



# Rethinking Systems Thinking—From a Perspective of Chinese Philosophy and Sustainable Development

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## 1. The relationship between systems thinking and Chinese philosophy

As we know, the approach of systems thinking is fundamentally different from that of traditional forms of analysis. Traditional analysis focuses on separating the individual pieces of what is being studied. To the contrary, systems thinking focuses on how the thing being studied interacts with other constituents of the system.

Although the approach of systems thinking is believed to have its foundation in the field of system dynamics, founded in 1956 by MIT professor Jay Forrester, but some Chinese researchers believed the original sources of systems thinking are lying in ancient Chinese philosophy (Liu, 1992).

Chinese philosophy is in its nature different from the philosophy in the western world. It is mainly based on experience sciences, not on the experimental sciences. However, Chinese traditional thoughts are in their nature something like systems thinking. For example, the concept of entirety is the key element of systems approach, and the thinking mode of taking the objects as an entirety has a long history in China. About 2500 years ago, the author of “The book of changes” believed that the essential qualities of one object had some relations with the dynamic functions of the components, and the entirety characters of objects were showed up by the dynamic functions of objects. It was also the universal principle that every thing had some special relations with others and every thing had some special structure (Luo et al. 1995). Another Chinese traditional thought of systems thinking is the indirect observation. The ancient Chinese inferred the changing tendency of astronomy, meteorological state, agricultural and human beings affairs by means of indirect observation. The principle of indirect observation is as following: the attribute of object A had some marks in object B because of the interaction between A and B, so the marks became the information of A, by studying the B, we can know the characters of A. Besides, there are other Chinese traditional thoughts which had the nature of systems thinking.

Another example is the thought of Confucian. Confucianism sought for the method to composite the entire society including different grades into a harmonious entirety applying the traditional concept of system from the social practice of ancient China. From the Dynasty of Xi-Han (206 B.C.), Confucianism was the thought system on that the ruling class of feudal age mainly relied. We must recognize that the life of Chinese feudal age was very long, and China was the most developed, open-minded and vigorous feudal society in the world, and in the feudal age Chinese science and technology were leading the world. All of the achievements were because of the theory of social management of Confucian.

According to Confucianism, the social management is in its nature the management of man. So the base of the theory of Confucian is the study of man. The most remarkable characteristic of Confucian’s study of man is that it regards the society as a whole although it is constituted of individuals. According to Confucianism, man is the real foundation of the society, and it emphasizes that we can understand the characteristics of man from the social relationship of man. Since it is one of the Chinese traditional thoughts that emphasizing the relationship and structure of the object, Confucianism studied man and society from a perspective of relationship and structure. It thinks the society is a system with a structure of several levels; the first level is the world, the second level is the country, the third level is the family and the fourth level is the man.

But why are the origins of the systems thinking lying in Chinese philosophy? Maybe we can find some answers by searching the traditional concept of the Chinese. One of the fundamental concepts of Chinese traditional culture is the concept of dynamic circularity. The concept of dynamic circularity believed that universe and every thing are moving circularly, they go round and round from the emergency to the development and to the die out.

Firstly, there are many influences of the concept of dynamic circularity in China. Ancient Chinese scientists gave careful observation and exploration to many phenomenon which changed periodically, such as the movement of Sun, Moon, and Stars, the alternation of seasons, the changes of meteorology, the birth, growth, strength and death of all living species, the dynamic circularity of the water in the natural world, and so on.

Secondly, the concept of dynamic circularity formed the thought of entirety and the synthetic method in ancient China. Some ancient Chinese thinkers believed that since every thing moved circularly, there are outer limits to the movements of everything, so every thing in the world is an entirety with the obvious boundary to other things. To know the objects comprehensively and thoroughly, we should composite every section of the object to an overall circulated entirety, and only with the understanding of the overall circulated entirety, we can reveal the essential qualities of the object. So, the concept of dynamic circularity itself contains the thought of entirety, and it determined that the method of entirety and synthesis is in the first place among other methods of traditional Chinese thoughts.

Thirdly, the dynamic circularity circle itself is a special structure, and the stable relationship forms structures in broad sense. So there are relatively stable structures among the sections in every dynamic circularity circle, otherwise the dynamic circularity circle itself can't be established. Because of the concept of dynamic circularity, the ancient Chinese regarded every thing from the viewpoint of development and special structure.

Fourthly, from the concept of dynamic circularity, the ancient Chinese thinkers took the lead in raising the theory of information feedback and adjustment in a plain and simple way in the world. Since the object doing circulated movement will come back to the original start point, the cause of the movement of the object will coincide with the result by careful investigation step by step. In the process of circulated movement, the cause will become the result and the result will become the cause, and such a logical relationship brings about the feedback adjustment. From the theory of system science, we know that the foundation of the feedback is causal loop and structure of the system. Without the circulated movement, there will no any feedback and adjustment. So the concept of dynamic circularity promoted the ancient Chinese to realize the feedback adjustment inside the system. The ancient Chinese theory of feedback and adjustment mainly applied in social management and traditional medical science.

Fifthly, one of the forms of the dynamic balance is the circulated circle, so from the concept of dynamic circularity the ancient Chinese looked upon every thing from a perspective of dynamics, and focused on the balance of every process. In Chinese theory of contradiction, the thought of harmony and balance was in the leading position all the time.

Sixthly, because the movement of everything is a process of dynamical balance and has the ability of adjustment by itself, it is easy for people to find the similarity other than the difference between objects. The method of analogy and the simple model method were applied widespread in ancient China, and the concept of seeking common points while reserving difference was one of the Chinese traditional thoughts.

Seventhly, because of the concept of entirety, the ancient Chinese philosophers paid attention to the difference of internal causes and external causes relatively early. There are many parts inside the entire object which has a circulated structure, such as A, B, C, ... Maybe A is the cause of B, B is the cause of C, C is the cause of A, so there is a causal loop composed of A, B and C. There are several causal loops inside the object. So it was easy for people to find the causes of object's changes inside the object and find that the most important factor was the internal causes.

Eighthly, from all of the discussions above we can safely draw the conclusion that the ancient Chinese

philosophers regarded every thing as a system with the ability of self-adjustment and had the independent characters, so the concept of dynamic circularity caused the concept of system, and the concept of dynamic circularity itself contained the possibility of developing into the concept of system.

## 2. The relationship between sustainable development and Chinese philosophy

If we study Chinese philosophy more deeply, we would find there are some relations between the concept of sustainable development and Chinese philosophy.

Since the Industrial Revolution and the advent of mechanization, the countryside has become more akin to the factory environment and less a place of beauty and a diverse natural environment. But in more recent times in opposition to this trend there is a movement toward integrating more sustainable and environmentally sound principles in the way we use the natural resources.

Over the past decade or so, the concept of sustainability has become a special word, widely accepted as the way to live in harmony with the natural environment. Sustainability of modern sense is generally associated with the definition of sustainable development given by the Brundtland Commission's "Our Common Future" (WECD, 1987). But some valuable ideas do exist in the background of Chinese philosophy or general culture that can be related to sustainability. Those ideas as conformation to natural laws, thrifty use of natural resources, generation concern, understanding about the function of human beings in relation to nature, are really favorable for the content of sustainability. We can say the origins of sustainable development lying in Chinese philosophy.

The fundamental thought in Chinese philosophy that can be related to sustainable development is the concept of regarding human beings and nature as a whole (Xie, 2005). By the guides of this concept, ancient Chinese tried to make overall plans and took all factors into consideration, and they tried to keep harmony with the nature. What the objective ancient Chinese pursued happen to coincide with the trend of international environment protection. In fact, the essence of the issues ancient human beings faced up and the contemporary human beings facing up are same, namely, the issues of how to survive and how to survive better.

Sustainable development is in its nature an issue of the treatment of the relationship between human beings and the nature. But to a more strict sense, sustainable development is not equal to the relationship between human beings and the nature. The relationship between human beings and the nature is an important issue with some philosophical sense and has a long history from the beginning of the human beings' awareness.

In fact, the relationship between human beings and the nature involves in several directions. Firstly, it is a problem of philosophy, and human beings realized they are a part of the nature and they thought about the questions such as "what are we?" and "Where did we come from?" Secondly, it is a problem of science, and human beings thought they are opposed to the nature and human beings wanted to know and to rebuild the nature. Thirdly, it is a problem of environment protection or sustainable development. Human beings realized that they are not only opposed to the nature but also a part of the nature, and they try to do every thing in concert with the nature. Although the concept of sustainable development is popular in recent days, and human beings realized this urgent issue gradually by bitter lessons, the source of this kind of thoughts has a long history. We can find some sources in ancient Chinese philosophers' thoughts.

Taoism is one of the most ancient philosophies in China with a documented history dating back over five thousand years with many treatises on agriculture, social development, medicine, and art, and at its core is a recognition of the profound link between human beings and nature both on the individual and social and environmental levels (Wei et al. 1994). Although it may seem foreign to some people it is in actual fact as close as we can hope to get today to the kind of natural philosophy followed by our forefathers in pre-Roman times, and it has its roots in practical methods that are directly applicable to the

problems we face in the modern world. We are not separate things from the world around us but our destiny is bound up with the fate of the natural environment and how we interact with it. In our society today people can become bogged down living in an urban environment and they find it hard to find any meaning in life other than consumer economy and materialistic goals. Our foodstuffs have become processed and denatured, and materialism drives us to exploit natural resources rather than conserve them as part of the natural heritage of the planet. If we follow the principles of Taoism, we can solve this kind of problems. It advocated limited consumption and limited feast.

Confucianism is distinguished by its concern for the cultivation of men relations towards a harmonious society rather than one's relations with the supernatural or natural. Confucianism is a philosophy that also contains profound environmental ethics through its inclusiveness of Heaven, Earth and the Human beings order. These form the traditional Chinese trinity which configure the ultimate harmony. Here Heaven means the rule of the nature and Earth means the natural environment.

This unaccustomed extension of Confucianism to ecological considerations is timely in the present age. With the planet's widespread industrial development and the rapid growth of population, ecosystems are in urgent need of ethical consideration. 'Saving' the environment requires that we understand it, our place within it, and our responsibilities toward it. The environment's unprecedented exploitation, in the absence of practices of protection and renewal, now threatens future economic and social development. In other words, an impoverished natural environment impedes both the material standard of living and socio-cultural quality of life. To the Confucian mind, this problem originates in the misconstruing of relations between human beings and nature. The solution may therefore begin with people understanding how to conduct such relations.

Confucian thinkers characteristically regard nature itself as holistic, all things in nature depending on each other and forming an organic whole. They also consider human beings as part of nature, as an existence within it, and emphasize that human beings and nature are closely bound in a harmonious, not conflicting, primary relationship. The pre-Qin (i.e. pre-221 B.C.) Confucian thinkers developed these ideas into the theory of the unity of human beings and Heaven or nature. Though Confucius (Kong Zi) did not put forward the theory, it was embodied in his thought.

Confucius affirmed that (1) the example of Heaven—or nature—could be followed. The affirmation showed the unity of the human beings and nature. The theory of “oneness of Heaven and human beings” was developed by later Confucians. In the Doctrine of the Mean (Zhongyong), (2) it is said that “All things exist together, and they do not do harm to each other; all ways exist together, and they do not come into conflict.” (3) Mencius (circa 385–312 B.C.) also expressed this idea of unity and its manifestations that “In all places by which the sage passes, misguided people are helped to change; in places where the sage stays, a mysterious role is played by him; the sage lives on up with Heaven, down with the earth.” (4) Lu Jia (died 170 B.C.) expressed the linkage thus: “Tradition has it that Heaven gives birth to the myriad things to be nurtured by Earth and brought to completion by sages.” (5) These expositions take the change and development of human beings and nature as a related, harmonious and balanced movement. Heaven, Earth and human beings are not considered in isolation. On the contrary, the three are placed within a larger system and are taken as a whole (Wei et al. 1994).

### 3. The relationship between systems thinking and sustainable development

Another interesting phenomenon is the essential relationship between systems thinking and sustainable development. As we know, there are obvious linkages between the emergence of sustainable development of modern sense in the world and the method of systems thinking (Meadows et al. 1972), and many researchers believed that the nature of sustainability is to develop systematically (Cabezas et al. 2005). The approach of systems thinking is believed to be an effective method to develop an empirical

study of sustainability (Xu et al. 2004).

The release of the “The Limits to Growth” report had caused great shock among the economists and the politicians, and it also caused a radical debate worldwide. Although there are different comments on the conclusions of “The Limits to Growth”, Tietenberg called it the basic pessimist model (Tietenberg, 1992). Many researchers mentioned the report of “The Limits to Growth” when they thought about the origins of sustainable development (Lumley et al. 2004 and Xiao, 1997). Because of the suddenly awareness of the physical limits of the planet Earth, we can say our society begun to think about the possibilities of sustainable development. As a matter of fact, Sarah Lumley believed that while the term “sustainable development” was popularized by the WCED report “Our Common Future” in 1987, it is generally recognized that notions of sustainability were promoted in “The Limits to Growth” and “Green” discourses in the early 1970s (Lumley et al. 2004).

Over the past decade or so, the concept of sustainability has become a special word, widely accepted as the way to live in harmony with the environment. Nowadays, sustainability of modern sense is generally associated with the definition of sustainable development given by the Brundtland Commission’s “Our Common Future”, namely, development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WECD, 1987). In fact, many researchers think this definition is not scientifically and practically enough. The Brundtland Report may be considered to be a political document, not based on rigorous scientific analysis (Glasby, 2002).

From the year 1987, many researchers defined the concept of sustainable development from the viewpoint of nearly all kinds of disciplines. In terms of economic development, the typical definitions are as following. Maximize the net benefit of economic development with guarantee of the quality and the provided services of natural resources (Barbie, 1987). When development ensured the increased well-being of contemporary generation, it should not decrease the well-beings of later generations (Pearce et al. 1993). Sustainable development is the economic development without lowering of environment quality and destroying of natural resources in the world (WRI, 1993).

Although the definitions above were accepted worldwide and regarded as the typical definitions, many researchers think they are not explicit enough. In fact, human beings’ activities couldn’t be harmless to the eco-environment, and economic development couldn’t be costless, the definitions of sustainable development caused too high expectations and it is hardly to operate in practice (Ren, 2003). Glasby believed that the concept of sustainable development as presently defined is a chimera, quite divorced from the reality of our occupation of this planet (Glasby 2002).

In my viewpoint the definitions above only emphasized the should-be of sustainable development with limited normal sense. They didn’t reveal the sustainable development with empirical sense. Namely, the definitions above are with the stress on the result of sustainable development. They didn’t deal with the implementation method of sustainable development. Because the nature of sustainability is that human beings’ development must coordinate with the natural environment, the implementation method of sustainability is to establish a media restrain mechanism between the human beings and natural environment, so the harmoniousness of human beings and nature will be ensured. The definitions above didn’t reveal the key restrain mechanism. Because of the deficiencies of sustainable development theories, it becomes a series of theories lack of practical sense. It is hardly to convert the theory into practice.

At the same time, many researchers from worldwide believed the nature of sustainability is to develop systematically. The representative views are as following. Our society has been undergoing a transition process from a mechanical to a systemic or ecological paradigm. Within the environmental context, this transition represents an issue of survival for human beings and for the biosphere itself. Which is being constantly assaulted by human beings’ productive activities and as a result of this has been suffering great physical changes (Seiffert et. al 2005).

The concept of sustainability applies to integrated systems comprising human beings and the rest of nature. The structures and operation of the human beings component (in terms of society, economy, law,

etc.) must be such that these reinforce or promote the persistence of the structures and operation of the natural component (in terms of ecosystem trophic linkages, biodiversity, biogeochemical cycles, etc.), and vice versa. Thus, one of the challenges of sustainability research lies in linking measures of ecosystem functioning to the structure and operation of the associated social system (Cabezas et al. 2005).

The pattern of sustainability means the implementing way of sustainable development, the theory of the pattern of sustainable development needs discussions from the systematical and dynamical characters of the development of our society. Systematical character requires us to regard the factors of population, resources, environment, economy as an entire system, to study the structure and the interactive function among each part, namely, to study the pattern of the harmonized development of the whole system consistent of each part. Dynamical character requires us to consider the equality among generations and equality within one generation, so sustainable development not only deal with the current generation or the coordinate development of population, resources, environment and economy of one nation, it also deal with the later generation and the conflicts and contradictions of population, resources, environment and economy among nations or regions (Yao et al., 1998).

From the viewpoint of system science and system engineering, the sustainable development system is an open system with the characteristics of complexity, uncertainty and non-linear. So the intensive growth, which concert with synthesis and optimization, is the prerequisite of sustainable development. (Fan et al., 1997).

The word “Intensification” has its own form in Chinese, “Ji-Yue” is a special word in Chinese language, “Ji” means concentrate or integration, “Yue” means conserve or giving up superfluous. So “Ji-Yue” means to concentrate all kinds of resources to compose a system, because one of the most important characteristics of system is that the subsystems are interacted each other, and the other is that the total effects are better than the plus effects of individual one, so the composed system have some qualitative change, some new characters and functions emerged. At the same time, conserving the resources, getting rid of the unnecessary use of resources, conserving the expensive and deficient resources, and saving unnecessary operations must be made. In China, development is the “core” principle (it means the first of all principle). The development speed depends on the base of best benefit. The fundamental way to pursuit best benefit is to enhance the efficiency. So, the intensification is the advanced type of the systematization (Wang Huanchen, 1996 & 1997).

The core of the theory of system dynamics is materialist dialectics. It emphasizes the viewpoint of system, relationship, dynamics and development. It emphasizes the main contradictory and the main direction of the contradictory. It emphasizes the objective objects and the viewpoint that the world can be known. It emphasizes the practice is the standard to test the truth. (Wang Qifan, 1999a)

From all of the discussions above we can safely draw the conclusion that the nature and the pattern of sustainability are to develop systematically. At first we should take the whole human beings and nature as an integrated system. One of the most important characteristics of system is that the subsystems are interacted each other, and the other is that the total effects are better than the plus effects of individual one.

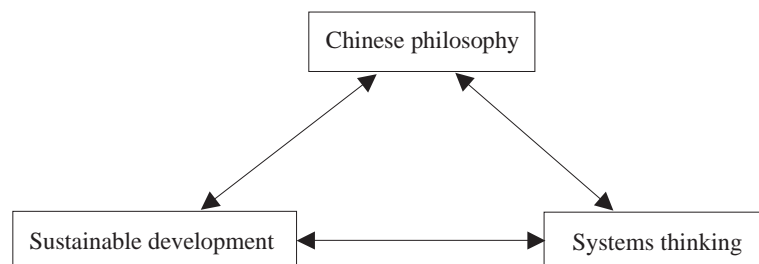


Figure 1. The triangular relationship among Chinese philosophy, sustainable development and systems thinking

So the second thing in implementing the sustainable development is to coordinate well with each subsystem in the course of pursuing human well-beings. In terms of economic development the most important things are the quality and the efficiency of the development especially in China. So to develop intensively is the prerequisite of the sustainable development and the intensification is the advanced type of the systematization.

#### 4. Conclusions

So there remains a triangular relationship among Chinese philosophy, sustainable development and systems thinking. The exploration of this relationship will benefit human beings' efforts of sustainable development following systemic principles. Nowadays, the western civilization has already exposed many bad effects. The environmental problems are among the catastrophe caused by industrialization. We can say human beings should follow the way of ancient Chinese wisdom, such as conforming to the natural laws, the principle of reconcile, balance, and golden mean of Confucian school.

From the viewpoint of knowledge development history, the phase of synthesis in ancient times was a time of orient, and the phase of analysis in modern times was a time of western. So the phase of entirety, namely systems thinking, in 21 century will be a time of the combination of orient culture and western culture.

Western culture has greatly influenced the development of human beings society in the past several centuries. Look what we have done today. The selfish exploitation of nature has caused an enormous waste of natural resources, the depletion of the ozone layer, toxic ocean water, environmental pollution and an imbalanced ecosystem. All these dreadful phenomena have greatly endangered the living condition of human beings. Western philosophy, which believes that "heaven and human beings are separable," cannot be excused for these problems with nature.

Different from Western philosophies, the Chinese philosophy emphasizes the "oneness of heaven and human beings"—human beings' activity must be analyzed in the research of "heaven (the rule of nature)" and vice versa. The "oneness of heaven and human beings," cornerstone of Confucianism, was first illustrated in "The Book of Change", an ancient Chinese divination manual and book of wisdom. This model of thinking reflects the inner link between human beings and nature and will be helpful in addressing the relationship between them.

In the 21st century, we have seen the development of science, technology and economy brought about by Western rationalism as well as democracy and rule of law. Indeed, it has promoted the prosperity and strength of the Western world. However, on the other hand, we have also witnessed two worldwide conflicts inflicted by Western powers. Even today, we are still threatened by terrorism, international conflict and a possible technological war. If Western rationalism can embody the Confucius humanitarian spirit such as "do not do to others what you would not want yourself" and "stay in harmony with each other while tolerating differences," then genuine peace and prosperity will be within our reach in the foreseeable future.

At present, we should not only reinstall and spread Confucius' wisdom and his philosophy, but also cultivate a new rationalism embodying his theories—fully integrating human beings virtues and human beings knowledge. The whole world should learn to recognize the interrelationship between life and the value of life, the reciprocity of development, the diversity of the world and the openness of study so as to advance global ethics.

## References

- Barbier, Edward B. (1987): “The Concept of Sustainable Economic Development”, *Environmental Conservation*, 14 (2), 101–10.
- Cabezas, Heriberto, Christopher W. Pawlowski, Audrey L. Mayer and N. Theresa Hoagland (2005), “Sustainable Systems Theory: Ecological and Other Aspects”, *Journal of Cleaner Production*, Volume 13, Issue 5, p. 455–467 (Stockholm, Sweden).
- Fan Chongjun and Wang Huanchen (1997): “The System Nature of Sustainable Economic Development”, *Shanghai Synthetic Economics*, No. 9, p. 12–13.
- Glasby, G. P. (2002): “Sustainable Development: The Need for a New Paradigm”, *Environment, Development and Sustainability*, 4: 333–345.
- Liu Changlin (1992): *Chinese Wisdom and Systems Thinking*, Taiwan Business Publishing Company, (Taipei, China).
- Lumley, Sarah and Patrick Armstrong (2004): “Some of the Nineteenth Century Origins of the Sustainability Concept”, *Environment, Development and Sustainability*, 6 (3): 367–378.
- Luo Guihuan (1995): *The History Materials of Chinese Environment Protection*, China Environmental Science Press, (Beijing, China).
- Luo Guihuan, Wang Yaoxian, Yang Chaofei, and Tang Xiren, (1995): *Historical Materials of Chinese Environment Protection*, China Environment Science Publishing House, (Beijing, China) (in Chinese).
- Meadows, Donella H., Dennis L. Meadows, Jorgen Randers, and William W. Behrens III. (1972): *The Limits to Growth*, Universe Books, (New York, U.S.A.).
- Pearce, David W. and Warford, J. J. (1993): *World Without End*, Oxford University Press, (New York, U.S.A.).
- Ren Baoping (2003): “Analyzing the Cost of Economic Development: Theoretical Basis of Sustainable Development Economics”, *China Population, Resources and Environment*, Vol. 13, No. 2, p. 1–5 (in Chinese).
- Seiffert, Mari Elizabete B. and Carlos Loch (2005): “Systemic Thinking in Environmental Management: Support for Sustainable Development”, *Journal of Cleaner Production*, Volume 13, Issue 12, p. 1197–1202.
- Tietenberg, Tom (1992): *Environmental and Natural Resource Economics* (3rd ed.), Harper Collins Publishers, (New York, U.S.A.).
- Wang Huanchen (1996): “Intensive Growth and Sustainable Development”, *System Engineering-theory Methodology Applications*, Vol. 5, No. 4, p. 15–18 (in Chinese).
- Wang Huanchen (1997): “MEI-system Economics and Sustainable Development”, *System Engineering-theory Methodology Applications*, Vol. 6, No. 1, p. 4–9 (in Chinese).
- Wang Qifan (1999): “Comprehensive and Dynamic Analysis and Model Set of Large Complex System”, *Journal of Management Sciences in China*, Vol. 2, No. 2, p. 15–19 (in Chinese).
- Wei Zhongying and Qin Zhiyong (1994): *Philosophy and Reality*, Renmin University of China Press, (Beijing, China).
- World Commission on Environment and Development (WCED) (1987): *Our Common Future*, Oxford University Press, (Oxford, U.K.).
- World Resources Institute (WRI) (1993): *Biodiversity Prospecting*, World Resources Institute, (Washington D.C.).
- Xiao Guangling (1997): “Sustainable Development and System Dynamics”, *Natural Dialectics Studies*, Vol. 13, No. 4, p. 37–41 (in Chinese).
- Xie Shufang (2005): “The Golden Mean of Confusion and the Philosophy of Environment Ethics”, *Journal of Social Science*, Vol. 13, No. 1, p. 31–35, (Xiamen, China).
- Xu Qingrui and Xu Decai (2004): “Sustainable Development System Dynamics Simulation and Policy Suggestion of Hangzhou City”, *Techno-economics and Management Research*, No. 3, p. 83–88, (Shanghai, China).
- Yao Yufang and He Juhuang (1998): *China's Economic Growth and Sustainable Development*, Social Science Literature Publishing House, (Beijing, China) (in Chinese).