

A COMPLEX ADAPTIVE SYSTEMS APPROACH FOR THE GREEN GROWTH

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As we know, one of the most interesting themes at 21st century is the environmental problems. Also, so many people interested sustainable development and the economic growth. Both of them adhere closely. They are related with environmental sustainability. With a line of connection, “Green Growth” is more interesting theme for Asia-Pacific region people. The Asia-Pacific region has 61 per cent of the world’s population and it covers 40 per cent of the Earth’s land area. Facing Second Millenniums Era, dramatic economic growth has facilitated poverty alleviation and social progress in many parts of the region. But, increasing demands for food, water, shelter, sanitation, energy, health services and economic and human security, all these added pressures make big issues. How are they satisfied with their increasing demands? How meet they the difficult global challenges before them, while simultaneously improving people’s lives and conserving their natural resources? As a result, the Governments in the Asia-Pacific region have unanimously agreed to respond to these challenges through the promising path of environmentally sustainable economic growth, as “Green Growth”

I’d like to research the Asia-Pacific countries’ efforts for environmentally sustainable economic growth, as “Green Growth” by Complex Adaptive Systems (CAS).

CAS is dynamic systems able to adapt in and evolve with a changing environment. It is important to realize that there is no separation between a system and its environment in the idea that a system always adapts to a changing environment. Rather, the concept to be examined is that of a system closely linked with all other related systems making up an ecosystem. Within such a context, change needs to be seen in terms of co-evolution with all other related systems, rather than as adaptation to a separate and distinct environment. Also, I intend to add software for achieving the Green Growth as Asia-Pacific region people wanted.

Keywords: Green Growth, sustainable development, economic growth, CAS

1. INTRODUCTION

In general, the proponents of sustainable development tend to explore the sustainable development, plan the environment-friendly policies, suggest the environmental protection, and research the principles of sustainability. The prospects for global sustainable development today are similar to a complex system. Also, it’s related with

A Complex Adaptive Systems Approach for the Green Growth

each component. It is interesting the economic growth and the sustainable development is related closely. Without the economic growth, achieving the sustainable development is impossible. So that, achieving sustainable development would be considered with economic growth. We need a long-term vision of sustainable development with the global development community. Actually, growing the environmental catastrophes led

us got a new trial for the sustainable development. One of the most interesting themes at 21st century is the Sustainable Development. It means that the Sustainable Development problems are all of human's problems. Also, it becomes clear that Environmental problems are the most important approach for sustainable future. (*Hyuk Kihl Kwon, 2006*)

Facing 21st Century, the Asia-Pacific countries meet the economic growth. Dramatic economic growth has facilitated poverty alleviation and social progress in many parts of the region. But, increasing demands for food, water, shelter, sanitation, energy, health services and economic and human security, all these added pressures make big issues.

How are they satisfied with their increasing demands? How meet they the difficult global challenges before them, while simultaneously improving people's lives and conserving their natural resources? As a result, the Governments in the Asia-Pacific region have unanimously agreed to respond to these challenges through the promising path of environmentally sustainable economic growth, as "Green Growth"

They made a big plan for achieving the 'Green Growth' for their future. Especially, they made an organization of the UNESCAP (*United Nations Economic and Social Commission for Asia and the Pacific*) for the Asia-Pacific region. With a membership of 62 Governments, 58 of which are in the region, and a geographical scope that stretches from Turkey in the west to the Pacific island nation of Kiribati in the east, and from the Russian Federation in the north to New Zealand in the south, ESCAP is the most comprehensive of the United Nations five regional commissions. Also, they have a map to Green Growth for the Asia-Pacific countries.

In this paper, I'd like to research the Asia-Pacific countries' efforts for environmentally sustainable economic growth, as "Green Growth" by Complex Adaptive Systems (CAS).

CAS is dynamic systems able to adapt in and evolve with a changing environment. It is important to realize that there is no separation between a system and its environment in the idea that a system always adapts to a changing environment. Rather, the concept to be examined is that of a system closely linked with all other related systems making up an ecosystem. Within such a context, change needs to be seen in terms of co-evolution with all other related systems, rather than as adaptation to a separate and distinct environment. Also, I'd like to add the idea for achieving the Green Growth as Asia-Pacific region people wanted. Of course, I'd like to analyze the flow map for the Green Growth. Also, I'd like to use the concept "Environmental Green Growth" and "Sustainable Development" is the same meaning for easy

A Complex Adaptive Systems Approach for the Green Growth

understanding. And, I will admit “Achieving the sustainable development” is “Environmental Economic Green Growth”

2. APPROACH TO COMPLEX ADAPTIVE SYSTEMS

2-1. Why the Complex Adaptive Systems?

Complexity theory is a relatively new field that began in the mid-1980s at the Santa Fe Institute in New Mexico. Work at the Santa Fe Institute is usually presented as the study of Complex Adaptive Systems (CAS). The CAS movement is predominantly American, as opposed to the European “natural science” tradition in the area of cybernetics and systems. Like in cybernetics and systems theory, CAS shares the subject of general properties of complex systems across traditional disciplinary boundaries. However, CAS is distinguished by the extensive use of computer simulations as a research tool, and an emphasis on systems, such as markets or ecologies, which are less integrated or “organized” than the ones studied by the older tradition (e.g., organisms, machines and companies).

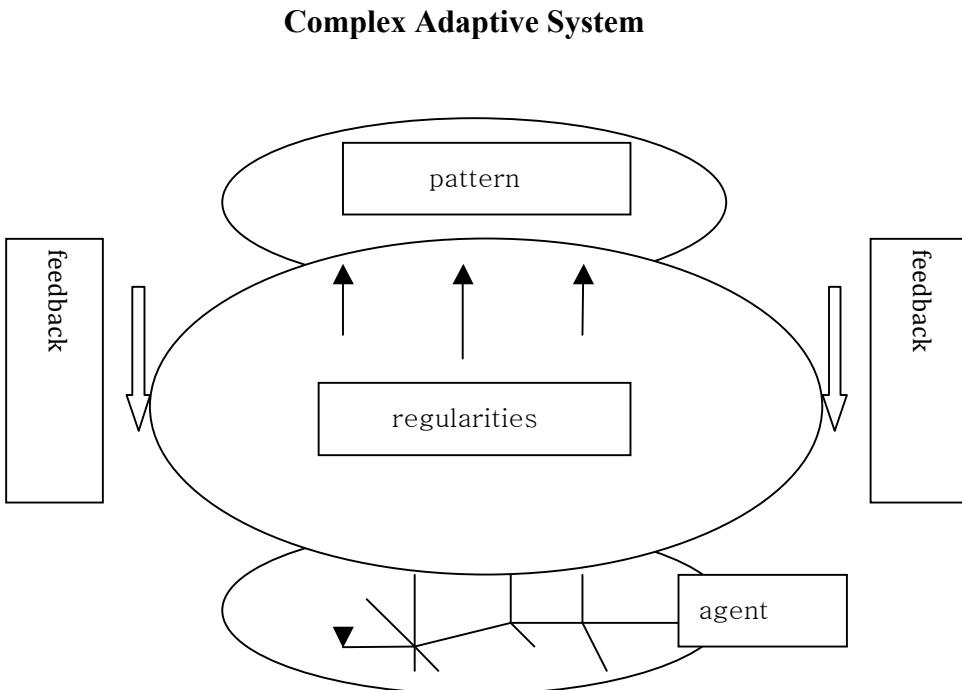
Complexity results from the inter-relationship, inter-action and inter-connectivity of elements within a system and between a system and its environment. Murray Gell-Mann, in “Complexity” Vol. 1, No. 5, 1995/96, traces the meaning of complexity to the root of the word. Complexity is therefore associated with the intricate intertwining or inter-connectivity of elements within a system and between a system and its environment.

Many natural systems (e.g., brains, immune systems, ecologies, societies) and increasingly, many artificial systems (parallel and distributed computing systems, artificial intelligence systems, artificial neural networks, co-evolutionary programs) are characterized by apparently complex behaviors that emerge as a result of often nonlinear spatio-temporal interactions among a large number of component systems at the different levels of organization. These systems have recently become known as Complex Adaptive Systems (CAS). The theoretical framework is based on work in the natural sciences studying CAS, e.g., physics, chemistry, biology. The analysis of CAS is done by a combination of applied, theoretical and experimental methods (e.g., mathematics and computer simulation).

CAS is dynamic systems able to adapt in and evolve with a changing environment. It is important to realize that there is no separation between a system and its environment in the idea that a system always adapts to a changing environment. Rather, the concept to be examined is that of a system closely linked with all other related systems making up an ecosystem. Within such a context, change needs to be seen in terms of co-evolution with all other related systems, rather than as adaptation to a separate and distinct environment.

2-2. Complex Adaptive Systems Model’s adaption

A Complex Adaptive Systems Approach for the Green Growth



(trojanmice, *What are Complex Adaptive System?*, by Peter Fryer)

3. WHAT'S THE ENVIRONMENTALLY SUSTAINABLE ECONOMIC GROWTH?

3-1. Principal Causes of Achieving the *Green Growth*

Achieving the Green Growth is a big issue for Asia-Pacific region countries. The principal cause of achieving the Green Growth is to be described like as below. First of all, industrial production in the region increased by almost 40%, compared with a global increase of 23%, from 1995 to 2002, with highly polluting industries that often use outdated technologies and operate under weak pollution control regimes. Second, agricultural production increased by 62% from 1992 to 2002, largely through agrochemical use intensity that exceeds world averages. Third, the swelling ranks of urban residents, with 600 to 800 million persons in the region estimated to be without adequate provisions for sanitation. Fourth, the development wastewater treatment, solid waste management and transportation infrastructure is not keeping up with the growth in the urban population. Finally, growth in water demand places significant pressure on the environment. (*MCED 2005, “Achieving Environmentally Sustainable Economic Growth” p.7*)

Some extraction from various sources is trouble for their future life. With the region's limited carrying capacity already shows the pressure of the current economic growth and environmental sustainability.

Under these circumstances, the Green Growth approach is a key strategy adopted by the Ministerial Conference to help Asia and the Pacific move towards sustainable development. The conventional environmental management approach has been

A Complex Adaptive Systems Approach for the Green Growth

focused more on improving environmental performance by controlling and regulating pollution and the discharge resulting mainly from production processes.

Rae-Kwon Chung, Director of ESCAP, Environment and Sustainable Development Division said,

“In safeguarding environmental sustainability, pollution control is not enough. We have to improve the ecological efficiency of our production and consumption patterns. Green Growth is about pursuing the economic growth necessary for poverty reduction while minimizing the environmental pressure on our limited carrying capacity by improving the eco-efficiency of our society as a whole.” (*ESCAP, the fifth Ministerial Conference on Environment and Development in Asia and the Pacific, 2005. p.9*)

The efforts of the Governments of the members and associate members of ESCAP to improve their environmental performance in the area of pollution control have met with some success. Air quality degradation has been reversed or slowed in some cities, the rate of deforestation has also slowed down in some countries and institutional and legislative frameworks for environmental protection have been established or strengthened. However, the environmental sustainability of the region has been placed under increasing pressure. In view of the region’s fairly limited ecological carrying capacity and the prospect for a rapid and huge increase in production and consumption in the course of economic growth, the environmental sustainability of the region is bound to deteriorate in the years to come unless “fundamental changes in the way societies produce and consume” are made, as called for in the Johannesburg Plan of Implementation.

Pollution control alone cannot improve the increasing pressure arising from economic growth and ensure “development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs” unless ecological sustainability is improved through “a fundamental change in the way societies produce and consume.”

In order to pursue *Green Growth*, Asia-Pacific countries need to introduce policy concept and system changes to improve the present generation’s ecological efficiency of current economic growth and maintain environmental sustainability for future generations, as is called for by the MDGs(Millennium Development Goals).

To make *Green Growth* possible and operational, countries have to introduce policy concepts, systems and options. The environmental standards and regulations have to be strength to improve the pollution. By changing the consumption and production pattern, eco-efficiency have to be improved. Also, by pricing the international of environmental cost mechanisms, the eco-efficiency has to be improved.

The environment has to be promoted as a growth driver, business opportunity and employment creator. Between the environment and the economy, a win-win synergy has to be created. The environment as a growth driver and employment is to be a creator, not as a burden on growth. The environment as a business opportunity for the

A Complex Adaptive Systems Approach for the Green Growth

private sector is not to be as an extra cost to business. And, the environmental regulations/standards to be as a research and development opportunity for improved industrial competitiveness. To decouple the increasing environmental pressure on the carrying capacity from economic growth, the regional Governments have to work. And improve the eco-efficiency of production and consumption patterns by fundamentally changing the way societies produce and consume as is called for by the Johannesburg Plan of Implementation of the World Summit on Sustainable Development 2002. (*MCED 2005, “Achieving Environmentally Sustainable Economic Growth”*)

3-2. Green Growth for the Asia-Pacific region

The *Green Growth* approach seeks to harmonize the two imperatives of “economic growth” and “environmental sustainability.” Changing in concept and system in the current paradigm of economic growth has two important factors. One is the integration of the environment and the economy, and the other is the creation of a win-win synergy between the environment and the economy so that the environment can be perceived as an opportunity rather than a cost and burden to the economy and business.

Improving the eco-efficiency of economic growth by decoupling rising environmental pressures from rapid economic growth in Asia and the Pacific, and in turn ensuring environmental sustainability as called for by the MDGs.

Improving the eco-efficiency of production and consumption patterns by changing the way societies produce and consume, as called for by the Johannesburg Plan of Implementation. Progress towards *Green Growth* can be measured with reference to two criteria: environmental performance and environmental sustainability. Environmental performance is essentially a measure of the gap between the actual states of the matter as opposed to the targeted policy goals. Environmental sustainability is reached when the pressure on resources (through consumption and production) is held within the carrying capacity limits of the natural environment. (*ESCAP, the fifth Ministerial Conference on Environment and Development in Asia and the Pacific, 2005. p. 10*)

Since the United Nations Conference on Environment and Development in 1992 and the subsequent World Summit on Sustainable Development in 2002, significant efforts have been made in pursuit of sustainable development. At the political level sustainable development has grown from being a movement mostly focusing on environmental concerns to a widely recognized framework utilized by individuals, governments, corporations and civil society that attempts to balance economic, social, environmental and generational concerns in decision-making and actions at all levels. At the September 2005 World Summit, the UN General Assembly reiterated that “Sustainable Development is a key element of the overarching framework for United Nations activities, in particular for achieving the internationally agreed development goals”, including those contained in the Millennium Declaration and the Johannesburg

A Complex Adaptive Systems Approach for the Green Growth

Plan of Implementation.(*Canadian International Development Agency, “Sustainable Development Strategy” : 2004-2006, A/RES/59/227*)

Of course, all of the country interested to achieve the “*Green Growth*” as a Sustainable Development. But, it’s not clear to have a program for the Sustainable Development. Every country has a different situation. Actually, Korean Government constructs the Sustainable Development Association (SDA) to achieve the Sustainable Development. But, its real activity is not enough to achieve the Sustainable Development. In a word, Sustainable Development is not easy to achieve. Every country has a different socio-economic environment. Their situation is different from each other. But, the Governments in the Asia-Pacific region have unanimously agreed to respond to these challenges through the promising path of environmentally sustainable economic growth, as “*Green Growth*” They made a big plan for achieving the ‘*Green Growth*’ for their future. They made the UNESCAP(United Nations Economic and Social Commission for Asia and the Pacific) for their future. And, they made up their mind to achieve the “*Green Growth*” The fifth Ministerial Conference on Environment and Development in Asia and Pacific, held in Seoul, Republic of Korea, from 24 to March 2005, concentrated on achieving environmentally sustainable economic growth, or “*Green Growth*”

“*Green Growth*” is innovative in that it constructively reconciles two potentially incompatible Millennium Development Goals. The one is economic growth to alleviate poverty and the other is environmental sustainability. Socio-economic development in Asia and the Pacific, home to two thirds of the world’s poor, has been considered and supported by most as the prime alleviator of poverty. Yet, with its limited environmental carrying capacity, the region is showing clear signs of environmental stress, resulting from rapid economic growth. Given this state of affairs, the only viable solution is to change the way that Asia and the Pacific grows. “Grow now, clean up later” is no longer an option. Integrating the three pillars of sustainable development into all aspects of development must prevail. (*MCED 2005, The fifth Ministerial Conference on Environment and Development in Asia and the Pacific, 2005. p.2*)

2002 Johannesburg Earth Summit on Sustainable Development, from August 26th to September 4th, 2002, is held with each countries stakeholder. Each stakeholder has a unique take on Sustainable Development that falls into one or more of the following approaches. It’s so called three pillars of Sustainability. They designated three factors of Sustainable Development. It was the economics, the environment, and social justice. (2002 Johannesburg Earth Summit on Sustainable Development)

3-3. Major works for Sustainable Development

A ‘sustainable future’ is one in which protection of the natural environment, economic prosperity and social justice are pursued simultaneously to ensure the quality of life of present generations and to secure the well-being of the next generations. I think

A Complex Adaptive Systems Approach for the Green Growth

'sustainable future' is not come by itself. It needs to plan, do, and see for environmental protection, economic prosperity and social justice. Of course, it's the result of co-operations with the ecosystems. (Hyuk Kihl Kwon, 2006) Also, 'Sustainability' is to be a real concept. It is very real, it is urgent, and it affects us all citizens, governments, corporations and organizations of the civil society. It necessitates a paradigm shift in the way we manage our institutions and it represents the fundamental challenge for the 21st Century. Environmental problems pose important questions not only about scientific knowledge and technological change but also about the social and political organization of our society and how these affect and are affected by global change. At twenty-first century, sustainable and environmentally friendly pattern of socio-economic development and resource use are an essential priority for us, mankind. John B. Robinson, Caroline Van Bergs, and Deanna McLeod asserted 'Sustainable Society Project (SSP)' traced the path of Canadian culture, institutions, and industry from the present to a more sustainable fictional future. (*Ann Dale & John B. Robinson eds, 1996. Achieving Sustainable Development, " Life in 2030: The Sustainable Society Project" John B. Robinson, Caroline Van Bergs and Deanna McLeod. UBC Press/ Vancouver.p.3*)

A sustainable society has socio-political as well as environmental and technological implications. The challenge in examining alternative future is to analyze these implications in a way that integrates all dimensions. The general approach of the project was to articulate sustainability values, to derive environmental-ecological and socio-economic design criteria based on these values, to develop a quantitative picture of Canada in 2030 consistent with these criteria, to construct a quantitative scenario in a modeling system intended to describe a path between 1990 and 2030, and to analyze the implications, feasibility, and implementation requirements of that scenario.

It is important to realize that sustainable development calls for potentially drastic changes in our current modes of production, consumption and decision-making. Also, sustainable development calls for a more general and more long-term oriented political support for attaining the pace towards sustainable development. (*Bergh. Jeroen C.J. M. Van Den. 1996*)

In a word, sustainable development means that improving quality of human life while living within the carrying capacity of supporting ecosystems. Sustainable development seeks to maximize human resource potential as well as the wealth provided by natural resources by managing all resources - natural, human, financial and physical - so that they can be used to serve the common good. Development is sustainable only when it meets the needs of present generations without compromising the ability of future generations to meet their own needs. (*Donald G. Kaufman, Cecilia M. Franz, 2000*)

Also, sustainable development presupposes sustainable resource use, that is, the use of renewable resources at rates that do not exceed their capacity for renewal. Sustainable use does not apply to non-renewable resources because the supply of non-renewable resource is finite, they cannot be used sustainable. At best, the life of non-renewable

A Complex Adaptive Systems Approach for the Green Growth

resources can only been extended through recycling, conservation, and substitution measures. Sustainable development and a steady-state economy could enable humans to make the transformation from a culture of consumption to a culture of maintenance. Sustainable Development has to be progressed with supranational systems approach. It's like a human's destiny. As we discussed, the Sustainable Development has to be accomplished. It's our one of assignment. I introduced the world Sustainable Development system interconnected every countries sustainable development systems. The prospects for global sustainable development today are similar to a complex system. Also, it's related with each component. We need a long-term vision of sustainable development with the global development community. (*Hyuk Kihl Kwon, 2006*) With the Millennium Declaration and the Millennium Development Goals issued by the United Nations in 2000, the world community has committed to a set of clear and measurable targets for sustainable development. At the United Nations Conference on Financing for Development in Monterrey in 2002, world leaders established a new compact for sustainable development. The World Summit on Sustainable Development (WSSD) in Johannesburg in September 2002 renewed the global community's efforts in many areas of sustainable development, including water and sanitation, agriculture and food supply, and sustainable production and consumption. All these international agreements establish a common foundation of values and reflect an unprecedented consensus on the goals, conditions, and resources needed to achieve sustainable development.

Miller thinks that basic research on general living systems theory is possible at all levels. (*James Grier Miller, Living System, 1978, Preface. P.13*)

Also, I think the model of supranational systems is possible to explain the sustainable development through the every country's co-operation. Of course, I think it's not easy to achieve the worldwide Sustainable Development. But, it's like the destiny for us human. We need more enforced program through the world. And, all of countries have to participate to achieve the Sustainable Development. The dimensions of sustainable development encompass the full range of economic, social, environmental, and governance activities, and they are interdependent and mutually reinforcing. They reflect the Millennium Development Goals commitments. In a word, the Sustainable Development is a complex and long-term process.

4. ACHIEVING GREEN GROWTH

4-1. The basic principles of the Green Growth

By the research of the ESCAP, the basic principles of the Green Growth are three. That's the quality of economic growth, the eco-efficiency of economic growth and environmental sustainability vis-a-vis environmental performance. (*Greening growth in Asia and Pacific, United Nations ESCAP. 2008*) At the starting point, the basic three principles are very important. Through its focus on the greening of economic growth, the work of ESCAP recognizes that different patterns of economic growth

A Complex Adaptive Systems Approach for the Green Growth

lead to different outcomes for ecological integrity and therefore also for human well-being. Quality of economy growth, in the context of sustainable development, may mean different things in various countries and regions. Developing policies to promote and measure the eco-efficiency of economic growth is therefore a key way to meet the most important challenge to sustainable development in this region reducing the pressure on the natural resource base while continuing to meet human needs. Eco-efficiency, minimizing environmental pressure while maximizing economic benefit, is a key sustainability principle. In the ESCAP report entitled “State of the Environment in Asia and the Pacific 2005: Economic Growth and Sustainability”, as well as in Ministerial Conference on Environment and Development outcomes, there has been an emphasis on the difference between policies and institutions that work to improve environmental performance, and those that contribute in a meaningful way to improving environmental sustainability. A focus only on improving environmental performance (that is, the end result, and mainly pollution control) results in end-of-pipe solutions. At the same time, there is a need to take action to address the environmental sustainability of the economy where the biggest eco-efficiency gains can be achieved. The green growth approach provides the tools for this.

ESCAP established in 1947 with its headquarters in Bangkok, Thailand. They seeks to overcome some of the region's greatest challenges. It carries out work in the following areas: * Macroeconomic Policy and Development, * Statistics, * Subregional activities for development, * Trade and Investment, * Transport, * Environment and sustainable development, * Information and Communications Technology and Disaster Risk Reduction, * Social Development. They focus on issues that are most effectively addressed through regional cooperation. Also, all or a group of countries in the region face the issues, for which it is necessary to learn from each other. That issues benefit from regional or multi-country involvement. Issues that are trans-boundary in nature, or that would benefit from collaborative inter-country approaches.

4-2. The Pillars of Green Growth

ESCAP is the regional development arm of the United Nations and serves as the main economic and social development center for the United Nations in Asia and the Pacific. They follow up to the World Summit on Sustainable Development: Taking action on the Regional Implementation Plan for Sustainable Development in Asia and the Pacific, 2006-2010. Also, they made a big program for achieving the Green Growth.

Following contents are the main pillars of *Green Growth*.

4-2-1. Eco-tax reform

ETR(Eco-tax reform), also known as green tax and budget reform, is a powerful policy tool for building more effective, efficient, socially beneficial and

A Complex Adaptive Systems Approach for the Green Growth

environmentally sustainable fiscal systems and economies. Its key principles are the internalization of environmental costs in the market and revenue neutrality, that is, green taxes should not pose an additional burden. ETR uses fiscal policy measures to steer economic burdens away from economically beneficial activities (such as energy) towards environmentally harmful activities (such as the generation of pollution). With this approach, decision-making at every level, by the individual in society up to the highest national Government forum, is steered towards minimizing the environmental impacts of growth.

ETR must be seen as far more than a convenient way of raising additional revenue for the Government under the guise of the “polluter pays” principle. Also, instead of reducing fuel consumption, the fuel tax revenues therefore can be said to encourage fuel consumption. (*Greening growth in Asia and Pacific, United Nations ESCAP. 2008*)

This is one example of the need for coherent support across Government fiscal systems. Such taxes can be used in economically beneficial but environmentally harmful ways, consequently turning an environmental tax into an anti-environmental tax. Several countries, including China, Japan, the Republic of Korea and Thailand, have made tentative steps, but still have a long way to go.

4-2-2. Sustainable Infrastructure

Green building design can reduce energy and water use by human settlements by more than 30% over the lifetime of the structure; this does not take into account the potential savings from applying eco-efficiency concepts to all types of infrastructure development. The resulting savings in building operation and infrastructure development costs can help a nation’s products and services become more cost-competitive in the global marketplace. (*Greening growth in Asia and Pacific, United Nations ESCAP. 2008*)

There are tremendous opportunities to improve the performance of built environments in developing countries that are in the process of improving, renewing and extending their infrastructure. According the source of ESCAP Expert Group Meeting, Sustainable infrastructure should;

- minimize resource use and ecological impacts throughout the life cycle
- preserve ecosystem integrity
- not aggravate adverse global phenomena as climate change and ozone depletion
- deliver economically viable goods and services
- maximize long-run economic growth for the benefit of all
-

(Report of the ESCAP Expert Group Meeting, Sustainable Infrastructure Development in Asia and Pacific, 11-13 June 2007, Bangkok, Thailand)

Sustainable infrastructure will ameliorate eco-system and will make clear our future. Therefore, Government leader go ahead with a plan for their future.

A Complex Adaptive Systems Approach for the Green Growth

4-2-3. The greening of business

High-speed economic development is continuing in the Asian and Pacific region. But, the visible signs that the natural capital, underpinning wealth creation is rapidly diminishing. The global economy has run an ecological deficit for at least the last two decades, and “red ink” is now flowing freely in the form of reduced wealth creation potential per capita. On the other hand, the social network (that is social capital) that facilitate sustainable business health are rapidly growing and are continually enhanced by public and private institutions such as the Grameen Bank, NGO partnership and sustainability-oriented public programs. These provide the Asian and Pacific region with substantial opportunities to synergize poverty reduction and environmental protection efforts. There has never been a better time for public policy managers to bring the magic of sustainable business prosperity to their stakeholders. (*Greening growth in Asia and Pacific, United Nations ESCAP. 2008*)

Government in the Asian and Pacific region will benefit from a whole-system approach to business development policies that examines all the policies, rules and incentives that influence business behavior those that detract from sustainable management, can be changed so that the entire Government approach reinforces sustainable enterprise management.

Sustainability strategies that flow “Green Growth” principles are a recipe for healthy business today and they will maximize the potential for future healthy to serve future generations from adequate national stocks of natural and social capital.

4-2-4. Sustainable Consumption

Sustainable consumption is often viewed as a Western or Northern concept. In reality, sustainable consumption is embedded in Asian and Pacific cultural values and traditions, which are still in evidence today despite rapidly changing economies and societies. In these days, urban areas are responsible for 75% of the all GHG emissions in the world. Almost 50 % of the world’s urban population (about 1.5 billion people) lives in Asian cities, of which 11 are mega-cities. Projections forecast that the urban population will grow by another 1.5 billion people by 2030, with a 165% increase in domestic energy demand. Passenger vehicle ownership per capita in urban areas is higher than the national vehicle ownership per capita in most countries in the region. There is a progressive increase in GHG(Mainly CO₂) from urban areas. Today, people in the Asian and Pacific region are looking for ways to revive and reinstate traditional cultural values that promote the sustainable, eco-efficient use of natural resources, and so build business competitiveness. Sustainable consumption is supported when traditional values, such as doing more with less, are embraced, and supported by public policy. Holistic approach to enhancing the sustainability of consumption is whole system keys. (*Greening growth in Asia and Pacific, United Nations ESCAP. 2008*) In a word, sustainable consumption strategies now have greater momentum and potential for success than ever.

A Complex Adaptive Systems Approach for the Green Growth

4-2-5. Monitoring Eco-efficiency indicators

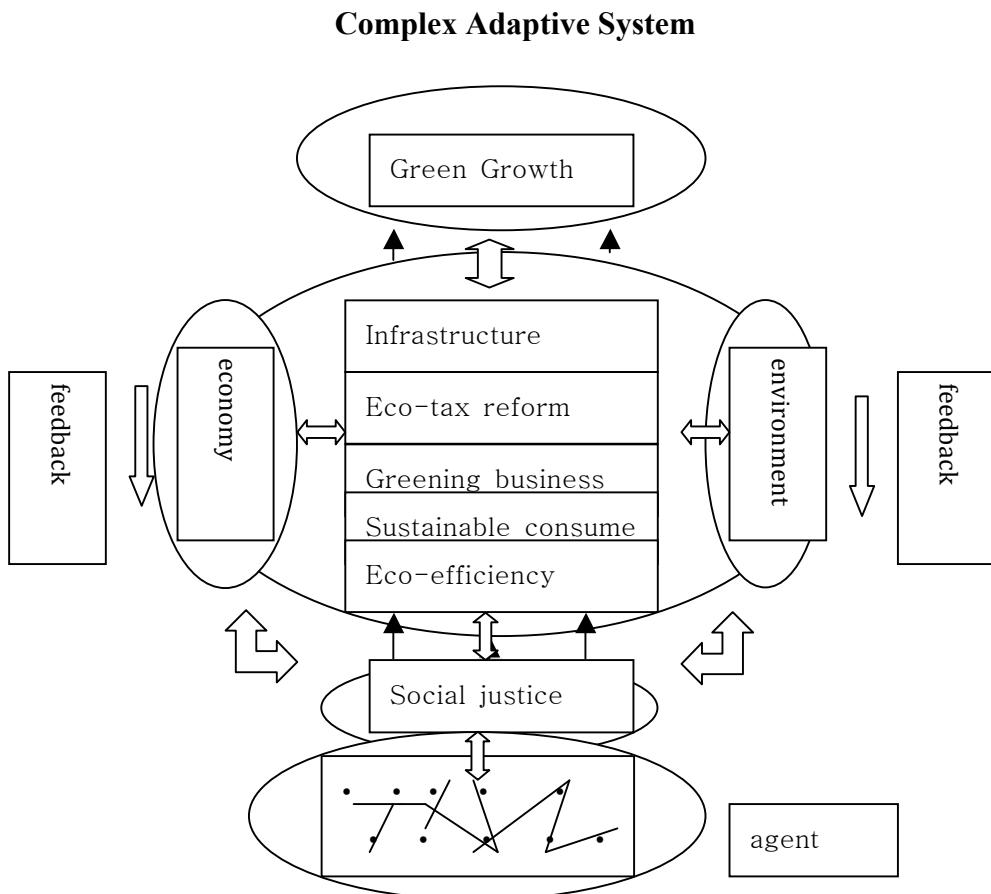
Environmental sustainability is a powerful indicator to measure the impact of a country's economic development with regard to the pressure on resources deriving from consumption and production processes. Environmental performance relates to action by governments and other actors, including implementation of processes that support environmentally sustainable economic growth. Essentially, environmental performance is a measure of the gap between the actual state of what is being measured and targeted policy goals. Regulation is necessary to ensure some improvement in eco-efficiency, essentially with regard to pollution-prevention and control, namely, through extended producer responsibility, recycling targets landfill and other waste directives, and voluntary agreements. (*GREEN Growth at a Glance, The Way Forward for Asia and Pacific, 2006*) Also, other indicators will use for checking the environmental sustainability. For example, extended producer responsibility laws, selected industries packaging so on. Korea tried to reduce the volume of waste. Also, environmental ethics education is reinforced. From the old to the child, they think the preserving the environment is the duty for everyone. I think so many countries try to preserve the natural capital for their future. But, using the eco-efficiency indicators will be a good guide for their future.

4-3. Complex Adaptive System as an analysis tool

I'd like to explain *Green Growth* by Complex Adaptive System. CAS is more explanatory theory. *Green Growth* is more emergent pattern through the Complex System. CAS shares the subject of general properties of complex systems across traditional disciplinary boundaries. However, CAS is distinguished by the extensive use of computer simulations as a research tool, and an emphasis on systems, such as markets or ecologies, which are less integrated or "organized" than the ones studied by the older tradition.

In general, Achieving Sustainable Development needs three pillars. It's the economy, the environment and the social justice. Therefore, I draw them at the center for the picture. Also, Achieving *Green Growth* needs five pillars for its purpose. They will affect each other. Of course, the various agents will affect each other. All of them will make emergent pattern, *Green Growth*.

A Complex Adaptive Systems Approach for the Green Growth



5. CONCLUSION

I'd like to suggest some ideas to achieve the *Green Growth*.

- Without the recognition about the Sustainable Development, Achieving *Green Growth* and Asia-Pacific region's future is not clear.
- At the regional level, countries must work together to establish and develop a regional and sub regional policy consultation forum to create a conducive environment for stimulating the integration of economic, social and environmental considerations into overall development plans in support of achieving the Millennium Development Goals on sustainable development, environmental sustainability, poverty reduction and gender equality and implementing the Johannesburg Plan of Implementation.
- Developed countries have to aid for developing countries with a long-term process.
- Actually, worldwide Agencies, WSSD, UNICEF, UNDP etc, needs more cooperation. Their cooperation will make better effect for regional environmentally economic growth.

A Complex Adaptive Systems Approach for the Green Growth

- Create a regional knowledge hub to exchange information and examples of best practices for application and putting into practice is the concept and system change towards environmentally sustainable economic growth.
- We should use the resources efficiently. It will encourage and support development and application of systems for proper resource allocation.
- Environmental ethics education is more reinforced.
- We endeavor to reduce, reuse, recycle and recover the products of our society. I think our efforts will be maintained with a long-term program. Develop and implement regional, sub-regional and national models of policy and system change would be maintained for *Green Growth* as the Seoul Initiative Network on *Green Growth* (SINGG).
- We need to support the long-term perspective of resource allocation for the environment.
- At the international level, there is a need to develop and promote an international system to support Green Growth. Also, we need to have endless environmental ethics education for our future.

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