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SUSTAINABLE MANAGEMENT-FEE COLLECTION MECHANISM FOR IRRIGATION AND DRAINAGE FACILITIES IN ISLAMIC LAW

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Abstract

Increasing the environmental stresses on water resources are causing countries to reconsider various mechanisms to improve water use efficiency. This is especially true for irrigation agriculture, a major consumer of water. The physical and hydraulic characteristics of the irrigation distribution system often form a major limit. Also the implementations of irrigation water fees are sensitive to physical, social, and religious beliefs, making it necessary to design allocation mechanisms accordingly. The purpose of this work is to study the water pricing mechanisms to improve cost recovery for irrigation and drainage facilities under the Islamic law and its impact on water saving. The study tries to find out if there is an irrigation water pricing system that better meets the social, economical, and environmental needs. Also the research tries to highlight Egypt's experience in dealing with the cost recovery in irrigated agriculture. the main findings to agree with Islamic law that cost recovery for irrigation and drainage services would be limited to those infrastructures that are used solely for direct irrigation and drainage and should ensure that at least the full operation and maintenance costs are recovered, because they reflect the service costs of providing farmers with irrigation water and ensuring acceptable drainage. When the pressure of demand on water resources is high and competition exists between uses of water, quota systems are imposed on agriculture. To get high cost-recovery rates, farmers should not only agree on the costs to be recovered but also see the fees collected are used to maintain and improve "their" system.

Key words**:** *cost recovery, Egypt* **,** *water saving*

INTRODUCTION

Problems of water management in agriculture are gaining increased importance worldwide. The implications of a rapidly increasing population on food demand, the environment and water availability are severe. Within this context water availability becomes an important reason in global development and issues of sustainable development and water management attract prominent attention. Per capita availability of water is declining rapidly in many regions of the world and in particular in Islamic countries because of a rapid population growth. Some of the countries in such regions move rapidly into a water scarcity and water crisis. Such alarming trends imply that issues of water availability transcend sectorial considerations and have important effects on a country's economic and social development. The social dimension is yet another reason that comes into play as farmers have their own views of water that are derived from cultural, traditional and religious beliefs [1].

Being a gift from God, it could be implied the issue of pricing water itself, would be a controversial one in an Islamic community, given the way every individual thinks about water based on the Holy Book (Qura'an).

One of the main concepts of Islam is the economic integration between people with different income. As water is the most important of life, it should be the first on the list of economic integration priorities. The Qura'anic verse says: "*So life will not be a trade between the rich*". The previous verse is a good example of economic integration, and shows the importance of equity in resources management [2].

Most Islamic Scholars agree that water sources such as rivers, canals and springs are

public ownership and should be managed wisely for the welfare of the whole community. There is only one case where water can be privately owned and that is the full enclosure, the same way it can be enclosed in a jar or a pool [3].

Pricing of the service of developing, purifying, and delivering water may be another issue "Islam allows water providers to recover their costs not for water itself". Governments, municipalities, and contractors in the Islamic countries can recover their costs for collecting, storing, treating, and delivering water, and for treating wastewater. Currently, about 80 % of water consumed in the region is used for irrigation, although with rapid population growth and urbanization, not enough is available for domestic purposes [4,5].

Islamic principles are often not made the basis of water policy in most of the Muslim countries because until recently there was no need for nor was there any tradition in the Islamic history for water management and distribution. As water shortages meet with other stressors of present times such as population increase and climate change, there is a need to internalize the Islamic principles into water management strategies as they are a part of every other aspect of Muslim life [6].

Among various policies in dealing with the intensifying water stress, pricing mechanism has been given a high priority. Carrying out pricing mechanism, efficiency of water use and sustainable management of water resources has been high on the agenda of policy makers at all levels [7]. So the main target of this work is studying the irrigation water pricing mechanisms to improve cost recovery and its impact on water saving according to the Islamic law. Also the work will study in deep the Egyptian case.

MATERIALS AND METHODS

In order to set up this paper, the study adopted both descriptive and quantitative analyses. As regards data, the study depended on published and unpublished data, issued by the Ministry of Agriculture and Land Reclamation (MALR); Ministry of Water Resources and Irrigation (MWRI) of Egypt; World Bank reports; and Food and Agriculture Organization of the United Nations (FAO). The influence of irrigation cost recovery was evaluated. Also, using a combination of field studies and surveys of the relevant literature as well as the authors' observations, the authors built up a picture of some key points and recommendation for water saving

RESULTS AND DISCUSSIONS

Water resources situation in Islamic countries

Most Islamic countries are situated in regions with similar agro-climatic conditions (arid to semi-arid) and with the most water scarcity in the world. Natural water resources are limited, fragile, and threatened. Freshwater is derived from rainfall that either recharges groundwater aquifer systems or is impounded in artificial reservoirs, where possible during rainy season, to be used throughout year. Huge freshwater bodies like big rivers and lakes are limited; freshwater supplies are unequally distributed, unequally shared, and irregular in time and space, creating water shortages in most of the countries [8].

Water resources development and planning has been the responsibility of governments in several Islamic and African countries but the governments did not have the financial and institutional ability to install, operate and maintain the water facilities. This has led to facilities and water infrastructures remaining poorly maintained and even collapsing such performing the sector as a whole remained grim. Despite moves being taken by some countries, there is still lack of appreciation to accepting water as well as social importance has an economic value which must be treated in all its competing uses. This has affected sustainability as funds for operation, maintenance, expansion and rehabilitation of projects in particular for irrigation purposes have not been fully recovered. Thus the issue continues to be one of the major underlying problems constraining water resources development [9].

Water pricing and cost recovery

Water fees are collected from farmers for two main reasons. The first is to cover the operation and maintenance (O&M) cost so the project is financially sustainable. Often, fees will also need to include a charge for the cost of capital needed to erect the project. This charge for capital is important for future irrigation investments. The second objective involves pricing to encourage farmers to use less water per unit of output or produce greater net economic returns per unit of water, or both. Historically, the first objective has been paramount, but as water scarcity increases, the water use efficiency objective is likely to grow in importance and be given a higher priority [10].

The current water prices in the most Islamic countries are still low, with relative differences between countries. The average share of water costs is way below 10% when considering all countries on which data is available. In countries where the prices are still low such as Pakistan and Syria, even doubling the current prices, which would be very sensitive from the political standpoint, would keep the share of water costs below 5 to 10%. Within countries, the share of water costs varies between regions as well as from one crop to another. In Tunisia, the share varies from 7% for winter irrigated crops, such as cereals and forages, to 30% for summer crops, such as vegetable crops and fruit trees. Whereas in Morocco, the share of water costs to variable costs varies from 8 to 33% with a mean in all irrigated schemes of 20% [1].

As mentioned before, these costs should be identified based on the concept that water is free under Islamic law and water tariffing has to never mean for selling water. It has a means of recovering part of the cost of service. Therefore, transferring and distributing irrigation water to each farm needs irrigation infrastructure and improvements for which costs for construction and/or reconstruction and O&M inevitably incurred.

Cost recovery mechanisms

There is no one easy means to improve cost recovery. However, many countries have improved cost recovery through basic irrigation reforms. The reforms varied with the irrigation system type, management structure, and government policies and institutional arrangements [11]. For instance, O&M of irrigation projects can become more efficient by setting up mechanisms that encourage farmers' participation and in this way willingness to pay of farmers is increased, the quality of services is improved, and irrigation projects become self-sustained.

The following are the most common ways of defining charges and their differentiation according to uses and users [4, 10, 12, 13]:

1. Area-based charge: the irrigator is charged according to the area irrigated, based either on: (i) the area owned; or (ii) the area cropped (declared by the farmer or assessed by the agency).
2. Crop-based charge: the charge is based on area and type of crop. Differentials may be justified by crop priority (e.g. Cereals for food security) or water diverted or consumed by crop or its value.
3. Volumetric charge: water is charged, based on diversions to a user or group of users (bulk water pricing). Metering is necessary but volume may be represented by time or the number of 'turns', provided discharges are more or less stable and predictable.
4. Quotas-based charge: its allotments often are used in these situations to mitigate equity issues or resource management issues; water conservation that arises with a water market or marginal cost pricing. By allowing quota allotments to be traded, the water authority can address equality concerns while promoting efficient allocations.
5. Market-based charge: the price of water is determined in a market where allotments can be traded (within season, seasonally or permanently). If the market is regulated, the regulator may set the price, set price limits, serve as broker, etc. (As in the California Drought Bank). To operate effectively, water markets need a well-defined structure of water rights, a clear and comprehensive set of rules for trading, an entity to manage water

delivery, and a judicial body to oversee trading activities and resolve disputes. They also need a well-developed conveyance system for transporting water to all participants.

Each method has its advantages and disadvantages, notably the ease with which charges can be calculated, justified and completed. Another modalities may also vary: for instance, charges may vary by season, be paid before or after cropping, in one or more instalments, in cash or in kind, etc.

Market-based price mechanism is rejected according to the Islamic law because it considers water like a good, whereas, most of the other mechanisms are acceptable provided for provision of services or improvements.

Egyptian case study

Egypt has no history of charging or pricing for water as same as most Islamic countries. Major infrastructures and facilities of the irrigation and drainage (I&D) system such as dams, barrages, pumping stations, levees, main canals, and drains are funded, operated, maintained, and rehabilitated under the government budget allocated to the Ministry of Water Resources and Irrigation (MWRI). Egyptian irrigation law needs cost recovery from beneficiaries for erecting mesqa and the field pipe drainage system improvements. The legal framework for forming Water Users Associations (WUAs) and cost recovery of mesqa construction costs was fully proved by the Law 12/1984 amendments and its 1995 by laws "These laws were drafted following the rules of Islamic law"**.** It allows establishing WUAs and allows the recovery of mesqa construction costs.

(a)Cost recovery for traditional land (nonimproved)

Today, farmers in Egypt pay very few taxes relative to their incomes. Farmers with three acres or fewer of land and no other source of income are free from land tax and other taxes that are attached to agricultural land tax. In all cases, these exemptions do not apply if the taxpayer has other sources of family income. To get an exemption, however, farmers must apply to their local authorities each year and go through an extensive bureaucratic process. As a result, most farmers pay their land tax whatever the size of their holding.

Table 1 presents the average costs the farmer pays per acre of agricultural land whether it is in the form of land taxes and other duties. Charges for water services had not been introduced [14]. Irrigation pumping is an individual activity for each farmer.

Table 1. Average farmer's contribution to irrigation water management in nonimproved old lands.

Irrigation management activity	Costs (LE/Acre/year)
Cleaning field ditches (marwas)	11
Desilting field canals (mesqas)	13
Cleaning field drain	15
Desilting private field drain	17
Capital cost subsurface drainage	35
Land tax	30
Total	**121**

Note: US$1= LE 6.90 (2013)

(b)Cost recovery for irrigation systems in old improved lands

The cost recovery for the mesqas and pumping stations in Improvement Irrigation Project (IIP) areas forms about 86 percent of the total cost of improvement. The remaining 14 % goes to the improvement in the branch canals that farmers are not repaying under the existing legislation.

The payment for mesqa investment, which is expressed as most incremental income charged to irrigation improvements, varies between 15 and 25 % [15].

This shows the ability of beneficiaries to pay, and it also shows that farmers have a strong incentive to participate in the IIP. O&M costs are the responsibility of farmers located downstream from the delivery point. Failure to fulfill this obligation results in the work being undertaken by MWRI and charged to the farmers on a general average value plus a 10 % administration charges.

(c)Cost recovery for irrigation systems in new lands

In the new lands, the government constructs the main parts of the irrigation system, including main regulators, main pumping

stations, drainage reuse stations, main canals, and drains at no charge. Farmers are charged for the investment costs for all infrastructures located downstream of the booster pumps that draw from distributary canals, which serve between 100 and 200 acres. Such investments may be undertaken independently at the farmers' expense or by the government with cost recovery according to the established rules [16].

(d)The impact of fee collection mechanism and pricing

Based on the study, the Irrigation and Drainage Law No. 12 of 1984 was amended to clarify and consolidate farmers' irrigation/drainage infrastructure. The Law clearly describes the cost of reconstruction of tertiary and on-farm irrigation/drainage infrastructure should be fully collected from farmers over a 20 year period with no interest charged. The cost of reconstruction of the tertiary and on-farm irrigation/drainage infrastructure can be collected with land tax [12]. Several studies by International Irrigation Management Institute [17] measured the impact of different pricing and fee collection alternatives on the agricultural sector in terms of irrigation water used and farm income. Three pricing schemes were tried. First, a fixed rate of LE 70 per acre, irrespective of crop or water use, resulted in a fall in farm income of 4.5 % but had no effect on the choice of crop or technology. Second, an area-crop-based charge, proportional to the calculated average water consumption of each specific crop, resulted in a 2.4 % fall in farm income. The demand for irrigation was water reduced by 3.5 % and the returns to water increased by 2.7 %. Third, a volumetric charge based on the quantity of water delivered resulted in almost identical impacts as those got in the second case. The key factor explaining the different responses appears to be the availability of crops that farmers can choose to grow [18].

(e)Short summary

Fig. 1 presents distributing cost recovery items according to the duties of improvements under the Egyptian law. Farmers are responsible for O&M of the improvements provided by MWRI at the tertiary-canal level. But the prevalent case is one in which MWRI is entrusted with the O&M; then, land taxes are levied at LE 30 per acre/year (on average), which accrue to local governments at a collection efficiency of 60-75 %. The cost currently incurred by farmers for irrigation (pump rental, tertiary-canal O&M) is 5-10 % of the farm budget (reaching 15 % for farmers growing sugarcane). An average fee of LE 85 per acre/year is estimated to be acceptable to meet the full O&M costs for irrigation services.

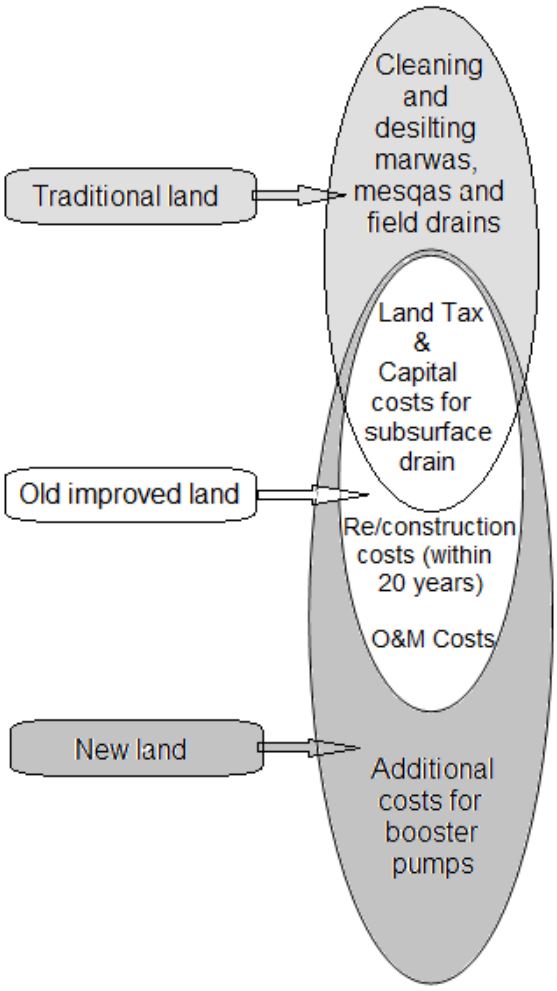

Fig.1.Distribution of cost recovery items in Egypt.

The collection rate of O&M cost for irrigation remains low because cost recovery is still a new concept and it is a transitional period in Egypt, the Government kindly provides subsidies to ease the farmers' burden.

The Water Boards Project is testing ways to transfer water management responsibilities at the secondary level of the irrigation system from the MWRI to user organizations. This would reduce the government's contribution to O&M costs about 50 %. The Project will be testing new organizational arrangements that fuse investment and operational functions managed by MWRI agencies with user organizations that operate and maintain the irrigation network below the secondary-canal level.

Key factors for reducing water use

To encourage farmers to useless irrigation water per acre, water charges have to be related to water that farmers receive. Thus, volumetric water pricing should be considered when reducing water use per acre is the major concern.

In cases of high volumetric measurement costs, area-crop or area-technology based charging methods can be considered as a second best approach if they can be designed to influence water use.

Another possible combination is area-technology-based charge. Although it has not received much attention, theoretically it should promote selected irrigation technologies. The basic idea is similar to area-crop-based charges, with farmers using water-saving technology paying lower per acre water charges. For example, drip and sprinkler irrigation allow better water control and more output per unit of water delivered than flood irrigation.

Therefore, a higher per acre fee could be levied on farmers not using these technologies to encourage them to switch. Also, if the government supports farmer by introducing the drip and sprinkler irrigation facilities with low capital cost, it can push them to switch. This step will lead to save more water that can help the government to expand the agricultural area.

CONCLUSIONS

The Muslim world cannot afford to waste a single drop of water. Governments should urgently implement sustainable water management policies which rationalize demand to ensure more efficient use. This can be achieved by attaching an economic value to water, measured by the value of the end product from each drop. Governments should implement water efficiency measures, shift from irrigation by flooding to more efficient irrigation systems, introduction of crop varieties that are resilient to salinity and aridity, recycle, treat and reuse wastewater, and develop affordable technologies for water desalination.

It will not be acceptable to most farmers particularly in nonimproved areas to introduce an extra fee for irrigation and drainage services other than land tax. Cost recovery for irrigation and drainage services would be limited to those infrastructures that are used solely for direct irrigation and drainage. Cost recovery should ensure that at least the full O&M costs are recovered, because they reflect the service costs of providing farmers with irrigation water and ensuring acceptable drainage.

The area pricing system that accounted for 60% of the sample studied by Bos and Wolters [19] modified according to the crop or irrigation techniques. It does not encourage water saving for a given choice of crop or irrigation technique, but it does have more effect than the area pricing system on the choice of which crops to irrigate or which irrigation technique to adopt. It can be used to discourage to irrigate certain crops for example, by applying a higher price to crops that consume a large volume of water (such as rice and sugarcane in Egypt).

When the pressure of demand on water resources is high and competition exists between uses of water, quota systems are imposed on agriculture. They then coexist alongside a pricing system whose only objective is to pay for the services of the water provider and possibly for the water itself. Quotas guarantees a limit to consumption which will not be exceeded, at least if the penalties and the laws ensure that it is followed.

To get high cost-recovery rates, farmers should not only agree on the costs to be recovered but also see the fees collected are

used to maintain and improve "their" system. Having the fees collected go back into the general revenue fund of the state or federal government, provides farmers with a strong incentive not to pay fees. One good approach is to have the water supply entity or the WUA collect and keep most of the fees for use in "their" system.

Mostly, the cost of water represent 10 -20% of the production costs for most crops. As for the vegetable crops, they may be as low as 5%. Might such costs would have a tangible impact on the production, they should be increased (double or more); a trend which is now favored in most countries. In such a case, the farmer will find ways to avoid cultivating the high water-consuming crops.

Since crop charges indicate to the benefit received, it is also recommended the basis for setting service charges to beneficiaries should be crop-related, and reflect water consumption of the crop. Beneficiaries should also have the right to claim if remission of rates in case of crop failure.

There are many factors that might affect the disfavoring of charging for irrigation water. There are economic reasons, as many people are under the poverty line. There are also cultural reasons, as Egyptians take pride in the River Nile, paying for its water will never sound like a pleasant idea to them. However, what might sound possible is charging penalties for landowners who violate the law by cultivating rice or sugarcane, or charging costs for irrigation and drainage for strengthening improves infrastructure.

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