

RESEARCH AND THEORIES IN SUSTAINABLE DEVELOPMENT IN CHINA

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Summary

Sustainable development is a new term but its thoughts have a very long history. Because of its plentiful connotation, it is difficult to define precisely the “what”, “when” and “how”. In other words, there are many uncertainties in such questions as “What is sustainable?” “When is development sustainable?” and “How to realize the sustainable development?”. It is true that sustainable development is the only way to promote

economic growth, rational utilization of resources and environmental protection. For this reason, almost every country's government has made arduous efforts to promote the concept and have made remarkable achievements since the early 1990s. But this is only the first step of the "long march". There is far more work to be done, both conceptually and in implementation of sustainable development. It is expected that there will be breakthroughs in sustainable development research. The first target is to establish an independent discipline of sustainable development. The second is to perfect the methodological system of sustainable development. Third is to search for rational and effective approaches towards sustainable goals. Therefore, much cooperation is necessary, not only the combination of different disciplines but different sectors, different regions, and different countries as well. Only by these means can thoughts of sustainable development be fully understood, strategies of sustainable development be implemented, and the goal of sustainable development be realized.

1. Introduction

In recent years, food security, employment, income generation, resource conservation and environmental protection have emerged as major world concerns. Since the United Nations Conference on the Human Environment, held at Stockholm in 1972, many efforts and grand plans have been made in order to solve these problems. These include the World Conservation Strategy, prepared by IUCN, WWF and UNEP in 1980, and the report entitled *Our Common Future* in 1987. The United Nations Environment Programme tabled its Environmental Perspective to the year of 2000 and beyond, particularly the Agenda 21, which was approved by the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The concept and principles of sustainable development have been formulated and widely accepted by decision-makers and peoples all over the world.

Thereafter, different countries have been seeking sustainable paths that will permit them to simultaneously address both socioeconomic and environmental concerns. Lots of research projects have been conducted and a great deal of theoretical and methodological achievements have been obtained. They cover almost aspects of sustainable development, e.g. the definition, connotation, conceptual framework, assessment method, indicator systems for assessing sustainability, implementation, approaches, etc.

2. Theoretical Research

2.1 Concept and Connotation

When development economics first emerged as an academic discipline after World War II, most economists believed that development would effectively duplicate the experience of those countries which had already industrialized during the nineteenth century, in particular, that development would follow the pattern of Britain, France, Germany, USA and Japan. In this period, economists stressed the importance of increased savings, and capital accumulated in economic growth.

In the 1960s, however, environmental degradation along with the rapid economic

growth alarmed many people. They became aware that unilateral pursuit to economic growth could bring humanity not only economic wealth, but also calamity that could ruin the Earth. So, economic development, as opposed to growth, was put forward. Many researchers made great efforts to find ways of growth with development, which is obviously different from economic growth without development.

What is the meaning of development? Based on the present-day interpretation and our new concerns, we can make a number of generalizations. Barbara summarized that it was closely linked to the historical dimension, structural change, modernization, distribution of income, political change, and ethical issues. In the 1980s, sustainability and sustainable development were put forward in many distinguished works such as *The World Conservation Strategy*, *Caring for the Earth—A Strategy for Sustainable Living*, *Our Common Future*, and *Agenda 21*, and were accepted by the international community.

Sustainable development is a popular topic at present, and there are various perceptions, interpretations, and definitions. Lélé gave a good review (Figure 1) of sustainable development. The many dimensions of the definition of sustainable development can be summarized as in Figure 1.

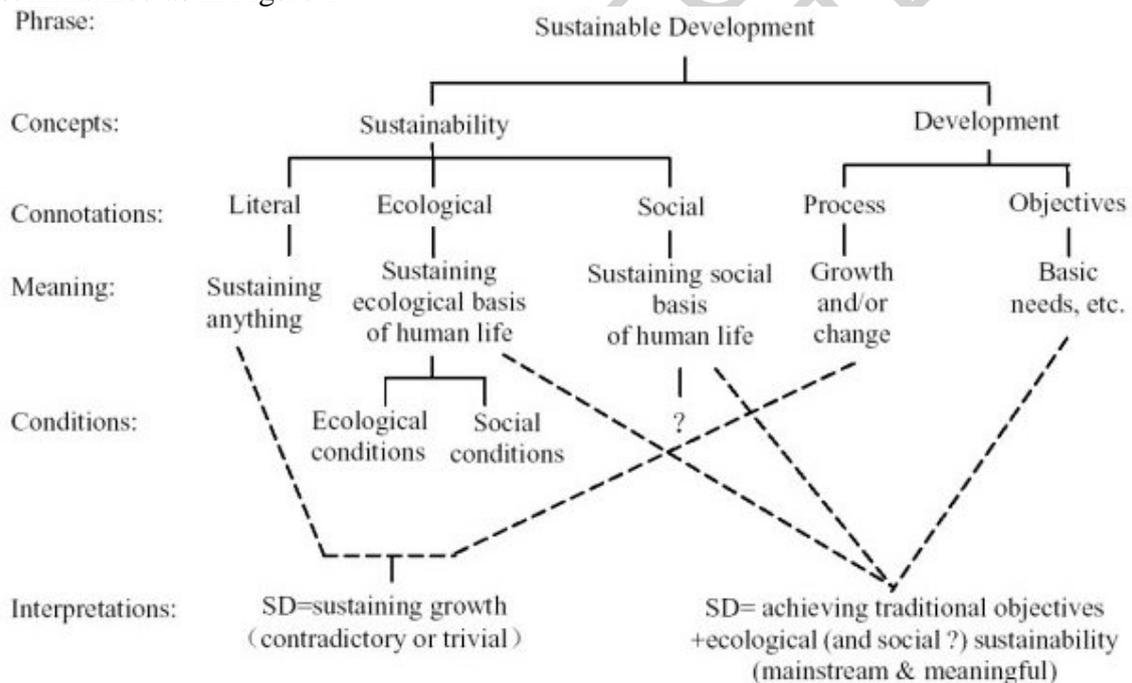


Figure 1. The semantics of sustainable development

2.1.1. Economic Dimension

Economists usually fail to pay enough attention to the issue of sustainability. Their definitions of development mainly focus on economic growth and human wealth. In *World without End*, Pearce and Warford (1993) defined sustainable development as “increasing the wealth of the present without decreasing that of the future”. Other economists expressed the same idea in their articles. These definitions paid more attention to economic wealth than natural and environmental capital. Recently, the

concept of capital has been expanded and now it encompasses natural capital, man-made capital, social capital and human capital. However, it is very difficult to measure the different forms of capital with the same financial indicators, because the substitutions between them have not been clearly determined.

There are two meaningful concepts that are closely linked to each other: Strong Sustainability and Weak Sustainability. The former denies the degree of substitution that Weak Sustainability assumes, at least for some critical elements of natural capital, and argues that sustainable development should protect the growth of each kind of asset, or maintain the amount of them. The latter is based on neo-classical economic theory and assumes that manufactured capital and natural capital are close substitutes. This means that costs of environmental deterioration (e.g. forest damage) can be compensated by benefits from manufactured capital (e.g. income). Thus, environmental damage is valued in monetary units.

2.1.2. Ecological Dimension

Ecological definitions focus on natural biological process and the continued productivity and functions of ecosystem. Ecologists argue that the ability of an ecosystem to provide humans with service and materials should be continued. Under the framework of ecologically sustainable development, human should keep ecosystem and ecological process stable and improve the structure and function of ecosystems. Strong ecological sustainability requires conservation of genetic resources and biodiversity. In many cases, however, we do not know how to achieve such goals. For example, some technological and engineering methods attempting to control and stabilize spruce budworm populations have actually led to a potentially vulnerable ecosystem. This indicates that for strong ecological sustainability, short-term variability is unsurprising and even necessary.

Meanwhile, there are another two useful concepts: Carrying Capacity and Ecological Footprint. The former was put forward in the 1970s. Its basic connotation is the maximal population size of a given species that an area can support without reducing its ability to support the same species in the future. The latter was put forward by Rees in the 1990s and it tries to calculate the amount of natural resources needed to maintain a certain living level. These two concepts are very useful in assessment of sustainability, but there are still many parameters which cannot yet be determined. In addition, there are some concepts that are similar to ecologically sustainable development such as ecological development and ecologically sound development (UNEP).

2.1.3. Environmental Dimension

Environmental definitions emphasize protection of environment. The objectives of sustainability include the environmental dimension. INTERCOL and IUBS (1991) pointed out that the ability of the environment to regenerate renewable resources should be sustained, and the development should not reduce the quality of the environment or damage the world's natural resource base for further economic development. Other definitions state that emissions of industrial waste should not erode environmental absorption and assimilation.

There are other definitions that address ethical, technological, political, and cultural aspects of sustainability. Caldwell argued that ecologically sustainable development depended on effective political support, because ethical conclusions or science-based conclusions alone were not enough to move governments to act.

2.1.4. Multi-Dimensions

The definitions provided above supply us implicitly with the following meanings.

- Temporal versus spatial scale. Sustainability may have a different definition and different measures, depending on the scale of concern. Any study of sustainability must focus on a certain temporal and spatial scale. Only when the temporal scale has been defined clearly, can we identify the objectives of sustainable development. We also need to identify the spatial scale on which we can maintain natural capital, e.g. at a regional, county or global scale. In addition, sustainability of regional development may have different implications at different scales.
- Unsustainability. Although researchers have defined sustainable development in different ways, they may have same opinions about what is unsustainable. In many cases, unsustainability may become a more useful concept. Peoples who have different opinions on the definition of sustainable development may find out that they do have same opinion about unsustainability, and they can work together to find the factors of unsustainability, their cause, and the countermeasure to overcome them. ICIOMD have defined Unsustainability as “a decline in the quality and range of options that are related to production, consumption, and welfare of the community”. Some research projects undertaken by ICIMOD focus on factors of unsustainability and indicators in HKH region.
- Capital versus Assets. World Bank put forward the concepts of four kinds of capital: natural capital, human-made capital, social capital, and human capital. Based on these concepts, they used genuine saving to measure the wealth of countries. However, substitution between different capitals needs to be studied further. For example, in many cases, natural capital cannot be substituted by other capital because of its peculiarity, which indicates that substitution can only go so far. Even so, we also study further the rate and speed of capital substitution.
- Cultural Aspect. We also need to make great efforts to study culture and its affects on the human perception of sustainability. In the past years, scientists underestimated the role of original knowledge in the mountain development process. In fact, indigenous knowledge has been infiltrating production practices and has often become the kernel of mountain culture. Macnaghten (1997) pointed out that we should pay more attention to cultural factors that control and support public participation in sustainability activities. We need to study people’s perception of sustainable development in different cultural backgrounds, and should protect cultural diversity as well as biodiversity.
- Process versus capability. Sustainability is a developmental process in which we try to arrive at the goals of socioeconomically and environmentally sound development. It is also a capability that the development process has to build.

- Means or objectives. Although interpretations of sustainable development are mixed because of different cultural backgrounds and different specialties, the connotation and the objectives in a specific region must be clear and concrete.

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Bibliography

Barbara I. (1993). The meaning of development: interactions between “New” and “Old” ideas. *World Development*, **21**(11): 1803-1821. [This presents a comparative study of the concept of development]

Caldwell L.K., Hol. L.L.D. (1984). Political aspects of ecological sustainable development. *Environmental Conservation*, **11**(4): 299-308. [This presents sustainable development from the political perspective]

Chen C.K. (1995). Outline of regional development—theory and case studies, *Toward Sustainable Development*. (eds. Ye W.H. and Cheng J.C.). Beijing: Beijing University Press, pp.66-70 (in Chinese). [This presents the general discussion of regional sustainable development]

Cheng S.K. (1998), Indicator system for assessing sustainable development in China., *Exploration of Sustainable Development Strategy*, (ed. Qin D.H.), pp.1-9. Beijing: China Environmental Science Press. [This presents a new and comprehensive indicator system for assessing sustainable development in China]

Cheng S.K., Xu Y.Y. and Zhu D.H., (1992). Surviving, development and ecology. *Sustainable Economic development and resources and environment*. (ed. Youth Committee of Chinese Society of Natural Resources), Beijing: Chinese Science and Technology Press, pp.85-90 (in Chinese). [This present a brief introduction to developmental ecology]

Daily G.C., Ehrlich, P.R., (1992). Population, sustainability, and Earth’s carrying capacity. *BioScience*, **42**(10). [This presents discussion on the relationship between population and sustainable development]

Hao X.H., (1996). Research on the indicators of sustainable development. *World Environment*. (1):11-13 (in Chinese). [This presents a new indicator system framework for sustainable development]

Huang B.W. (1996). On geo-systems science and the strategy of sustainable development (I), *Journal of Geography*, **51**(4):350-354 (in Chinese with English abstract). [This presents the geo-systems science as the principle of sustainable development]

Klaus, R. and Hubert W. (1997), Steps toward indicators of sustainable development: Linking economic and ecological concepts. *Ecological Economics*, (20): 25-36. [This presents a new indicator system framework of sustainable development.]

Li W.H., Min Q.W. (1999). Integrated farming system: An important approach toward sustainable agriculture in China, *AMBIO*, **28**(8):655-662. [This presents a comprehensive discussion of sustainable agricultural development in China]

Li W.H., Min Q.W. Miao Z.W. (1999), Eco-county construction in China, *Journal of Environmental Sciences*, **11**(3):283-289. [This presents a brief introduction to the creation of eco-counties in China]

Ma S.J., Wang R.S. (1984). Social-economic-natural complex ecosystem, *Acta Ecologia Sinica*, **4**(1):1-9 (in Chinese with English abstract). [This presents new thoughts on modern ecology]

Mao H.Y. (1996). The research about an indicator system of sustainable development in Shandong Province, *Geographical Research*, **15**(4): 16-23. (in Chinese with English abstract). [This presents a general indicator system of sustainable development at provincial level]

Niu W.Y. (1995). *Introduction to sustainable development*, Beijing: Science Press. (in Chinese). [This presents a comprehensive introduction of sustainable development]

Sustainable Development Research Group (1999). *'99 Report of Sustainable Development Strategy in China*, Beijing: Scientific Press. (in Chinese). [This presents a comprehensive analysis of sustainable development in China]

Wang R.S. (ed.). (1991). *Human Systems Ecology*, Beijing: China Science and Technology press. [This presents the sustainable development from the ecological perspective]

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