

SUSTAINABLE DEVELOPMENT IN KOREA, KEY ISSUES AND GOVERNMENT RESPONSE

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This paper examines the current status of sustainable development in Korea to identify key issues to be solved in achieving sustainable development. Since the publication of *Brundtland Report* in 1987 and Earth Summit in 1992, the term 'sustainable development' became a popular phrase as a new guideline and value to be pursued in every sector of society. In the public sector, it is emerging as an alternative development model in the 21st century and in the private sector, it is being widely adopted as a new business strategy to fulfill business social responsibility. Even with lack of clarity in its meaning, it has been generally agreed that the term 'sustainable development' indicates a balanced development of economic, social, and environmental sectors at the same time. Korean society also has been moving toward a sustainable development since the Earth Summit. The pace, however, has been slow and even inconsistent. This paper examines the status of sustainability in Korea from economic, social, and environmental aspect with main emphasis on the environmental area. Literature review and analysis on existing data from various sources were used for this purpose. Having examined the Korean sustainability status, key issues and shortcomings of government response to be addressed to achieve sustainable development were discussed with some policy suggestions.

Key Words: Sustainable Development, Korea Environmental Policy, Causal Loop Diagram

BACKGROUND

Korea is a mountainous country. 65.4% of total land area of South Korea is covered by forest. The *Baekdu Daegan Mountain System* (BDMS), which is the ecological backbone of Korean Peninsula, stretches north and south along the eastern length of the peninsula. Korea is surrounded by ocean on three sides with more than 3,200 islands and the coastline extends for about 17,000km. West coastal line forms a world rare rias coast and tidal flat. With such natural inheritance, Korea is well known for biodiversity and genetic excellence of bio species with characteristics of strong resilience and resistance against extreme natural conditions.

However, the total of population 48 million on 99,866 km² of land area makes Korea one of the most densely

populated countries in the world. As a result, the pollution pressure is very high. In addition, accelerated economic growth since the early 1960s has led to growth-first orientation of government policies, deterioration of natural scenic sites and ecosystem, and rapid increase of environmental pollution.

This paper examines the status of sustainable development in Korea, identifies key issues to be solved in achieving sustainable development and government response to the issues. Since the Earth Summit in 1992, Korean society has been moving toward a sustainable development although the pace has been slow and even inconsistent. Decision making power has been decentralized from the central to the local, from the government organization to non-government organizations, and both government and citizen environmental concerns

have increased considerably. Research on sustainable development in Korea has also mushroomed in recent years. They include studies on sustainability indicators (Moon, 1998; Ahn et.al., 1999), sustainable urban and rural development strategy (Oh, 1998; Kim, 2003; Kim, 2005), sustainable energy strategy (Yoon, 2002, 2003), and residential perception on sustainable development (Choi, 2004). Unlike previous studies on sustainable development which focused on narrow and specific research interests, this paper concentrates more on the broad context and key issues of sustainable development in Korea.

The term 'sustainable development' was popularized since the publication of *Our Common Future* in 1987 prepared by the Brundtland Commission. In the report, sustainable development was defined as the development that meets the needs of the present without compromising the ability of future generations to meet needs. Since then, the definition has been further developed by UNEP and ICLEI, the International Council for Local Environmental Initiatives (Hams, et.al., 1994: 2-3). But, like other suddenly fashionable words and phrases, the term sustainable development has been misunderstood and misused frequently. Sometimes, it has been used to misinform so as to gain advantage for narrow and special interests (Bartelmus, 1994; Munro, 1995). Even though the definition has been criticized for ambiguity, it has been generally agreed that the concept has three different, but closely interrelated components; economical, social, and environmental (Munro, 1995: 27-35). Thus, to achieve a sustainable development, economic and social development needs to be attainable in a healthy balance apparatus while this kind of development does not deteriorate our natural environment. These triangular supports -the economic, social, and the environmental development- together can achieve sustainable development. With three core components of sustainable development, the term sustainable development was used in this paper to indicate the first careful use of natural resources and effective environmental preservation second, social development that meets all public needs and third, stable economic growth and employment (Green Ministers Committee, 2000).

Pursuing sustainable development is not an easy task since it encompasses not only the environmental area, but also the economic and social areas as well. This paper focuses mainly on environmental aspect of sustainable development in Korea. But current issues on sustainable development cannot be free from legacies of

the Korean past development path. This paper begins with a brief review on the Korean economic development to provide a general context of issues on sustainable development in Korea. Then, key issues on sustainable development in Korea and government response will be examined.

LEGACY OF ECONOMIC DEVELOPMENT IN KOREA

From the early 1960s to the late 1990s until the economic crisis began in 1997, Korea has achieved a remarkable economic growth. Up until the turn of 1960s, Korea was a typical underdeveloped, largely agrarian country. However, thanks to the success of export-oriented industrialization, the country transformed itself into a modern industrialized country. Economic growth averaged over 8 percent per annum for more than thirty years, the GDP volume soared from 2.1 billion US dollars in 1961 to 484 billion US dollars by 1996, just before the economic crisis of 1997, while the per capita GNP increased from 82 dollars to 10,543 dollars over the same period (The Bank of Korea, 1998).

Korean strategies for economic development can be divided into three phases: growth first period of 1960s and 1970s, stabilization and liberalization period of 1980s, and globalization period of 1990s and thereafter. Korean developmental strategies were based on GIO-oriented (growth-, industry-, and outward-oriented) strategy (Song, 1997: 88) and the government vigorously implemented a series of five-year economic planning since 1961, right after the inception of the *Park* regime.

During the 1960s and 1970s, the major beneficiaries of economic development policy were large businesses. Large scale enterprises (*chaebols*) expanded rapidly in the 1960s and further accelerated expansion during the heavy and chemical industry promotion period (1973-1979). For example, the average number of member companies of the ten largest *chaebols* grew from 7.5 per *chaebol* in 1972 to 25.4 per *chaebol* in 1979. Assets in manufacturing sectors among 10 *chaebols* increased from 362 billion won to 5,263 billion won, a staggering 1,400 percent increase (Moon, 1992: 63).

From 1980, with new government headed by *Chun Doo Whan*, Korean developmental strategies shifted from "growth first" to an emphasis on "economic stabilization" even though the government has not abandoned its economic growth altogether. The economic

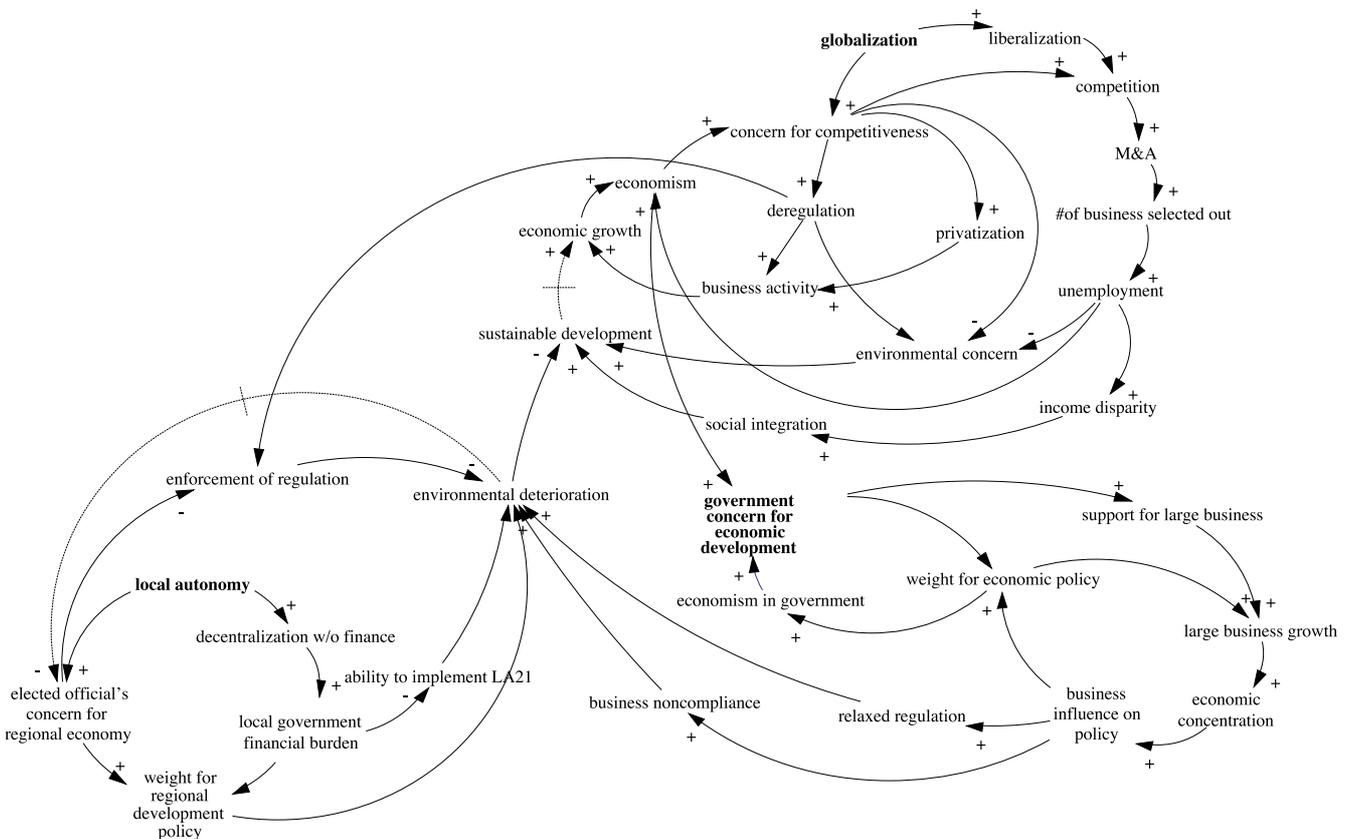
stabilization policy was accompanied by a gradual reduction in government intervention in the market economy. The governmental support for business has gradually been reduced, and the protection of domestic business has been eroded by the gradual opening of the Korean market to international market. In 1986, the Korean economy marked a turning point by simultaneously achieving the “triple economic targets” of high economic growth, price stability, and a trade surplus for the first time since industrialization. However, with accelerated democratization process under the new president, *Noh Tae Woo*, 1980’s economic growth came to an end with an explosive public demand that had long been repressed.

As the Korea economy progressed into the 1990s, problem of ‘high-cost and low-efficiency’ industrial structure deepened amid a sharp increase in competitive pressure. High costs had become an endemic with high wages, high land prices and high interest rates, due to price instability and inflexible adherence to business’ management strategies of external expansion. The financial and real estate sectors became markedly less efficient, because market principles could not operate prop-

erly in a political, social and economic environment characterized by deepening economic concentration on few large *chaebols*, strict regulation, and government intervention in the financial sectors for preferential loan to politically favored firms, especially for large businesses. While Korean companies were neglecting to improve productivity through technological development, they faced intense competition with foreign companies owing to the rapid growth of late developing countries, the launch of WTO, and the unprepared acceleration of market opening to meet OECD entry criteria under the *Kim Young Sam* government.

Coping effectively with these tough new changing economic environments required a stronger drive for economic stability and structural reform. However, policies along these guidelines were pursued only half-heartedly and the previous growth first strategies tend to persist because of a growth-oriented governmental inertia, business resistance against reform, and political reasons. As a result, economic growth raced ahead, while the current account balance shifting deeply into the red and price instability continued. Total foreign debt rose sharply from 29.4 billion in 1989 to 104.7 billion US

Figure 1. Global, National, Local Level of Constraints on Sustainable Development in Korea



dollar at the end of 1996 (The Bank of Korea, 1998). Even worse, from the beginning of 1997, non-performing loans of financial institutions had rapidly accumulated due to a string of large corporate insolvencies. Korean credibility was lost in the eyes of international investors and they repatriated capital from Korea. It was the beginning of the Korean financial crisis.

It is ironic that the very factors that contributed to the Korean economic growth -governmental growth first policy together with close ties with large conglomerates-became a major factors that triggered the Korean economic crisis and that weakened economic basis of sustainable development (Ahn & Moon, 2001: 137-158). This situation can be summarized in causal loop diagram as follows (Moon, 2004).

Figure 1¹ shows globalization, central government deep concern for economic development, and the strong development oriented policies of local governments are structured in a way to constrain sustainable development in Korea. Governmental growth-first policy led to economic concentration and growth of business influence. Governmental deep concern for economic growth was gradually institutionalized in the government and society as a form of economism. Economism places heavy weight on economic value on every occasion. Globalization since the late 1990s further accelerated economism. Together with increased influence of business on government policy and society, government economic growth oriented policies are further accelerated, forming a vicious circle. Under these circumstances, there seems to be little room for sustainable development unless these structured constrains are lifted. Heavy economic concentration on large conglomerates, institutionalized economism which places heavy weight on economic growth, large business strong influence on society as well as government, and impact of IMF crisis are legacy and context within which Korea society has to deal with in pursuing sustainable development.

CURRENT STATUS OF SUSTAINABILITY

Table 1 shows the current Korean status of economic, social, and environmental performance in comparison with other OECD nations. Followings are a rough assessment of economic, social and environmental sustainability in Korea with those statistics from OECD and other information.

Economic Sustainability

According to OECD Fact Book of 2005 (see Table 1), Korea's GDP is the 10th high one among OECD countries, showing a rapid economic growth. 3.8% of labor productivity increase rate is the second highest among OECD countries and R&D expenditure is the 8th high. It also shows the highest percentage of household with PC, the least unemployment rate, and the highest education expenditure in OECD countries. On the surface, it seems fair to say that Korea has overcome financial crisis in 1997 successfully and is making a firm progress toward economic development.

However, critics argue that the Korean economy became more vulnerable to international market and foreign capital influence (SERI, 2002). Besides, economic concentration of large business became deepened than before the IMF crisis, making Korean economy more dependent upon large businesses and leave small and medium businesses behind. For example, the number of subsidiaries of 30 largest businesses increased from 544 in 2000 to 624 in 2001 and the economic concentration of the four largest businesses is greater than before the financial crisis of 1997. The percentage of total production by the four largest businesses in GDP increased from 6.8% in 1997 to 8.7% in 1998, 9.3% in 1999, and 10.9% in 2000. Total tax payment of the four largest conglomerates was 14.6% in 1997, 15.3% in 1998, 14.9% in 1999, and 18.5% in 2000. With regard to the total amount of export, the proportion has increased from 41.6% in 1997, 44.1% in 1998, 47.4% in 1999, and 49.8% in 2000. Total employment by these conglomerates decreased from 4.5% in 1997 to 3.8% in 2000 (*Hankook Ilbo*, May 16, 2001; *Kukmin Daily*, April 2, 2001). As of 2002, the largest 3 business groups in Korea -Samsung, LG, SK- were growing 100% annually since the 1998 and the total value among all businesses listed on the stock market increased from 28% in 1998 to 43% in 2002. More recent figures show heavier economic concentration on few businesses. According to the Financial Supervisory Service, the proportion of the five largest businesses' total assets among 18 largest business groups² in Korea increased from 59.2% in 2003 to 63% in 2004. Among these, Samsung shows the highest economic concentration. Its total assets take more than one third of the 18 largest businesses' total assets. Its portion of assets among the 18 largest businesses increased from 30.3% in 2003 to 32.1% in 2004 (*Kyunghyang Sinmun*, 2004.7.12).

Table 1. OECD Factbook 2005 Summary

Area	Indicator			Korea		OECD average
		unit	year		rank	
Population & migration	Population	1,000	2003	47,925	9	1st USA
	Pop growth rate	%	2003	0.6	12th	0.68
	Birth rate	person/1,000	2003	-	-	1st Turkey
	Aged population(1)	% of total population	2000	15.1	20th	17.7
Macro-economic trends	GDP	\$ billion	2002	898.7	10th	962.4
	GDP per capita	\$	2002	17,016	24th	25,810
	Labor productivity	%	94-03	3.8	2nd	1.8
Economic Globalization	Share of trade increase in GDP	% GDP	90-03	1.7	18th	2.5
	Trade in goods	\$ billion	2003	15	8th	-132
	Trade in services	\$ billion	2003	-7.6	26th	1.9
	Balance of payment	% GDP	2001-2003	1.6	11th	-
Prices	CPI increase	%	90-03	4.9	8th	3.8
	PPI increase	% manufacture	90-03	2.2	10th	2.5
	Consumer price	OECD(95)=100	2003	64	25th	-
Labor market	Employment rate	%	2003	63.0	21st	64.9
	Self employment	% employed	2003	34.9	3rd	-
	Unemployment rate	%	2003	3.6	1st	7.1
	Long term unemployment	% unemployed	2003	0.6	1st	31.0
Science & technology	Expenditure on R&D	% GDP	2002	2.96	8th	2.33
	Researchers	person/1,000	2001	6.4	7th	6.5
	Household with PC	% household	2002	77.9	1st	-
Environment	CO2 emission	mil tons	2002	452	6th	418
	Water consumption per person	m ³	2002	560	14th	920
	Waste generation/person	kg	2002	380	24th	570
	Renewable energy	%	2003	1.08	28th	5.9
education	PISA(2)					
	-reading	average score	2003	534	2nd	494
	-science	average score	2003	538	3rd	500
	-math	average score	2003	542	2nd	500
	University education expenditure per Person	\$	2001	6,618	26th	-
	Education expenditure	% GDP	2001	8.2	1st	6.2
	-Public education expenditure	% GDP	2001	8.2	17th	4.8
	-private education expenditure	% GDP	2001	3.4	1st	-3.68
Public policies	Health expenditure per person	\$	2002	519	27th	-
	Total tax Revenue	% GDP	2001	27.2	29th	36.9
	Tax burden on worker	% labor expense	2003	14.1	30th	36.5
Quality of life	Life expectancy	age	2001	76.4	24th	77.4
	Infant mortality	death/1,000	2002	6.2	8th	6.3
	Obesity rate	% of 15 years and older	2003	3.2	1st	30th USA
	Health expenditure per person	\$	2002	996	26th	-
	Working hour per person	hours/year	2003	2,390	1st	-
	Road fatalities	per million population	2002	149	4th	-
		per million vehicles	2002	612	1st	-

(1) people aged 65 and over

(2) The OECD Program for International Student Assessment

* Employment rate=employed/labor force (age 15-64). Seoul Yunhap News.

Social Sustainability

Social sustainability indicates social development that meet public needs, especially for those of needed people. OECD statistics shows that Korea marked the lowest unemployment rate of 3.6% and long term unemployment rate of 0.6% (see Table 1). But the employment rate marked 63% and this is lower than OECD average, taking the 21st place among OECD countries. Since the employment rate is defined as the proportion of employed people among the labor force, this low employment rate indicates that economic participation rate is lower and “not economically active population” is higher than other countries. The labor force in Korea is being under utilized.

The problem is that since the IMF crisis in 1997, the gap between the rich and the poor has been widening and posing a negative impact on social integration. For example, according to the National Statistical Office, the difference between the average income of the upper 20% and lower 20% is widening from 5.12 times in 2002 to 5.16 times in 2003. Also the income growth rate of upper 20% of urban worker was 5.4% while that of lower 20% was 2.1% during the same period.

Also, number of part time workers are increasing rapidly compared to full time workers. Part time workers increased from 7,720,000 in 2002 to 7,840,000 in 2003 and wages for part time workers decreased from 52.9% to 51% of full time workers’ wage. The low wages of non-regular workers is compared to regular workers and is one of the important reasons of unstable living conditions.

Another characteristics of changes in wealth distribution since the IMF crisis is that household property value -usually in the form of real estate- difference between upper income people and lower income people has also been widening, making a further discrepancy among classes, deepening frustration of lower class. (Lee, 2005).

Unfortunately, suicide rate has been increasing rapidly from 10.5 per 100,000 in 1994 to 24.2 in 2004. This is the highest suicide rate in OECD countries followed by Hungary (22.6), Japan (18.7), Belgium(18.4), and Finland (18.4).

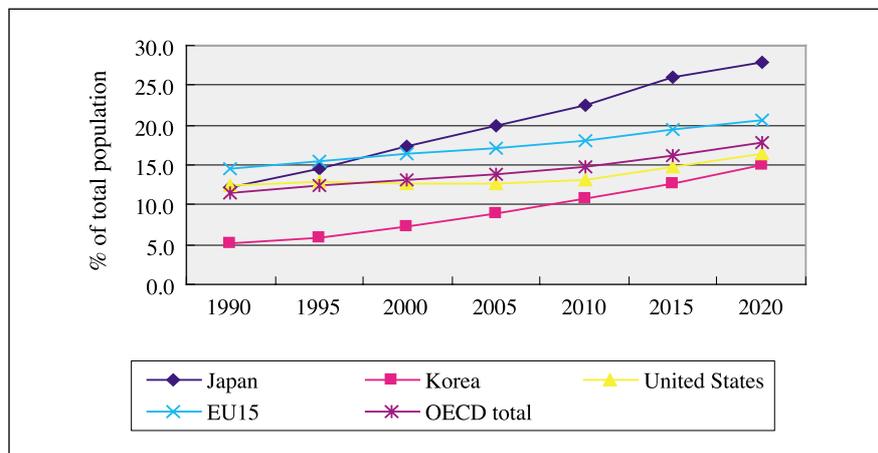
In terms of quality of life, statistics shows a gloomy picture. Life expectancy is 76.4 years, the 26th place among the OECD countries, health expenditure is the 24th, working hours are the longest, road fatalities is highest among OECD countries.

Academic performance of students are high, but public education expenditure and university education expenditure is low. However, private education expenditure is highest among OECD countries. This high private education expenditure is causing a tremendous burden on parents with school children.

Korean society is aging rapidly and poses another serious challenge. Its birth rate is 10.4 per 1,000 people, making it the 200th lowest birth rate country out of 226 countries. Its total fertility rate per woman is 1.26, indicating that the total population is decreasing and aging (CIA, 2005).

According to the 2004 OECD Fact Book, proportion of population aged 65 and older is projected to increase to 15% of total population (see Fig2). Increasing aged

Figure 2. Aged Population Trend and Projection



Source: OECD Fact book. 2004.

population and young population decrease can increase social cost, and cause labor force shortage. Both trends are not regarded as good indicators of sustainable development, socially and economically.

ENVIRONMENTAL SUSTAINABILITY

The environmental performance of Korea is lagging behind compared to economic and social area. While there has been a substantial improvement in social welfare policy during the IMF crisis, environmental problems did not draw serious attention in the course of overcoming financial crisis. Besides, high population density with small national land area is one important factor making Korea an environmentally stressful country. One indicator of environmental negligence came from the World Economic Forum. The Forum assessed sustainability of world countries in 2005 and Korea was ranked as the 122nd among 146 countries.

The followings are a detailed key issues in environmental sustainability and government responses to them.

Sustainable Land Use: Integrating Developmental Needs and Ecological Preservation

Land use has a direct impact on environment. It has been unfortunate that national land use has been a major source of environmental deterioration in Korea. Since the rapid economic development of Korea from the 1960s, land policy in Korea has been heavily oriented toward meeting developmental needs without considering the impact on a natural environment. Deregulation initiatives by the *Kim Young Sam* government during the early 1990s further aggravated the situation. Government deregulated restrictions on semi-agricultural land use and the result was widespread unplanned developments all over the country. The problem of unplanned

development was most serious in the Seoul Metropolitan Area where developmental pressure was higher than other places in Korea. Worsening traffic congestion, deteriorating environmental quality, decreasing green space were typical results of unplanned development.

The followings are an explanation of recent land policy from the 1990s to the early 2000s and resulting land use problems (Moon, 2003).

One of the most important issues in the 1990s was globalization. Korea joined the globalization since the late 1994 when it was initiated by former President *Kim Young Sam*. National competitiveness and economic efficiency became the utmost priority with globalization (Ahn & Moon, 2001). Thus, the focus of land policy during this period was to increase international competitiveness. Demand for higher competitiveness was translated into deregulation of the land policy to promote business activities. In 1993, Act on Special Measures for the Deregulation of Corporate Activities was enacted and business land use activities were substantially deregulated. Also Act on Utilization and Management of National Territory was amended and regulation on land use was mitigated. As a result the total land available for development increased from 15% to 42% of total national territory. In addition, after the Seoul Metropolitan Area Readjustment Planning was changed in 1994, usable land increased from 37% to 50% of total metropolitan area. Besides, Enforcement Decree of the Seoul Metropolitan Area Readjustment Planning Act was revised in March 1994, allowing construction of large building in the metropolitan area if it pays overcrowding charges. Furthermore, Enforcement Decree of Industrial Placement and Factory Construction Act was revised in July 1994 to allow large businesses to extend up to 30% of existing facilities within growth management area. Parallel with these deregulations, government policy on non-business land was substantially retreated. Requirement of bank approval for real estate transaction

Table2. Sustainability Index Comparison (rank)

Country	Total		Environmental Quality	Pollution Load	Environmental risk	Institutional Response Capacity	International Cooperation
	rank	score					
Japan	30	57.3	130	128	48	5	10
German	31	56.9	105	135	19	9	40
Netherlands	41	53.7	141	142	10	8	20
England	66	50.2	106	141	39	10	93
Korea	122	43.0	137	146	67	18	78

of large business was abolished in 1994.

Result of these retirements of land use policy was destruction of natural environment and unplanned development. During the period of 1994 to 2001, some 1405.4 km² of agricultural and semi agricultural land area was developed into urban area. Most development was unplanned and the destruction of natural ecology and landscape was serious. Unplanned development was most serious in *GyeongGi* province, metropolitan area. For example, unplanned development such as construction of apartments, luxurious villas, and factories in *Hwasung* county, *Yeosu* county, *Yongin* city and *South Yangju* city destroyed one fourth of the total forests of the nation. Total decreased area of forest between 1995 and 2000 was 5,989 ha and it was equivalent to 27.4% of a total decrease in forest area of the nation. Damage to ecological system was serious too. For example, as of 2002, 72 roads are crossing the *Baekdu Daegan Mountain System* every 9 km on the average and 30 of them are disintegrating and damaging ecological system of *BDMS*. Furthermore, there are 5 railways, 12 mines, and 6 dams, and many electrical transmission towers in the *BDMS*, damaging the most precious national ecological system (MOE, 2004).

The rush of government to deregulate land use did not stop there. During the *Kim Dae Jung* government, government deregulates regulations on green-belt areas around 14 major urban areas. In July 1999, government announced that it would deregulate the green-belt areas around 7 medium size cities completely and would ease regulations on green-belt areas around 7 large metropolitan areas. Environmentalist and concerned people criticized that the government was abandoning precious green space that has been kept for almost 30 years to prevent an urban sprawl and environmental deterioration.

Land policy in the early 2000s was largely a reaction to the land policy in the 1990s. Recognizing the serious impact of unplanned development on the environment, government renovated land use policy completely in 2001. National Assembly enacted Framework Act on National Territory and Act on the Planning and Utilization of the National Territory in 2001 by merging Act on Comprehensive Plans for Construction in the National Territory, Act on the Utilization and Management of the National Territory, and Urban Planning Act. These acts took effect from January 2003.

The Framework Act on National Territory provides sustainable development as a basic guideline of national territory planning. The act requires achieving a balanced

national territorial development, improving competitiveness of national territory, and aiming environmentally friendly management of national territory.

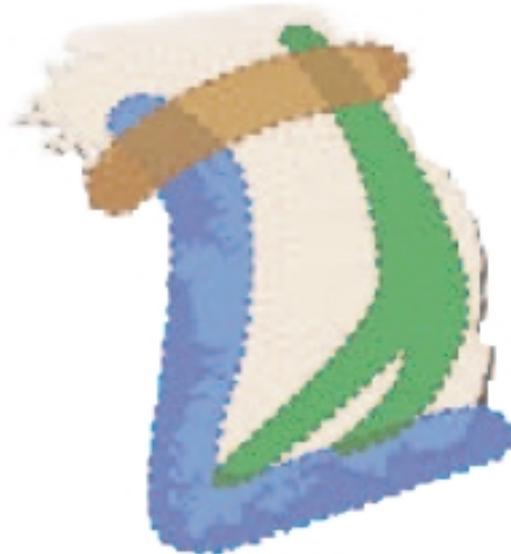
Act on the Planning and Utilization of the National Territory provides provisions on preventing unplanned development and environmentally friendly use of national territory. The act strengthened legal basis of "plan first, develop later" principle in developing national land by requiring to apply urban planning to both urban and rural area as well. The act revised and simplified zoning system and extended district planning system to outside urban areas adopted development permit system and adequate public facilities requirement system.

Newly enacted land policy laws in 2001 are expected to change the land policy of Korea substantially toward a more sustainable one. However, how much the new policy would mitigate the unsustainable nature of the land policy of Korea is yet to be seen. Even with the new land policy, there are problems to be solved. One of the important problems is lack of institutional capacity to achieve sustainable land use in an integrated manner. Currently, the Ministry of Construction and Transportation (MOCT) has the responsibility of implementing land policy. Most of land use decisions that have important impact on the environment are made by the MOCT and environmental concerns are usually not integrated in the process. Besides, since the MOCT is strongly oriented toward development rather than preservation, the Ministry of Environment (MOE) has been critical against the MOCT. Unless the coordinating mechanism between the two agencies is firmly established, the effect of the new land policy can be jeopardized (Moon, 2002).

Ministry of Environment responded land use problems too. One of such efforts was the MOE initiative to create eco-network on the Korean Peninsula to conserve the bio-diverse ecosystem of *Baekdu Daegan Mountain System*, the Demilitarized Zone, and various small islands and coastal regions (See Fig3). For this purpose, the Act relating the *BDMS* Protection was enacted in 2003, and a comprehensive plan and strategies for preserving the DMZ and small islands and coastal regions is being prepared (MOE, 2004). To be a successful policy, all land use policies and plans, including national land use plan, urban and regional plans need to be closely coordinated with this project.

Figure 3. Ecological Network in Korea

- Demilitarized Zone
- Baekdu Daegan Mountain System
- Small Islands & Coastal Areas



Source: MOE, Green Korea 2004

Clean and Healthy Air

Air pollution is the most important pollution problem because the impact on human health is most direct and immediate. Polluted air brings acid rain, pollutes water, deteriorates ecological system, and contaminates land and underground water. Polluted air destroys the ozone layer and changes the global climate, and damages the global ecological system.

Air Quality Management District (AQMD) and Total Air Pollution Load System

In Korea the air quality problem is especially serious in the Seoul Metropolitan Area (SMA). This area is only 12% of the total land area while 47% of national population and vehicles are concentrated in this region.

According to OECD statistics (Table 3), concentration of PM₁₀ in Seoul Metropolitan Area is the worst among 31 OECD countries. It is 1.7 to 3.5 times worse

than London, Paris, Tokyo and New York. CO₂ emission is the 6th among OECD countries and NO₂ and O₃ concentration are worsening. NO₂ concentration level is 1.7 times higher than other leading cities.

Social cost of air pollution in this region was estimated some 10 trillion Won (8.7 billion USD) annually (KEI, 2002, recited from MOE, 2004). Also early deaths from air pollution were estimated at up to 11,127 a year (KDI, 2003, recited from MOE 2004). If current trend continues, number of vehicles is expected to rise 63% more and primary energy use is estimated to increase 45% more, making current air quality even worse.

As shown in the Figure 4, air quality in Korea around major urban area has been improving except NO₂, O₃, PM₁₀ and CO₂ level. This is largely due to the rapidly increasing number of vehicle (see Table 4). It is offsetting strengthened emission standards and reduced pollutant emission from cars.

Responding to this worsening air quality problem in the Seoul Metropolitan Area the government established

Table 3. PM₁₀ and NO₂ Concentration in Major Cities

	Seoul	London	Paris	Tokyo	New York
PM ₁₀ (µg/m ³)	71	20	20	40	28
NO ₂ (ppb)	37	25	22	29	30

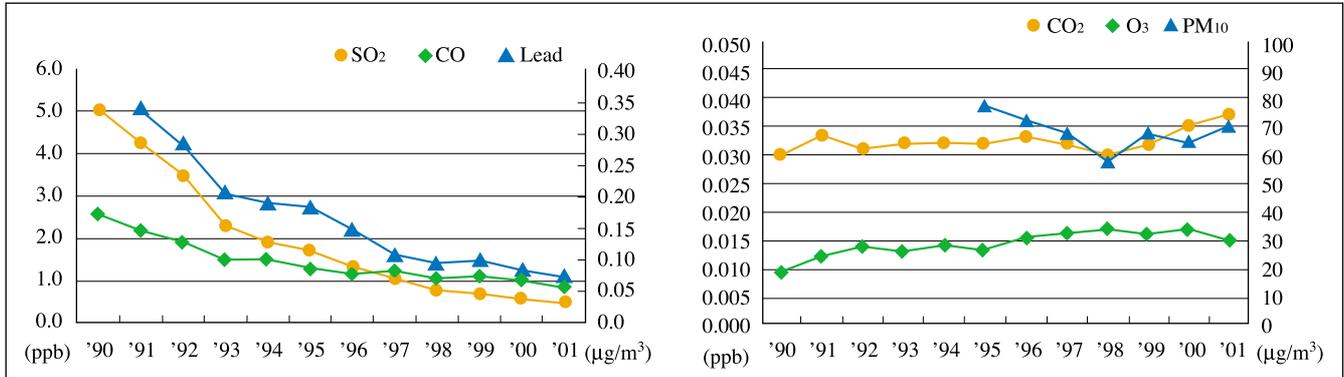
Source: MOE, 2004, Green Korea.

Table 4. Population and Vehicle in Metropolitan Area: The Growth Rate

	1990	2000	Growth rate
Population	18,340,000	21,910,000	20%
Number of vehicles	1,790,000	5,577,000	211%

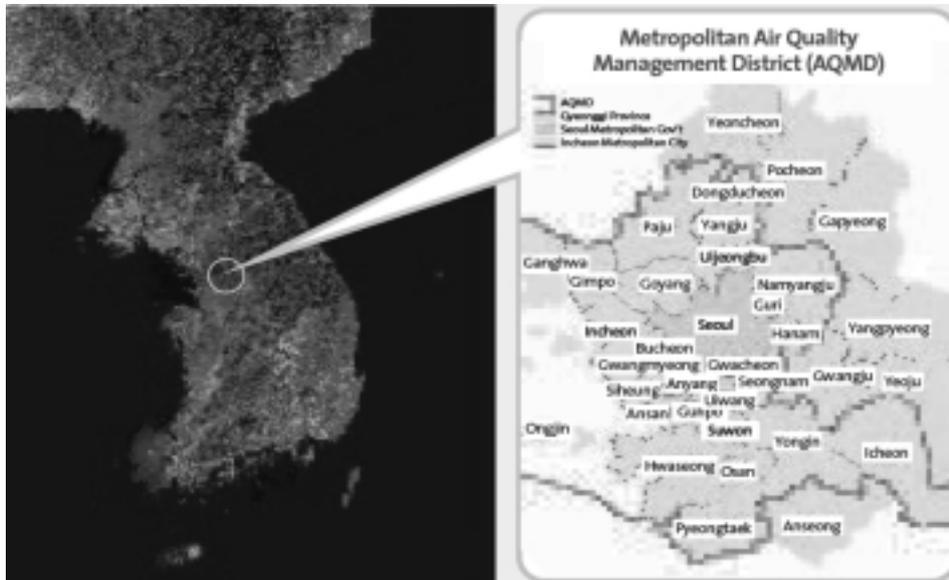
Source: Green Korea 2004.

Figure 4. Air Pollutant Levels in Metropolitan Area (1990-2001)



Source: Green Korea 2004.

Figure 5. Metropolitan Air Quality Management District



Source: Green Korea, 2004.

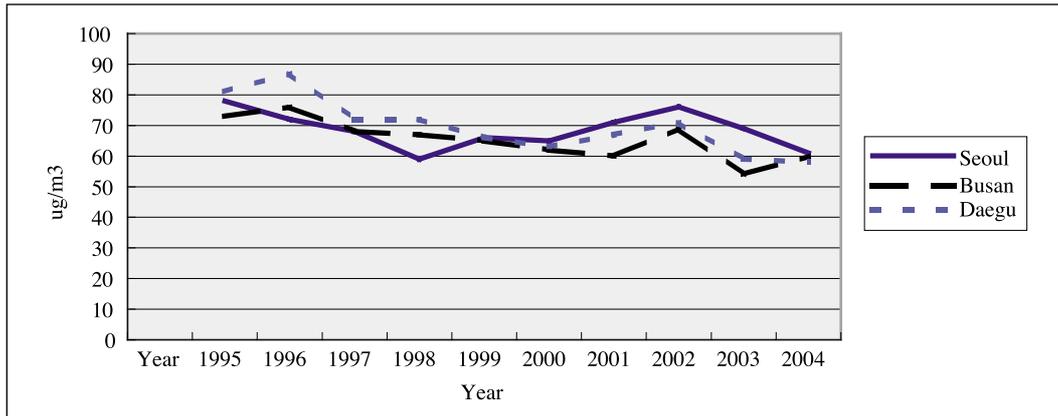
Special Measures for Metropolitan Air Quality Improvement, passed Special Act on Metropolitan Air Quality Improvement in 2003. These measures grouped the metropolitan area into an integrated system of air quality control. Metropolitan air Quality Management District (AQMD) was established following the special measures as shown in the Figure 5.

In the AQMD, air quality is managed by the Total

Air Pollution Load (TAPL) management system. In this system, environmental carrying capacity is calculated and maximum amount of pollution discharge is allocated to each region to cap the total amount of air pollutants in the SMA to stay within the limit of regional carrying capacity.

Successful air quality management through AQMD depends on accurate allocation of maximum amount of

Figure 6. PM₁₀ in Seoul, Busan, Daegu



Source: MOE, 2005, Environment White paper.

pollution discharge, strong enforcement, close coordination with transportation policy, and land use planning.

PM₁₀

Particles less than 10 micrometers are called PM₁₀. Particles are major causes of various respiratory disease and low visibility. PM₁₀ concentration has been regulated since 1995 and it shows gradual improvement in all cities, including Seoul. But, when comparing to that of

other cities, the PM₁₀ level Seoul is the worst among OECD countries.

This high level of PM₁₀ concentration is causing low visibility and increasing number of respiratory related disease in the Seoul Metropolitan Area. Since major contributor of high PM₁₀ concentration level is from diesel cars and managing diesel vehicles is the key to this policy.

Another concern is that more fine particles such as PM_{2.5} which is 100 times thinner than human hair and

Table 5. Air Quality Standards in Seattle Metropolitan Area (Puget Sound Region)

Pollutant	Standard	Level
Ozone	The daily maximum 1-hour average cannot exceed the level more than an average of once per year over a 3 consecutive year period	0.12 ppm
	The 3-year average of the 4th highest daily maximum 8-hour average concentration cannot exceed the level	0.084 ppm
Particulate Matter (10 micrometers)	The 3-year annual average of the daily concentrations cannot exceed	54 µg/m ³
	The 3 year average of the 99th percentile (based on the number of sample taken) of the daily concentrations cannot exceed	154µg/m ³
Particulate Matter (2.5 micrometers)	The 3-year annual average of the daily concentrations cannot exceed	15.4 µg/m ³
	The 3 year average of the 98th percentile (based on the number of samples taken) of the daily concentrations cannot exceed	65 µg/m ³
Carbon Monoxide	The 1-hour average cannot exceed the level more than once per year	35 ppm
	The 8-hour average cannot exceed the level more than once per year	9.4 ppm
Sulfur Dioxide	Annual arithmetic mean of 1-hour averages cannot exceed	0.02 ppm
	24-hour average cannot exceed	0.10 ppm
	1-hour average cannot exceed And no more than twice in 7 consecutive days can the 1-hour average exceed	0.40 ppm 0.25 ppm
Lead	The quarterly average (by calendar) cannot exceed	1.5 µg/m ³
Nitrogen Dioxide	The annual mean of 1-hour averages cannot exceed	0.053 ppm

Note. Daily concentration is the 24 hour average, measured from midnight to midnight.

Source: Puget Sound Clean Air Agency. WA, USA. 2004..

less than 2.5 micrometer need to be managed with special concern. Because these fine particles are composed of toxic organic compound and heavy metals, it is reported to cause more serious respiratory disease and visibility problem. In the US, particulate less than 10 micrometer is called big particles and less than 2.5 micrometer are called small particles. Adopting new regulations on PM_{2.5} should be seriously considered and existing standards also need to be strengthened (Table 5).

Indoor Air Quality

Besides outdoor air quality, indoor air quality is drawing serious attention recently with rising demand on “well being” lifestyle and reports on Sick House Syndrome.³ Since people spent most of the time in “indoor,” indoor air quality is directly related to health issues.

Government enacted the Indoor Air Quality Management Act and became effective in May 2003 (see Table 6). To be a successful policy, it should be able to regulate environmentally friendly construction materials which release no health risk pollutants. Close monitoring and enforcement is critical for the success of this policy.

Trans-boundary Air Pollutants

East Asia region is growing rapidly economically and total population in this region is 34% of total world population. The East Asian economy is expected to grow into the world largest economic bloc, sharing 29% of world economy. Especially, the rapid economic

growth of China is expected to trigger explosive energy and food demand, burdening world resource market. The rapid economic development in this region poses serious environmental challenges. Trans-boundary air pollutants is one such challenge. For example, yellow dust and sand storms from China and Mongolia are a serious problem in Korea. It is estimated that some 20 million tons of yellow dust and sand are blowing from China and Mongol in April 2005. During this period, concentration of particles in ambient air increased 24 times higher than the usual level.⁴

Water

Water Quality

Water quality in four major rivers in Korea has been improving gradually since 1997. *Nakdong* and *Youngsan* river have improved in the later part of the 1990s. The *Han* river stayed at same water quality of BOD 1.3ppm in 2004. Considering rapid population increase around the river basin area, maintaining water quality at the same level could be regarded as successful results.

But as indicated in the Figure 7, recent data shows some deterioration of water quality in major rivers except the *Han* river. Among total of 193 rivers, only 35.6% are attaining designated water quality standard. Besides, among 498 tap water supply reservoirs, less than 50% satisfy the 1st grade water quality. The proportion of river segments that sustain the 2nd grade water quality -water quality where people can swim- is 23% in *Han* River, 18% in *Geum* River, and 12.5% in *Youngsan*

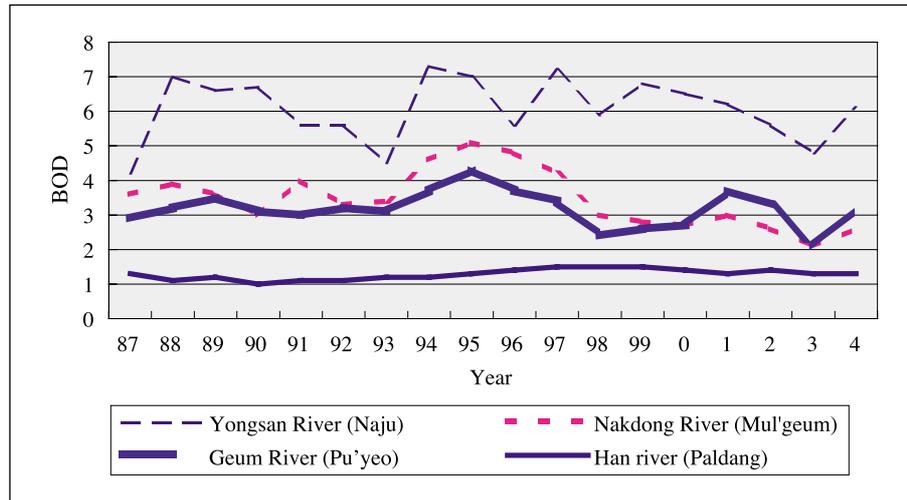
Table 6. Indoor Air Quality Standards

Facility	Pollutant	PM ₁₀ ($\mu\text{l}/\text{m}^3$)	CO ₂ (ppm)	HCHO ($\mu\text{l}/\text{m}^3$)	TBC (CFU/ m^3)	CO (ppm)
Subway stations, underground markets, libraries, museums, galleries, funeral house, saunas		Under 150	Under 1,000	Under 120	-	Under 10
Medical centers, childcare centers, medical centers for elders, maternity recuperation centers		Under 100			Under 800	
Indoor parking lots		Under 200			-	-

Pollutant	Type	Adhesives	General Materials
Formaldehyde		Over 4	Over 1.25
Volatile Organic Compounds (VOCs)		Over 10	Over 4.00

Source: Green Korea, 2004.

Figure 7. Water Quality in Four Major Rivers



Source: MOE, 2005. White Paper on Environment 2004.

River (PCSD, 2005).

Major policies toward water quality improvement include the total water pollution load management system, riparian buffer zones, land purchase, and water use charge measures. The Total Water Pollution Load (TWPL) management system was adopted in 2003 replacing previous regulations based on pollution concentration.

Problem is that TWPL management system faces difficulties in implementation. For the Han river basin, adopting TWPL management system remains as a voluntary one, resulting in limited participation. Also, lack of data for amount of water flow and pollutant amount makes implementation more difficult. There has been criticism that it also lacks an adequate implementation strategy (PCSD, 2005).

Another issue is related to non-point source pollution. Non-point source pollution contributes 22-37% of the total pollutant load in the four major rivers and 44.5% of Paldang water reservoir. Current water management is weak in dealing with non-point source pollution from small streams.

Table 7 shows high pollution concentration from road and high density apartment areas during rainfall. Non-point source pollutant measures need to be closely coordinated with land use planning and road construction plans. Also, monitoring, citizen participation, incentives, and regulations are needed to restore small stream water quality, thereby improving the water quality of major rivers.

Water Supply

With regard to water supply, Korea needs to prepare for water shortages. The Comprehensive Plan for Long Term Water Resource Plan estimated that Korea is expected to face some 1.8 billion tons of water shortage in 2011. Korea is also classified as a water stress country according to the PAI (Population Action International) classification. The annual precipitation of Korea is estimated at 1,283 mm, which is 1.3 times higher than the global average (973 mm). However, annual precipitation per capita is estimated at 2,705 tons, one-tenth of the

Table 7. Comparison of Pollution Generation During Rainfall between Roads and Urban Areas

Item Category	Pollution concentration (mg/L)		Pollution load (kg/ha/day)	
	Roads	High-density Apartments	Roads	Urban areas
BOD	7.2	6.1	1.7-5.5	0.8-1.1
COD	4.2	15.9	1.9-6.4	1.3-1.4
SS	3.4	59.6	11.0-28.4	1.7

Source: Korean Environment Institute (2002) "Stormwater effluent management measures for non-point source pollution reduction," recited from Green Korea, 2004.

world's average due to the high population density. Available water resource per capita is estimated at 1,550 tons which makes Korea a water stress country.⁵

Problem is that while more than 40% of water resources are supplied from dams, the government is facing tough challenges in undertaking dam constructions due to strong opposition from residents near the dam construction area. As a result the government planned 12 new additional dams have not been constructed yet.

New dam construction projects must be consulted with nearby residents and environmental NGOs closely and need to be proceeded with fair compensation when necessary. Also the demand side of water policy and measures to facilitate water savings needs to be strengthened.

Governance for Sustainable Development

Government alone cannot achieve sustainable development. It needs a broad participation of all segment of society and decentralization of decision making and implementation power. Thus, sustainable development is a process of making balanced economic, social and environmental development with broad participation of government, citizen, business groups, women, experts, and NGOs. Compared to previous mode of policy formulation and implementation which was dominated by the government, new mode of participation and cooperation shows characteristics of equal footing basis where no participating group can have a dominant influence.

This type of new governing style is called "governance." For this purpose the Presidential Committee on Sustainable Development (PCSD) was established in 2000 to provide consultation to the President on major policy directions and plans for a sustainable development and social conflict related to a sustainable development. It also provides consultation on water and energy policy. The five major areas of activities include sustainable energy policy, sustainable water management policy, sustainable land and nature management policy, implementing a global key action plan for sustainable development, and developing a conflict prevention and resolution system (PCSD, 2004).

It is true that PCSD was established as a leading body of new governance system and has made a noticeable contribution for a sustainable development. Contributions include expanding organizational function in the area of managing social conflict, drawing attention of the President, making Presidential Declaration on Vision

for Sustainable Development on the 10th Environment Day in 2005. But as an advisory body without policy implementation authority, it has fundamental limitations on coordinating policies of different jurisdictions. Since it has no direct leverage on related government bodies, it is difficult to make government policy to follow PCSD's recommendation. To coordinate government policies in a consistent manner and effective way, it is recommended to place "green officers" in each ministry to screen and coordinate policies from sustainable perspective. Green officers from each ministry and department can form a green officers meeting to exchange information and to further policy coordination.

At a local level, local government began to make local agenda 21 since 1995 usually with local NGOs. As of May 2005, 85% of local governments established local agenda 21 and 7% are establishing it, making 92% of total 250 local governments involved in establishing and implementing local agenda 21 (Korean Council for LA21, 2006). It is remarkable to see such a rapid proliferation of local agenda 21 within a short period of time. Major contributors were NGOs which have been mushrooming since the late 1980s democratization process. Without NGOs' active initiative, MOE's efforts and local governmental response, such a wide spread of local agenda21 has been impossible. But it also has problems to be solved. With major participants from NGOs, it suffers a lack of widespread citizen participation. NGOs are also experiencing declining citizen participation too, weakening governance system of sustainable development.

Another issue with LA21 is that it is not well transformed into local governmental plans and budget. Because of this lack of integration, it is hard to make an effective implementation of LA21. Also, business participation to the LA21 is not active compared to citizen groups. In this sense, establishing a sustainable governance system at local level still has a long way to go.

International Cooperation for Sustainable Development

There has been several cooperative meetings for environmental consideration in Northeast Asia region. They include Tripartite Environment Ministers Meeting (TEMM) among China, Japan, and Korea, Northeast Asian Conference on Environmental Cooperation (NEAC), Meeting of Senior Officials on Environmental Cooperation in Northeast Asia. Besides, there have been

Table 8. OECD/DAC Member Countries ODA Trend

(Unit: million USD, %)

	1998		1999		2000		2001	
	ODA	ODA/GNI	ODA	ODA/GNI	ODA	ODA/GNI	ODA	ODA/GNI
DAC total	51,891	0.24%	56,428	0.24%	53,737	0.22%	51,354	0.22%
Denmark	1,704	0.99	1,733	1.01	1,664	1.06	1,599	1.01
Netherland	3,042	0.80	3,134	0.79	3,135	0.84	3,155	0.82
Luxemburg	112	0.65	119	0.66	127	0.71	142	0.80
Sweden	1,573	0.72	1,630	0.70	1,799	0.80	1,576	0.76
Belgium	883	0.35	760	0.30	820	0.36	866	0.37
France	5,742	0.40	5,639	0.39	4,105	0.32	4,293	0.34
Switzerland	898	0.32	984	0.35	890	0.34	908	0.34
Ireland	199	0.30	245	0.31	235	0.30	285	0.33
England	3,864	0.27	3,426	0.24	4,501	0.32	4,659	0.32
Spain	1,376	0.24	1,363	0.23	1,195	0.22	1,748	0.30
Germany	5,581	0.26	5,515	0.26	5,030	0.27	4,879	0.27
Australia	960	0.27	982	0.26	987	0.27	852	0.25
Austria	456	0.22	527	0.26	423	0.23	457	0.25
New Zealand	130	0.27	134	0.27	113	0.25	111	0.25
Portugal	259	0.24	276	0.26	271	0.26	267	0.25
Canada	1,691	0.29	1,706	0.28	1,744	0.25	1,572	0.23
Japan	10,640	0.28	15,323	0.34	13,508	0.28	9,678	0.23
Greece	-	-	194	0.15	226	0.20	194	0.19
Italy	2,278	0.20	1,806	0.15	1,376	0.13	1,493	0.14
USA	8,786	0.10	9,145	0.10	9,955	0.10	10,884	0.11
Korea *	183	0.058	318	0.079	212	0.047	265	0.063

DAC. Development Assistance Committee.

Source: KOICA, 2004.

bilateral cooperation between China, Mongolia, Japan, and Russia.

Environmental cooperation programs include a tree planting project in the west China area to prevent desertification, establishing yellow dust and sand storm monitoring station network in cooperation with China, and waste water treatment facilities training programs. The Korean International Cooperation Agency spent about 6.1 billion won in 2004 for environment and women related projects as a form of ODA.

As a country with the world 10th economy size, Korea needs to expand ODA and cooperation for sustainable development in Northeast region. Table 8 shows Korea's ODA trend in comparison with other countries. In 2004, Korea's ODA was 423.3 mil USD and 0.06% of GNI (KOICA, 2005.11. <http://www.koica.or.kr/>).

CONCLUSION

This paper examined key issues and government response to the issues for a sustainable development in Korea focusing on environmental area. Issues included in this paper span sustainable land use, air quality problem especially with regard to NO₂, CO₂, and particles, indoor air quality problem, trans-boundary air pollutants, water quality degradation and water shortage problem, issues in sustainable governance system in relation to PCSD and local agenda21, and international cooperation.

However, these are not comprehensive list of key issues for sustainable development in Korea by any means. There are many other issues and problems that were not mentioned in this paper. They include energy saving and conservation issues, clean energy issues, issues related to integrating environmental and agricultural policy for safe food production, waste management issues, and social conflicts issues. Each issue deserves

separate discussion for its own.

Sustainable development is not a problem of environmental areas only. It is a problem of ecological, political, economic and social system as a whole. That problem comes from conditions the Korean society has endowed from the nature and inherited from the past development path which has inertia and hard to change. This is why problems of sustainable development are hard to solve unless government as a whole puts more serious efforts to change them. There is a need to fight hard against those structured constraints explained in the beginning of this paper in order to make all the policy suggestions made in this paper work and to overcome shortcomings of government responses to key sustainable issues (Figure 1).

In order to make this happen the government needs to change the development strategy from the economic growth oriented one to a more sustainable one. In the short term, one way of changing it may begin by reshuffling government functions especially between MOCT and MOE. Since one of the most serious impacts on sustainable development is currently resulting from the MOCT's various developmental planning and national territorial planning, screening and controlling these planning functions from the MOE's sustainable perspective could be one effective way of changing government policy toward a more sustainable one. In the long run, however, more attention needs to be paid in education for a sustainable development. It needs to be integrated into a public education system. Also, NGOs can play an important role in this respect. Korean NGOs have been quite successful in monitoring and checking government policies. Parallel with this success, more attention and efforts seems necessary for a 'sustainable development education' in various ways. Unless change happens at an individual level, it is hard to expect any changes in the policy and ecological level. Changing the world must start from changing individual.

NOTES

1. In the diagram, the plus (+) sign on the arrowhead indicates the variables at the opposite ends of the arrow move in the same direction while the minus (-) sign indicates an inverse relationship. For example, increased concern for competitiveness decreases environmental concern. The direction of variables in the relationship is opposite in this case and the minus sign on the arrowhead denotes this inverse relationship. But increased concern for competitiveness tends to increase privatization and deregulation. The direction of variables in this case is in the same direction and the plus sign denotes this relationship. The dotted lines indicate a long time delay of causal relationship between linked variables. For example, a higher level of concern for the environment can lead to a more sustainable development but only after a long delay.
2. Business group with more than 5 trillion won of asset size.
3. Symptoms complained by residents moved in newly constructed apartment building, such as eye irritation, nasal congestion, and severe headaches. Major contributors of the symptom are known as formaldehyde and volatile organic compounds.
4. Yearly TSP emission from Korea is 90,643 ton, and PM₁₀ is 70,120 ton (MOE, 2005: 366).
5. According to PAI (Population Action International), country with less than 1,700 m³ of available water per capita per year could be classified as water-stress country, more than 1700 m³ is water sufficient country, less than 1000 m³ is water-scarce country. Korea is projected to have 1,327 m³ of renewable fresh water in 2050 and could be classified as a water stress country (Gardner-Outlaw & Engelman, 1997).

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