Paper 10

Discussion on the Paper
Technological Innovations in Irrigated Agriculture

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THE PROBLEM

THE AUTHOR HAS eloquently presented the big issue in food sufficiency for the ever-increasing population of the world against the finite land resources available for expansion of agricultural areas. This scenario indicates that increases in agricultural production to keep pace with population growth have to come mainly from intensification of cropping in presently cultivated areas and yield increases from irrigated areas.

In the Philippines, for instance, the country's estimated total population of about 62.7 million in 1992 will increase to about 71.0 million by the year 2000. Food supply for this fast-growing population has to come from its limited land area devoted to agriculture which is about 1/3 of its total land area of 9.0 million ha. Since only about 1/3 of this agricultural land is suitable for irrigation, serious efforts in improving the performance of existing irrigation systems and in increasing yields have to be made if sufficiency in staple food is sought. In addition, the remaining rain-fed land, but potentially irrigable, has to be provided with irrigation facilities if sufficient capital investment is available.

The Philippine scenario is probably not very different from the situation in other developing countries. The developing countries in the Asia-Pacific region, for instance, have a total land area of about 2,2000 million ha and the arable land is only about 1/5 of this or about 400 million ha (FAO-RAPA 1991). The total population of these countries in 1989 was nearly 2.8 billion yet only about 1/3 of the agricultural land in these countries is irrigated.

IRRIGATION TECHNOLOGY—STATE OF THE ART

While major innovations in irrigation technology have occurred in many industrialized countries particularly in water-lifting and pressurized systems, the developing countries in Asia are continuing to use traditional methods of surface irrigation. Sophistication and adoption of new technologies in automation and pressurized systems have been limited to a few privately owned and managed irrigation areas.

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Irrigation development in developing countries remains a major responsibility of each government through its irrigation agencies. Most of these irrigation agencies operate on limited funding support from the government or compete with other infrastructure agencies for their capital investments. Although there are varying structural arrangements in the organization of these agencies, their primary concern is the provision of irrigation and drainage service to the country's agricultural areas at the most economical means. Adoption of more sophisticated technology requires more intensive investment and is therefore limited. Modernization of irrigation systems by automation of its water delivery, for instance, has been very seldom, if at all, adopted. Agency resources are rather invested in irrigation area expansion using the simplest and most economical schemes possible.

In the Philippines, system improvement and modernization have been limited to the provision of canal lining to curb excessive percolation losses, better control and measuring devices, sediment control structures and intensification of agricultural support services such as farm-to-market roads and facilities for irrigation associations.

Water Delivery Systems

In the Philippines, water delivery systems still follow the traditional gravity flow in open channels. Innovations in this area are concentrated in improving the reliability of regulating, dividing and measuring the flows of water to attain more equitable distribution of irrigation water to the various parts of the command area. Although rehabilitation and system improvement projects have been implemented in the past, disparity of water supply to farmers in the upstream sections and those in the tail end still exist. This is particularly significant during the dry season when there is limited river flow and only part of the command area is serviced.

The most important innovation in the Philippines to address the question not only on equitable water distribution but also on other problems in O&M is probably the implementation of farmers' participation program in irrigation development. While this may be considered more technical, it could be important in the application of modern technology. In this program, farmer-beneficiaries are organized to form Irrigation Associations (IAs). The officers and members of the IAs are provided with a series of training to develop their capacity in handling the O&M of the system and in running the affairs of the association. The IAs are then contracted in a joint management scheme in the agency-operated irrigation systems. In the agency-constructed communal irrigation schemes, the IAs take over the O&M of the system which they will eventually own.

In the National Irrigation Systems (NIS), the organization of IAs is oriented on the canal systems. The Turnout Service Area (TSA) covers 30-50 ha at the initial organization level. The TSA groups are then federated in a watermaster's division, in a lateral and then in the entire system. In the case of the Upper Pampanga River Integrated Irrigation System (UPRIIS), an integrated system covering some 100,000 ha, the organization of IAs follows the TSA (up to 50 ha), the watermaster's division (up to 1,000 ha), the zone engineer's area (up to 8,000 ha), the district level (up to 25,000 ha) and then the system-wide federation.

In the Communal Irrigation Systems (CIS), on the other hand, a single IA is organized for each CIS. As the CIS covers an area of generally less than 1,000 ha, the IA organization is much simplistic but because of a total turnover of the entire system the IA development is more thorough.

With the participation of farmers through the IA, coupled with improvement of the system's hardware as implemented since 1989 by the Irrigation Operation Support Project (IOSP), achievements in system performance signal a generally positive trend. This is shown by the two indicators: (1) the national average cropping intensity of all NISs gradually rose from 134 percent

in 1987 to 140 percent in 1991; and (2) the collection efficiency of irrigation service fee has gradually increased from 47 percent in 1987 to about 60 percent in 1991.

Another positive impact of the farmers' participation is the progressive turnover to IAs of a substantial portion of the routine O&M activities within the IA areas. This would result in a gradual decrease in NIA's overall staffing at the field, and in overall O&M cost.

On-Farm Water Application Systems

The most commonly used method of on-farm water application in the Philippines is the gated turnout. This is an 18-inch or 12-inch concrete pipe laid out across the embankment of the supply canal and this discharges water directly to the farm ditch. Individual farmers in turn apply water to farms through cuts in the earthen embankment of the farm ditch and then through paddy to paddy flooding. The gated turnouts are installed in such a way that water could be diverted even at low water level in the supply canal. The assumption is that the farmers will voluntarily close the gates when water is not needed.

Today, some operation problems have been identified in the use of the gated turnout. Since there are periods when delivery of water in the supply canals becomes erratic, the farmers have, in many cases, tampered with the control mechanism of the gate so that it becomes open at all times and water could be diverted into their farm ditch whenever it is available at the supply canal. In this situation, excessive diversion becomes a common practice resulting in water shortages at the downstream section of the system and localized drainage problems in low-lying areas.

This problem is gradually being tackled through the more active involvement of the IAs. However, a tamper-free turnout that could satisfactorily deliver the water required would provide a more permanent solution. This is particularly important in developing countries where irrigation agencies deal with numerous farmers owning very small landholdings.

Irrigation Methods

Since irrigated agriculture in the Philippines is synonymous with rice irrigation, surface flooding is still the most commonly used method. Depending on the available water, the water application could either be simultaneous throughout the command area or intermittent or rotational.

Adaptability of Modern Irrigation Technology to Developing Countries

This issue was discussed thoroughly in the paper. I agree with the concerns raised on the adaptability of modern technology relative to irrigation. It must be realized that a major constraint in the adoption of these technologies by developing countries, particularly those dealing with automation and pressurized systems is the persistent insufficiency of capital investment. In many cases, therefore, most developing countries will opt for traditional but less-expensive technologies. In addition, as irrigation is particularly established for rice production, particularly in tropical Asian countries similar to the Philippines, traditional systems with improved flow-regulating and -measuring structures are considered sufficient up to a certain level of economic development.