

Modernization techniques

- Improving irrigation water management, in order to increase productivity and minimize adverse effects such as salinization, is one of the main contemporary issues in the agricultural sector.
- A considerable effort is being made to improve irrigation operations and to reduce costs.
- Society in general and water user associations, particularly where they have to bear the cost of irrigation, are demanding that irrigation become more cost-effective.

Rehabilitation, which consists of re-engineering a deficient infrastructure to return it to the original design. Although rehabilitation usually applies to the physical infrastructure, it can also concern institutional arrangements.

Process improvement, which consists of intervening in the process without changing the rules of the water management. For instance, the introduction of modern techniques is a process improvement.

Modernization, which is a more complex intervention implying fundamental changes in the rules governing water resource management. It may include interventions in the physical infrastructure as well as in its management.

Defining modernization

Irrigation modernization is a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation schemes combined with institutional reforms, with the objective to improve resource utilization (labour, water, economic, environmental) and water delivery service to farms.

The need for a consistent framework for modernization

- Increasing water productivity
- Increasing the cost-effectiveness
- Increasing the reliability in irrigation deliveries.
- Increasing the flexibility of deliveries.
- Consideration of other uses of water
- Increasing knowledge and human resources development

Obstacles in the way of modernization

Successful modernization is not straightforward, and failure to achieve targeted performance objectives, in some instances, requires further investigation of the underlying causes. As far as the technology is concerned, significant hardware and software progress has been made in irrigation system operations in the past decade, including computer facilities, information techniques, measurements, and canal control concepts

Technical gaps between the requirements needed to implement the improved method (availability of expertise, technical maintenance of equipment) and available local resources.

Financial constraints resulting from the gap between the cost of equipment for the improved method and the gain in water savings and improved services, as water is generally not priced or charges are low.

Social constraints. Human resources are relatively less expensive in developing economies than alternative technological solutions. An irrigation agency, often a large employer in the area, has some obligation to maintain local staff.

Institutional constraints. Bureaucratic centralized irrigation administrations are not well suited to service-oriented activities.

Model for the modern irrigation enterprise

- It is clear for many that the irrigation sector in general has not reached the same level of effectiveness as other sectors, such as the industrial and service sectors.
- Hence modernization can be seen as a means to create and favour modern irrigation enterprises by introducing methodologies which have proved successful in other sectors.
- We advocate that modern enterprises in irrigation require a reengineering of their processes in order to cope with the new challenges faced by irrigation.

Reengineering irrigation system operations

The reengineering of the irrigation operation should consist of designing the most cost-effective answer to the redefined water service within the scheme. It should consider:

The spatial distribution of the effective demand for the water service. The service might differ significantly with user demand, e.g. cash-crop farmers might ask for a high quality and costly service whereas farmers with an alternative source (wells) might be satisfied with a low and cheap service. The service might also differ because of other considerations such as hydrological hazards (salinization, water-logging) and opportunities (recycling of water).

The spatial distribution of the physical infrastructure characteristics. The sensitivity of the canal delivery structures, the efficiency in controlling water depth, the ease of monitoring and implementing operation - these are some of the important features that should be considered when designing an appropriate answer to meet the demand.

Flexibility in modernization

The concept of flexibility has long been discussed and advocated in the field of irrigation modernization.

So far it has encompassed the notion of flexibility in water deliveries as opposed to rotational and fixed deliveries.

Flexible deliveries can be proposed to users in different forms (on request, free access, etc) at a cost compared to a strict rotational distribution.

This concept of flexibility leads to abandoning the homogeneous approach of irrigation systems that has so far prevailed.

Instead, a heterogeneous approach of the demand and of the efforts (inputs) to operate irrigation systems is sought for a closer match of water availability to demand requirements.

Modernization is a never-ending process of adapting activities to current constraints and objectives. The agricultural and economic contexts are permanently evolving and so are the demands from society. What was modern and up to date some decades ago might now appear to be incompatible with current needs, and this is not only true of the technical aspects of irrigation.

Low-cost technologies

The introduction of low-cost technologies, which could be part of the modernization of small-scale irrigation projects, provides another example of the site-specificity of success.

Inexpensive treadle pumps have been successful in some South Asian countries in extracting irrigation water from shallow aquifers.

The farmer has full control over the timing and amount of this pumped water, which given the effort involved is used sparingly.

For example, the area under irrigation by one treadle pump in West Bengal, India, varies between 0.033 and 0.13 ha. Treadle pumps have also been introduced in Africa, including the urban and peri-urban areas of Ndjamena, Chad. Here, the vegetable growers rejected the pumps in favour of mechanical pumps because they could afford the cost of fuel and spare parts.

Bucket drip-irrigation kits

Positive experience has been reported with the introduction of bucket drip-irrigation kits. These kits are suitable for the irrigation of small plots of vegetables and fruit trees in peri-urban areas (close to markets). In Kenya, the return on an investment of about US\$15 for one bucket drip-irrigation kit was some US\$20 per month. Farmers in Kenya have bought over 10 000 kits, although some of these farmers could not be described as very poor.

Rehabilitation - the renovation of a scheme to meet its original design criteria

- Inadequate operational practices may limit improvements to water supply expected from improved infrastructure.
- Trained and motivated operational staff are needed. They must be committed to delivering a specified minimum level of service. Institutional will and government policies are needed to effect such changes.
- Farmers must be willing and able to exploit a better supply. They may need training in water use and maintenance. A formal or informal water user group must exist.
- Until the water supply is improved, it is unlikely that farmers will cooperate.

Maintenance activities in a reservoir itself comprise:

- controlling aquatic weeds,
- removing large debris (e.g. tree trunks) floating in the water that may damage hydraulic works,
- monitoring the water quality: not only from the salt content point of view but also from a biological standpoint in order to detect possible sources of pollution
- surveying the solid deposition in the bottom of a reservoir.

The retention in good working order of open drains includes the following operations:

1. light deforestation
2. weed control in the canal section

3. maintenance of flow gauges and other measuring devices
4. removal of silt
5. maintenance of pumping stations where water cannot be evacuated by gravity.

Optimization of water use

Water efficiency of irrigation can be improved by making the right decisions regarding:

- Crop selection
- Irrigation scheduling
- Irrigation methods
- Source of water.

Improving Irrigation practices can:

- Reduce water and pumping costs
- Reduce costs for fertilizers and other agricultural chemicals
- Maintain a higher soil quality
- Increase crop yields – by as much as 100%

