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BEST POLICIES AND PRACTICES FOR AGRICULTURAL WATER MANAGEMENT IN THE NEAR EAST REGION

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SUMMARY – With the most acute water-deficit in the world, the Near East Region challenge for economic and social development is likely to be jeopardized unless drastic measures are taken. The increasing need for water stems from population growth, national economies based primarily on agriculture and harsh climatic conditions and climate change that make rainfed agricultural production volatile. Over the past half century, the increase in food production was mainly due to increase in water availability. Water has contributed more than any other input factor to regional food security. Today, the conventional response to water demand increase through the mobilization of additional resources is either limited or cost-prohibitive. The agriculture sector, by far the largest user with nearly 90% of the total, is faced with the paradox of meeting increased food needs with less water as a result of competition from other sectors that have higher priority and greater value-added to water use. At the same time, agricultural water use has a lower productivity in comparison to its potential as a result of several policy and management drawbacks. Countries of the Region are gradually shifting to water demand management and alternatives to freshwater, through the use of low-quality water resources and desalination of seawater. However, the pace of change is slow and could easily be taken over by increased demand, on one hand, and the options considered are often fragmented and lack integration, on the other. Based ob FAO experience in the Region, the paper first highlights a diagnosis of the main issues facing agricultural water management, focusing on key policy, managerial and technical aspects, and on the lessons learnt from past experience. Then it proposes strategic options that are likely to address these issues, with due consideration to ensuring the highest possible level of food security, resource sustainability and environmental preservation. The foundations of the proposed options stem from the need for countries to chart new irrigation strategies that are marked by departure from previous approaches and which address the underlying causes of the problems rather than the symptoms. They are based on improving productive efficiency of irrigated and rainfed agriculture and removing policy constraints by improving water allocative efficiency. The option of virtual water, as a complement of the proposed reforms, is assessed and the extent and conditions of its applicability are discussed.

Keywords: Near East, Agriculture water management; Productive efficiency; Allocative efficiency; Virtual water

1. INTRODUCTION

The Near East Region is facing a huge challenge with water shortages and food insecurity. The population of the 30 countries exceeds 652 million and is expected to reach 1.5 billion over the next 30 years. The Region is characterized by an acute and unparalleled deficit in water resources, to the extent that 16 countries have less than the “deficit threshold” of 500m3/capita/year. This alarming situation is aggravated by the dry climate which make agriculture and food production very dependent on irrigation. With the exception of the major oil producers, national economies are based primarily on agriculture and so the importance of water resources for economic and social development becomes more evident.

The demand for water is not static. It continues to grow as the population increases and living standards improve. According to recent FAO estimates, farming, industrial and urban needs will increase water demand by 40 percent by 2030 in arid, developing countries. Over the past decades countries in the Region have tried to overcome this problem by investing heavily in mobilizing their water resources. At present 60% of all renewable resources have been put to use, and many

countries have resorted to their non-renewable resources, to the use of non-conventional resources, such as treated wastewater and low-quality water, and to desalination of seawater.

Continuing to increase the usable quantities of water is no longer an option in most countries of the Region, as only limited quantities of renewable resources remain available for mobilization, the expansion of supply is limited by economic and environmental costs, and non-renewable resources are expensive to recover. At the same time, the share of resources allocated to agriculture (now close to 90 percent) is decreasing because of competition and the priority of other sectors. As a result, countries are shifting their water policy from supply driven management to demand management; but the pace of change is slow and could easily be taken over by increased demand, on one hand, and the options considered are often fragmented and lack integration, on the other.

2. WATER AND AGRICULTURE ECONOMY

The Near East Region is the most water-scarce in the world. It covers 14 percent of the total area of the world and contains 10 percent of its population. Its renewable water resources are only 2.2 percent of the global total. The issue of water scarcity is further exacerbated by a high dependence on water resources that originate outside of the Region, in terms of both freshwater inflow and imports of foodstuffs. Growing population and the need for food and drinking water, usually coupled with a short vision on water resources planning and management, have resulted in an imbalance between water supply and demand. Pollution, salinization, climate change and frequent severe droughts are making the problem more serious and the future uncertain. This is all leading to greater competition for water and, consequently, to greater risks of food insecurity in the Region.

Agricultural land represents only 8-10 percent of the Regional land area. Only less than 32 percent of this arable land is irrigated but contributes more than 50 percent of the total agricultural production. The importance of agriculture in the economy is indicated by its significant contribution to the gross domestic product of the Region (5 - 40 percent, with an average of 25 percent) and the provision of job opportunities for 37 percent of the labour force. It also accounts for the Region’s total non-oil export earnings (4 percent) as well as for a range of other socio-economic and environmental benefits. Irrigated agriculture induces higher benefits for farmers, through increased and more stable incomes and higher value of irrigated land.

When considering all forms of irrigation, including spate and non-perennial, the irrigated area in the Near East has increased from 9Mha in 1950 to about 48Mha in 2000; with 72% concentrated in 5 countries. This increase over 50 years was a major factor in increasing agricultural productivity and production. Presently, the total Regional water use for agriculture is around 560 billion m3 (BCM). The increase in production was mainly due to increase in water availability from both surface and groundwater sources. Water has contributed more than any other input factor to regional food security.

3. MAIN ISSUES WITH WATER MANAGEMENT

The key question for the Near East countries is whether the current policy frameworks for water and land use will lead to the achievement of the Region's future food security objectives. According to FAO, water demand will increase by 40% by the year 2030 in semi-arid, developing regions. Moreover, 60-70% of food-demand increase will have to come from irrigated agriculture. With this and the diagnosis given above, the Near Countries will need to do more to promote more efficient measures for managing scarce water and agricultural land in a sustainable manner. Water scarcity, deteriorating quality, the rising cost of irrigation development, and the low efficiency (both productive and allocative) of irrigation water are key issues. Within the food security context, there is an urgent need to assess how the growing food deficit can be met under water constraints and what role ‘virtual’ water will continue to play in narrowing the gap.

3.1. Water quantity decline

Water resources in the Region are limited and vary from year to year. The average share of less than 2.2 percent of the world's total water resources reduces to about 1.2 percent when considering internal renewable water resources; the rest flows in from outside the Region. The average annual precipitation is only 3.5 percent of the world's total freshwater. The available resources are not evenly distributed within the Region and are characterized by extreme inter-annual and seasonal variations.

The demand for water in the Near East continues to grow as a result of high population growth rates (more than 3 percent in some countries) and the push for greater economic development. This has steadily reduced the per capita share of water resources over the past half century, offsetting socio-economic development efforts.

Groundwater continues to be one of the dominant sources of water in the Near East Region. The management of groundwater has not always met the required standards and there are clear indications of major problems, including mining of fossil, non-renewable water and over-abstraction of renewable resources, with their consequences in several parts of the Region. Groundwater level has dropped by up hundreds of meters and many aquifers have either dried out or reached high salinity levels; however, the full impact of this on many rural and urban populations is not well known.

Desalination is an option used by oil producing countries to augment their limited quantities of surface and groundwater resources, but it is used mainly for domestic and industrial purposes. The Gulf countries account for nearly 60% of the world's desalination capacity. Desalination is still not cost-effective for agricultural production. Its widespread use in the Region for this purpose is constrained as long as the value of traditional supplies does not reflect the scarcity value of water and the high cost of the desalination technology.

Wastewater in most countries of the Near East Region is increasingly being recognized as a vitally important alternative source of water provided it is treated and made safe for reuse; but the expansion of its reuse is linked to a number of issues and constraints. The treatment and management of wastewater is costly and places an additional burden on countries whose economies are already weak. Unclear polices, institutional conflicts and a lack of regulatory frameworks also hinder implementation and proper operation of wastewater reuse projects in the Region.

From the available data and future projections, it is evident that there are insufficient water resources available to meet the expected food demand in the coming years. Renewable water resources have fallen from 3,500m3/capita/year in 1960 to 1,500m3/capita/year in 1990. Continued population growth over the coming decades will exacerbate this problem. The World Bank predicts a figure of 667m3/capita/year by 2025 compared with a worldwide average of 4,780m3/capita/year.

Water availability for food security has to be addressed alongside the implications of importing food i.e. access to 'virtual water'. This may not be a problem for the richer countries but it could create difficulties for middle income and the least developed countries in the Region.

3.2. Water quality degradation

Problems of water quantity are exacerbated by the problems of water quality. These have grown as countries have tried to meet their water demands through water recycling, without due consideration to long-term negative impacts. Whilst water has been instrumental in economic growth in the Region, its mismanagement has resulted not only in overuse but also in degrading its quality. Wasteful overuse in one area can deprive users in other areas, leading to falls in agricultural production, loss of jobs and of food security.

Several countries continue to face the traditional problems of salinity and water logging that have rendered important areas of the Region sterile since ancestral times. Similarly, seawater intrusion in coastal aquifers resulting from over-pumping of groundwater is a major cause of declining productivity.

Domestic and industrial sewage is a source of contamination for both surface and groundwater resources. Domestic sewage comes from the towns and cities, and in some countries it is treated and

released for reuse in irrigation. As urban areas expand, so does the amount of sewage available for reuse. Industrial sewage can be more difficult to deal with. It can be hazardous, and even small volumes of liquid waste can contaminate large quantities of freshwater with elements toxic to both humans and plants.

Pesticides, insecticides and fertilizers, when used intensively and without the necessary precautions, can cause serious contamination to freshwater resources, and pose a threat to both human health and the environment.

Groundwater can deteriorate as a result of over-exploitation or direct contamination or some combination of both. This may be direct or indirect and it stems from inaccurate assessment, inadequate planning and a lack of appropriate management.

Although water quality is a major concern in the Region, in practice little has so far been done to address it.

3.3. Inappropriate water use management

In the Near East, only 8-10 percent of the total land area is suitable for agriculture and production is highly dependent on irrigation. According to FAO, 47.7Mha of land are irrigated and this uses 90 percent of the total water withdrawals or 60 percent of the potential withdrawals. Countries of the Region have invested in irrigation to varying degrees over the past half century. Where water and suitable land were available, large irrigation schemes were established requiring substantial investment. But recent assessments show that the performance of irrigation in terms of water productivity and irrigation efficiency is low, usually as a result of poor irrigation water management. Full or partial control, surface irrigation is by far the most widespread method of irrigation covering 93 percent of the area. This method, combined with poor management practices, is causing large amounts of water to be wasted (overall irrigation efficiency of no more than 50%.) Modern irrigation methods such as sprinkler and localized have been introduced but their use is still very limited except in countries where the total irrigated area is small. In some Gulf countries, more than two-thirds of their irrigated areas are equipped with modern systems, particularly central pivots. However, their efficiency is generally low in comparison with their potential because of poor on-farm management.

The development of capacity within the farming community and in services to support them is too often overlooked in irrigation projects. It is generally wrongly considered that addressing infrastructure or economic problems is enough to improve the situations.

3.4. Decline of investment in irrigated agriculture

Between the late 1950s and 1980s, most countries invested heavily in irrigation development, especially infrastructure such as dams, water conveyance and distribution schemes and irrigation networks. The irrigated area expanded by an average of 1 percent per year during the early 1960s, reaching a maximum annual rate of 2.3 percent from 1972 to 1975. The financial crises in the second half of the 1990s adversely affected investment in irrigation and thus it has continued to lag behind output and trade growth.

Most forms of investment in land and water decreased significantly over the past few years. In the year 2000, government expenditure on agriculture in the Near East Region was at its lowest level, around 1 percent. This decline in investment is affecting not only the expansion of irrigation but also the operation and management of old irrigation schemes and this in turn affects both efficiency and productivity.

Relative low productivity of irrigation in the Region results in part from weak investment in productivity-enhancing factors such as management, appropriate practices, the use of proper inputs, service and marketing.

3.5. Potential regional conflicts

The location of several countries within the catchment areas of the major river basins in the Region affects the actual share of these countries from the flows of such rivers. The cases of Euphrates, Tigris, Nile, and Jordan rivers had been creating disagreements and unilateral actions for water

development plans leading to political conflicts and tension among the riparian countries in these water basins. It was now well admitted that co-operation between riparian countries is the most beneficial option for all; but unfortunately this option had not always materialized in the Region with a few exceptions.

3. 6. Water, trade and food security: the issue of "Virtual Water"

The food gap in the Near East Region is growing. According to FAO estimates, all Near East Sub-regions will have relatively large food deficits by the year 2010, with the exception of Turkey, which has large agricultural resources. The Region's food gap compared with that of 1995 is likely to increase by around 54 percent, reflecting an annual growth rate of 2.9 percent. About one-third of the countries would have a food Self Sufficiency Ratio (SSR) of less than 60 percent, including three oil-rich countries and two low-income ones. But regardless of inter-country variations, the fact remains that the entire Region (with the exception of Turkey) would continue to have a food deficit.

During the 1960s and 1970s, governments of the Region sought to achieve self-sufficiency for basic food crops, irrespective of the natural resources base of the country. This policy ignored the economic and environmental cost of such a policy. However, with economic stagnation, growing water scarcity, broader policy reforms and new and changing global trade policies, the old paradigm of food self-sufficiency is being replaced with concepts of self-reliance and competitiveness.

Up until the early 1970s, it was possible to find, or otherwise mobilize, new water resources through regulating surface flows or pumping additional groundwater. Since that time this option has no longer met the Region's strategic water needs for food self-sufficiency. As a result, the Region has been importing larger quantities of food.

Importing food is the equivalent of importing water in a condensed form, called `virtual water'. The principle behind virtual water is to diversify production based on the comparative advantage of a country or a region as a means of earning foreign exchange to buy food imports instead of growing low-value, high water consuming crops. Virtual water is considered as the simplest and least costly form of water transport and trade between regions. An FAO survey of irrigation and water resources estimated that 86.5km3 of water would have been needed to grow the food that was imported into the Region in the early to mid-nineties. This is more than the annual flow into the Region of the Nile River. Egypt, Saudi Arabia, Algeria and Iran import 44 km3 of water equivalent in food. Turkey is the only country in the Region that is a net exporter of cereals.

Virtual water trade is not only potentially beneficial for the importing countries but also for global water management for two reasons. Firstly, one of the main imports is cereals and these can be produced with less water in countries having high water productivity. Secondly, the bulk of the imported grain is produced under rainfed, temperate conditions and is therefore only 'consuming' soil moisture, and not surface and groundwater that might be allocated to other uses.

Prices of basic foods, in particular cereals, have fallen steadily on the international market for many years in real terms and so importing grain to save water for other competing uses might be a prudent policy to adopt. One option is for countries to use their limited water resources to grow high value crops for export. The foreign exchange earned from this can then be used to buy cereal imports. This, however, is a sensitive subject that needs to be evaluated on both political and economic grounds.

4. STRATEGIC OPTIONS FOR IMPROVING WATR MANAGEMENT AND FOOD SECURITY UNDER WATER SCARCITY CONDITIONS

The options to alleviate the burden of water shortage and its impact on food security can be grouped into two categories: Options not directly liked to water resources, such as population growth control and changing nutritional and dietary habits, and those that concern water resources per se. While governments are advised to address both categories in an integrated manner because they complement each other, the focus of this paper is on policy and strategic options of direct concern with water resources development and management.

Given the above policy diagnosis, what can be done to improve water management while sustaining a high level of food security? Is virtual water a policy option for countries facing budgetary and marketing constraints bearing in mind the expected rise in world grain prices? The Region needs to chart a new irrigation strategy, marked by a departure from previous approaches and addressing the underlying causes of the problems rather than its symptoms. Often policy reforms are highly politically charged as different interest groups see the modality of approach differently. The success of reforms will depend on how actual implementation takes place.

Water demand management offers a means of replacing the need for additional water resources and can forestall certain supply costs. It refers to improving both the productive and the allocative efficiency of water use. In practical terms, it calls for an integrated use of conservation practices and pricing to influence water use – both the total level of water use and the pattern of use. However, water demand management does have limitations. Therefore, the appropriate use of water demand management is not to replace supply-side sources and investment but rather to encourage a cost effective mix of supply and conservation resources. The new strategy should aim achieving the following objectives, as explained in the sections below:

- Improving productive efficiency of irrigated and rainfed agriculture;
- Removing policy constraints by improving water allocation efficiency;
- Assessing virtual water as an option to fill the gap under the above two options.

4.1. Enhancing water conservation and productive efficiency

The supply management policy, based on investment in infrastructure, subsidies and management by the public sector, should lead the way progressively to demand management policies, based on more efficient irrigation, enforced technical support services and the participation of farmers in water management and maintenance of their irrigation schemes.

4.1.1. Improving water use efficiency under irrigation

The overall irrigation efficiency in the Region is estimated at 45-50 percent, inferring a loss of more than 50 percent of the water diverted for irrigation. Although part of this loss is recycled, the rest is not economically recoverable. In addition, the loss often results in lowering water quality, degrading land and water, and decreasing farm profits. The total water loss in 9 countries represents 28% of the Region's total renewable water resources.

The concept of efficient water use may sound simple in theory, but it is complex and difficult to achieve in practice. However, improving efficiency can contribute significantly to meeting growing demands. For example, increasing the average regional water use efficiency to 70 percent by the year 2025 would save enough water to meet about 50 percent of the increased demand for additional water supplies in the period 1990-2025. Where water is the most limiting factor of production, optimizing water productivity is a better objective to be sought from the economic standpoint than simply increasing water use efficiency. It is also the best alternative from the financial standpoint when the farmer bears the cost of water; however, when water services are provided free of charge, maximizing the yield is more beneficial to farmers than optimizing water productivity.

It should be noted that the term "irrigation efficiency" as used above is concerned with the delivery of water from its source and on the farm in relation to that actually used by the crop. It is not concerned with the efficiency with which individual plants make use of the available water. Research into the latter to reduce the water use by the crop itself could be as important in terms of water savings and improving irrigation efficiency.

4.1.2. Modernization of irrigation scheme management

Given the need to use irrigation water more efficiently on existing schemes, it follows that the bulk of new investment should focus on modernization rather than on new schemes. Where irrigation expansion is still possible, it is advisable to adopt small-scale schemes with the participation of beneficiaries in the design and management process and their involvement in the issues of social equity and environmental sustainability. These schemes are preferred as large-scale ones in view of the social, economic and environmental problems associated with the latter. In order to maximize returns, scheme improvement should incorporate lessons from previous irrigation developments and

not simply rehabilitate projects to old standards. Improving performance includes repairing and modifying structures and enhancing scheme management and associated institutional arrangements.

There is an acute need to move towards service-oriented management to allow flexibility in farming systems. It is difficult to develop crop diversification and cash crops as alternatives to cereals with unreliable and rigid water distribution systems. Promoting sustainability for irrigation also implies that users will bear the cost of service and therefore must be in a position to decide about what level of service they are willing to subscribe to. Furthermore the need to implement integrated water resource management is also a strong motivation to re-engineer irrigation management in line with reforms in the other water sectors and in the environment.

Emphasis on modernization can contribute to improving returns on new investments in irrigation in a number of ways. Another advantage is that project unit costs are usually low, a fact which increases the likelihood of economic viability.

4.1.3. Improving operation and management

Inadequate operation and management of irrigation schemes is often a major cause of poor project performance and weak sustainability. Many governments have found it increasingly difficult to finance the costs of irrigation operation and management, as well as being effective providers of water services to large numbers of small farmers. These factors have led to infrastructure deterioration, shrinkage of the area irrigated, poor distribution and wastage of water, and advancing waterlogging and salinity.

Many governments are attempting to transfer management responsibility for irrigation systems from government agencies to farmers, organized into Water Users Associations (WUAs). Consensus is emerging that operation and management problems, scheme maintenance, irrigators' ownership of their systems and cost recovery are all interrelated.

The keys to these unusually complex, interrelated problems reside in the principles of financial autonomy and irrigator participation in organization and management by means of viable WUAs. The most promising route to improvement lies in making irrigators responsible for their own organization and management and in providing them with the requisite technical support.

An important factor affecting agricultural water demand is the low capacity of farmers and, more generally, of all those who provide services to irrigation. Recent regional and international events on irrigation advisory services, organized by FAO, identified the lack of such services and the low capacity of existing ones as one of the main constraints to improving irrigation performance and stressed the need to give this issue priority. Developing the capacity of irrigation stakeholders is considered essential to overcome lacks of skills, inadequate organizations, ineffective legislation and insufficient motivation that often jeopardize the best irrigation projects.

The gradual and selective privatization of organization and management (and other aspects of irrigation) shows considerable promise as a way of improving scheme viability and sustainability. Investment in privatization measures has produced encouraging results in other regions, but its introduction in the Near East has been slow. The development of effective Private Public Partnerships (PPP), especially for large-scale irrigation schemes is an important challenge for irrigation operation and management in the Near East. In this respect, there is a need for clear policies on the issue and for definition of the functions to be handled by the private sector and those that should remain with the public sector.

4.1.4. Improving drainage and reducing salinity

Drainage management is also a key to sustainable irrigation in arid areas. Reduction or stagnant crop productivity in many large irrigation schemes of the Region are attributed to poor drainage and salinity build-up. Because of the prevailing climatic conditions, most of the existing irrigated lands are prone to damage resulting from the lack of drainage and soil salinisation. In addition to reducing these risks, drainage would also enable farmers to diversify and intensify cropping, to adopt high-yielding crop varieties and to improve the effectiveness of inputs such as fertilizers and mechanization.

4.1.5. Improving water productivity under rainfed agriculture

About 70 percent of the Region is arid or semi-arid where low and erratic rainfall severely restricts food crop production and causes production instability. In areas where rainfall is 300mm and above, there is considerable potential for increased crop production. In these less-favoured areas, farmers operate under low input/low output production conditions. Improving the production system and introducing water conservation techniques and supplementary irrigation can result in yields competitive with those under irrigation and, at times, more cost effective to farmers. Small-scale farming can be productive in marginal rainfed areas if supplementary irrigation is available to overcome short-term droughts that are critical to crop yield. If there are cost-effective ways to collect and store water and apply it to crops at critical growth stages, then crop production can be considerably increased. Low-cost water harvesting, land improvement techniques and integrated watershed development, coupled with access to credits and markets, have shown promising results. However, farmers in rainfed areas need to be supported to reduce the risk and achieve the production potential. The integrated development of rainfed areas also helps fix rural population, thus limiting migration to cities and the overcrowding of irrigated schemes.

4.1.6. Using non-conventional water for irrigation

The amount of treated wastewater in the Region was estimated at 2.6-4 billion cubic meters in the year 2000, while the untreated amount was 2 to 50 times higher. By 2015, the Region will produce around 40 billion cubic meters of municipal wastewater.

There are considerable potential benefits to be gained from the use of wastewater for irrigation. Reducing the pollution loads of water used by farms, industries and urban areas would enable much more of it to be re-used in irrigation. However, it does require careful management and professional monitoring to reduce the potential risks. Clean up technologies and management tools are available, but technical assistance and regional cooperation are needed to transfer and adopt them.

4.2. Improving water allocation efficiency

The problems of water scarcity, groundwater depletion, pollution, waterlogging and salinity are symptoms of a much deeper problem embedded in policy, institutional and market failures. The instruments to correct these policy and market failures range from outright area restriction to letting market signals dictate the supply response. The most commonly used economic and non-economic tools include institutional instruments, command and control, economic instruments and innovative instruments.

Water reallocation takes place according to the prevailing incentive measures. As agriculture and the rural sector use more than 90 percent of the water and as scarcity of water grows, increasing demand for agriculture to release water to other competing demands puts long term agricultural growth in question and raises food security issues. Among other solutions, this calls for improving the “allocative” efficiency of water use, including both "Inter-sectoral allocative efficiency" and "Intra-sectoral allocative efficiency", because of its implications on the economy and food security.

Inter-sectoral allocative efficiency: Maximizing water productivity means not only maximizing agricultural production per drop of water, but also maximizing the number of rural jobs that can be created with limited water resources. Broadly speaking, non-agricultural users draw much higher benefits from water use and are more willing and able to pay much higher costs. Agricultural users draw fewer benefits and strongly resist higher water charges.

The enormous cost differential will continue to put pressure on agriculture to release water from low value use to high value use, such as for domestic and industrial purposes. This translates into the simple fact that, in the future, the agriculture sector will have to use less water to produce more food. The result will be the exclusion of poor farmers in rural areas, unless they are protected by water rights. Regulations to ensure transferable water rights could lift the controversy over water reallocation, by allowing farmers to negotiate the transfer of these rights against other development packages or other benefits. The obstacles to applying inter-sectoral water allocation on a wide scale include the lack of a clear definition of water rights and their marketability, and the lack of a widespread perception of the true value of water under the circumstances of declining availability.

Intra-sectoral allocative efficiency: Low water prices enable farmers to cultivate high water consuming crops, which cannot be economically grown if water commands a high price. Thus the price of water is a factor that determines the cropping pattern, particularly popular food crops. In practice, as soon as water tariffs come into play or where farmers have to support pumping costs, crops that cannot support the water charges start to be discarded from the cropping patterns.

A common feature of irrigation schemes throughout the world is that the price of water to farmers is subsidized. This usually means there is not enough funding available for system maintenance and there are excessive demands for water. If the cost recovery rate is raised, farmers would have to adjust their cropping patterns and their technologies, so as to demand less water and/or accept fewer benefits from irrigation. This may, however, have adverse effects on the production of some crops of national interest, particularly the production locally of cheap staple food crops that are accessible for the poor layers of the population. Other conditions for farmers to reallocate their water resources to high-value crops and to risk investing in these crops include the availability of credits and access to export markets.

4.3. Polluter should pay to clean water

Clearly, sustainability requires that water quality is not degraded to the point where it cannot be safely used. Countries usually introduce regulations to control pollution. These have largely been command and control methods but more economic and innovative approaches are being used in some countries. However, the regulations are not enforced everywhere in the Region.

The present level of water pollution warrants that steps be taken through more serious pollution control legislation and economic incentives to safeguard the available water resources. There is compelling evidence that at least 20 to 30 percent of the water currently used in households, agriculture, mines, and industry can be saved by adopting appropriate regulatory and policy instruments. The twin benefits of suitable water and reduced demand can be obtained if water recycling and reuse of treated and untreated water is encouraged wherever practical and enacted as law.

4.4. Regional cooperation and conflict resolution

Cooperation between countries on the management of transboundary water resources is extremely limited in the Near East Region. The situation is described in a recent report (2004) by the United Nations Economic and Social Commission for West Asia (ESCWA): “in the ESCWA region, there have been a limited number of successful experiments in creating organizational frameworks for transboundary water resources. In general, these have consisted of little more than setting up institutional frameworks for some boundary-straddling aquifers, […]. Cooperation in managing the waters of the Euphrates, the Nile and the Orontes is also noteworthy. In many cases that cooperation has been essentially driven by projects funded from external assistance and loans; it has no firm institutional roots, and may well come to an end once the projects in question have been completed.” The same situation applies to the rest of the Near East Region, outside of the ESCWA sub-region.

4.5. Virtual water as a policy option

A key question at the macro-water scale is whether the Region should produce its own cereals domestically or import cheaper food grains from outside. The answer to this question for a number of Near East countries depends not only on how they value water financially, but also on other considerations.

The issue of virtual water is still very complex and cannot be fully analyzed at present to decide on what crops should be produced locally or imported. The prevailing incentive framework for agriculture in general has a strong anti-export bias in developing countries. Moreover, a distortion exists in international prices, which is often used as a reference price for wheat, to establish the comparative advantage and competitiveness of virtual water in water-scarce, developing countries. The price transmitted to the farmer is highly distorted with domestic support to the agriculture sector at two levels; the production subsidies and export subsidies. The end result is that the farmer’s comparative

advantage is also distorted and he cannot compete with cheap imports and the high transaction cost of exporting. In such a case, it is simply not possible to know the exact value of the so called 'virtual water'. It does not let developing countries establish their natural comparative advantage on which to base their competitiveness.

The reliance on virtual water for water scarce countries is obviously a policy option which can theoretically lead to a win-win solution. Importing countries save precious water resources and can reallocate them to more valuable uses in agriculture or in other sectors. At a global level this usually generates water savings. However, there are many obstacles that should not be underestimated: barriers to market access and lack of reciprocity in trade, issues of quality and safety of food products in developed countries markets, warranty and reliability in accessing staple food supplies for importing countries, etc.

Countries facing food insecurity and water stress need to be assured that they can have fair and secure trade with water-abundant nations. This should become a priority for the World Trade Organization. Some countries are not yet able to export enough to earn the foreign exchange required to purchase the food imports they need. Similarly, individuals may not have the cash to purchase food for themselves and their families, even though food is available in the market. This highlights the continuing need for agriculturally based rural development programmes in the Region.

In short, the concept of virtual water is well founded, but it cannot be considered without its close linkage to the economic and political interests associated with agricultural trade. Its application requires that countries have a more transparent picture of its comparative advantages and accordingly they can translate it into a competitive advantage. For this and other reasons, countries are not ready to change their trade policies on the basis of water shortage. Only around 20-25% of all cereal trade takes place from water-rich to water-short countries (Fraiture *et al.*, 2004). An assessment of the impacts and implications of virtual water is still needed and would help countries understand it better and, eventually, adopt it as a policy option for water management.

The second issue pertains to the level of the economic base, i.e. whether a country is well developed and diversified enough to take the decision to reallocate water from cereals, which provide subsistence living to large sections of rural population, to other higher value uses. The experience in the Region, perhaps globally, is that a number of economic, political and social factors come into play when resources are reallocated in this way.

5. CONCLUSIONS

Although some countries are better off that the rest, the Near East Region is already in a situation of water-deficit crisis that affects its social and economic development. The water shortage challenge started in the early seventies, materialized by a net balance of food imports to the Region, and has steadily increased since then despite important efforts by countries. These efforts have largely been off-set by population increase and the resulting hike in water and food demands.

The crisis is likely to be exacerbated in the future, especially with respect to food deficit, as a result of lower possibilities and higher costs for water supply increase, combined with greater demand for water and high pressure on agriculture to release some of its current share of water use.

Past food security policies in the Region and elsewhere were based on area expansion, to support the objectives of self-sufficiency and to enhance exports. The supply enhancement era witnessed unprecedented growth not only in irrigation but also in groundwater development with the advent of new technology, subsidy in credit and low electricity costs. That era seems to have peaked out and future increase in agricultural production must come from the increased land and water productivity, both in terms of higher yields and cropping intensities for which scope still exist. This would lead to greater water savings by reducing water losses and achieving more efficient water use and higher productivity per unit of water use.

There is nowadays consensus that water crises are in effect crises of governance. Consequently, good governance within countries is seen as an essential element for sustainable development. It

requires an enabling environment that facilitates public and private sectors initiatives, a regulatory framework that permits water transactions, and shared responsibility for conserving water resources.

Viable options for alleviating the effect of water shortage exist, but they are not easy to implement under the prevailing national policies. They require a fundamental shift in the current perceptions of water resources and in the practices and attitudes towards their management, focusing on demand management principles and the lifting of constraints on water allocation. The new policies should give due consideration and a real priority to water demand management, combined with a rational supply increase where possible, as a means to alleviate current and future water shortage problems. The available options for water demand management in agriculture open avenues for contributing effectively to addressing the prevailing water-deficit in the most rational, economic and sustainable manner.

The potential of the new water management policies does not warrant the complete food security of the Region. The food security objectives, as perceived in the past in terms of “food self-sufficiency”, are in direct conflict with the issue of resources use efficiency based on comparative advantages. With respect to food security, a certain level of water-deficit would still persist even under the most optimal water management conditions and would have to be filled through the import of virtual water.

The notion of virtual water is appealing from the conceptual standpoint and can lead to a win-win situation for both food producing and importing countries. However, in practice it is still faced with obstacles not in favor of importing countries. Lifting of these constraints and externalities requires additional negotiations, within the framework of global trade, and would lead to some improvement in water management. A certain degree of food self-sufficiency is still a national priority in many countries, as a result of the political and economic consequences associated with imports.

Even if trade barriers were lifted so as to allow for virtual water to be applied, poor countries without enough water and/or capacity to produce high-value crops or to access markets, for earning hard currency to import food, would have to be supported otherwise. Similarly, within countries, access to food by poor layers of the society would have to be addressed through specialized development programs targeting these groups.

The proper management of water resources requires also ample regional cooperation and a certain level of development that still have not been reached in the Near East Region.

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