Development and Transfer of Agricultural Technologies for Sustainable Mountain Development: the Approach in China

Chen Guangwei
International Centre for Integrated Mountain Development, Kathmandu, Nepal

Introduction

The twenty-first century is a century of knowledge and information. Technology plays an important role as many nations try to promote knowledge-based economies. Incentive mechanisms could be set up to encourage technicians to go to villages to serve farmers who need technology at a grassroots level. Development of training materials, development of institutions, and planning of action are also important for disseminating technology .

This paper presents the importance and general methods of knowledge and technology input for integrated rural development, with a set of examples of ways to select suitable technologies, technology transfers, and guidelines.

Importance of Knowledge and Technological Input

Technological input is a low-cost but highly efficient way to help achieve sustainable development (SD). Key issues for technology development and transfer for SD include selecting suitable technology; organising teams of trainers and resource persons; preparing training materials; establishing pilot demonstration sites or flagging households for seeding activity; using public media (TV, radio, telephone hot-lines, posters, technology fairs, the Internet, and others) for spreading technology and information; organising training and extension activities; establishing a technological extension network; and utilising the resources of universities and research institutes.

China's Agenda 21 and poverty reduction

China's Agenda 21 programme provides an example of poverty alleviation through technology transfer. Agenda 21 initiated a programme to collect suitable advanced technology for SD of mid-sized cities and townships (Gan and Wang 1996). Under this programme, professional staff from agricultural universities and research institutions attend science and technology fairs for rural people, providing technical consultation, new seeds, and market information to farmers. The technologies considered suitable for sustainable develop of townships and villages are listed below.

Sustainable development of agricultural resources and technology

- Technology of biomass utilisation
- Integrated technology of biogas
- Technology for agricultural water resources
- Technology for agricultural land environment
- Green food production
- Integrated utilisation of light and thermal resources
- Technology for agricultural product storage and preservation

Integrated utilisation of industrial resources and clean production

- Improvement of paper making technology, waste water treatment, and use of waste materials
- Technology for three-waste treatment of chemical fertiliser plants
- Technology for waste water treatment of organic phosphorous pesticides
- Technology for integrated treatment of waste water from the textile industry
- Technology for integrated treatment and recycling of waste water from the leather industry
- Technology of solid waste treatment and uses for recycled waste

Exploitation and utilisation of clean energy

- Clean energy technology of shaped coal
- Liquidising and gasifying technology of coal
- Water and coal mixed-burning technology
- Solar energy technology
- Wind energy technology
- Small-scale hydropower technology
- Biomass energy technology
- Applied technology of geothermal energy

Technology of building sustainable housing and its management

- Energy saving technology
- Clean water and water saving technology
- Gardening and farming technology
- Technology to control indoor environments
- Technology of residential environmental management and waste recycling use

Technology for crop growing

A book entitled 'Applied Technology 300 for High Efficiency of Agriculture' was prepared by more than 400 scientists and technicians who have practical experience introducing high-yield methods of growing rice, wheat, maize, cotton, rapeseed, potato, sweet potato, vegetable, herbal medicinal plants, fruits, flowers, edible mushroom, and so on. In it, rotations, inter-cropping, mixed farming, and others are described for various farming systems (Guo 1993).

In 'Village Prosperity by Means of Science and Technology', Li (1988) discusses many technologies applicable to activities like agricultural product processing, forestry and fruit trees, crop farming, animal husbandry, and aquatic farming, as well as business management, decision-making, and accounting.

Examples of technology use for sustainable development

Watershed Rehabilitation Project (WRP)

There are many examples of technology use at project level in the 181 page of the 'Technical Rules' or the Y2.2 billion[1] World Bank Loan for China's Loess Plateau Watershed Rehabilitation Project covering five provinces in the middle reaches of the Yellow River (WBP 1995). The table of contents is as follows.

1. General principles
2. Comprehensive planning and management of small watersheds
3. Terracing
4. Sediment control dams
5. Irrigated land, land formation from river bed reclamation and warping land
6. Other soil conservation works
7. Afforestation
8. Orchards
9. Nursery
10. Forage grass

Annex 1: Tillage practices of soil and water conservation

Annex 2: Provisional technical specifications of sediment control dams of soil and water conservation (SD175-86)

Integrated Rural Development in Ansai County

Ansai County has a population of 130,000 and an area of 3,000 sq.km, and is situated in a loess plateau in China, a mountainous area of the watershed rehabilitation project (WRP). The area has suffered from severe soil erosion averaging 5,000 t per sq. km per year. It is officially designated as a poverty county. The following experiences have influenced regional development.

- The oil industry of Ansai is one of the driving forces of its economy. But as oil is a non-renewable resource, the government has started to promote agriculture as a 'green industry'.
- Water and soil conservation projects have been carried out one after another to grow trees and grasses, to build terraced farm land on the hill slopes, and to build dams to catch silt (to improve the ecological environment, which is considered accumulation of 'natural capital').
- Four service companies have been established: a sheep-stock service company, an apple service company, an apricot nut service company, and a potato service company. The objectives are to create a sheep production base, a potato production base, an apple production base, and an apricot production base. Organising production on a suitable scale to allow entry into the market is considered 'social capital development'.
- Policy reform, household contracts for small watershed management, demonstration of technology transfer, and others are also social capital development. As a mechanism to achieve this, technicians have to earn a portion of their salary through technological service. Farmers are the fundamental users of their knowledge/technology. Technicians must provide technical service focused on the grass roots level according to the requests of households. For example, the villagers of Chafang jointly hired a technician from the apple service company and paid him Y2,000 for his services to ensure a good apple harvest .
- Benefit sharing is an equal opportunity base. For example, the improved farm land built through water and soil conservation projects was reallocated according to household input (social capital development).

[3] In 1995, Yuan 8.3 = US$ 1 approx.

The economy and social development have been improved and poverty eradication goals have been met. It is important to link soil conservation projects with poverty reduction and economic development.

Other applications

There are other technologies readily available on CD-ROM or the Internet, including pictures, figures, maps, and technical details, as well as market information. Specialised technologies exist in small watershed management; gardening and farming of high quality fruits, mulberry, bamboo, medicinal plants, flowers, and mushroom; plastic greenhouses; and raising high-value wildlife (the foxes, turtles, snakes). Appropriate technology can also help establish a production base for special native products on a certain commercial scale (such as chestnut, Chinese date, jingo, walnut, apple, peach, grape, and melon).

Conclusions

The most important aspect of technology transfer is to provide technology to the groups that need it, and therefore to pay great attention to the grass roots level. Incentive mechanisms must encourage technicians to serve farmers. Technological input has great potential to aid rural development. Integrated rural development is a major necessity to be pursued by all the means available. More attention should be paid to promoting the economies of mountainous areas by means of knowledge and technical input.

References

Gan, S.; Wang, R. (1996) *Guide Book of Suitable Advanced Technology for SD of Medium Cities and Townships. A Technology Volume.* Beijing: China Science and Technology Press

Guo S. (ed) (1993) *Applied Technology 300 for High Efficiency of Agriculture.* Beijing: Beijing Science and Technology Press

Li Zhimin (1988) *Village Prosperity by Means of Science and Technology.* Beijing: China Economic Press

WBP (1995) *Technical Rules of World Bank Loan for China Loess Plateau Watershed Rehabilitation Project (WBP).* Washington DC: WBP, Central Project Management Office