# Opinions of Management to Realize and Improvement Water Productivity in Agriculture

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**Abstract**
In dry areas, water, is the limiting factor in improving agriculture production. Maximizing water production is therefore a better strategy for on-farm water management under such condition. Water productivity is an important issue in arid and semi arid regions that are already experiencing a shortage of water. The productivity of crops is commonly measured in related to inputs such as capital, land, energy and labor or fertilizer but in recent years, increasing attention to water consumption. Conventional water management guidelines, designed to maximize yield per unit area, need to be revised for achieving maximum water productivity instead. The purpose of this paper is takes a general look at water use by plants and concept of water productivity. In other section discussed the opportunities for increasing water productivity with various factor of management and to lay down some of concepts and complexities in management analyses related to increasing water productivity. We have to be very careful in identifying the scale at which we measure water productivity. The issue of the scale of analyses is fundamental. As we move from one scale to another, the potential utility of a cubic meter of water changes and this potential can increase the water productivity with reusing return flows, adding storage facilities and use of groundwater aquifers and pounds of farmers fields through gravity and pump diversions to increase irrigation water area.
**Keywords:** water productivity, management

**Introduction**
One of the critical challenges of the early 21st century will be the resolution of the water crisis. The water productivity in Iran is very low and approximately is 0.75 kg/m$^3$.
Today’s world population of 6000 million is expected to reach about 8100 million by 2030, an increase of 35%. The growing population will result in considerable additional demand of food. Simultaneously, the water demand from non-agricultural sectors will keep growing in both developed and developing countries. A recent FAO analysis (Anonymous, 2003) of 93 developing countries expects agricultural production to increase over the period 1998–2030 by 49% in rain fed systems and by 81% in irrigated systems. Therefore, much of the additional food production is expected to come from irrigated land, three quarters of which is located in developing countries.
The irrigated area in developing countries in 1998 nearly doubled that of 1962. There are many reasons to believe that such rapid rate of expansion will not continue in the next

decades. FAO estimates that the irrigated area in the selected 93 developing countries will only grow by 23%over the 1998–2030 periods. However, the effective harvested irrigated area (considering the increase in cropping intensity) is expected to increase by 34%.

Water productivity is dependent on several factors, including crop genetic material, water management practices, agronomic practices and the economic and policy incentives to produce. Corresponding to this, there are many people working in parallel on means to increase the productivity of water but the effort remains disjointed. Part of the reason is that we do not have a common conceptual framework for communicating about water productivity. Water use and management in agriculture cross many scales: crops, fields, farms, delivery systems, basins, and nation. Working with crops, we think of physiological processes: photosynthesis, nutrient uptake and water stress. At a field scale, processes of interest are different: nutrient application, water conserving soil tillage practices, bonding of rice field, etc.

When water is distributed in an irrigation system, important processes include allocation, distribution (primarily for irrigation farmers), conflict resolution and drainage. At the basin scale, allocation and distribution are again important, but to a variety of uses and users of water. Processes between scales are interlinked. Basin scale allocation practices can set a constraint on how much water a farmer receives and the influence on farm water management practices.

At the field scale, water enters the domain by rain, by subsurface flows and, when irrigation is available, through irrigation supplies. Water is depleted by the processes of growing plants: transpiration and evaporation. The remainder flows out of the domain as surface runoff or subsurface flows or is retained as soil moisture storage. In estimating water productivity, we are interested in water inflows and water depletion.

Within an irrigation system we have the same inputs as in rain fed agriculture rainfall and surface and subsurface flows plus artificial irrigation supplies. To the intended depletion by crop transpiration, water is also depleted by evaporation from weeds, trees, fallow land and water bodies. Drainage water is sometimes directed to sinks. Other outflows can be recaptured for use.

At the basin scale, other processes uses – industrial and domestic as well as depletion by ecosystems are significant. A closing basin has no discharge of unable water in the dry season. Therefore any additional depletion in this season results in a decrease in existing uses. However closing system does have discharge of unable water in the wet season. Thus there is at least the possibility that the basin can be reopened through the development of upstream surface and subsurface water storage of wet season flows for use in the dry season.

At the basin scale, outflows require special consideration. Some out flow is required to maintain an environmental balance to flush out salts and pollutants, prevent saline water intrusion and supply water and nutrients for coastal fisheries and ecosystems. Floodwater that cannot be captured by existing facilities is considered utilizable for within basin use.

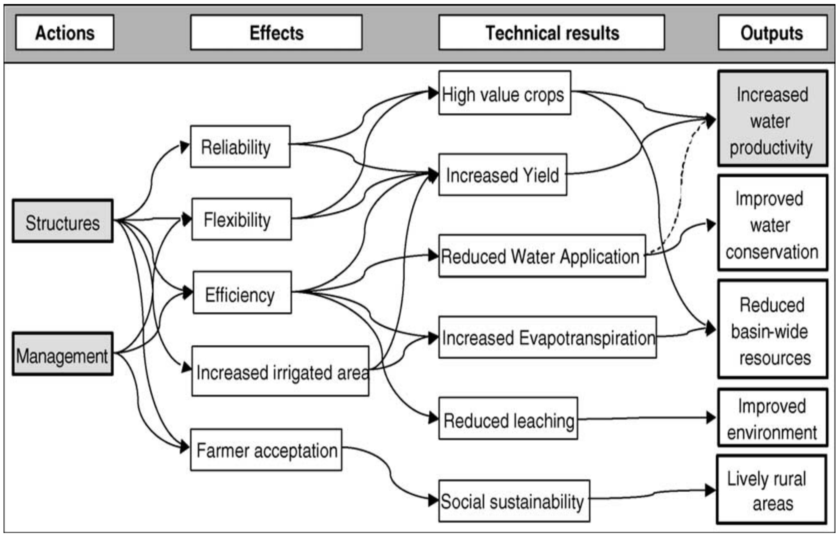


**Fig.1. Flux diagram of the actions, effects, technical results and outputs related to irrigation modernization and optimization.**

According to Fig. 1, from a qualitative standpoint, basin-wide water resources are bound to decrease with irrigation modernization and optimization.

The aim of this paper is to discuss how the modernization and optimization of irrigation systems can contribute to the increase of water productivity in a context of global water scarcity and to propose a conceptual framework to enable us to work and communicate better together. Attention will be paid to the role of irrigated agriculture in the satisfaction of the growing food demand.

## Conclusion

The analysis of water productivity requires clear understanding of the scale of analysis and the interaction between scales. The productivity of water expressed as mass per unit of water transpired (ET) is a basic measure of water productivity, valid at any scale.

We have to be very careful in identifying the scale at which we measure water productivity. The issue of the scale of analysis is fundamental to the improvement of water productivity. The potential utility of a cubic meter refers to the volume of water transpired. But at the basin scale a cubic meter may have many potential uses, each of which values the same water quite differently. There is a need to understand interaction between scales. Intervention made on a local farm or irrigation scale does not necessarily lead to direct increases in productivity at larger scales, nor do they necessarily free water for higher value uses. Adequate irrigation scheduling can be used to optimize crop yield for a given level of crop evapotranspiration, therefore leading to more yield per unit of evapotranspirated water. However, the magnitude of such expected improvements is small in comparison with the required increment in global food production. Therefore, prospects for the future include a sustained increment in yield, Research will be required in the next years to assess the quantitative effect of irrigation modernization and optimization plans on basin-level water use.

Irrigation system and basin level strategies to increase water productivity:

- Improved water management: provide better timing of supplies to reduce stress at critical crop growth stages.
- Improving non-water inputs: agronomic practices such as land preparation and fertilization can increase the return per unit of water.
- Reducing depletion: lessening of evaporation by decreasing area of free water surface and controlling weeds. Reduce deep percolation and surface runoff.
- Reduce return flows: through gravity and pump diversion to increase irrigated area.
- Adding storage facilities: including reservoir impoundments, ground water aquifers, and small tanks.

One peculiarity of assessing the productivity of water is that the values are highly dependent for water at farm level may result in significant improvement in water productivity when measured at farm level may remain unchanged unless there is a specific effort to utilize the water not used by an individual.

**Reference**

Modlen D., H. Murray, 2003. A water productivity framework for understanding and action. Water productivity in agriculture.

Seckler, D., R.Barker, 1999. Water scarcity in the twenty first century. Water brief 1, IWMI, Colombo, Sri Lnaka.

Seckler D., Sakthivadivel, R., 2003. The concept of efficiency in water resources management and policy. Water productivity in agriculture.

Smith M., 2000. Optimizing crop production and crop water management under reduced water supply. Microirri Cape Town.