

Rural development with environmental sustainability

Lu Yonglong, Wang Rusong

Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China

Abstract—Rural development is a broad and meaningful concept. It means not only economic growth but also changes towards a better direction in economic structure, social structure, relation between human society and environment, and even political structure. Present development should not damage the environment but leave the same or an improved natural resource endowment as a bequest to the future. This is the development with environmental sustainability. In this paper the characteristics of rural development were reexamined, and what environmental sustainability means and how to measure it were explicitly presented. Practical approaches for achieving environmental sustainability were also given with some cases from China.

Keywords: rural development; sustainable development; environmental sustainability.

1 Rural development with environmental sustainability

1.1 Rural development vs rural growth

The relation between development and growth has been widely discussed for decades. It is generally recognized that, growth is an increment of actual output of material goods and services in a given time, or in a reasonable word, increment of actual output per capita in a given time. And it is generally measured by GNP or GNI (gross national income) or their per capita quantity. But it can only represent the output, not the input of material, money, labor and other production factors, and most seriously, it cannot tell us how the output is produced at the expense of environmental pollution, urbanization and so on. In other words, it cannot explicitly describe the input-output ratio, and furthermore, the inventory of production and consumption materials, in particular the inventory of fixed assets. While the actual living standards depend on not only the output or income at that time but also the inventory of consumption materials and status of basic living facilities.

Development is a much more broad and meaningful concept. It means not only economic growth but also changes towards a better direction in economic structure, social structure, relation between human society and environment, and even political structure. Its primary objective is to meet the human needs for improvement in nutrition, education and hygienic conditions, utilization of human resource, living and recreational environment, and improvement in poverty, unemployment and unequitable distribution of income in particular. For a rural community, development indicates:

(a) Improvement in living standards of the rural people

In most developing countries such as China, rural people enjoy a relatively lower living standard compared with the urban residents. Improvement on living standards

represents increase of disposable income, improvement in housing and health care conditions, increase in length of average schooling, decrease of infant mortality rate, and long life expectancy and so on. And the difference in living standards between the rural and urban is gradually reduced.

(b) Increase of labor productivity

Given the technological level labor productivity counts on the combination form of human capital with other production factors and management and decision-making level. In most rural communities in the developing countries, there are surplus labors on one hand, on the other hand there are great shortage of such input factors as capital and land, marginal labor productivity is thus very low, approaching zero or even negative.

(c) Maintenance of soil fertility and conservation of agricultural land

There is a Chinese saying: "no stability without agriculture". It sums up the importance of agriculture in stability of social society. Land is a primary resource for the development of agriculture and for the subsistence of the people. While land area for agriculture use has been diminishing and soil fertility has been losing in recent years, because much land has been used for such purposes as industrialization and urbanization, and more and more farmers have diverted their attention from agriculture to other sectors. It is a typical question in China now, many farmers, particularly those who have special skills, are not willing to live on agriculture, therefore, they do not take measures to conserve the land and maintain the soil fertility while devoting themselves to money-oriented sectors such as industry and trading. If so, in the long run, there would be no agricultural development, and then no rural development. Even in an industrialized country, a rural community still has the responsibility for providing food and other basic living materials, thus, soil fertility still needs to be maintained and agricultural land conserved.

(d) Reformation of social structure and relation

In an undeveloped rural community, kindred plays a key role in social structure and relation. If a kindred is powerful in both population and social caste, it has more power in decision-making, the people of other kindreds have no way but submission. Most social contacts and activities, even marriage, are carried out among the people with the same kinship. Few or even no interexchange among the different kinships. This confines the people to so small a circle that broad-minded ideas and scientific thinking cannot easily penetrate into it. Only way out for rural development is to discard this kind of social structure and relation.

(e) Rural community's development has become every member's own objective, they are more willing than ever before to improve themselves in order to reach the objective.

Human resource development as an important means of promoting economic development is well acknowledged. However, in most rural communities in some developing countries, the shortage of technical skills at different levels, labor discipline, common objective and poor management have constrained the development. To overcome the constraints, they must put more emphasis on relevant education and appropriate training. Economic progress cannot be achieved by the more input of materials or by the in-

production of technology. It also requires many motivated individuals who are willing to work diligently and with ingenuity for the community (Fujioka, 1988).

1.2 Environmental sustainability for intergenerational rural development

The basic rule of environmental sustainability is to leave the same or an improved natural resource endowment as a bequest to the future. As the Brundtland Report indicated that "it meets the needs of the present without compromising the ability of future generations to meet their own needs". Or put it another way, effectively managing limited amount of resources is considered essential to the prosperity of both the present and future generations. It is about being fair to the future from a long term perspective, referred to intergenerational equity as an overriding ethic. There is a paradox that, on one hand sustainable development needs the support of environmental stock, on the other hand, much environmental capital has the feature of being irreversible and does not have man-made substitutes; once lost it cannot be regained. For these reasons, we should not only be cautious in running down environmental capital but also find ways of compensating for any environmental losses by replacing those losses with similar assets. In terms of these clarifications, for a rural community, attributes of environmental sustainability should include: high human awareness of environmental risks and impacts; satisfaction of human needs with possibly minimum resource use and waste production; stable or reduced net increase rate of human population; maintenance of biological diversity within the carrying capacity of the region; maintenance of agricultural land area and soil fertility without soil erosion; full use of organic fertilizers and pesticides instead of chemicals; great reduction of usage of non-renewable resources; great reduction of non-reusable or intractable waste production; great reliance on sustainable usage of renewable resources; reduced consumption of environment-related materials per unit output or per capita.

All the attributes are not entirely independent, some of them overlap. It is difficult for us to give a numerical value or degree for each attribute to which environmental sustainability can be reached, for it is surely related to the specific conditions. Nevertheless, by defining the attributes we are clear about which approaches to achieving environmental sustainability.

2 Achieving rural development with environmental sustainability

2.1 Public environmental awareness: public participation

In such a human-centered society as a rural community, a lot of environmental problems are caused by misleading human behavior or ignorance of environmental awareness of the public. In terms of environmental sustainability, the relationship between people and environment and the transformation of nature must be placed to the center of both any rural development strategy and environmental awareness education.

The goal of environmental education, as described at the first Intergovernmental Conference on Environmental Education held in Tbilisi in 1977, is "to develop a world population that is aware of, and concerns about, the total environment and its associat-

ed problems and which has the knowledge, attitudes, motivations, commitment, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones."

For this purpose a joint effort of all disciplines at all levels involved in environmental problems should make a rigorous contribution to the solution of complex environmental problems and to a comprehensive view of all relevant aspects of environmental degradation. An interdisciplinary approach is needed in order to "avoid a practical view of the environment by focussing, not only on the components of the whole, but also on emphasizing the natural interrelationships that relate to the whole" (Nijkamp, 1990).

In recent years, great efforts have been made in enhancing the public environmental awareness in China. An increasing number of teaching materials, instruction programs and audio-visuals in such fields as ecology, environmental science, environmental economics, which would facilitate the understanding of the nature, causes and remedies of environmental problems, have been very popular. Regular and irregular workshops or seminars on an environment-related issue are often held at different levels in order to facilitate the community's participation. Many local journals and newspapers are specially devoted to environment-related issues. And most important are some environmental education and training programs specially intended to children so as to foster their future awareness. But much effort is still needed to improve the environmental awareness of the rural people.

2.2 Ecological suitability analysis of different kinds of land use

In a rural community, almost every human activity is carried out on a limited land base. Improper land use planning and management have often resulted in environmental deterioration. How to rationally arrange and adjust land use is a critical determinant in environmental sustainability. Ecological suitability analysis is an analysis of suitability of a given land use pattern in a specific environmental condition. It is attempted to give a suitable land use distribution and adjustment alternative from an ecological point of view. It includes the following steps:

(a) Assessment of the present land use pattern, including evaluating the status of natural and artificial environment, social and economic development and land use characteristics;

(b) Analyses of requirements by different kinds of land use (agriculture, rural industry, green area, housing, entertainment, etc.) including geology, vegetation, landscape, climate, water availability, infrastructure, convenience, etc.

(c) Analyses of the environmental capabilities and sensitivities and their distribution. The environmental capacities include slope stability, hydrology, microclimate, landform features, vegetation distribution, wastewater treatment, current situation of land use, etc. The environmental sensitivities include distribution of potential earthquakes, surface hydrology, soil erosion, economic productivity, pollution levels, etc.

(d) Analyses of development capabilities and constraints of different kinds of land use.

(e) Analysis of ecological suitability of different kinds of land use.

Ecological suitability = development capability - development constraint.

Any proposed project should be located where it is suitable based on the result of ecological suitability analysis. And any unsuitable project should be removed and put to where it is suitable. Institutional and financial measures should be taken to punish the wrong-doers. In China, it is at the beginning stage and has not put into practical applications. It is our researchers' task to popularize this idea and help to put it into practice.

2.3 Environmental impact assessments of the proposed development projects

Environmental impacts assessment (EIA) is the major operational tool to approach sustainability in projects so far available. EIA is carried out during project preparation, before appraisal, and should be closely linked to the feasibility study. The purpose of EIA is to ensure that the development options under consideration are environmentally sound and sustainable. Any environmental consequences should be recognized early in the project cycle and taken into consideration in project siting, planning and design. EIA identifies ways of improving projects environmentally, and preventing, minimizing, mitigating, or compensating for adverse impacts (Goodland, 1992).

In EIA statement, any positive and negative impacts likely to result from the proposed project should be identified and assessed. Any mitigation measures and residual impacts that cannot be mitigated should be explicitly identified. Costs and benefits of the impacts mitigation and opportunities for environmental enhancement should be presented. And other topics that do not need further attention should also be specified.

In China, it is compulsory that EIA should be carried out on every proposed project at its preparation stage, as stipulated in the Chinese Environmental Protection Law, which was enacted in 1979, that "Attention should be put to prevention of environmental pollution and deterioration in siting, design, construction and production of every enterprise. Once a project is proposed for construction, reconstruction or extension, a complete statement of environmental impacts assessment of the proposed project should be submitted to the responsible environmental protection agency and other related organizations, the project can only be implemented after the approval of the statement". For a decade, in fact, more efforts have been made for large and middle scale projects than for small-scale projects. While in a rural community small-scale projects play a dominant role in environmental degradation. It can not be ignored and needs more attention.

2.4 Ecological restoration of environmentally damaged areas

The rapid growth of rural economy in some developing countries such as China, especially with the objective of obtaining short-term results, has resulted in passing over of arable land to rural industrialization, over-exploitation of natural resources, soil erosion, water pollution, formation of swamps and solid waste hills in some rural areas. These environmentally damaged areas, if cannot be restored to what they were, should be restored to a certain degree which is ecologically acceptable. In general, they can be divided into three categories: environmental damage to land, to water and to atmosphere. For dealing with these problems, on one side we should find the "sources" and take active measures to dispose of the sources, on the other side, we should treat the "sinks" by ecological restoration. For restoration of environmentally damaged land, some biological species should be introduced and cultivated in the affected area, according to ecological principles of survival of the fittest, species symbiosis, cycling and re-

generation, in order for the soil to regain its productive capacity. For restoration of polluted water physical and chemical measures should be taken to establish water treatment plant. But up to now no better way than treating the pollution sources is available for restoration of environmentally polluted atmosphere.

For ecological restoration of environmentally damaged area, two factors are critical: technology and financing. Through training programs the rural people can master the restoration technology. The biggest problem for them is financing, they cannot afford the heavy cost. In this regard, polluter-pay policy should be strictly adhered to, all restoration expenses should be borne by the people or factories that cause damage to the area.

2.5 Free access to ecological engineering and technology

Ecological engineering or technology, by its definition, emphasizes multi-level comprehensive use of material, in accordance with ecological principles of species symbiosis, material recycling and regeneration and optimization methods in systems engineering, to gain both economic and ecological benefits (Ma, 1987).

In China, ecological engineering has been used in at least 430 villages, where environmentally sustainable development has been taking place. Among these villages, Liiuminying Village is the most successful example.

Liiuminying Village is located in the suburbs of Beijing. The project construction and research of agro-ecosystem of Liiuminying Village was begun in 1983 and finished in 1986, and jointly carried out by the Beijing Municipal Research Institute of Environmental Protection and Liiuminying Village. The village was originally a poor village in Beijing with monoculture of wheat and rice. In order to gain high production, a great amount of energy was consumed and much of it wasted. Since the project started, the economic structure has been diversified from single rice and wheat production to including animal husbandry, rural industry, agricultural products processing and other side-line sectors according to ecological principles of energy flow and multi-level comprehensive use of material and energy. At present, biogas is the main energy source in summer with solar energy as subsidiary. Biogas and solar energy complement each other in spring and fall. Only in winter coal is the main energy source with biogas as subsidiary. The system of recycling and comprehensive utilization of organic waste material has also been established. For example, the biogas residue and water are used for fish raising, the crop stocks are used to feed the livestock whose waste is returned to the field, the chicken's droppings are directly put into the pigsties as fodder, the stock and biogas residue are also used for raising mushrooms, etc. (Bian, 1988). This practice has not only established and promoted interdependent relationships among the economic sectors but also promoted the economic development and purified environment.

The village has been listed as one of the world-wide models of using green technology to protect environment and a model of transformation of the poor to rich.

The success of the Liiuminying Village gives us an example of achieving environmental sustainability by using ecological engineering and technology. It is, therefore, vital that, free access to ecological engineering and technology be organized in an orderly way.

3 Conclusions

Rural development means not only rural economic growth but also changes towards a better direction in economic structure, social structure, relation between human needs and environmental supply, and even political structure. Its primary objective is to meet the human needs for improvement in nutrition, education and hygienic conditions, utilization of human resource, living and recreational environment, and improvement in poverty, unemployment and unequitable distribution of income in particular.

Environmental sustainability is the key to intergenerational rural development. That is, effectively managing limited amount of natural resources is considered essential to the prosperity of both the present and future generations.

Any combination of the above approaches for achieving environmental sustainability may apply to a different real world situation. In other words, for a specific community or condition, appropriate approaches should be taken towards rural development with environmental sustainability.

Sustainable rural development is participatory development. It can only be achieved through the public awareness of and participation in the whole development process.

References

- Arnol SH. *Development-Journal of SID*, 1989; 2/3:21
- Bian YS. *The eco-agrosystem of Liuminging Village*. Beijing; Chinese Environmental Science Press, 1988
- Brundtland GH. *Our common future; from one earth to one world*. New York; Oxford University Press, 1987
- Dong FR. *Research of economic development strategy*, Economic Science Press, 1988
- Douglas GK. *Agricultural sustainability in a changing world order*, Westview, Boulder, Colorado, 1984
- Dovers, S. *Development-Journal of SID*, 1989; 2/3:33
- Fujioka M. *Development-Journal of SID*, 1988; 2/3:26
- Goodland R, Daly HH. *Development-Journal of SID*, 1992; 2:35
- Lu YL. *Ecological Economics*, 1993a; 1:14
- Lu YL, Wang RS. *Internal and environmental sustainability with case studies from China*, Proceedings of the international conference on sustainable village-based development. Colorado State University. 1993b; Vol III;1517
- Lu YL. *Sustainable development and ecology* (Ed. by Chen Changdu), Beijing; China Science and Technology Press, 1993c; 183
- Ma SH. *Agro-ecological engineering in China*, Beijing; Science Press, 1987
- Nijkamp P. *Human ecology in China* (Ed. by Wang Rusong), Beijing; China Science and Technology Press, 1990; 39
- Pearce D. *Development-Journal of SID*, 1989; 2/3:17
- Song CX. *Growth economics*. Beijing; The People's Press, 1987
- Tan CT. *Development economics*. Beijing; The People's Press, 1987

(Received April 5, 1994)