

Toward the Solutions of the World's Most Vexing Problems in Developing Regions

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The impacts that human beings give on the environment can be classified into two types: one is developed regions' type, as a result of affluent life, and the other is developing regions' type due to poverty. We have finally found out clearly that the capacity of the earth is limited. Unless we human beings reduce the impacts we give on the environment, the environment will be no longer capable of withstanding the damage from us, and the earth will become a place where no human beings can live. Both types of the impacts must be reduced, but first, the people living in developed regions should eliminate an unnatural, useless and uneven way, and change their lifestyle in such a way that the impacts on the environment are smaller. On the other hand, of course the elimination of poverty is the thing that whole human races desire, it is important to solve this problem as soon as possible. At the same time, however, when we eliminate poverty, the impacts on the environment will increase. Therefore, it is indispensable in developing regions to design development methods by which environmental impacts will not increase, even when poverty disappears. In this paper, how development methods should be generalized and some specific method for solving those issues is discussed.

1. Introduction

Paul Ehrlich has warned us about the irrevocable global destruction which would result in if the Impact (I) continues to increase at the present rate. Suppose population is represented by Pi and the average impact on environment per person by Ci, then we have the following equation to define the total impact human beings give on the global environment:

$$I = \sum_{i=1}^N P_i * C_i \dots\dots\dots(1)$$

where N represents the number of nations or races.

Today, however, the finite permissible destruction of the global environment is widely understood. We should discuss this problem based on the "dynamic differential quantity (dI/dt)" rather than on the impact quantity (I), since it is logically more accurate to think that if human beings continue to increase the Impact (dI/dt) and that the accumulated Impact will some day exceed the finite quantity of permissible destruction and so render the earth no more habitable for us [1].

$$\frac{dI}{dt} = \sum_{i=1}^N \frac{dP_i}{dt} * C_i + \sum_{i=1}^N P_i * \frac{dC_i}{dt} \dots\dots\dots(2)$$

The necessary condition for the continuation of the human species requires us to curb the growth of dI/dt and change the value >0 to =0. Ideally, we should bring it down to <0 as quickly as possible. The growth of the Impact (dI/dt) is the sum of the contribution by population growth (dPi/dt) and the sum by life-style (dCi/dt). 95% of our population growth (dPi/dt) comes from developing regions. On the other hand, two groups (affluent developed regions as well as poor developing regions) contribute to dCi/dt. The environments of both popula-

tions have been seriously undermined by the consumption of huge amounts of energy in developed regions and reckless deforestation to procure wood fuel and develop cropland to sustain growing populations in poor developing regions.

In order to curb the growth of the Impact (dI/dt) in the long-term, people in developing regions must control their population growth right away, while in developed regions, the Impact should be decreased by changing the life-styles with less burdensome on the environment. Nevertheless, even if population growth in developing regions is successfully controlled and the life-styles in developed regions become less burdensome on the environment, whether human life will continue on earth is not guaranteed. Why? It is because getting rid of poverty is everybody's wish. If poverty were eliminated in developing regions, the improved standard of living would increase dCi/dt. With regard to the growth in Impact, the population of developing regions is already four times larger than that of developed regions. The second term (Pi*dCi/dt) which is the product of a large quantity of Pi and the increased quantity of dCi/dt would become an enormously large quantity.

Food and energy consumption contribute to Ci. Especially when foods are applied, we can identify the problem very clearly. In this case, dI/dt represents the increase in food consumption by all human beings, and the first term of Equation (2) represents the contribution of population growth, which was the increase indicated by Malthus. On the other hand, the second term depends on changes in life-style conditions upon economic growth and so on, which is irrelevant to population growth. What we must be careful about is that when compared with the first term, an increase in the second term could take place extremely fast. While population growth usually does not

exceed 3%, it is not unusual for it to exceed 10% when the economy grows very fast. Like population growth, economic growth multiplies exponentially. Unlike a linear increase, differences in growth rates will expand over time. Increases in populations due to this non-Malthusian factor have already become a reality in Southeast Asian regions and China. Population growth has already erased the effects of the increased food production caused by the green revolution, and food shortages in large scale have developed in this region. Recently, however, this region is suffering from a serious economic crash and as a result, the food shortage issue has disappeared except for Indonesia. This is evidence to show how food consumption is influenced by changes in lifestyle as a result of economic growth.

One of the indispensable conditions for sustainability of human beings is to control the population increase in developing regions and simultaneously to change the present lifestyle in developed regions to the one in which the damage to the earth's environment is smaller. There are two reasons why the people living in developed regions must reduce the impacts on the environment. One is that we must reduce the impacts on the environment since it is our own problem. The other reason is that the people in developing regions long for the lifestyles in developed regions and look at them as their goal, hence it is essential to change our lifestyle right now if we want to reduce the impacts on the environment by the future lifestyles in developing nations. Moreover, we must work hard to eliminate poverty in developing regions. This, of course, will require economic development. This economic development, however, must be formulated in such a way as to reduce the damage to the earth's environment.

2. Various problems in developing regions

The conditions of natural and social environment in developing regions have been deteriorating day by day. Both sides are closely related to each other, but the most fundamental problem is the miserable socioeconomic condition called poverty. Unless the problem of poverty is solved in these regions, deterioration of natural environment will not only continue in the area but affect the surrounding areas in global scale, and will eventually jeopardize the survival of mankind.

The single gravest problem in developing regions is the problem of poverty. In the field dealing with poverty issues, the people who cannot secure the amount of food necessary for daily living are called the absolute poor. The population of the absolute poor reaches from 800 million to one billion. The absolute poverty begets starvation in a large scale; accelerating over-cultivation of fields for various crops; logging excessively; and driving children who are the weakest in the society to death. Although it is difficult to identify accurate figures on this subject, nearly 20 million children younger than 5 years old are considered dying from starvation and malnutrition every year.

The economic mainstay in developing regions is the primary industry, and this fact makes it difficult for women, who have disadvantage in physical strength, to

participate in economic activities. This is the most significant factor to lower women's social status in developing regions. Domestic routine works, such as firewood gathering and water fetching, are very hard and detrimental to women's health. This is one of the major factors to the high infant mortality. Economic independence of women will result in late marriage, which will contribute to population control.

A mass of people flows out of those areas where poverty and rapid increase in population take place to seek a better place for life. This phenomenon is observed in the developing regions, and the population overflow is directed from rural villages to cities. As a result, unusual urbanization occurs in developing regions. Over-paced urbanization will notably amplify the slums and will deteriorate the social environment to a considerable extent. To increase productivity of modern industries and to transform their structures into those whose impacts on the earth's environment are smaller are, therefore, indispensable requirements to curb deterioration of the social environment as well as the natural environment.

Furthermore, a great deal of people are forced to become refugees seeking for food. Since refugees migrate to other regions, conflicts are likely to occur there, and sometimes they develop into war. Most small-scale conflicts occurring in Africa these days originate in poverty. For the purpose of comparison, 55 million people died during World War Two, whereas, if we take into account that this war lasted for five years, the number of deaths of children today is greater the number of war dead. Tolstoy who wrote 'War and Peace' said in this novel, "if we don't have war, we will have peace." However, absence of war does not necessarily mean we can enjoy peace nowadays. From the perspective of the whole human beings, this phrase should be changed from 'War and Peace' to 'Poverty and Peace.' Since the main reason why wars break out is poverty and wars become the most destructive factor to the environment, we must first start directing our major efforts to solving the issue of poverty. If developed nations do not cooperate in eliminating poverty and leave it as it is, the conditions mentioned above will continue to occur frequently and threaten the preservation of human beings themselves, and not to mention, the sustainability of human beings will be doubtful because of environmental destruction.

3. How to achieve economic development

In order to aggressively work toward the elimination of poverty, the people in developed nations must cooperate in pressing forward economic development in the developing regions. This economic development in developing regions must not be a similar one to the economic growth in Southeast Asia until last year, which tumbled down so easily due to the financial crises. We must strive to maintain economic development in developing regions in the future and stand on the firmer ground than before to withstand economically and politically upsetting factors.

Because of the consideration on the earth's environment, it was decided that the development in developing

nations must have the least impact on the environment. With respect to how we should address the issues of development and what kind of industries should be appropriate to develop, we have gotten a great clue from the financial crisis that shook Southeast Asia after it broke out in Thailand last year.

The financial crisis unleashed by the devaluation of baht in July 1997 spread into other regions of Southeast Asia by domino effect. One year later, the economic conditions in Thailand, Malaysia, Indonesia and so forth differ a great deal even though they had the same financial crisis. Especially, the situations between Thailand and Indonesia are extremely different.

The key factor of the economic crisis in Thailand was a rapid deterioration of trade balance due to the sharp increase in import, because the people in Thailand sought after higher living standards than they could afford. After the substantial devaluation of baht in July 1998, the Thai's import decreased rapidly. As a result, two months later in September, the Thai's trade balance got into the black and remained so for the most part afterwards. Since then, the exchange rate has been very stable with a little upset with only temporary not so serious baht crisis in January 1998.

It is especially remarkable that while Indonesian rupiah was appreciated tremendously at the time of the political revolution that broke out in May 1998, Thai baht did not change so much. This implies that the financial market recognized marked differences in the future prospect of political situations of Thailand and Indonesia, which means that the market was aware that the political situation in Thailand is stable and the future of Thailand is far more stable and rosy than those of Indonesia.

The effects of the financial crisis became serious in big cities like Bangkok. Nevertheless, most of its effects are kept within the extent of building construction being left undone in the middle, delay of monthly payments of high-class condominiums and automobiles, deserted high-class hotels and restaurants. These situations have not developed into riots among the public. On the other hand, thanks to the cooling of economic activities, which had been a little overheated, such merits as alleviation of traffic congestion and atmospheric pollution have been obtained.

Thailand has achieved an extremely high economic growth since 1990. At the same time, it has secured self-sufficiency for food, and earned much foreign currency simultaneously by exporting the primary products aggressively. What is remarkable is that although it has developed the secondary industry to a great extent, it has managed to maintain the front position in export of rice both in volume and value.

Similarly, Indonesia has achieved a tremendous economic development since 1990. On the contrary, however, due to a rapid population growth in the past along with an economic growth leading to the increase of food consumption as the result of changes in lifestyle, the demand for food skyrocketed. Actually, Indonesia managed to increase rice production substantially during ten years between 1986 to 1995 from 39.28 million tons to 49.86 million tons [2].

Nevertheless, Indonesia has a large population of 200 million, and the growth in production of food did not match with the inflating demand for food. Consequently, there was a rice import of 3.16 million tons in 1995, making Indonesia the biggest rice importer in the world. Furthermore, between 1997 and 1998, partly due to El Nino event, it was hit by a draught while suffering from the financial crisis at the same time, resulting in a drastic drop in rice production. The large-scale draught occurred with frequent incidents of mountain fires. Huge amounts of smoke generated by mountain fires reached Malaysia and Singapore, causing impediments to navigating ships in the Strait of Malacca and a smoke from the fires was the main reason for the occurrence of an aircraft crash.

At present, it is assumed that rice is short by the amount of over 5 million tons. However, we do not know the exact figure about the extent of the shortage. Ironically, the currency crisis caused Indonesian rupiah to depreciate drastically, which made exporting rice more profitable than selling it domestically. As a result, rice was exported in the midst of domestic rice shortage, which made the shortage of rice in Indonesia much more serious domestically.

The food shortage, especially rice shortage, became especially serious in big cities like Jakarta and Surabaya, skyrocketing rice prices. It became difficult for the lower income segment and the poverty-stricken segment of residents to even secure a minimal level of food necessary for daily living. These residents turned into rioters and started to plunder in supermarkets and department stores. Then, today, the plundering act is spreading into rich general households to suburban farms. Especially, most serious is the intensive attacks on rich Chinese residents, which has the connotation of ethnic persecution. Since Chinese residents have big power in the economic community, the persecution of these citizens means the outflow of human resources and capital to overseas, making economic rehabilitation in Indonesia much more difficult.

Plundering of farms causes the devastation of farmlands, which in turn accelerates the drop of food production of the next fiscal year. The purchase of fertilizers and pesticides is difficult under the financial crisis. If the devastation of farmlands continues in the future, a more serious food shortage will occur without doubt in the long run.

In developed countries, it is very rare that an economic chaos such as a substantial devaluation of currency would lead to riots caused by the public, which undermines the safety of the community and causes the prolonged political unrest. On the other hand, in developing regions where their economic foundations are vulnerable, it is often the case that an economic chaos will threaten the foundation of the public lives and lead to outbreaks of riots.

The greatest factor of turning the public into rioters is the destitution of living conditions caused by the difficulty of securing food. The greatest factor of undermining the safety of Indonesia and leading it into a political unrest during the late financial crisis derived also from the difficulty of securing food.

It is certain that the food shortage in Indonesia cannot be solved so easily and that it will last for a long time in the future. Under such circumstances, public safety will continue to deteriorate, and the political situation will not be stabilized. There is little hope of having a stable economic growth in the nation where the political condition is not stabilized. Consequently, it will be impossible to solve the issue of poverty in the present situation. The various conditions of Indonesia after the late financial crisis will show us a clue as to how economic development in developing regions should be planned in the future and what kinds of industries should be promoted in those regions.

The rapid population growth in developing regions is still continuing. Moreover, the increase in food demand due to the changes of lifestyle as a result of an economic growth further accelerates the rapid food shortage. Therefore, even in a country where food is sufficiently produced domestically at present, it should strive to make sure that they stand on the firmer ground in self-sufficiency of food to prepare for the future. This means that it is necessary to implement the policy to put emphasis on agriculture.

The principal industry in developing regions is the primary industry. It is important that we do not make light of the existing primary industry, rather we should try to increase productivity of the present primary industry and transform its structure to the one whose impact on the earth's environment is smaller. If we neglect the primary industry and give priority to the secondary industry instead, it will result in a rapid increase of the import of producers' goods, which will contribute to the rapid deterioration of the trade balance. This in turn will make a country's economic system very vulnerable to a financial crisis.

The regions that are prone to a financial crisis in the future include not only Southeast Asia, but also Latin America, Russia, and China, and ten years later, India. This means that the frequency of having a financial crisis in the future will further increase. It is important not to wipe out the property that has been acquired by economic growth until then in a short while every time a financial crisis happens, as it was indeed the case in Indonesia lately.

In pressing forward with economic development in developing regions of the world in the future, it is important to put emphasis on agricultural policies so that the foundation of food self-sufficiency will be on a firmer ground. China has already changed its policy that puts emphasis on the agricultural policy. It is also important for developing nations to increase productivity of those sectors other than the primary industry by introducing advanced technology from industrialized nations, making efforts to reduce impacts on the earth's environment. As for the promotion of the secondary industry, it should be done gradually and in harmony with the improvement of school systems and other social capitals without stretching too much too soon.

4. Warning

Agricultural land per person in Indonesia is 0.9 hectares, whereas in Thailand it is 1.1 hectares. The farmlands of Thailand and Indonesia are 20.8 million hectares and 30.17 million hectares, respectively. On the other hand, the number of farmers in Thailand and Indonesia are 20.42 million and 47.5 million, respectively. It is thus certain that Thailand could accomplish self-sufficient food supply. A wide area of forest, however, was cut down and now the percentage of it to total land area is only 26.3% [2]. As Indonesia is confronted by food shortage, forests are converted into farmlands. Though it is a very rough calculation, if Indonesia is to become a stable agricultural country with self-sufficient food supply in the future, 18.21×10^6 ha of land will be required. This means that a wide area of forest may be destroyed in order to meet this demand since agricultural land is cultivated by clearing the forest. Therefore, no matter how many institutions such as the United Nations are working for the conservation of tropical rain forest so aggressively, unless the food shortage issue is solved, we cannot avoid a continuation of deforestation. What is meant by it is that we must find a way to increase food production efficiently without destroying the forest. In addition, we must find a way by which we can use forest effectively and increase income by managing forest.

5. Appropriate industries and their methods

5.1 Food production in tropics by utilization of catchment area

What kinds of industrial sectors and what kinds of methods are available in the primary industry? With respect to grain productions for food in tropical regions, since the land suitable for wheat production is very limited, the kinds of crops that can be produced are restricted to rice and corns. Especially in a country located directly under the equator like Indonesia, there is little land suitable for wheat cultivation. Also, since corns aggravate the outflow of the surface soil, their cultivation will destroy the environments on not only sloping land but also flat land where they have a lot of precipitation, which makes it necessary for us to be careful about cultivation of corns. On the other hand, in the downstream of the rivers in Sumatra and Kalimantan (Borneo) flowing into the Pacific Ocean, there are wide marshes suitable for rice cultivation. However, although this region is suitable for rice cultivation, it is too hot and humid and not very suitable for inhabitancy of human beings. This can be regarded as one of the reasons for the food shortage in Indonesia.

In tropical regions, organic matters decompose quickly, and decomposed organic matters flow out with the soil by rainfall. This makes the soil in tropical regions poor, which makes it difficult to cultivate the same crop on the same land repeatedly. On the other hand, in the land where there is a catchment area nearby, there is an abundance of water which contains rich organic nutrition. The crucial point in promoting the primary industry with small impacts on the environment in tropical regions is to make

to improve the social status of women in developing regions.

Sericulture and the related industries such as the spinning, textile, and sewing industries are suitable to women. Development of sericulture will result in development of the related industries, thus creating employment opportunities for women in a larger scale. There is a close correlation between women's status in a society and population increase and infant mortality, and the enhancement of women's social status will automatically reduce a population growth rate and an infant mortality rate [4].

As mentioned earlier, cassavas are grown in many places in the world in great quantity. The leaves of castor-oil plants can be harvested three months after they are planted. Since an Eri silkworm can be multiplied by 100 times in 45 days, they can be increased to the 16th power of 10 (10,000 times of one trillion). Therefore, the sericulture with Eri silkworms can be developed into a major industry in a short time, and will be able to contribute to the solution of poverty. The solution of poverty in developing regions has been cried out since the time of the late President Kennedy, but it has not been solved at all to this day and age (Fig. 1).

Since sericulture has declined in Japan, leaving many sericulture researchers and specialists without work, these people can contribute to the technological assistance in this field in developing nations. This new type of international cooperation we have been proposing is done by helping the development of sericulture in developing nations, and is unique to Japan, which other developed nations like European nations and America cannot duplicate. I hope that Japan will lend a powerful hand in the international assistance in this field.

6. Environmental conservation in developed nations and sericulture

In this section the issues related to Japan are discussed. The national land of Japan has been used for paddy fields in the plains and sericulture and forestry in the mountainous regions ever since Nara era. Especially, mountainous regions have been developed aggressively for increasing wealth through sericulture, ever since Meiji era up until the beginning of Showa era. However, after it

peaked in 1930, sericulture in Japan has declined until today. As a result, mountainous regions, which represent three fourth of the entire national land area of Japan, became extremely devastated.

Nevertheless, if we apply the recently developed technology where artificial feed is used to operate sericulture in Japan, we can restore sericulture and we will be able to conserve the environment in mountainous regions in Japan. The new method of sericulture by using artificial feed will change the traditional way of sericulture and increase productivity tremendously. For example, if we use artificial feed for keeping worms, since the worms need to be fed for every two days even during the period when the growth of worms are the greatest. Another advantage is, since fresh leaves need not be supplied as feed, facilities for rearing the worms need not be placed next to a mulberry field.

In sericulture, human labor is concentrated on harvesting of leaves and management of worms. As for harvesting leaves, mechanization become possible by using machines. Thus, it became easy to manage as many worms as 100,000 by a person. The recent experiment results show that 350 kilos of feed is needed for keeping 20,000 worms.

Artificial feed is prepared by mixing 85% of mulberry, 15% of soybean powder after they are used for the extraction of oil for the purpose of protein supplement, and some addition of the vitamin B group. The condition of raising worms by this artificial feed was little different

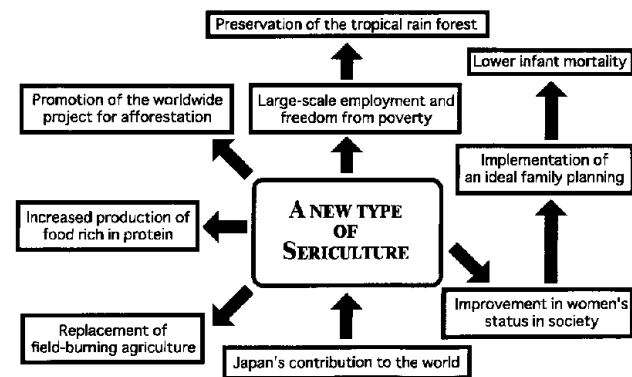


Fig. 1 Solutions of current problems made possible by establishing a new type of sericulture.

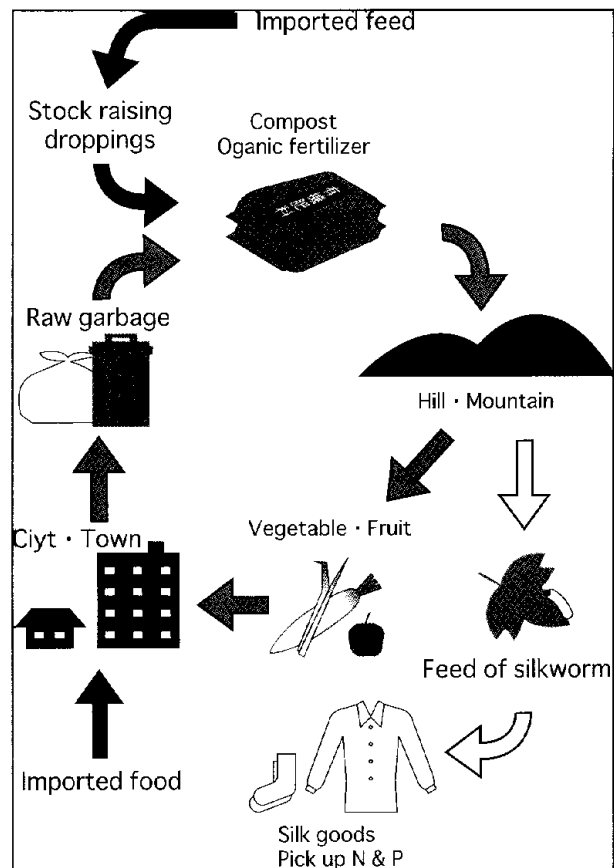


Fig. 2 Recycling of nitrogen and phosphorus.

from the one with mulberry plants. The content to be added is soybean power, which costs 125 Japanese yen per one kilo and is quite cheap. Therefore, artificial feed developed lately has a substantial potential to lower the costs.

If preservatives are added to artificial feed, it can be kept for a long time. Consequently, sericulture can be carried out, independent of the time of harvesting mulberry plant leaves. In this way, productivity will increase as well. A mass supply of low-cost artificial feed is used not only for the purpose of producing cocoons, but it is also effective for social welfare of the aged. Japan is going to enter an extremely aged society in the years ahead, by which time there will be many senior citizens living alone. Keeping living things around these people and making them take care of these animals everyday will help the aged people who want to maintain very good mental health. If we transfer the fund for the welfare and environmental conservation to the mulberry growing, it becomes possible to reduce the costs of feed substantially and, not to mention, the social effects we will create.

The following issue can be considered as an interesting issue of ecology. Japan imports as much as 40 million tons of food every year. As a result, a great amount of nitrogen and phosphorus are being accumulated in the Japanese soil. Moreover, kitchen garbage is produced in a great amount in big cities and the practice to make compost out of it has become very popular in recent years. The disposal of this compost is posing a big problem in cities in Japan. If we bring this compost into mulberry plant fields in mountainous regions, we can create an ideal recycling system.

It is usually necessary for us to put so many chemical components consisting of nitrogen 35 kg, phosphorus 15

kg, lime 100 to 200 kg, and a compost more than 1,500 kg, into 10 area of the mulberry plant field in order to obtain 130 kg of rare cocoons. We can harvest twice a year and the yield of green leaves from mulberry trees is around 3.5 tons from the field. Since the weight of dried mulberry contains 20% of protein, it absorbs a large amount of nitrogen and phosphorus. 70 percent of nitrogen is contained in leaves as components of aminoacid [5]. Vegetables and fruit will return these nitrogen and phosphorus back to earth, but in the case of mulberry, they are reduced to silk by way of sericulture, and thus nitrogen and phosphorus will be removed from the biological cycle. In this way, the eutrophication of soil can be controlled. Moreover, large-scale development of mulberry plant fields in catchment (source of water) areas of big cities also serve as tree planting projects, and they will become nourishing forest to secure stable headspring in Japan (Fig. 2).

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