H-1   Urban Design and Individual's Attitude towards Reduction of Pressure to
       Global Environment (Final Report)

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1. Introduction

       Breakthrough in the socio-economic phase as well as in technological one become
essential to prevent anticipated global change in the long run.   Such recognition can be
found in international and national action program, such as Chapter 4 of the Agenda 21
(change of consumption pattern) and Japanese action program to arrest global warming
(formation of urban and regional structure with low CO_2 emissions, realization of life style
with low CO_2 emissions).   "Participation" was adopted as one of the four key element of the
long-term target in the Basic Environment Plan of Japan, and the Plan refers to the revolution
of our daily lifestyle.

2. Research Objective

       Our study tried to analyse the linkage with environment, of the social aspect, in
particular, structure, facilities and management of urban area, and of attitude, perception,
behavior and knowledge of individuals who lives there.   By addressing those social
mechanisms that governs basic human activities, this study plans to suggest a set of policy
options for more environment-oriented society.

3. Methodologies, results and Discussions
(1) A new development and assessment of urban-infrastructures coupled with eco-life of
residents
       The goal of the present research work is to identify an eco-sound urban
infrastructure which can enhance the effect of changing life style for reducing environmental
load, particularly CO_2 emission.   A regional development in Kei-han-na Science City has

been investigated as a test field.   Firstly, a selection was made of 10 major facilities of urban infrastructures such as waste sludge composting, citizens' farm and disposer, which would possibly reduce CO2 load from the region.   Secondly, a questionnaire survey was made on how the selected facilities could be accepted by residents with more or less changing their life style. Thirdly, an effect of life style change was evaluated in term of reduction of CO2 emission.   Finally, an optimum design was conducted of the urban infrastructures related to material and energy cycle in the area, which would guide and support new eco-sound life style.

This system, which we investigated and proposed here, is considered and introduced as a new model of an eco-infrastructure in Kei-han-na Science City development.

(2) Planning infrastructures with lower environmental impact
Planning infrastructures to reduce the environmental impact was examined using life cycle assessment (LCA).   District heating system with three system, namely 1) refrigerator and boiler system (conventional system), 2) heat pump (HP) system with releasing heat to atmosphere (Air HP), 3) heat pump (HP) system with releasing heat to sewage (sewage HP) were examined.   LCA of these systems when they are applied to hypothetical districts were conducted.   The heat pump systems show clear advantage over the conventional system. The sewage heat pump system can show its advantage in District B where total amount and density of heat supply are high. The utilization of sewage heat for district heating system is suitable in area with high density of heat demand such as central business district.

Possible methods to reduce environmental impacts of new town development were evaluated with LCA.   Inventory analysis was conducted by using the detailed information of the used materials.   CO2 emission during the land preparation stage can be reduced by 6 to 11.7% by changing the slope construction, change of other concrete structures, and park design.   These methods can also save the construction cost,   but may bring poor amenities. Photovoltic cell system can also save CO2 emission, but it is not economically feasible in new town in suburb area.

Sludge management system was examined by LCA.   Lower CO2 emission is not the sole criterion in actual sludge management in urban area.   Requirement of land space for sludge treatment facility and volume of final material for landfill are important factors. Methane fermentation of the sludge can save CO2 emission, but it requires large land space and produces large amount of sludge to be landfilled.   On the other hand, formation of slug from the sludge significantly saves the volume to be landfilled, but CO2 emission is the greatest.   This research developed the method to quantitatively evaluate these aspects which are necessary in decision making.

(3) Global environmental loading related to the urban carrying capacity

Considering recent environmental problems, reuse system of a waste and a by-product is one of the most effective countermeasures. Few evaluating method of environmental loading could indicate the advantage of reusable materials. We investigated on an evaluating method for the availability of effective utilization of a waste and a by-product. Firstly, we expressed the allocation of the environmental loading by combining quantity of materials with their economic value. As a case study, we made a model for the material flow around the cement industry in 1990. In that model, the carbon dioxide emission and the drying up potential of limestone resources were considered as environmental loading. After the model analysis, we could successfully evaluate a reduction effect of the environmental loading by effective utilization of a waste and a by-product in the cement industry.

(4) Measurement of external cost of road transport

There is no doubt that road transport activities are vital contributors to Japanese economy. Despite this economic importance, there is opinion that automobile users do not pay its full cost. We have to consider external costs not only public expenses for road works but also the costs due to road transport activities such as noise, air pollution, accidents, greenhouse gases (GHG) emissions and loss of greens due to road constructions, this cost do not take into account. This study tried to construct a balance sheet by calculating, on the one hand, amount of public tax revenues and loans borne by automobile users, on the other hand, the public expenses for road works and external costs related to road transport activities.

According to this study, public tax revenues and loans were 9.5 trillion Yen, whereas the sum of public expenses for road works (11.6 trillion Yen) and external costs (2.7 trillion Yen) amounted to 14.3 trillion Yen. Consequently, about 5 trillion Yen is regarded as potential subsidy. If this imbalance is imposed as tax on fuels for automobiles, the additional tax will be 9.4-58.3 Yen per liter.

(5) An impact of transport improvement analyzed with modeling of a system of cities

Over-agglomeration of population into a metropolitan area is the most serious problem in nationwide spatial planning, because it causes urban issues in the area and economic and social decline in peripheral regions. As one of the most effective measures for the problem, improvement of interregional transport network has been expected to contribute to forming well-balanced spatial structure of a nation. However, the impact of interregional transport improvement has not been analyzed sufficiently on theoretical basis. This study aims at examining the impact on a nationwide spatial structure in the context of a system of cities where the utility of locator depends on accessibility and on disutility of congestion, and location choice is logit type. The result of simulation showed that as transport cost decreases (transport improvement), the population distribution changes as dispersed-

>mono-polar concentrated->dispersed.

(6) Improvement of urban freight transportation

This study aims at designing the freight transportation policies which enable to reduce the volume of emissions especially CO2 from freight vehicles and estimating the effects when we introduce these policies in some urban area. In the study, three types of joint freight transportation and internalizing the social costs of freight transportation are proposed and examined.

We have found the following results. In the first fiscal year, it is estimated that the total volume of CO2 emitted by all vehicles in the central commercial area, when the joint freight transportation is put into practice, can be reduced about 2% of total emission from vehicle. The decrease level in CO2 emission is strongly affected by two factors. One is the consignors and carriers have accurate information about the joint freight transportation. The other is the consignor does not ask carriers for just in time delivery.

Next, we designed a new joint freight transportation system for parcel delivery in high population density area. The system in consists of low emission delivery trucks, parcel post installed in each apartment and depot for sorting of parcel. The case study in Hikarigaoka area shows that the introduction of the system enable to reduce not only CO2 emission but also delivery cost.

In final fiscal year, we evaluated two different freight policies: joint use of loading-unloading space along the road and internalizing the social cost of fright transportation. Based on simulation, the former policy supported with information about state of occupation of road space can reduce about 30% of air pollution compared with present condition. The case study is conducted to estimate effects of the latter policy vehicle by means of fuel price increase, the heavy freight vehicle traffic is reduced 30%. The light freight vehicle traffic is reduced 20% and the CO2 emission is reduced about 25%.

(7) Inter-relationships between urban environmental systems and lifestyles

Environmentally friendly lifestyles, in particular green consumption of final goods and services and no car use, were analyzed in terms of inter-relationships between urban environmental systems and lifestyles.

First, we focused on embodied carbon dioxide emission patterns due to consumers' expenditure. We used the statistic family expenditure survey data and Input-Output data(fig.1). Our results are as follows.

1) The shift to the eating out and other services increases indirect carbon dioxide emission in the relevant industrial sectors.

2) Rapid increase of the carbon dioxide emission by both younger and elderly single households was observed in recent years, and they tend to give greater contribution in 2000-2010.
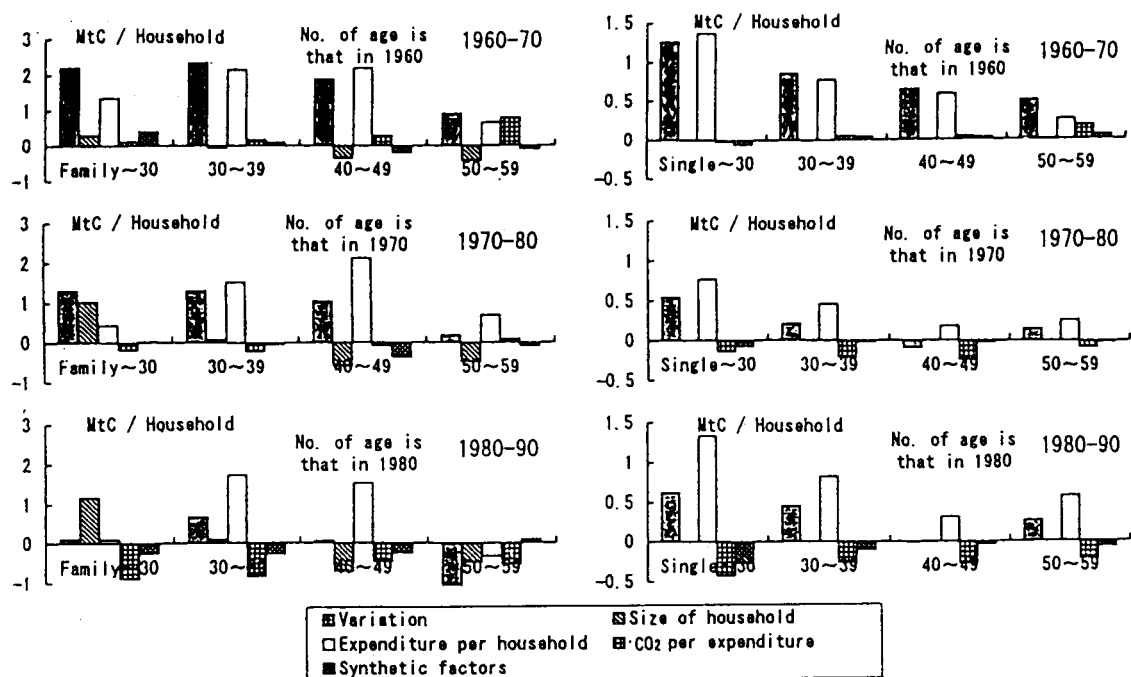
fig.1 Variation factors of the CO_2 emission per household in 1960 - 1990

3) At least 2 principal components were extracted from environmental bookkeeping data and consequently some of 5 clusters showed emission patterns with household utilities related to the lifestyles beyond life stages as well as the learning effect.

Secondly, we focused on personal peculiarities to affect modal choices in shopping trips. We attempted to identify characteristic variables which affect transportation mode choice in shopping trip based on the questionnaire survey data in Kokubunji and Suginami, Tokyo. Environmental friendliness factors were extracted from principal component analysis, as well as spatial factors identified through Hayashi's quantification method II analysis. The results were as follows: 1) arterial roads services have influence on neighbors to choose automobile mode more than public transportation services; 2) environmental friendliness affect residents' car usage activities rather than car possession.

(8) Communications between business and consumers

This research examined whether consumers have the potential to reduce the impact of environmental problems. In contrast to recent media reports our research has found that consumers have a strong awareness on the environment through various channels. This research also revealed the communication between business and consumers has not been adequate. In many cases, consumers are not aware of corporate efforts to care for the environment, while companies often have inadequate systems to fully respond to consumers' demands.

In 1995FY, our consumer survey result shows that there are significant growing green consumers in Japan. Over 65% of our respondents answered that consumers could make market green to a certain extent via their purchasing. Over 30% of them answered that they

would like to buy products of green companies, though 26% of them thought that companies who expressed their commitment to environmental causes were using this commitment as improving their images up(fig.2). These results show people have become recognized companies efforts for improving our environment with some hesitation.
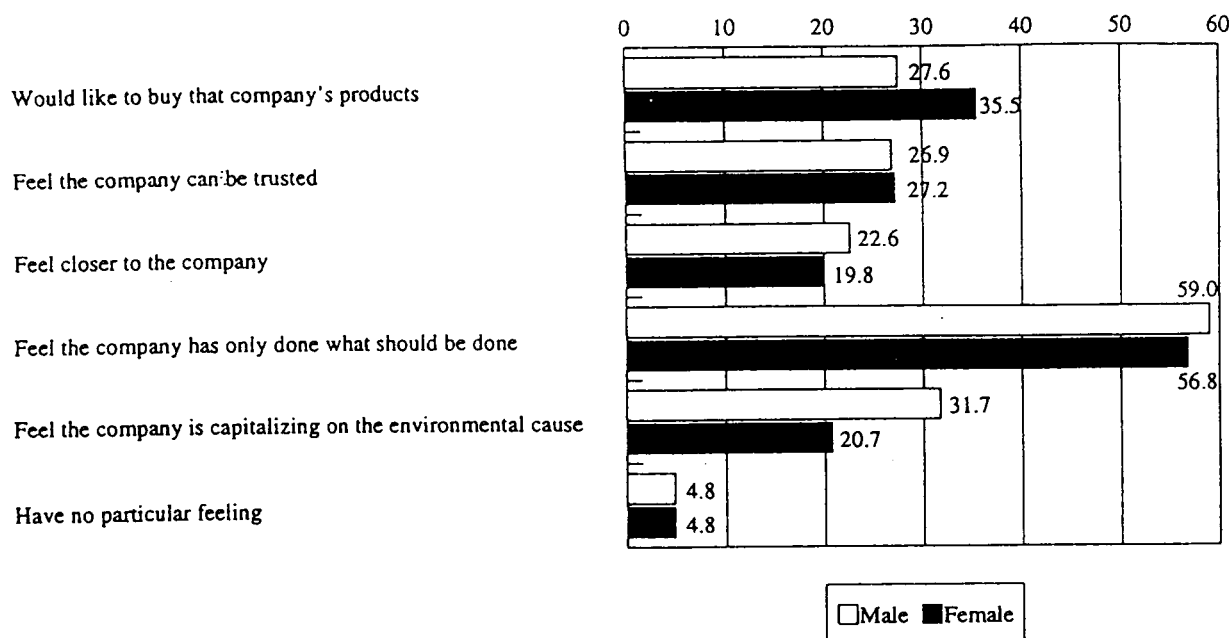
| | 0 | 10 | 20 | 30 | 40 | 50 | 60 |

Would like to buy that company's products — 27.6 (Male), 35.5 (Female)

Feel the company can be trusted — 26.9 (Male), 27.2 (Female)

Feel closer to the company — 22.6 (Male), 19.8 (Female)

Feel the company has only done what should be done — 59.0 (Male), 56.8 (Female)

Feel the company is capitalizing on the environmental cause — 31.7 (Male), 20.7 (Female)

Have no particular feeling — 4.8 (Male), 4.8 (Female)

□Male ■Female

fig.2 Evaluation of companies

This 1997 FY, our project decided to focus on " Green businesses", as another players of green market. After several meeting, our Green business survey was conducted at September 1996.

a) Consumers' survey

The survey was fielded during September 1995. 2,000 adult male and female residents in following area aged 20 to 64 were sampled by random sampling. The areas covered by the survey are: Kanto (within 50 kilometer radius from Tokyo), Chukyo(within 30 kilometer radius from Nagoya), and Kinki (within 40 kilometer radius from Osaka). The survey points (total 100 municipalities) were sampled after the above areas were stratified according to the scale of cities. Questionnaires were delivered and later picked up by survey staffs. The survey was conducted under the name of National Institute for Environmental Studies. Our results are as follows:

i) Strong sense of awareness on the environment

Consumers have a strong awareness on the gravity of environmental problems. Some 70 percent of respondents answered they think of environmental problems as impeding issues, and not as something in the distant future.

ii)Limited understanding on environmental issues

Environmental problems that draw consumers' attention can be roughly divided into two

of companies answered 'We need economic growth to improve our environment.'

ii)About half of companies evaluated current environmental wave on their businesses positively, while others evaluated negatively. Companies who take current environmental issues positive pointed out that this is the new business chance, and that managing their companies environmentally sound would result decreasing their costs.

iii) It depends on sectors that to what extent companies perceive the environmental issues seriously, and what strategies have been taking. Energy sectors (power generating companies, gas and heat suppliers take environmental issues more serious than others. Their range of activities spread widely in almost all sections, which are their facilities, their office management, employee education, and regional contribution activities.

iv)Among manufacturing industry, companies of materials industry, processing and assembly industry evaluated environmentally consciously management positively, because it would reduce their production costs. Perception and management of construction companies are also high. Their businesses are deeply related to expected Environmental Assessment Law. But some sectors don't take environmentally sound management seriously at all. Insurance companies and financial companies answered 'We do nothing for the environment on our businesses, because our businesses have no damage on the environment,' while over 80 % of them recycled papers at their office, and do regional contribution activities. Their attitudes are to join some environmental sound activities as a consumer, but business is a business.

v)Transportation companies recognized they have serious damage on environment. But a few of them tried to make their own standards independently, besides laws and regulations by Japanese government. Only one company cannot do nothing, and from their managerial point of view, taking environment into their consideration would increase costs.

Most of retail traders and distribution companies are not environmentally conscious and do nothing for the environment. The average number of companies who answered 'doing nothing for the environment' in this sector is 10 % higher than our grand average.

vi)Large-sized listed companies perceive environmental issues more seriously and make more efforts than non-listed companies. Thirty percent of them ask their business counterparts to produce and to carry their supplies more environmentally sound measure, and 26 % to group companies, while non-listed companies ask 21% and 14%, respectively.

vii)According to logistic regression analysis, trading with EU and north American countries is major determinant of Japanese companies' high efforts for the environment. They have their own environmental standards besides governmental ones, and also they succeeded or tried to get international environmental management audit.

viii)Nearly 60% of respondent companies recognized consumers requirement for green products and services as 'very much higher' or 'higher' than before. However, 60% of total samples still regard consumers' priority as price, not environmentally sound produced goods and service. Over 50 % of them answered that consumers do not purchase time-and labor-

groups. Environmental issues close to home such as "garbage disposal and recycling" and "contamination of drinking water"; and global issues relatively frequently reported by the mass media, for instance, "climate change caused by global warming" and "depletion of the ozone layer and the subsequent increase in ultraviolet rays." The fact that only a small percentage of consumers are interested in globally-interrelated issues or fundamental problems that deeply involve economic activities and energy .

iii) Information on the environment as the key

Consumers who have information and knowledge on the environment are twice as likely to take environment into consideration at the time of shopping than those without such information or knowledge. People get information most from mass media. Some 90 percent of them cite TV, newspapers and other media channels. PR and information journals issued by businesses are about 20 %, newsletters published by municipal government are 28%.

iv) Consumers' purchasing behavior can change business activities

More than 60% of respondents believe they can make companies more environment-conscious through their purchasing behavior. Also, some 60% said environmentally conscious companies are taken as granted.

v) Middle-aged and older women as environmental leaders

Among the middle and older age groups, women are more likely to have a stronger awareness on the environment and take environmental concerns into consideration in their daily and purchasing activities. Among women in middle and older age groups, many in their fifties talk with their family about environmental protection and problems while many in their forties teach their children about the preciousness of the environment.

vi) Strong sense of crisis and weak action on the environment as seen among the young

The survey showed that young people in their twenties have and act with less concern for the environment than those in other age groups in their daily action and consumption patterns. Young people have a strong sense of crisis and feel that environmental problems will affect their lives in not so distant future. However not many are willing to bear the burden of resolving such problems or feel they should do something to save the environment for the coming generations.

b) Industries' survey

We focused on the existing efforts and companies' strategies for the environment and their customers. Our sample size was 6000, which includes small to large companies quoted on the Tokyo, Osaka, Nagoya and other local Stock Exchanges, and also companies not quoted on them. The effective responses were about 2,093(34.9%). The results are as follows.

i) Majority agreed that they took priority to improving the environment over economic development. Over 60% of respondents chose 'We need to a certain strategies to overcome environmental problems, even if it causes slowing down economic growth', while about 10%

consuming products and services, even they are less harmful to the environment. As a result, they do recognize growing consumers environmental awareness, but it is not different from purchasing. However, nearly 10% of companies reported their sales has increased.

viiii)There remains some gaps between consumers' expectation and companies' perception

Our consumer survey completed in 1995 showed that 78% of consumers expected manufacturing companies to be responsible for collecting and treating their useless products, but only 36 % of manufacturing companies answered they were expected to do so.

Similarly, consumers expected retail traders and distributors to do more effort for collecting bottles, trays and cans(64%), for selling more various 'green products' which are made of recycled materials or are energy-saving(61%), and for using less wrapping or packaging(70%). But retail traders and distributors answered each categories for 23%, 32%, 44%, respectively. Contrary, they answered they were expected to use less energy in their shops(24%), to choose environmentally sound transportation(26%), while consumers expected these efforts only at 15%, 14%, respectively.

x)Only 20% of companies made effort to inform consumers for their environment related activities.

xi) We used 6 key words which are discussed in the context of recent sustainable economy to check their 'Environmental Literacy': LCA, Green purchasing, Eco-Labeling, Eco-Design, Environmental Tax, and Environmental Accounting. Companies who have high literacy are positively taking actions for current environmental movement. They establish their own environmental standards over existing rules and regulations, succeed or try to get international ISO14000 qualification, make strategic efforts to respond green consumers movement.

(9) Citizen's Attitudes formation towards the Environment

The respondents consist of 1,624 male and female age 16 years and over, by national, two stratified random sampling. Other countries did the same, 1,014 in former West Germany, 1,852 in the Netherlands, 1,261 in Great Britain, 957 in Ireland, and 1,000 in Italy.

We focused on 1)value systems and the environment, 2) the relationships between recognition and value, 3) relationships between self-declared action and value, and 4) the relationships between 'political effectiveness belief' and self-declared action in Japan.

What kind of effect does the difference in values have on the recognition of and behavior for environment? In order to analyze it, we divided respondents into 3 groups as 'priority on environment' group, 'priority on status-quo' group, and middle group.

In each country (former west Germany, Great Britain, United States, Italy, Ireland, and the Netherlands), respondents in 'priority on environment' group are more likely to take actions such as recycling, buying organic fruits and vegetables, and cutting back on driving. But in Japan, we could not recognize this tendency, especially in cutting back on driving.

For buying organic fruits and vegetables, we can see the difference in this item only, and this is statistically significant. Japan has a high average as a country. Italy and Ireland tend to show similar tendency as Japan.

We grouped respondents by different way from before. We did it by its possession of the sense of social participation, according to the answers to the above questions. The respondents who answered positive in above questionnaire are put into social participation group, while negatives are not.

The result clearly supports our hypothesis. The respondents who are grouped in social participation group tended to have a deeper recognition than others, and also tended to take actions.

<References>

Morioka, T. and N. Yoshida : Comparison of Carbon Dioxide Emission Patterns Due to Consumers' Expenditure in UK and Japan, Journal of Global Environment Engineering, Vol.1, pp.21-40, (1995)

Aoyagi, M. : "Environmental Activities among Lay Peaple,the Analysys of the attributes of Peaple Who are Aware of Environmental Activities" ,in Matsugi T., and A.Oberhausser ed., 'Interactions Between Economy and Ecology', Duncker & Humblot, Berlin, (1994)

Morisugi, H., E. Ohono, K. Hoshi, A. Takagi and Y. Takahashi : Definition and Measurement of a Household's Damage Cost Caused by an Increase in Storm Surge Frequency due to Sea Level Rise;Journal of Global Environment Engineering, Vol.1, 127-136 (1995)

Yoshida, N. and T. Morioka : Carbon Dioxide Emission Patterns in Linkage of Industries with Involvement of Consumers' Expenditure, Kankyo System Kenkyu, Vol.24,(1996)

Aoyagi, M. : Environmental Activities among Lay Peaple, the Analysys of the attributes of People Who are Aware of Environmental Activities, Freiburg-NagoyaUniversity Joint Seminar 1993, (Freiburg, Germany, (1993.3)

Aoyagi, M. : Factors Affecting the Formation of City Dwellers' Attitudes towards the Environment, presented at the X Ⅲth World Congress of Sociology, 18-23 July 1994, Bielefeld, Germany

Ueda, T. : A Welfare Analysis of a System of Cities in Transport Network,WCTR Sydney,(1995)

Aoyagi-Usui, M. (1996) : A Big Discordance between the Beliefs and Behaviors among Japanese People, paper presented at Symposium Responsible Environmental Behavior at IKAO, University of Bern, Bern, Switzerland, 5.Sep.1996