The "Win-Win" Strategy for Sustainable Development; A Case Study of Recycling System in European Countries[1]

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Abstract:

According to static mindset, any regulation for ecological preservation means an unavoidable cost imposed on private economic activities, and promotes only a "end-of-pipe" type of technology. However, regulations devised from the view point of evolutionary mindset can reconcile economic development with ecological sustainability by encouraging an ecologically benign technology on micro level. However, the "win-win" strategy may result in "wrong-wrong" strategies, unless the private initiative on micro level is induced to achieve the purpose of ecological sustainability on macro scale by public policy networks. In this paper, a European experiment in the "win-win strategy" initiated in Germany is examined, with a view to introducing its merits to Japanese policy making for regional economic development.

1. Introduction

As well known, the idea of sustainable development was confirmed in the Earth Summit at Rio de Janeiro in 1992[2]. In Europe it was reconfirmed in 5th Framework Programme of the European Commission in 1993 (Faucheux and Nicolai [6]). The "win-win" strategy is an idea on each firm's side corresponding to that of sustainable development on macro scale.

According to this idea, regulations for ecological protection are not recognized by each firm as an exogenously imposed cost, but as a chance for enhancing its industrial competitiveness, while, at the same time, contributing to the improvement of environmental quality (Porter and Linde [11], and Porter and Linde [12]). It requires each firm to turn about its conception from static to evolutionary mindset, because the "win-win" outcome can be achieved only by innovative and break-through technologies for the development of which each firm has to bear the present huge cost.

Therefore, it may be shortsightedly concluded that as long as each firm can turn about its conception from static to evolutionary thinking, the purpose of sustainable development can be achieved on voluntary basis without any regulation policy. However, it has been pointed out that it invites "locked-in" technology and "auto-regulation" to leave ecological protection up to the competitive initiative of private companies (Allal and Fauchux [2], Faucheux [5], Faucheox and Nicolai [6], and Jaeger

1 This research work was financially supported by a grant for "Creative and Innovative Research" awarded by the Ministry of Education of Japan. I am grateful to Professor Tsunekazu Toda for his support to this research project. My gratitude is also given to Professor Martin O'Connor, Dr. Yves Henocque, Dr. Wörner, Professor Siegfried Berninghaus, and Professor Anna Soci, for their helpful support to my research work in Europe.

2 As to the outline of the Rio Declaration, refer to Thom [17].

et al [7]). The private initiative without any regulatory policy may bring about some technical innovation which does not contribute to the improvement of environmental quality, and / or some private coalition among core stakeholders which transfers the cost for ecological protection onto other non-core stakeholders such as consumers, future generations and less developed countries.

The nature and direction of the technical innovation of private companies are affected by not only customers' preference but also other social pressure, to the extent that they feel pressed. Therefore, we still need some public policy network in which all stakeholders are organized for them to participate in influencing the nature and direction of technological innovation for ecological protection. It is called "governance for sustainable growth policy" (Fauchex and Nicolai [6])[3].

Turning our eyes to European experiments in private initiative for sustainable growth, we can observe many private systems for eco-certification such as ISO14000, French X30-2000, British BS 77-50, and International Electorotechnical Commission. Even these voluntary systems for eco-certification bear the same risk as the "lock-in" and / or "auto-regulation" (Fauchex and Nicolai [6]).

On the other hand, we can observe a mix of private initiative and public policy network in the recycling system for packaging wastes, initiated in Germany in 1991 and permeating into other six European countries now. According to this recycling system, all packaging wastes must be taken back and recycled by packaging manufacturers and distributors, except for incineration with energy recovery of 75 per cent. Producers' side is obliged to dispose of packaging wastes. In the case of sales packaging among all packaging wastes, however, firms may be exempted from their obligation to collect and recycle packaging wastes by themselves, if a nationwide system is set up for collecting, sorting, and recycling them after households' consumption. This task is taken over by Duales System Deutcshland AG (hereafter, abbreviated as DSD), which is, since the beginning of 1997, a public limited company with around 600 shareholders who are companies from the packaging and consumer goods industry and the retail trade industry. This company is run by three executives who are controlled by a supervisory board of twelve members. The supervisory board has three members from the packaging, the consumption, the retail trade, and the waste management industry, respectively. Furthermore, the advisory panel, consisting of the representatives from politics, research and science, consumer organizations, and industry and trade, acts as an intermediary between the company and various social groups.

DSD is a non-profit organization but finances its activities by licensing the trade mark called "Der Grune Punkt" (the Green Dot) to fillers, packers and importers. Once a company concludes trade mark contract, it is obliged to attach the Green Dot Mark to its packaging. DSD has now about 17,000 companies as its customers (Rob [13]).

Under such a recycling system, each contracted company is expected to have an incentive to reduce packaging volume, because the reduction of packaging volume can reduce its price through decrease in license fees. In this respect, this system can reconcile the "win-win" strategy on micro level with the improvement of ecological quality on macro scale. However, exported products are exempted from this recycling system. Furthermore, the license fees are transferred onto prices, and consumers are assumed to cooperate with DSD in bringing and sorting household wastes. As the most serious point, it should be suspected that DSD itself has an incentive to reduce packaging wastes, because it brings about a retrenchment from its business.

The main purposes of this paper are; to investigate whether the "win-win" strategy under the recycling system of DSD can be reconciled with the improvement of overall ecological quality, and to try to find out the more improved ways for recycling system.

3 Regarding introduction of participation of social groups in decision making or economic assessment, see O'Connor [10] and Cohen and Dron [3].

2. A Brief Summery on Approaches to Sustainable Development

The natural resource which was considered as a limit to economic development in the day of Malthus was land. He reacted to this limit by proposing the control of population growth. However, succeeding technological innovations in agricultural production have been pushing back that limit. Turning to our eyes to the post-Second World War era, industrial pollution problems was reacted by various regulation policies, and economists responded to these policies by the theory of externality. When OPEC challenged to oil-importing developed countries in 1970s, they reacted to this challenge by finding out new ways to rely on less oil consumption. Neo-classical economists responded to them by introducing natural resources into their economic growth models (Stiglitz [16]). In 1990s, economists reacted to ecological globalization by introducing global pollution problems into the theory of endogenous growth (Aghion and Howitt [1]). In this section, those theories are examined from the point of view of evolutionary approach.

As Fauchex points out[4], key players in the analysis of technology change are; (i) those who determine the contents of the technical change, such as R&D departments, (ii) those who indirectly influence the direction of the technical change, such as government regulatory organs, and (iii) those who link the former activity of technology generation with the social pressure of the latter, such as firms' environmental department.

The direction of the technology change is influenced by external pressure on firms, even if they are the main players who decide on the contents of the technology change. Accordingly, we have to link these three main players in order for all of them to act consistently with the purpose of the innovation of technology for ecological sustainability. It means we have to devise well-designed public policy networks to induce the private initiatives to achieve such a type of technological innovation. First of all, therefore, the orthodox approach to sustainable development should be examined from this point of view.

Secondly, it depends on the mindset of firms whether or not the break-through technology can be pursued on each firm's side. If a firm is locked into static mindset, it can not bear the cost to develop such a type of technology, because the benefit of the cost comes later. The "win-win" strategy should assume many of firms to have a dynamic or evolutionary mindset. From this view point, the effects of regulation policy should be examined below.

2-1. The Concept of Sustainability in Neo-Classical Economic Models

The neo-classical theory of growth introduced extracted natural resources into its production function, but supposes that those natural inputs can be replaced by physical capital goods. Therefore, if technological innovation is such a type as substituting physical capital for the extracted natural resources, the limitation imposed by natural resources can be offset. The theory of endogenous growth introduces not only extracted natural resources but also intellectual capital. Therefore, if the intellectual capital, that is, "greener capital", is substituted for inputs from the extracted natural resources, ecological sustainability can be also achieved.

Both growth theories put their emphasis on the importance of technological innovation to offset the limits imposed by natural resources. However, they do not show how such a type of innovation can be brought about. They lack the analysis of the incentive design to induce firms to develop the break-through technology. We have to ask what on the earth induce the firms to make such a innovation.

Both the theory of externality and the theory of endogenous growth define welfare in such a way that recognizes some substitutability between man-made consumption goods and ecological quality. They assume that individual's utility is a function of not only the former but also the latter. According to

4 Faucheux [5].

this view, the problem of ecological sustainability is convertible to that of the trade-off between consumption goods and ecological quality, or to that of the trade-off between the consumption needs of present generations and that of future generations.

Even if World Commission on Environment and Development [18] defined sustainability, with some metaphor, as "development that meets the needs of present generations without compromising the ability of future generations to meet their needs", we should not forget that the sustainability is essentially a concept to express the survival conditions for human species, and that the preservation of ecological harmony is one of the most influential conditions. It does not mean that wild nature must not be changed any time, but it means that if the preservation of ecological harmony is not certain, any wild nature must be protected. In this case, we can not trade off between the present consumption and the future consumption. In this case, we have to look for completely a new way to overcome that problem. The welfare concept of the neo-classical approach fails to introduce the diversity of ecological sustainability into the utility function.

2-2. Technological Innovation and Time-Horizons

Even if any person is an individualist in social life, his or her time-horizon is various according to the type of each person. If one individual is a myopic type, his or her time-horizon to calculate cost and benefit is confined to a short period. On the contrary, if a long run type, the time-horizon is extended beyond that short to a longer period. This difference of time-horizon plays a crucial role in influencing the direction and contents of technical innovation induced by regulation policy or by a change in consumers' preference pattern.

The majority consumers in some European countries may be considered to have a new preference pattern, according to which each consumer is ready to pay more for the improvement of ecological quality (Jaeger et al [8]). The government which can anticipate, with confidence, such a change in consumers' preference may introduce some regulatory policies to preserve ecological systems, such as tax on emission and obligation of disposal of any wastes based on the principle of product responsibility. However, the reaction of firms to such regulation policies is different according to the difference of their time-horizon mentioned above.

Any regulation inflicts some present costs on each firm, such as additional costs for taking back wastes and disposing them by themselves, tax payment, and / or costs to develop technology to dispose of wastes. Accordingly, if a firm is of a myopic type, it opposes to any regulation as their first response, and it tries to develop "end-of-the process" type of technology, if it is forced to develop any technology for wastes disposal. The theory of externality supposed such a type of firm and consumer.

On the contrary, if a firm is of a long run type, it may take those regulation policies as a strategic opportunity to increase its profit, and launch itself on the development of the break-through type of technology. The "win-win" strategy, that is a correspondence on firm's level to sustainable development on macro scale, can be pursued only by the latter type of firm. In order to achieve the purpose of sustainable development, therefore, governments have to induce both consumers and firms to take a long run point of view.

This change in firms' mindset from static to evolutionary one can contribute to not only the improvement of ecological quality, but also a new type of economic growth. According to the report of Japanese Ministry of International Trade and Industry (MITI [9]), about 40 per cent of world's production over the first half of the 21st century may come from products and technologies linked with ecology protection. A broad field for industry and employment is expected to grow open.

2-3. An Evolution Game Approach to Sustainable Development

We can explain the main ideas of the "win-win" strategy and public policy network for it to be linked with ecological sustainability on macro scale by

recourse to a game theoretic model with two stages and its extension to an evolution game model.

Let's suppose that our community is occupied with two "species", consumers and firms, and that each "species" consists of two types, a long run type and a myopic type (abbreviated as L-type and M-type, respectively). The L-type of players tries to maximize the total payoff of two-stage game. On the other hand, the M-type of players sticks to maximizing only the payoff of the first stage because of their myopia. One firm and one consumer are selected from each "species" at random, and they play a game in a period. Here, the payoff matrices of the L-type of firms and consumers are supposed to be those in the Table-1.

Table-1 Two-stage game of L-type

First Stage

	c_1	d_1
C_1	p-a, u-a	0, 0
D_1	0, 0	p, u

Second Stage

	c_2	d_2
C_2	p, u	0, 0
D_2	0, 0	p-b, u-b

In the above tables, the row player is a firm of the L-type, and the column player is a consumer of the L-type. The action C_i (c_i) and D_i (d_i), $i = 1,2$, denote contribution to preserving ecological sustainability and non-contribution, respectively. "p" and "u" mean the profit of the firm, and the benefit of the consumer, respectively, when exchange between them is concluded. On the other hand, "a" means the present cost for contributing to the preservation of ecological system, such as costs for the development of new technology and for the payment of higher prices. "b" means a cost inflicted by the worse quality of ecological system.

We assume that $p-a<0$, $u-a<0$, $2p-b<0$, and $2u-b<0$. These assumptions mean not only that both of the present cost to contribute to preserving the quality of ecological system and of the future damage from the worse quality of it are very big, but also that the latter is much bigger than the former. The long-run type of players is such a type as to be able to perceive both of them properly. On the other hand, $2p-a>0$ and $2u-a>0$ are assumed, which mean that the present costs borne by the L-type of players are compensated enough in the long run.

In the first stage, the combination of C_1 and d_1 behavior, or of D_1 and c_1 behavior can not conclude any exchange between a pair of players. Accordingly, the payoffs corresponding to them are zero for both. However, when the first stage begins with the combination of C_1 and c_1 behavior, then at the second stage they can get the payoff of "p" and of "u", respectively. These bigger payoffs are brought about, thanks to the cost borne at the first stage. On the other hand, when the first stage begins with the opposite combination of D_1 and d_1 behavior, the payoff of (p-b) and of (u-b) follows it at the second stage, owing to no effort toward preserving ecological quality.

Here, we can summarize the outcome of the two-stage game in the Table-2.

Table-2 Outcome of the two-stage game

	c_1	d_1
C_1	2p-a, 2u-a	0, 0
D_1	0, 0	2p-b, 2u-b

According to the above assumptions, beginning with the action of contribution at the first stage is only one dominant strategy for both players. Therefore, as long as the players of L-type are paired and they can identify their opponent players as that type, the firm can choose the "win-win" strategy with confidence.

If 2p-b is positive, to the contrary, the strategy beginning with contributing action ceases to be a dominant strategy. In such a case, regulatory agency has to manage to inflict some "virtual damage" in order to add it to "b".

The M-type of players is interested only in the first stage of the above Table-1, because of their myopia. Accordingly, the non-contribution action is always their dominant strategy. Such a myopic strategy inflicts some damage on them at the future stage, but they do not care about it at the present stage when they have to make decision on their strategies. Quite unluckily, furthermore, the payoff of the dominant strategy of the L-type is smaller than that of the M-type, because $(2p-a)-p=p-a<0$. Therefore, when our community consists of not only the L-type but also the M-type of players, the population share of the latter grows to the majority in the long run, with deteriorating ecological quality, according to the idea of the replicator dynamics of evolution game theory[5].

We can not escape from this long run tendency toward an ominous situation where the M-type of not only firms but also consumers grows to the majority of our community, even if they are the minority in the beginning. It is owing to this ominous result expected on macro scale that we can not perfectly leave the initiative for sustainable development to any unlimited private initiative such as the "win-win" strategy. Government has to play an important role in leading the private initiative for technological change to the ecological sustainability on macro scale. It is possible for any government to change the rule, if supported by the majority of community members. It means that as long as the L-type of players is the majority still, the government supported by them makes laws in favor of them. Under a new rule, any myopic behavior is not allowed.

From the points of view mentioned above, in the following sections, we examine a German experiment in recycling system of packaging wastes in order to check whether or not it can reconcile the "win-win" strategy on micro level with ecological sustainability on macro scale.

5 It was assumed up to this point that each player can identify the type of its opponent player with certainty. When the game changes to one with incomplete information, we can assume that each player of the L-type expects the type of its opponent player, based on the information of the population share of each type in the previous periods. Then, we can derive the same conclusions mentioned above.

3. An Outline of the Recycling System for Packaging Waste in Germany

Germany also experienced a miracle economic prosperity in 1950s and 1960s, but it was supported by disregard for the other side of the story: Wastes from production and consumption process were allowed to grow to a critical level. In 1972, the government reacted by the Waste Act to the unleashed "throw away" attitude of the people. It stated that wastes could be disposed of only in some sealed landfills. It was not before long that Germany stood on the verge of a catastrophe. It became impossible for the inland country to continue accepting growing mountains of wastes. Packaging wastes accounted for 50 per cent by volume and 30 per cent by weight of all household wastes in 1990. So, the packaging wastes were targeted by the government, first of all. The Packaging Ordinance, which came valid in 1991, was introduced to reduce packaging and to recycle the packaging materials. In this section, we summarize the main outline and outcome of the Packaging Ordinance.

3-1. The Packaging Ordinance 1991

The Packaging Ordinance was introduced with the following objectives of waste management; (1) packaging must be manufactured from materials which are environmentally compatible and do not hamper the environmentally compatible reuse or recycling of the materials used,(2) waste from packaging must be avoided by ensuring that packaging is, restricted in volume and weight to the dimensions actually required to protect the contents and to market the product, is designed in such a way that it may be refilled provided this is technically feasible and reasonable as well as compatible with the regulations applying to the contents, and (3) the waste from packaging must be reused or recycled if

the conditions for refilling do not obtain. (Packaging Ordinance, Article 1.)

This Ordinance applies to anyone who manufactures packaging or products from which packaging is directly manufactured (manufacturers), or brings into circulation packaging (distributors), with the exception of residual substances constituting a risky pursuant or having to be disposed of in compliance with other legal provisions. (Packaging Ordinance, Article 2.)

The definition of packaging in this Ordinance includes transport packaging, sales packaging, and secondary packaging. The transport packaging is that to serve to protect the goods from damage during transport from the manufacturer to the distributor. The sales packaging is to be used by consumers to transport the goods or until such time as the goods are consumed by them. The secondary packaging is to be intended as additional packaging around the sales packaging to serve advertising purposes, to allow goods to be sold on a self-service basis, or to prevent the possibility of theft. (Packing Ordinance, Article 3).

The Packaging Ordinance introduced the principle of product responsibility into waste legislation for the first time. Industry and trade are obliged to take back and recycle transport, sales and secondary packaging under this Ordinance. However, in the case of sales packaging, firms may be exempted from their obligation to take back by themselves, if they join in a nationwide system that guarantees the regular collection of used packaging from the final consumers. (Packaging Ordinance, article 6.)

This collection system was obliged to meet the following requirements;

(1) This system shall be harmonized with existing collection, recycling and reuse systems by the authorities responsible for waste disposal in whose area it is set up.

(2) This system must achieve on January 1, 1993 at least the following quantitative target of the collection of total packaging wastes; glass 60%, tinplate 40%, aluminium 30%, cardboard 30%, paper 30%, plastics 30%, compounds 20%. From January 1, 1993 to June 30, 1995, at least 50% of each material must be collected. From July 1, 1995, the target of 80% of each material must be achieved. The Federal Government publishes the average amount of packaging per inhabitant used in each area. Proof of the actually collected proportion must be furnished by the applicant, based on the population statistics and the per-capita consumption of used packaging published by the Federal Government.

(3) This system must achieve the following target levels of recycling and reusing the collected materials; on January 1, 1993, glass 70%, tin plate 65%, aluminium 60%, paper 60%, plastics 30% and compounded 30%, and on July 1, 1995, glass 90%, tin plate 90%, aluminium 90%, cardboard 80%, paper 80%, plastics 80% and compounded 80%. Residual material from the sorting process which can not be recycled or reused must be transferred to those responsible for public waste disposal. Proof of the sorting quotas must be furnished by the applicant.

In order to take up the task of the above system, 95 companies from packaging and consumer goods industry, and retail trade founded Duales System Deutschland GmbH (abbreviated as DSD) on September 28, 1990. The number of shareholders grew to 552 as of 1997 and the company has been operating as a public limited company (AG) since the beginning of 1997.

3-2. DSD

DSD is run by an executive board consisting of three executive officers. They are paid salary, about DM 1,654,000 in total for the 1997 financial year. The board is monitored and supervised by a supervisory board of twelve members. Each quarter of the twelve is from the packaging industry, the consumer goods industry, the retail trade industry, and the waste disposal industry, respectively. The supervisory members are elected by the shareholders' meeting. The Advisory Panel of 18 members,

consisting of representatives from politics, industry and trade, research and science, and consumer organizations, acts as an intermediary between DSD and various social groups. Members of the Advisory Panel are paid remuneration, DM 44,000 in total in the 1997 financial year. The company has a workforce of 357 employees as of December 31, 1997.

The net income and retained earnings for the 1997 financial year is about DM 110 millions and DM 55 millions, respectively. The main revenues comes from license fees, about 4,172 millions, and the main costs is that of contracted services of waste management firms, about DM 4,012 millions for the same financial year[6].

The companies participating in the waste disposal system of DSD have to pay the license fees for the Green Dot, which can function as proof of their having fulfilled their legal obligation imposed by the Packaging Ordinance. These license fees are calculated on the basis of the weight and number of items sold. They take account of the cost for collecting, sorting and recycling the packaging materials. The participating companies pay the fees only for the items sold in Germany. The weight and item fee are listed below[7]:

(1) Weight fee in DM per kilogramme plus VAT

Glass	0.15
Paper	0.40
Tinplate	0.56
Aluminium	1.50
Plastics	2.95
Beverage cartons	1.69
Other composites	2.10
Natural materials	0.20

(2) Item fee in pf per item

Item fee depending on volume:

For 50 to 200 ml, and over 3 g	0.1 to 0.6
For 200 ml to 3 litters	0.7 to 0.9
Over 3 litters	1.2

Item fee depending on area:

For 150 to 300 cm_2, and over 3 g	0.1 to 0.4
For 300 to 1600 cm_2	0.6
For over 1600 cm_2	0.9

Let's take some examples for calculation. In the case of an ice cream tub with 1,000 ml volume and plastic fraction of 38.1 gramme, the material fee is 11.24 pf and the item fee is 0.90 pf. In the case of tin cans with 380 ml volume and 47.09 g tinplate fraction, the material fee is 2.64 pf and the item fee is 0.70 pf. Therefore, the total cost of 12.14 pf and 3.34 pf are transferred on to the price according to the market condition of Germany.

3-3. Contractors

The main services of DSD are classified into the collection, sorting, and recycling of packaging wastes. In order to comply with the Article 6 of the Packaging Ordinance, DSD had to be integrated into existing collection, recycling system run by the authorities responsible for waste disposal. For this purpose, DSD made contract with 530 private and municipal firms for waste management, and at the same time agreed with about 900 local authorities on the local structure of the system in 1993 just when it set up a nationwide system of waste management of sales packaging. The business of the contractors is classified into three groups in line with the main services of DSD which are taken over by the contracted disposal companies and recyclers. The disposal companies collect packaging wastes from the final consumers. Their sorting plants sort out the collected wastes to each item and take them to the recycling companies. The recyclers convert the sorted-out recyclables into new products or secondary raw materials.

The collection system has two models; the kerbside system and the bring system. In the first system, light-weight packaging manufactured from plastics, composites, aluminium and tinplate is collected and picked up from households by the contractors. In the bring system, consumers take the packaging they collected to recycling stations or

6 Duales System Deutchland [4]

7 Rob [14], p.11.

containers installed in their vicinity. Almost all of glass and paper / card board are collected under this system.

The documentation of the quantities collected by the disposal companies must be submitted to DSD. The documentation of the quantities sorted out by the sorting plants and the quantities accepted from them by the recyclers must be submitted to DSD through the guarantors which work for DSD to guarantee that used materials for packaging is materially recycled in compliance with the Packaging Ordinance. At last, DSD must submit all these documentation to the Environmental Ministry of the Federal State.

4. Performance

The waste management organized by DSD could show good performance in terms of waste reduction and of industrial growth, which will be shown in this section.

4-1. Waste Reduction

Since the introduction of the principle of product responsibility in 1991, packaging consumption in Germany, which had been rising up until then, has dropped continuously. The amount of consumption for sales packaging fell by about 900,000 ton from 1991 to 1995. See the following table[8]:

Packaging Consumption from 1990 to 1995 (million t)

1990	7.1
1991	7.6
1992	7.3
1993	7.0
1994	6.9
1995	6.7

These figures show that firms tried to reduce their packaging volume in order to reduce the payment for the Green Dot fees. The reduction of the fees assures those firms of a more advantageous position in industrial competition. Therefore, the introduction of the principle of product responsibility can be considered to have given the firms an effective incentive for reduction in packaging. The figure was further reduced to 6.3 million tons in 1997, of which about 89 per cent of the sales packaging from households were collected.

The recycling rates achieved by DSD exceeded the target rates set by the Packaging Ordinance. See the following table[9]:

Recycling rates (%) in 1997 (figures in parenthesis are the target rates)

Glass	89 (72)
Paper / Cardboard	93 (64)
Plastic	69 (64)
Tinplate	84 (72)
Composites	78 (64)
Aluminium	86 (72)

Furthermore, the achieved rates were improved, compared with the corresponding figures in 1996.

According to the above two tables, we may make a rough conclusion that DSD has been achieving the main purposes of the Packaging Ordinance. This is the first an industrially advanced country has made a success of disconnecting industrial growth with increase of wastes. It became possible by the combination of reduction of packaging with recycling or reuse of wasted materials, and the whole process was carried out by the private initiative under the enforcement system of the Packaging Ordinance.

The way of the Packaging Ordinance, in which materials for packaging are recycled or reused in manufacturing process, has been a successful model to close the loop. The Product Recycling and Waste Management Act, which has the same spirit as the Packaging Ordinance, came into force in 1996. It states that waste must be avoided from the beginning of production process. Industrial firms are

8 Rob [14], p.7.

9 Duales System Deutchland [4], p.15.

required to take account of the recyclability of their goods during production. Other two subordinate regulations are following it; the Ordinance on Used Batteries and Electronic Scrap, and the Used Car Ordinance.

4-2. Macro Performance

According to the Federal Environment Ministry, 240,000 jobs are available in the waste management and recycling industry in 1997, and the Federation of the German Waste Management Industry sets that figure at 340,000. This figure is equal to about one third of all jobs in environment protection sector. A recent study of the Federation Office of the Environment expects the number of those jobs to increase to 1.1 million by the year 2,000. It means that the waste management and recycling industry can accommodate about the same number of jobs as the automobile industry[10].

A report of Frost and Sullivan [7] estimated the market size of recycling equipment in Europe as US$ 1.72 billion in 1996. Germany has the biggest share in this market, 34.3 per cent, followed by France with 17.2 per cent, and by Italy with 9.2 per cent.

In the world market of environmental goods, German companies have the top share with 18.7, followed by the USA with 18.5 and Japan with 14.5.

In the environment industries, research and development plays an important role, because a huge possibility to improve their technology remains open. Fifty per cent of European patents for the environmental technology are held by German companies. It may be concluded that the highest standards for environment regulation could contribute to the German leading role in the development of innovative environmental technologies.

4-3. Effects on Other European Countries

The principle of product responsibility in sales packaging has also been extended to other European countries, and the European Packaging Directive 94/62 was established. It aims at harmonizing legislation for packaging wastes in Europe, and it stipulates that each member state of the European Union must implement the European Packaging Directive. It sets the target rate of recycling at 50 per cent in the year 2001.

The ordinances and nationwide management system with the same purpose and organization as the German DSD system have been founded in other European countries. In 1992, Eco-Emballages S.A was founded in France, followed by Fost Plus system of Belgium and ARA system of Austria in 1993, by VALORLUX asbl of Luxembourg in 1995, and by Sociedade Ponto Verde, S.A. of Portugal Ecoembalajes Espana, S.A. of Spain in 1996.

If manufacturers are forced to put the various trade marks in order to prove product responsibility on their packaging, it may obstruct international trades among them. The Packaging Recovery Organization Europe (PRO EUROPE) was set up to avoid such a trade barrier in 1996, which has its head quarter office in Brussels. Its primary task is to award the Green Dot to qualified organizations and to establish this mark as a European mark.

5. Evaluation from the View Point of Incentive Design and Conclusion

In view of the penetration of the principle of product responsibility into other European countries as just mentioned above, it is easily expected that a new "high-tech" market is emerging in Europe. We should conjecture that the effect of European environmental policies spreads to other regions. Whether or not a country can take the lead in this market depend on the possibility of the development of innovative technology for waste disposal and recycling. In this section, we examine what incentive systems DSD has been providing for the development of the innovative technology.

The DSD system to close the loop crucially depends on the commitment of the consumers.

10 Regarding the above figures, refer to Duales System Deutschland [4], p.43.

According to Rob [13], nine of ten households collect and sort their wastes today in Germany. Jaeger et al [8] point out that European citizens evaluate ecological quality high enough, so that they do not necessarily consider energy saving as a sacrifice. According to their evaluation on the maturity of environmental consciousness of European consumers, the majority of them can be recognized as the L-type of consumers. Accordingly, the L-type of firms can secure higher profits and larger market share, and so can grow to the majority of environmental industry in the long run. We can say that markets in Europe will be occupied with the L-type of consumers and firms in the long run.

In this respect, we may suspect that the governments were not required to impose the principle of product responsibility on firms. Waste management to close the loop could be achieved through the L-type's growing to the majority voluntarily without any enforcement. It should be sure to happen "in the long run". However, we can not calculate the real tim- period of "the long run", and we can not expect what will happen to the ecological system in the converging process. The Packaging Ordinance could have the effect of shortening the converging process. The enforcement of the law contributed to curtailing the time and energy for firms to know the true preference of their customers through trial and error.

Firms have to pay the license fees for the Green Dot mark, but they can transfer those fees, as a cost, on their products' price. Accordingly, producers do not actually have to pay for the cost to close the loop. The principle of product responsibility has been converted to that of consumers' payment through firms' power to control their prices. However, the firms have still an incentive to reduce packaging, because they can set their prices at a lower value, if they can curtail the packaging. This can give them an advantage in market competition. Such an incentive can be considered as a contributor to the reduction of packaging wastes after the enactment of the Packaging Ordinance.

However, firms do not have to pay the Green Dot fees for exported goods. This means that the packaging wastes taken from Germany to other countries should be dealt with by the latter themselves. If these countries have not prepared for any system for waste disposal, the DSD system loses its meaning from the global point of view, if they would not make effort to spread the system to close the loop to other countries. As explained below, however, DSD has an incentive to do it.

DSD is a non-profit organization, but they can secure their minimum revenue by license fees. Thanks to the revenue, they can leave their primary services of collecting, sorting and recycling the packaging wastes to their contractors, that is, the disposal companies and the recycling companies. On the other hand, the supervisory board of twelve members consists of the representatives of all core stakeholders on the suppliers' side, that include waste management companies but does not include consumers. Under such a system, how can we expect that the waste management companies are given an incentive to develop innovative technology?

The waste management companies have no incentive to pursue cost efficiency, if re-contract with DSD is not pre-conditioned on their effort to do it. However, DSD itself has an incentive to develop innovative technology for waste management, because they can secure the revenue from the sales of know-how and patent right in the world market of this waste management industry. For this purpose, DSD set up a 100 per cent subsidiary called SYSTEC in 1997. The major activities of this subsidiary company are to develop the innovative technologies for the sorting of lightweight packaging and the preparation and recycling of plastics. This is because the field of sorting offers the largest potential to save costs, and the mixed plastic agglomerate produced by the recycling company is required to be standardized for the use of a universal secondary material for any product. In February, 1998, DSD concluded the fourth Amended Contract with the waste management industry, according to which the re-contract of the waste disposal companies with DSD is conditioned on the gradual

conversion of their sorting plants to fully automatic ones developed by SYSTEC. Any cost saving is passed on to the license fees[11].

The know-how and patent right obtained by SYSTEC is transferred not only to German disposal companies but also to the world market of environmental industry. The latter is offering an interesting business chance to SYSTEC[12]. This chance is becoming more optimistic by growing waste problems and sterner regulations all over the world.

We can, therefore, derive a conclusion that even if the DSD system is supported by the commitment of the consumers not only to their sorting and bringing of packaging wastes, but also to their paying higher prices, this system based on the private initiative is contributing to the purpose of the sustainable development. It is contributing to both ecological sustainability and industrial growth. The further success depends on the development of innovative technology for sorting and recycling. As long as the business of DSD is not only involved in organizing a domestic nationwide system for waste management, but also given an incentive to promote the sale of the know-how and patent right of innovative technology in the world market of environmental industry, the burden of the consumers can be reduced, and the "green sector" of Germany can grow to one of the most dominant industries.

In this respect, the company system of non-profit organization will be re-examined in the future, because DSD must be given the incentive to be more involved in the international business for technology transfer in order to continue developing more innovative technology for waste disposal. Then, we should expect that European countries take more aggressive strategies in any international debate on ecological sustainability[13].

At last but not least, the Advisory Panel should play a more important role to intervene between DSD and all stakeholders including consumers. The technology developed by the profit-pursuing company may lead to "locked-in" technology, and "win-win" strategy may be converted to "wrong-wrong" strategy, unless that company have to take account of claims of all social groups.

11 According to the KAKUTUS technology, which presents a fully automatic sorting and recycling plant for light weight packaging, 50 per cent of cost saving in the plastic sector is expected.

12 The first technology transfer was agreed with Hitachi Ltd in 1997. In 1998, the most progressive feedstock recycling technology is marketed by SYSTEC in the world market.

13 If non-European countries will not introduce regulations with the same strictness as the Europeans, a new protective policy such as imposing a tariff on imported products from the former countries can be taken up as a focal policy issue. Regarding the logic of such a tariff, see Sartorius [13].

Reference

[1] Aghion, Phillip and Peter Howitt, *Endogenous Growth Theory*, Cambridge, Massachusetts; MIT Press, 1998.

[2] Allal, Samir and Stlvie Faucheux, "Economic Globalization and Sustainable Development: What kind of Governance?", Discussion Paper presented for "Communication in the International Workshop" as Universite' Versailla in November 1997.

[3] Cohen, M and Dominique Dron, "Economic Assessment and the Environment in Public Decision Making", Documentation francaise, Official Report Series, 1998.

[4] Dualse System Deutschland, *Annual Report 1997*, Cologne: Duales System Deutschland AG, 1998.

[5] Faucheux, Sylvie, "Technological Change, Ecological Sustainability and Industrial Competitiveness", included in *Sustainability and Global Environmental Policy: New Perspective*, ed. by Dragum, A.K. and K.M. Jacobson, Edward Elgar, 1997, pp.131-148.

[6] Faucheux, Sylvie and Isabelle Nicolai, "Environmental Technological Change and Governance in Sustainable Development Policy", *Ecological Economics*, forthcoming.

[7] Frost and Sullivan Report, "European Recycling Equipment Markets," London: Frost & Sullivan, 1997.

[8] Jaeger, C.C., Barher, T., Edenhofer, O., Faucheux, S., Hourcade, J-C., Kasemir, B., O'Connor, M., Parry, M., Peters, I., Ravetz, J., Rotmans, J., "Procedural Leadership in Climate Policy: A European Task", *Global Environmental Change*, Vol.7, No.3, 1997, pp.195-203.

[9] Ministry of International Trade and Industry of Japan, *White Paper on Industrial Technology*, Tokyo; MITI, 1988.
[10] O'Connor, Martin, "Pathways for Environmental Evaluation", *Ecological Economics*, forthcoming.
[11] Porter, Michael E. and Claas van den Linde, "Green and Competitive: Breaking the Stalemate", *Harvard Business Review*, Sep.-Oct., 1995, pp.120-134.
[12] ———, "Toward a New Conception of the Environment-Competitive Relationship", *Journal of Economic Perspective*, Vol. 9, No. 4, 1995, pp. 97-118.
[13] Rob, Peter, *The Green Dot in Europe*, Cologne: Duales System Deutschland, 1998.
[14] ———, *Packing Recycling*, Cologne: Duales System Deutschland, 1998.
[15] Sartorius, Christian, "Role of Mobility in Institutional competition", Discussion Paper presented for the Annual Conference of EAEPE in November 1998.
[16] Stiglitz, J.E., "Growth with Exhaustible Natural Resources", Review of Economic Studies, Symposium Volume, 1974, pp.123-137.
[17] Thom, David, "Engineering to sustain the Environment", Ecological Economics, Vol.2, No.2, 1997, pp. 8-15.
[18] World Commission on Environment and Development, *Our Common Future*, Oxford: Oxford University Press, 1987.