nations recorded average annual growth rate of 4.5%, while Japan experienced by far the most outstanding economic performance with average annual growth rate of 10%. Over the same period, developing countries by and large had enjoyed steady economic growth. The average annual growth rate of all developing countries exceeded that of advanced countries by 2% on an aggregate basis and by 0.5% even on a per capita basis. It should be reminded that the rapid economic growth of East Asian countries had started already during the period and these countries recorded average annual growth rate of 7.9% in the period between 1965 and 1973.

The second subperiod (1973 - 1980):

In the early 1970s world economy was enjoying a boom and even over-heated. It was in such a situation that the first oil crisis suddenly hit world economy. The rapidly increased oil price resulted in a worldwide stagflation. Over the period between the first and second oil crisis (1973 - 1980) the economic growth rate of advanced countries decreased sharply to 2.9% and also the growth rate of Japan halved to 5%. As long as developing world is concerned, the effect of the oil shocks largely differed among countries. Let me take some examples. When the first oil crises broke out, Sub-Saharan African countries were among the hardest hit. The growth rates of those countries rapidly declined to 0% p.a. or even minus on a per capita basis. The countries have suffered from perpetuated economic stagnation until the end of the 1980s. On the other hand, some other countries could maintain a relatively steady economic growth. The middle income countries in Latin America and East Asian countries were the typical cases, excluding the oil producing countries. After slight recessions, they recovered rapidly to steady growth. Compared to advanced countries they recorded a 3% higher growth on an aggregate basis. It was the changes in the flow of international funds that they were able to contain the impact of the worldwide stagflation to a seemingly slight degree.

Reflecting the economic stagnation, investment activities in industrialized countries remained in active during the period. In such occasion, huge amount of money which were once shifted from oil importing countries to oil exporters were in turn recycled to the financial markets in Europe and America as "oil dollars". Since this phenomenon just occurred when investment opportunities were relatively dull in advanced countries, a part of those funds were loaned via commercial banks at relatively low level of real interest rates to newly industrializing countries (like Brazil, Argentina, and Korea etc.) and to countries endowed with abundant resources (such as Mexico, Peru, and Malaysia etc.). Recycled "oil dollars" had supported the investment activities in these countries and their economic growth rates were maintained at a relatively high level. Please notice that Asian NIES, especially Korea and Taiwan, entered their phase of heavy industrialization in the 1970s.

The third subperiod (1980 - 1985)

In the early 1980s, world economy was faced the worst recession ever since the Great Depression. As a matter of fact, expansion of production and foreign trade of the world as a whole came to a complete halt at one time. What must be mentioned to the U.S. economic policy adopted at this time was its financial policy of sustaining tight control on the quantity of money based on monetarist policy. This policy option was intended to contain rampant inflation; and, although it did

succeed in containing inflation, it resulted in prolonged recession and in raising interest rates to a historical high. The dramatic changes in the international economic circumstances such as the sustained world recession and aggravated terms of trade coupled with the enormous soaring of real interest rates further adversely affected most of developing economies. Highly indebted countries like Latin American middle income countries, which had maintained their growth by foreign borrowing in the 1970s, were among the hardest hit. These countries encountered prolonged stagnations following the debt crisis and financial instability in the first half of the 1980s. They, unfortunately, could not come back to steady growth paths by the end of the decade. For these countries the 1980s became a "Lost Decade".

Countries which quickly recovered from the impact of the changes in the international economic environment were Asian NIES, especially Korea and Taiwan. These countries have experienced extremely rapid economic growth on the basis of export-led industrialization in the past three decades. They rapidly expanded exports to the United States as soon as the U.S. economy began to recover since 1983 and successfully came back to the steady growth paths. The United States' expanding budgetary deficits and the appreciating dollar exchange rate during the period turned out to be a blessing for Asian NIES. Actually they became the main beneficiaries of the twin deficit resulted from "Reaganomics".

The fourth subperiod (1985 -):

Appreciation of the Yen and depreciation of of the dollar exchange rates since the Plaza Agreement in 1985 also resulted in improving the competitiveness of Asian NIES and led them to further expansion. Although ASEAN countries experienced slight stagnation mainly due to fall in the prices of primary commodities in the mid-1980s, the exchange rate adjustment gave them the opportunity to expand their economy following Asian NIES. In the recent past, Thailand and Malaysia especially have recorded accelerated growth on the basis of rapid expansion of manufacturing exports.

(2) Export-led Growth of East Asia

Today Asian NIES and ASEAN countries are reputed as a "Growth Pole" of world economy as a consequence of rapid economic expansion in the past three decades. The high rates of economic growth of these countries have been achieved on the bases of export-led industrialization, or more specifically, the rapid increase in manufacturing exports. It is widely recognized that East Asian countries, especially Asian NIES, have provided the experiences and a model of industrialization. Let me briefly review the mechanism of NIES' economic growth.

Generally speaking, industrialization starts with "import substitution" of manufactured goods which until then imported from advanced countries. Under the "import substitution" regime the domestic manufacturing sector is set up under protective measures like tariff barriers or quotas on the importation of certain commodities. The industrialization of Korea and Taiwan followed this way. What is significant, however, is that both countries took some measures to promote export of manufactured goods in their early stages of industrialization. Now let me explain briefly how the mechanism of export-led growth does work.

The starting point should be put on an increase of export. An increase of export turn out to be increased ability of foreign exchange earnings, which in turn means expanded capacity of import. If the enhanced foreign exchange earnings goes to purchase of capital goods and intermediate goods from abroad, then this could result in expansion of production capacity. Increased production capacity could lead to further increase of export. We come back to the starting point of the story, from which the second round could start. It is generally understood that striking economic success of Asian NIES in the past were largely based on this kind of mechanism.

Meanwhile, the industrialized countries, especially Japan and the United States, play important roles in the process of "export-led" industrialization of Asian NIES like Korea and Taiwan. Japan assumed the role of suppliers of capital goods and intermediate goods to these countries. Rapid expansion of production capacities in the countries was accomplished by importing such goods from Japan. The United State, on the other hand, provide large market for their products.

(3) ASEAN Countries Following NIES

The industrialization of ASEAN countries also started with "import substitution". As following Asian NIES, these countries have gradually resorted to export promotion of manufactured goods since the early 1970s. There is little doubt that now they adopt "export-led" strategy of industrialization.

Let me review briefly the industrialization of these countries over the period since 1960 from the viewpoint of structural transformation.

It is widely recognized that changes in the sectoral composition of production and sectoral shifts in the composition of the labour force are associated with income growth or industrialization. It appears hat ASEAN countries also have experienced structural transformation in this sense. There was a significant shift in production from primary activities to manufacturing and services more or less in each

country. Especially in the Philippines, Thailand, and Malaysia, share of production in manufacturing already surpassed that in agriculture. So far in the composition of the labour force, however, such a significant shift has never come about in these countries. Share of employment in agriculture is still dominant in the countries except Malaysia. This may suggest the low labour absorption of industrial sector as many have observed in the countries.

More significant is that the 1980s by and large witnessed the structural changes in trade in ASEAN countries. Those countries that have been traditionally primary commodity exporters are now turning out to be manufactured goods exporters. In 1988 the export industrialization rate (manufactured exports/total exports) was 66.4% for the Philippines, 57.7% for Thailand, 42.1% for Malaysia and 26.7% for Indonesia, respectively. Here it should be reminded that the export industrialization rates of Asian NIES except Singapore are already over 90%.

The rapid exchange rates adjustment following Plaza Agreement in 1985 gave ASEAN countries a good opportunity for "catching-up" with industrialized countries. Some noticed that it was a "historical Japan opportunity" or "historical NIES opportunity", since they got export markets for their manufactured goods in Japan and NIES to ASEAN countries and, on the other hand, direct investment from Japan and NIES to ASEAN countries significantly increased through the adjustment process.

2. Economic Development and Environment

(1) Industrialization and Environmental Disruption

Major failure of the advanced countries, especially Japan, in the field of environmental management, is closely related to their development strategy. For instance, throughout Japan's "catching-up" process, overriding priority was placed on industrialization and export promotion and the environmental fallout was largely ignored as an insignificant side effect.

Following rehabilitation and reindustrialization phase early in the post war era, in the middle of 1960s Japan by and large reached to the final stage of her "catching-up process". The industrial maturity in this stage, however, brought an extreme environmental disruption. This in turn resulted in a number of tragedies: the methyl-mercury poisoning cases in Minamata area and the Agano River (Minamata Disease), the cadmium poisoning cases along the Jintsu River (Itai-Itai Disease), and Yokkaichi asthma. Public awareness of severe environmental problems became nationwide, and movement against them arose in response. While the pressure by anti-pollution movement increasing, local and national

governments were forced to take steps. It was, therefore, only after the mid-1960s that comprehensive sets of ministerial, legal, and planning frameworks for environmental protection was established in Japan. Japanese success with pollution control in the 1970s has been noted internationally, especially in Western Europe. It is, however, worthwhile paying a special attention to the fact that citizen movement played an important role in that process.

As above mentioned Japan's case suggests, advanced countries' government almost never took action until they encountered severe environmental hazards and environmental problem became a political issue. This often resulted in tragedies. Minamata Disease is one of the most serious. Once such disasters happen, cost of compensating the damage would be uncountable and it would be almost impossible to offset or recover the damage completely. The irreversibility of the problem should be reminded.

Unfortunately, the traditional approach to development seems to be still popular. Asian NIES, especially Korea and Taiwan, already followed Japan's path, and ASEAN countries appear to take the same way.

Taiwan is now reputed as one of the most polluted countries in the world, while petrochemical and plastic industries growing rapidly, partly owing to her high tolerance for pollution. Recently the government has told that only now has the time come to "clean up". In Korea, where pollution-intensive industries have grown rapidly, partially owing to high tolerance for pollution again, another tragic case has come about.

Let us briefly review the tragedy:"Onsan Disease"[1)]

> Ulsan City is located at the south-east coast of Korean Peninsula, about 400 km to the south-east from Seoul and about 40 km to the north from Pusan. Onsan Myoeon is in the south of Ulsan city. Ulsan/Onsan Industrial complexes are the biggest industrial zone in Korea in terms of production as well as in terms of area. There were 147 firms in operation in the complexes as of December, 1985. Among them thirty-one firms were established with foreign capital (TNCs). The industries stationed in the complexes are largely pollution-intensive: Chemical/petrochemical industries, machinery equipment, and primary metal smelters. Ulsan/Onsan area indeed is the place, where pollution damages have been the most frequently publicized in the country.
>
> Recently the environmental problem in this area drew a big public attention as some of the inhabitants around Onsan Industrial Complex were found to be inflicted with a certain nerve system

disease. The symptom is said to be very similar to the Itai-Itai Disease (heavy metal contamination). It was named "Onsan Disease". The companies frequently accused of being responsible for these incidents were mainly TNCs, even though the exact cause-effect relationship have not been proven scientifically.

To solve the ever increasing complaints on pollution damages in the area, the government finally decided to evacuate over 30,000 inhabitants from the industrial zones. The estimated cost of evacuation is more than 120 billion won.

In Korea and Taiwan, the governments have already stepped in to establish legal, ministerial, and planning frameworks for environmental protection since the 1970s. Such frameworks, however, have not worked well in practice. And now a number of bills on environmental protection are laid before the Diet in both Taiwan and Korea. Behind this kind of recent development, there are some political factors: development of public environmental awareness and increasing public interest-group pressure.

Comparing with ASEAN countries, Japan, Korea and Taiwan are early industrializers. So far they have, on the whole, followed the same way of Development or, more precisely, industrialization. The process, unfortunately, was accompanied by a number of disastrous incidents. Minamata Disease and Onsan Disease are the typical cases. If "advantages of relative backwardness" really exist, then late industrializers like ASEAN should take a safer way at least never to repeat such tragedies. Several tragic cases, however, are already reported in ASEAN: one such site is Jakarta Bay area in Indonesia.

(2) Globalization and International Coordination

One of the major features of world economy in the recent past is rapid globalization, the increased interdependence of world economy: capital and even labour can be internationally transferred as well as commodities. Here Transnational Corporations (TNCs) play an important role. It is so far widely recognized that TNCs contribute to the host economy to facilitate capital accumulation, transfer of technology and/or managerial skills. A point to be discussed here is related to the transfer of technology. As long as environmental technology is concerned, there is some evidence that TNCs have not contributed much to the transfer. A recent research on TNCs' activities in Ulsan/Onsan Industrial Complex conducted by Seoul National University reported the following facts:[2)]

There seemed to have been little transfer of pollution control technology through TNCs. The technology transfer was largely lim-

ited to production technology. ...Judging from the fact that all the pollution control facilities of the TNCs ... were simply designed to meet domestic emission standards which is much looser than those in Japan, U.S.A., West Germany ..., the TNCs were obviously adopting double standards, which means looser standards in Korea. Therefore, the TNCs did not play any positive role in dissipating advanced control technologies to domestic industries.

Please remind that this survey conducted in Ulsan/Onsan Industrial Complex in which recently a certain nerve system disease "Onsan Disease" was found. According to a research conducted by Japan Overseas Association, on Japanese joint venture firms in ASEAN countries, TNCs affiliated with Japan also appear to behave in that way. Their pollution control measures were largely designed to meet local emission standards.

These facts suggest that if domestic emission standards are looser than in home country, then TNCs tend to just meet the former, and not the latter at all. If TNCs behave that way, it is plausible that there is little transfer of pollution control technology through them as long as looser standards exist.

Above mentioned facts certainly indicate that environmental policy should coordinate with changeing economic circumstances. It should be considered that international emission standards, for example, need more internatinal coordination towards 21st century. Recommending tougher regulations would be only a part of such efforts, for adoption of such a measure by a country may simply encourage TNCs to seek for alternative locations.

(3) Natural Resources Depletion: A Disease Caused by Poverty

In developed nations, people usually perceive the environmental degradation to be the cost of development or economic growth; the environmental problem is a product of industrialization, urbanization and overconsumptive life style. So it is largely a disease caused by affluence. In developing world, we find that another story exists: a disease caused by poverty. In his excellent paper, Mark A.McDowell precisely describes it as follows:[3)]

Under conditions of poverty people may be driven to destroy their own natural environments, through deforestation or overgrazing, for example, to ensure their short-term survival. The consequences of such environmental degradation are much more dire "in a context of absolute poverty" than they are in more affluent societies. Thus, while citizens in the developed world tend to see a trade-off between development and the environment, many in

the third world see development as the solution to environmental problems, a way of easing many of the pressures which cause environmental degradation.

As McDowell suggests above, the environmental damage in the developing world is arising in a more complicated manner than that in the developed nations. On the other hand, people in the developing world are encountering a disease by poverty. On the other side, a disease by affluence is also coming about at the same time as a consequence of effort for development. The former is more "dire" than the latter, since it is forming a self-feeding downward spiral. For a while, let us focus on one of disease by poverty: deforestation.

Special report for the US government, entitled "The Global 2000 Report to the President" (1980) indicated the following trend: while forest cover rate was around 25% of world land area 22 years ago, it was reduced to 20% in the late 1970s. It is estimated that the rate will continue to be reduced to 16% in 2000, and to 14% in 2020. Major deforestation is coming about in tropical areas. According to the report, estimated depletion rate of tropical rain forest is 18 to 20 million hectares per annum. A survey by FAO/UNEP entitled "Tropical Forest Resources" (1982) also estimated that the rate is approximately 11 million hectares per annum.

Deforestation is one of the most serious problems of environmental degradation in Southeast Asian countries. We find the typical case in the Philippines. The forest cover rate, which was 75% in the 1950s, declined by 25% by the late 1970s. In Thailand the situation is similar. Thus, the governments of both countries were forced to actually implement, or at least eagerly consider, an option for a total ban on logging. It is significant that Thailand already became a net importer of wood, while Indonesia and Malaysia are still two of the largest exporters of woods, they are also enforced to change their system of forest management.

Deforestation contribute to a number of ecological problems: soil erosion, increased surface runoff, flooding, and drought. These problems have increasingly become severe in ASEAN countries. "It is now a matter of life and death. ... Our forests are almost gone, our rivers are almost empty, ... during the monsoon rains, flash floods destroy everything in their path." [4]

It is widely recognized that a number of human activities contribute to the depletion of forest: shifting cultivation and firewood collection in traditional sector, clearing a large extent of forest for cash-crops and timber industry in modern economic sector etc. Currently, there is no consensus with regards to the "main" factor of

deforestation. Some strongly accuse timber industry, while others blame shifting cultivation.

All of those factors, however, are closely related to poverty, in a broader sense, of the developing world. Under the condition of poverty, people in developing countries are forced to deplete their forest resources. First, they have to export their wood products to get enough funds for alleviating their poverty, although under the international pricing system timber prices may not reflect the "true" cost of replacement, and it is largely questionable whether wood exports have really contributed to poverty alleviation.

Second, there is no other way for the poor to get daily needs, food and firewood than clearing their forest. This is typically the case for landless farmers who consist of the majority of the poor.

In the developing world, the poverty itself is one of the main causes of environmental degradation. As Mr. McDowell suggested, thus, "many (people) see development as the solution to environmental problems."

The developing world comes into industrialization to solve their unique environmental problems and industrialization in turn contributes to another type of environmental problems. We should recognize that many of the developing countries are encountering this kind of dilemma.

Damages caused by poverty itself, such as deforestation, is more difficult an issue to check. The dilemma is likely to be carried on well into the 21st century. Policies should point two directions. Alleviation of poverty itself will reduce the dire necessity of short-sighted destructive activities. At the same time, especially in fighting against deforestation, a new pricing framework which takes real cost into account may have to be devised. This also calls for international coordination.

Note:

(1) Graduate School of Environmental Studies, *Environmental Aspects of Transnational Cooperation Activities, Impact and Regulation* (Phase II), Seoul National University, 1990.

(2) See Note (1).

(3) McDowell, Mark A., "Development and the Environment in ASEAN", Pacific Affairs, Fall, 1989.
(4) Clad, James, "The Fragile Forests", *Far Eastern Economic Review*, 25 February 1988

Table 1 Three Decades of Development

	1965-73	1973-80	1980-86	1987	1988	1989
Developing Countries	6.6	4.8	3.8	4.5	5.4	3.3
Low-income Countries	6.0	4.6	6.1	6.1	8.9	4.2
Middle-income countries	6.9	4.9	2.5	3.5	3.0	2.8
Sub-Saharan Africa	5.9	2.7	0.3	-1.1	2.5	3.5
East Asia	7.9	6.5	7.9	9.6	10.0	5.1
South Asia	3.6	4.1	5.6	3.2	8.9	4.8
Middle East	7.5	4.2	3.2	1.4	2.4	-
Northern Africa	6.5	5.1	0.9	3.0	1.2	1.5
High Debt Countries	6.4	5.2	1.0	1.0	1.6	1.4
Advandced Countries	4.5	2.9	2.6	2.6	4.3	3.6
World	4.9	3.4	2.8	2.8	4.6	3.4

Source: The World Bank, *World Development Report 1990*, 1990 Oxford University Press

Table 2 Domestic Emission Standards

(No. of Firms)

	Looser than Japanese	Equivalent to Japan	Stricter than Japanese
Indonesia	19	6	3
Malaysia	4	10	4
Philippines	2	3	1
Singapore	8	15	2
Thailand	11	10	3
Taiwan	2	1	0
Total	46	45	13

Source: Report on the Environmental Management of Japanese (Manufacturing) Firms in ASEAN countries, Japanese Overseas Enterprises Association, 1990 (Zai-ASEAN Nikkei Kigyou (Seizou-gyou) no Kankyou Taisaku ni kansuru Chousa Houkokusho, Nippon Zaigai-Kigyou Kyoukai, 1990)

Table 3 Emission Standards of TNCs

(No. of Firms)

	Domestic Standard	Japanese Standard	Other Standard
Indonesia	23	5	2
Malaysia	9	0	1
Philippines	4	1	0
Singapore	16	0	1
Thailand	23	0	2
Taiwan	3	0	0
Total	78	6	6

Source: See Table 2.