How Irrigation is Responding to the Challenges of Volatility, Vulnerability and Changes in Agriculture

Gao Zhanyi

Session 5: The Future of I&D Design and Development

Introduction

Food is the basic need of people, and food security is always an important and highlighted issue worldwide. In 1996 the World Food Summit set up an ambitious target to reduce the number of undernourished population in developing world from 840 million in 1995 to 420 million in 2015. However, since 1995 we have not seen the reduction of the number, by contrary this number has been increased and reached to the new peak of 1000 million in 2009.

The World population is expected to grow from 7 billion at present to 9 billion by 2050, as shown in Figure 1. Most of the increased population will be in the emerging and least developed countries, and almost no growth is expected in the developed countries. Furthermore, with the rapidly rising standard of living in the emerging countries (almost 75% of the World population) the diet has changed and will continue to change with more meat consumption, which implies more water and cereal consumption. It is estimated that the required increase in cereal production will be within the range of 70 to 100% in the next 25–30 years.

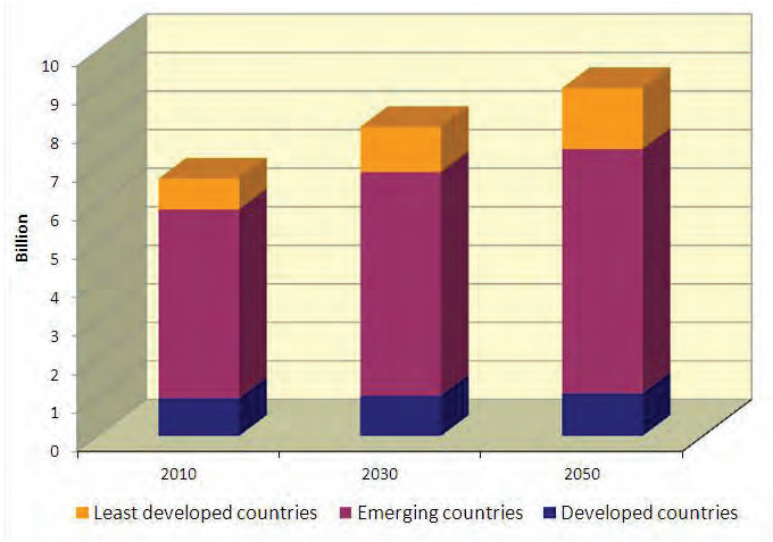

Figure 1. Population and population growth in the least developed, emerging and developed countries (after Schultz et al., 2009 and UNDP Population Reference Bureau)

The total cultivated area in the world is about 1,500 million ha, in which 1,100 million ha is under rainfed conditions without any water management system, only about 270 million ha is equipped with irrigation system (among which 60 millions with drainage also) and 130 million ha with a drainage system only. At present about 55% of the food production comes from areas with irrigation and drainage systems, which is only accounting for 27% of the total farmland; and 45% from the areas without a water management system, which is accounting for 73% of the total farmland, as shown in Figure 2. With the impact of climate change it is difficult to increase the yield of the farmland without water management system. Hence most of the increased cereal production will have to come from the farmland with irrigation and drainage system.

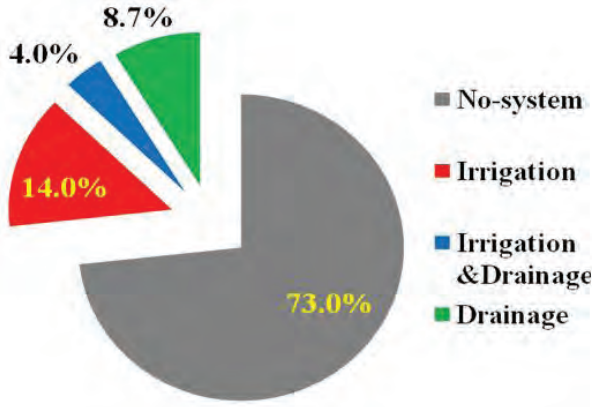

Figure 2. Proportion of farmland with and without water management system

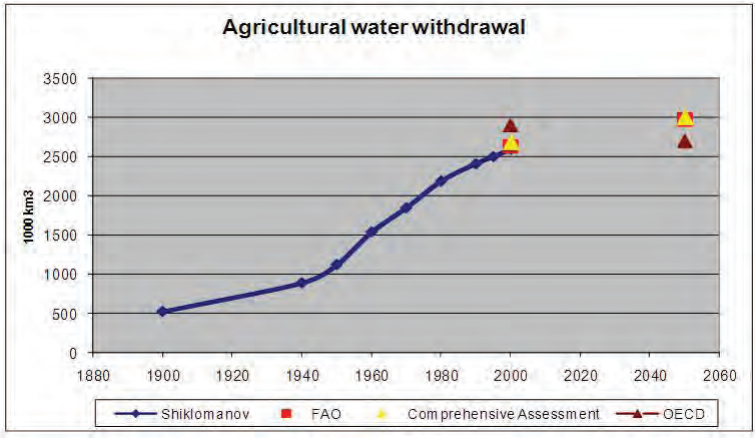

Figure 3. Projection of water withdrawal for agriculture

The development of irrigation has to be based on existing water withdrawal with marginal increasing potential. Therefore, the water use efficiency and productivity have to be increased significantly.

In the past, low cost recovery, inadequate management and insufficient investment were worldwide problems for the sustainable development of irrigation systems. However, with the population increase and urbanization, the need for agricultural products has increased and prices of agricultural products have also increased accordingly, as shown in Figure 4. Therefore, there will be good opportunity to increase the revenue from irrigated agriculture and improve cost recovery.

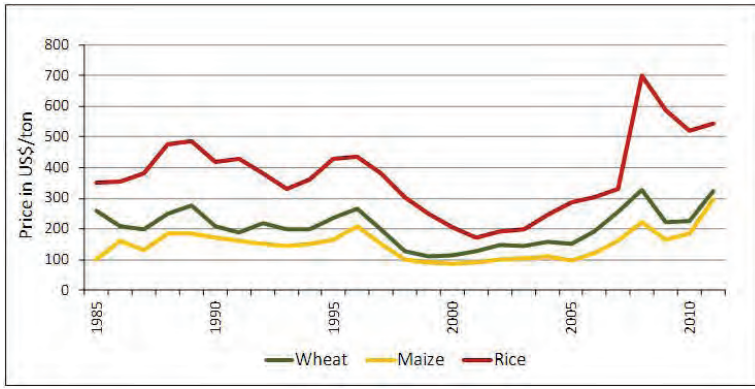

Figure 4. World market prices for wheat, maize and rice (International Monetary Fund (IMF) and updated after International Commission on Irrigation and Drainage (ICID), 2011)

There is good reason to say that now it is ideal time to enhance irrigation development to increase water use efficiency and productivity by adopting comprehensive measures. The major measures including:

1. Rehabilitate Infrastructures

The problems of aged and incomplete irrigation infrastructures exist in many developing and the least developed countries. These problems lead to poor performance and low water use efficiency and water productivity in many irrigation schemes. There is a huge need to rehabilitate the infrastructure of existing irrigation schemes.

2. Improve Management

Due to the financial and institutional problems many irrigation schemes are managed improperly, which lead to poor water supply service, low productivity and less collection of water fees. There is huge potential to improve management institutions to achieve better performance and productivity of irrigation schemes.

3. Increase Investment

For many developing and least developed countries financing irrigation development suffers from two distinctive problems: (a) the funding for rehabilitation of existing

irrigation schemes was inadequate, leading to poor facilities and management, in turn reducing the benefits; (b) the investment for construction of new irrigation schemes is not available. There is urgent need to increase investment in irrigation sector.

4. Strengthen Capacity Building

Technical service is still weak in many irrigation schemes. With the increase of irrigation scale, irrigation system and water management are getting more and more complex, especially for the large and medium irrigation schemes with mainly smallholder water users. The increase in the system complexity needs more technical capacity to operate and maintain the irrigation systems. However, technical capacity is very weak in many irrigation systems. To strengthen the capacity building will significantly improve the performance of irrigation system and increase the water productivity.

5. Support Small holder farmers

Small land holding is one of the major constraints for extension of advance irrigation technologies and improve water and land productivity. The households with small land holding have difficulty to generate enough revenue to maintain sustainable production, and also with difficulty to get loan and better water supply service. Water user association (WUA) system is an effective way to help the small land holding households to overcome the above problems. In some countries increasing urbanization means more people are moving to urban and land holding for farmers is increasing. This trend might be continued for next 30 years. In such a process the farmers need support to develop and manage irrigation system in their larger farmland.

6. Implement Land Consolidation

Land consolidation should be implemented during the rehabilitation of irrigation systems. The purpose of land reconsolidation is to improve land and irrigation systems in an integrated manner. Land consolidation can solve land leveling and land scattered problems and mismatch problem between village administration and hydraulic boundary of irrigation system. After consolidation land can be redistributed to farmers according to their original holding area. The land consolidation could significantly improve the irrigation water management and increase the productivity and profitability of irrigated land. It has been adopted by several Asian countries.

7. Institutional Reforms and Governance

The experiences have proved that the government itself could not maintain the sustainability, productivity and profitability of the irrigation systems without the active involvement of stakeholders, especially farmers. Farmers themselves are not be able to develop and manage irrigation systems without the support and leadership from government and technical assistance from specialized management agents, especially for the medium and large irrigation schemes. The

major roles of government, specialized management agents and WUAs should be well considered and implemented based on the condition of the individual country and irrigation system.

(1) Roles of Government
- Provide leadership
- Work out future vision
- Set policy and provide legal framework
- Work out and implement development planning
- Reform institutions
- Enhance capacity building
- Mobilize financial resources

The role of government at different levels should be clearly stated. The government at national level should focus on setting policy, and providing legal and institutional framework, working out national development planning, raising funds and supervising the implementation of planning.

(2) Roles of Specialized Management Agents
- Carry out rehabilitation of the main canals and structures of irrigation systems
- Operate and maintain the main structures and canals system;
- Bridge the gap between government and WUAs;
- Provide technical support to WUAs;
- Supervise and monitor irrigation systems;
- Keep documentation of irrigation schemes;
- Collect water fees from WUAs.

(3) Roles of WUAs
- Rehabilitate on-farm canals and structures;
- Operate and maintain on-farm structures and canals system;
- Collect water fees from farmers.

Conclusions and Recommendations

Although the targets for irrigation development to achieve food security have been developed at global level, the practical irrigation development planning can only be developed and implemented at national level. In many developing countries the governments have played an important role in development of irrigation systems. It is certain that without the government support and leadership the irrigation systems could not be developed to the existing stage. As agriculture sector is still the major contributor of GDP in many developing and all least developed countries. Irrigation is of significant importance to food security, social and economic development and social stability. Therefore, the government should continue to play an important role in irrigation development to achieve food security and increase farmers'

income. Recent years many countries, such as China and India have worked out national irrigation development planning and increase the investment in irrigation sector. Many experiences on development of water saving measures, rehabilitation and modernization of irrigation systems have been achieved. It will be useful to exchange and share these experiences.

Driven by the increasing demand for food and bio-fuel, the prices of cereals and other agricultural products rose to new high levels. It is expected that this trend will continue. In addition, climate change is expected to impose huge impacts on agricultural production. Therefore, more robust irrigation and drainage systems are needed to increase the resilience of agricultural production systems. Therefore, there is increasing need for irrigation development, especially in developing and least developed countries. International organizations can play an important role by supporting training program to enhance capacity building, collecting and sharing international experiences, financing pilot projects and increasing financing for irrigation development, especially for the rehabilitation and modernization of irrigation schemes and extension of water saving technologies and measures. It can also be expected that the irrigation schemes can generate good revenue by increasing water use efficiency and productivity.

References

Report for Theme 2.2. Contribute to Food Security by Optimal Use of Water, 6th World Water Forum, Pasquale Steduto (FAO), Bart Schultz, (ICID), et al.