4th International Conference on Water Resources and Arid Environments (ICWRAE 4): 462-470
5-8 December 2010, Riyadh, Saudi Arabia

The Impact of Water Regulation and Privatization in Jordan

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Abstract: Jordan is known to be one of the most water scarce countries in the world, where water shortage has become of permanent nature and meeting water demands is a challenge. Jordan is considered to be one of the 4 poorest countries worldwide in water resources. Jordan is characterized by an arid to semi-arid climate and its population increases at a high growth rate (the 9th highest in the world). The water demand in Jordan is steeply increasing and the gap between water supply and demand is getting wider. The available renewable water resources are dropping drastically to an annual per capita share of 140 m^3 in recent years, compared to 3600 m^3/capita in 1946. Factors prompting such a decrease include, aside from the most prominent one of steep population growth, sudden influx of refugees due to political instability in the region. Competition between demands on limited fresh water quantities is ever increasing. The expanding population and the climatic and topographical conditions of the country have caused enormous pressure on the limited water resources and created a severe water supply-demand imbalance. Despite the huge investment in the water sector, a considerable water deficit will still be facing Jordan. A major cause of poor access to water services in Jordan is the inefficiencies of water utilities. Although privatization appears to have the potential to improve water services and meet the needs of the poor, these goals may be difficult to achieve. Opening up the water services sector in Jordan to private participation offers significant potential benefits in terms of investment, technology and management expertise. But to realize these potential benefits requires an effective regulatory framework. Water privatization and regulation can improve the access to safe, reliable and reasonably priced water services. Also, regulation can be based on environmental considerations. Water privatization and regulation might be technically and economically viable to cope with water scarcity and overcome the water deficit in Jordan. A regulatory impact assessment (RIA) can make an important contribution in informing policymakers of the likely impact of liberalization on their national development goals. Better understanding of the likely consequences will enable Jordan to undertake appropriate domestic regulatory measures to mitigate the potential adverse consequences of liberalization. Also, as it is expected that, the outcome will be very fruitful for the water scarcity in Jordan and it will contribute to decrease the losses in water piping network and to encourage the civilization to reduce their consumption of water. Also, the present study aims to shed some light on the technical and economic feasibility of privatization and regulation of water sector in Jordan.

Key words: Water privatization • Water regulation • Water shortage in jordan

INTRODUCTION

Jordan is an arid to semi-arid country with land area of 89,556 km^2 located to the east of the Jordan River. Jordan's topographic features are variable. A mountainous range runs from the north to the south of the country. To the east of the mountain ranges, ground slopes gently to form the eastern deserts, to the west ground slopes steeply towards the Jordan Rift valley. The Jordan valley extends from lake Tiberias in the north, at ground elevation of -220 m, to the Red Sea at Aqaba. At 120 km south of lake Tiberias lies the Dead Sea with water level at approximately -420m. Due to the variable topographic features of Jordan, the distribution of rainfall varies considerably with location and the annual rainfall ranges from 50 to 600 mm. Rainfall intensities vary from 600 mm in the north west to less than 200 mm in the eastern and southern deserts, which form about 91% of the surface area. The average total quantity of rainfall which falls on Jordan is approximately 7200 million m^3/year (MCM/year) and it varies between 6000 and 11500 MCM/year. Approximately 85% of the rainfall evaporates back to the atmosphere, the rest flows in rivers and wadis as flood flows and recharges

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groundwater. Jordan's Renewable freshwater resources are estimated to about 850 MCM/year, consisting primarily of surface and ground water. Options for non-conventional water resources that can be mobilized are modest where nearly all of Jordan's renewable water resources have been developed and most citizens in Amman receive water only once a week. The options for augmenting water supply are limited; some additional rainwater can be harvested and some brackish water can be pumped from sandstone aquifers, e.g. [1, 2].

Jordan is known to be one of the most water scarce countries in the world, where water shortage has become of permanent nature and meeting water demands is a challenge. Jordan has reached its water crisis; present water use already exceeds the renewable freshwater resources by more than 20%. The freshwater resources will be fully utilized and there remain no more known resources within the country to develop. Jordan's Renewable freshwater resources are estimated to about 850 MCM/year, consisting primarily of surface and ground water. Options for non-conventional water resources that can be mobilized are modest where nearly all of Jordan's renewable water resources have been developed and most citizens in Amman receive water only once a week. The available renewable water resources are dropping drastically to an annual per capita share of 140 m^3 in recent years, compared to 3600 m^3/capita in 1946. The per capita share of renewable water resources is among the lowest in the world and is declining with time. It is projected to fall from 140 m^3/capita/year at present to 90 m^3/capita/year by 2025, e.g. [1, 2].

The expanding population and the climatic and topographical conditions of the country have caused enormous pressure on the limited water resources and created a severe water supply-demand imbalance where the deficit is about 220 MCM/year, e.g. [1]. The water shortages in Jordan can be attributed to the semi-arid climate that is associated with limited annual rainfall, high natural population growth, rural to urban migration and major influxes of population in response to political and economic crises in the Middle East, e.g. [3]. The lack of water resources became more prominent with the increase in water demand in response to the natural and crises driven population growth, improvement of living standards and the developments of the economic, industrial and touristic sectors, e.g. [3]. Despite the huge investment in the water sector, a considerable water deficit will still be facing Jordan. This deficit will double by 2025 even if all unconventional water sources are used, e.g. [3].

Jordan's water resources comprise surface water, renewable and non-renewable groundwater and treated wastewater, which are used by agriculture (69%), industry (10%) and municipalities (21%), e.g. [1]. With the exception of springs and the King Abdullah Canal, surface water resources are exclusively used for irrigation. The municipal water supply and industry mainly depend upon groundwater and springs, which are limited and often over-drafted. The Jordanian citizen has only about 90 liters of drinking water per day compared to up to 300 liters in the neighboring countries.

The variability in the surface water resources left no choice but the use of groundwater resources to cover part of the shortage. The total renewable safe yield of the groundwater resources in the whole of Jordan is 277 MCM/year, which does not include the Disi aquifer as this is a non-renewable source, e.g. [4]. Although extraction from these sources exceeded this safe yield by more than 200 MCM/year in recent years, Water Authority of Jordan was unable to meet the substantially increasing demand. Continuation of this overexploitation of groundwater sources at these high levels will lead to mining these sources as well as deteriorating the quality of abstracted water, which will lead at the end to an extensive damage of the aquifers, e.g. [3]. New sources were identified to relief the existing groundwater source and allow the natural recharge of these sources and to restore their water quality which shall relief part of water shortage in Greater Amman area. The water supply in Greater Amman area has been outstripped by the demand and this situation is deteriorating each year by the increase of demand and therefore, MWI had to consider the option of implementing the Disi Project by conveying water from the southern part of Jordan to Amman, e.g. [5]. The contract for the Water Conveyance System from Disi-Mudawarra to Amman was awarded by MWI to a Turkish company last year.

Also, the adoption of non-conventional sources (e.g. desalination) for water supply reinforcement is inevitable in the near future for Jordan's sustainable development. For instance, desalination has been widely and successfully used in Middle Eastern oil-producing countries [6]. Although water and energy resources are scarce in Jordan, desalination of seawater from the Red Sea might be economically feasible by efficient use of non-conventional energy resources [7-10]. Hydropower and solar technologies are the most effective non-conventional energy resources for water desalination. Water shortage occurs most at places of high solar radiation. It is usually peaks during the hot summer

months of maximum solar radiation. Hence, solar desalination could be one of the most successful applications of solar energy in most of the hot climate countries having limited resources of fresh water, e.g. [11]. In addition to the water scarcity in Jordan, the water sector suffers from duplication and poor technical performance and financial capacity. One of the solutions proposed to activate the technical and financial performance is a process of private sector participation in management activities in the water sector. In the present paper, the feasibility of private sector participation in the management of the water sector and the benefits from it has been also discussed.

Water Challenges in Jordan: The water resources in Jordan consist primarily of surface and ground water resources, with treated wastewater being used for irrigation. Renewable water resources are estimated to be around 750 MCM/year, include ground water at 277 MCM/year and surface water at 692 MCM/year of which only 70% is of economic use. An additional 143 MCM/year is estimated to be available from fossil aquifers. Brackish aquifers are not yet fully explored but at least 50 MCM/year is expected to be accessible for urban uses after desalination, e.g. [12-15]. The total renewable safe yield of the groundwater sources in the whole of Jordan is 275 MCM/year. Extraction from these basins in the year 1998 was estimated at 416 MCM of which 173 MCM was for municipal use. At present, most renewable groundwater reserves are fully exploited. The groundwater aquifers in Jordan are being exploited at more than double their sustainable yield on average in order to meet the country's growing water demand. Also, the situation has reached a level where the toxicity index (pollution load compared to renewable water resources) is high, e.g. [12]. The Disi-Mudawarra to Amman Water Conveyance System will result in a reliable water supply to Amman especially during the summer, e.g. [16]. The typical water related problems in Jordan include the inefficient management of national water resources; subsidized water to end users; poor aquifer and surface water quality; inefficient irrigation networks, illegal water use; and inefficient use of irrigation water, e.g. [12-15]. The water strategy stresses on the need to tap the full potential of surface and ground water to a feasible extent, the marginal quality and brackish water support irrigated agriculture, seawater desalination produce additional water for municipal, industrial and commercial consumption.

The sector most affected by water availability is irrigated agriculture during dry weather years, e.g. [15]. Rainfall is the only source of water supply in Jordan to recharge the groundwater aquifers. The groundwater resources distributed all over the groundwater basins constituting Jordan are very scarce and actually vary in quantity and quality. Generally, the surface groundwater basins in Jordan are divided into renewable and non-renewable groundwater resources, e.g. [10]. The surface groundwater basins constituting Jordan are 12 basins, which are subdivided according to the upper most aquifer system, occurred in each of the basins. The only two-groundwater basins, which contain nonrenewable groundwater resources, are the Disi-Mudawarra basin and Jafer basin. The estimated abstracted groundwater amounts from the Mudawarra and Jafer are 125 and 18 MCM/year/50years, respectively, e.g. [3].

The sources of irrigation water are surface water, groundwater and treated wastewater. 75% of the total available water supplies in Jordan are used for irrigation and one third of this percentage is used for agriculture in the uplands. The irrigation water used in upland areas is drawn from groundwater resources that are under extreme pressure. This contributes to declines in groundwater levels as well as water quality deterioration from overexploitation and from return flows from irrigation. The use of the upland aquifer for agricultural purposes is contributing significantly to the reduction of the renewable groundwater reserve which limits the available water for municipal and industrial supply. The irrigation demand was frozen due to lack of water supply for the agricultural sector, e.g. [15]. No fresh water will be considered for irrigation after few years and a considerable reduction in fresh to brackish water. Treated wastewater could be the only source available for irrigation in the future. Despite the huge investment in the water sector, a considerable water deficit will still be facing Jordan. This deficit will double by 2025 even if all unconventional water sources are used. At present there is said to be some availability of additional surface water, but most renewable groundwater reserves are fully exploited. Predictions are that by 2025 water supplied will exceed available renewable resources by 33%. The result is that there is increasing focus on unconventional sources such as wastewater re-use and the improvement of demand management. The former brings a whole new set of variables into scenarios since legislation at present is poorly geared to innovations. It also creates a new interdependence between water availability, consumption

and demand management within agricultural, domestic and industrial water supply which needs to be explored. The later would suggest the provision of initiatives to increase availability and productivity of water.

In order to carefully plan for the future, Jordan has adopted a National Water Strategy. The strategy is a comprehensive set of guidelines employing a dual approach of demand management and supply management. It places particular emphasis on the need for improved resource management, stressing the sustainability of present and future uses. Government policy objectives currently include developing and optimizing the use of available natural and agricultural resources, hence increasing farmers' income and consequently improving their standard of living accordingly. Typical water related problems in Jordan include the inefficient management of national water resources; subsidized water to end users; poor aquifer and surface water quality; inefficient irrigation networks, illegal water use; and inefficient use of irrigation water, e.g. [11].

The population and economic growth requires an increased of 4% per annum of municipal water. The agriculture consumes about 60% of available water and municipal uses about 35% and major industries to about 5%. Competition for water between agriculture and other uses has started and despite the limited contribution of agriculture to national income, but it is one of the most important sectors of employment with the employer. The water available in is approximately 1050 MCM, compared with the need of 1400 NCM. The deficit in water in 2020 will be about 400 MCM. The jump in the requirement of drinking water from 300 MCM in 2006 to 600 MCM in 2020 increases the pressure on the government to look for more water resources and to use more efficient piping network e.g. [17].

The water strategy stresses on the need to tap the full potential of surface and ground water to a feasible extent, the marginal quality and brackish water support irrigated agriculture, seawater desalination produce additional water for municipal, industrial and commercial consumption. The strategy also ensures that wastewater is collected and treated to standards that allow its reuse in unrestricted agriculture and other non-domestic purposes, including groundwater recharge. Resource management aims at achieving the highest possible efficiency in the distribution, application and use of water. Previously developed resources must be sustainably used with special attention to the protection against pollution, quality degradation and depletion. The government adopts a dual approach of demand management and supply management. Priority in water resources allocation is given to the basic human needs; as such first priority is given to allocation of a modest share of 100 litres/capita/day to domestic water supplies, followed by tourism and industrial purposes, e.g. [18].

Solution of Water Crisis in Jordan

Implementing Mega Water Projects in Jordan: The government of Jordan is willing to implement two mega projects to reduce the effect of water shortage in the country. There two projects are Disi projects and Red-Dead Sea Conduit.

The Disi Aquifer, also known as Rum aquifer system, is a transboundary aquifer that extends from south of Jordan into Saudi Arabia where it is known as Saq Aquifer System. However, both the Rum and the Saq actually form one aquifer system with the larger portion located within Saudi Arabia, e.g. [3]. The main objective of the Disi project is to convey additional water to the Greater Amman Area from the Disi Aquifer. At present Aqaba city is provided with 16.5 MCM for domestic purposes and 75 MCM for agricultural purposes, e.g. [12]. An important aspect of the Disi project is that its implementation will secure an additional source of drinking water to Amman and thus relieve the upland aquifers from over-use. The Disi project will have an indirect effect on the quality of wastewater which in turn will lead to better quality water to be used for irrigation as a replacement for valuable freshwater. The Disi water will form a major portion of the extra water that is planned to partially replace the low quality groundwater consumed domestically in Amman, e.g. [16]. The average abstraction of this well field will be 100 MCM/year. The Disi Conveyance System will have positive cumulative impact on the public health in the region as well as on other areas in the direct zone of influence where salinity is increasingly affecting drinking water supply from underground resources. A clean water supply combined with good public awareness will have direct and cumulative impact on the household health conditions overtime, e.g. [19-22]. Finally, focuses should be concentrated on the development and investment to the existing water sources and unexploited dragging Disi basin water to areas of central Jordan in addition to the Red-Dead Sea project, e.g. [23]. However, it should be noted that the Disi project would cover only part of the water shortage problem but would not close the country's growing water gap.

The Red Sea-Dead Sea Conduit is a water conveyance system designed to bring water from the Red Sea to Dead Sea. In addition, the Conduit can enhance the overall supply of drinking water in this parched region by supplying feed water for sustainable seawater desalination at the Dead Sea. The Dead Sea is drying up, with severe negative consequences on the ecosystem, industry and wildlife in the area. Current rate of decline is about 1 m/ year. Considering the huge amounts of sea water transferred from the Red to the Dead seas the potential of sea water desalination alongside the project area becomes obvious. Desalination of 850 MCM with 20 to 300 mg/l TDS, annually can be produced. The basic principle of hydropower is that if water can be piped from a certain level to a lower level, then the resulting water pressure can be used to do work on mechanical component which can be used to derive electrical generators. Desalination plants will produce up to 850 MCM/year fresh water to meet future water needs in Jordan and other regional countries. Desalinated drinking water will be conveyed to Jordan via pipelines. Up to 1900 MCM /year feed sea water and 45% of the sea water will be recovered as fresh water, i.e. 850 MCM/year. Also, an additional electricity of 550 MW is required for pumping.

Water Privatization: The privatization process in Jordan was part of an integrated economic package adopted by the government since the beginning of the nineties as part of the economic reform program and self-reliance in the wake of the economic crisis that befell the national economy. This is in addition to global economic developments in globalization and increased competition and the removal of customs and administrative barriers to global trade liberalization and capital flows and information and communication revolution and the need for Jordan to open up the world. Water in Jordan is particularly important in economic and social development. It has become one of the hindrances to development if successive governments have not put this sector at the top of their priorities. In addition to the scarcity of renewable water resources, groundwater depletion, water sector suffers from poor performance of supply systems and water distribution and the high percentage of wasted water and the inadequacy of the current water tariff to cover the cost and the limited capacity of water purification plants on sewage treatment quantity and quality.

The new system to privatize the water sector before the developing world in particular requires taking into account the implementation of certain standards of market mechanisms, namely to regulate property rights and use of certain quantities of water, to create a sufficient degree of social acceptance for the idea and to provide an appropriate management structure and efficient based on the rules, regulations and procedures and an adequate infrastructure, systems and storage and distribution of water surplus. A major cause of poor access to water services in Jordan is the inefficiencies of water utilities. Although privatization appears to have the potential to improve water services and meet the needs of the poor, these goals may be difficult to achieve. Opening up the water services sector in Jordan to private participation offers significant potential benefits in terms of investment, technology and management expertise. But to realize these potential benefits requires an effective regulatory framework. Water privatization and regulation can improve the access to safe, reliable and reasonably priced water services. Also, regulation can be based on environmental considerations, e.g. [24, 25].

A regulatory impact assessment (RIA) is necessary to be carried out. RIA can make an important contribution in informing policymakers of the likely impact of liberalization on their national development goals. Better understanding of the likely consequences will enable Jordan to undertake appropriate domestic regulatory measures to mitigate the potential adverse consequences of liberalization. Also, it is expected that the outcome will be very fruitful for the water scarcity in Jordan and it will contribute to decrease the losses in water piping network and to encourage the civilization to reduce their consumption of water, e.g. [26]. There is a need to conduct a RIA for water privatization in Jordan since regulation commonly has numerous impacts and that these are often difficult to foresee without detailed study and consultation with affected parties. The role of an RIA is to provide a detailed and systematic evaluation of the potential impacts of a new regulation in order to assess whether the regulation is likely to achieve the desired objectives. Economic approaches to the issue of regulation also emphasize the high risk that regulatory costs may exceed benefits. From this perspective, the central purpose of RIA is to ensure that regulation will be welfare-enhancing and the benefits will exceed costs, e.g. [27, 28]. RIA is an aid to decision makers in making decisions and it cannot provide answers to conflicting goals. RIA cannot quantify everything and RIA cannot guarantee perfect regulation. The involvement of the private sector in dealing with all tasks to be undertaken to resolve the water problems and the responsibilities of the water is necessary.

The regulation process of the water sector in Jordan has resulted in a severe scarcity of regulatory result of lack of resources and competencies that interested in the process. So it was not imperative to search for a solution to the problem of water regulation and the adoption of integrated management systems and to clarify the legislation and regulatory frameworks. The principles state that any good regulation should be transparent, accountable, proportionate and consistent, e.g. [26]. There are many barriers involved in government networks for water sector such as complexity and inconsistency, policy fragmentation and lack of co-ordination. Also, confusion on the role of regulation in modern society in addition to poor regulatory implementation capacities consist also other barriers. The new technologies and the social needs can change the good regulation to bad regulation with time. The poor regulatory design causes detailed controls rather than flexible and market-based approaches. The growth and rapid development in the world and a new technological revolution has led to the spread of a new type of government regulation. The characteristics of the old or traditional regulation are reflexive, static and standardized. The characteristics of the new-style regulation are skeptical, dynamic, flexible, balanced, cost effective and efficient.

As it was mentioned before, the most challenges and difficult problems of water sector in Jordan are depletion of ground water, high losses during distribution and weakness in delivery and the limited waste water plants efficiency. So, the MWI has many challenges to meet the growing needs of water at least partially and to deal with the effects of water shortages and how to overcome them. Also, the level of services provided to citizens should be raised in order to improve citizen satisfaction with the service. The MWI should increase the efficiency of irrigation networks, reduce losses in the networks as well as to improve management and increase efficiency in the institutions responsible for water sector. The poor condition of water networks and the high cost of maintenance as a result of non-allocation of the amounts required for renewal over the years. Currently and according to the data from the water authority, the revenue and self-report coverage rates of the cost usually 60-70% of the total costs. The rest of the cost is secured through government support and foreign aid and international loans and local. The price of water in Jordan is still low in comparison with the costs, but the government consider carefully before it was amended taking into consideration the income level of citizens, e.g. [19].

The most important reasons for privatization can be summarized as follows: efficiency, raise the level of service, reduce redundancy, reduction of government support, access to technology.

For water services which exhibit significant network economies of scale, it will typically be more efficient to have a single supplier of piped services to any particular area. Historically, local natural monopolies have been in public ownership and at present over 90% of the world's piped water is delivered by publicly owned bodies, at both national and municipal levels, e.g. [29]. Recent years have seen a movement away from state ownership towards more reliance on private markets to supply goods and services traditionally provided by the state. This has resulted in an increase in private sector participation in water services provision in both developed and developing countries, particularly during the 1990s. More than 2,000 water and sewerage projects with private participation were undertaken in developing countries.

The privatization process in whatever form is important that both parties benefit: the government and the private company. Usually, the government wants to keep the decision-making in some of the important things such as determining the price to protect the public. It is found that the best way to adjust the relationship is the establishment of an independent regulatory body or semi-independent from both parties and determine the composition in advance and to give it the status of independence are often its expenditure are covered from service revenue. Also, it should be mentioned that it is very important to introduce the modern technology in the field of management and organization, use, control and disposal and water protection from the risks that threaten the quantity and quality, e.g. [30].

Private sector participation in water services has been associated with contracts that take the following forms, namely: leases and management contracts for existing facilities (without new private sector investment), concessions (requiring the private sector to invest in facilities), divestitures (sale by the state of some or all of the equity in state-owned enterprises) and greenfield investments (including build-operate-transfer [BOT] schemes). Of 233 water and sewerage contracts with the private sector arranged between 1990 and 2002 on the World Bank's PPI Project Database, 40% involved concession contracts and these accounted for 64% of the total amount invested. While the forms of private participation in the water sector vary in the allocation of risk, duration of the arrangement and assigning of asset ownership, all involve some form of contract with, or regulation by, the public sector, e.g. [29].

Where the private sector is involved in the delivery of water services, a regulatory institutional structure is needed to ensure compliance with economic, social and environmental objectives. This has a number of policy implications for the adoption of trade liberalization in water services in developing countries. Donor agencies advocate the privatization of public utilities in lower-income economies to promote more efficient operation, increase investment and service coverage and reduce the financial burden on government budgets. In response, a range of services including water supply has been opened up to private capital. The provision of high quality water services remains a priority for most developing economies. Improved investment in water services and their more efficient management are a development priority, e.g. [25].

Public-Private Partnership in Water Sector: Despite the limited water resources, Jordan has achieved good results in the provision of water services over the past years. 98% of population is particularly served to the water network and 60% of population employer sanitation. Water distribution role is minimum of (24) hours per week. Also, water-related diseases such as malaria and cholera were sharply decreased in Jordan during the last level. There is no expansion of irrigated agricultural and in some seasons vulnerable farmers have to cultivate only part of the earth, e.g. [14, 31].

Public-private partnerships (PPPs) refer to an arrangements between the government and a private enterprise, where the private enterprise supplies infrastructure assets and services that traditionally have been provided by the government. As the roles of government in public-private partnerships are not only to provide services, but also to monitor the marketplace, a well-defined regulation framework is essential. A sound regulatory framework will increase benefits to the government by ensuring that essential partnerships operate efficiently and optimize the resources available to them in line with broader policy objectives, ranging from social policy to environmental protection. In turn, it provides assurance to the private sector that the regulatory system.

The partnership between the private sector and public sector can take place in several forms, e.g. [25]:

- Simple contracts: where the government institution contracted with a private company to carry out certain acts as a measure of technical studies or implementation of projects or to supervise them. Usually contract expired at the end of the project.
- Management contracts and operating: where the agreement with a private company to manage the work of the institution or part thereof such as the operation and maintenance of pumping stations and purification or read water meters and issuing bills or maintenance of networks and the like.
- Concession contracts or warranty or lease: Typically the parties agree that the private sector to provide water services to a specific geographic area for a certain time period of up to 20 or 30 years for participation in profits or to pay a certain amount each year to the government. The most important thing in these contracts that the ownership of the project remains government and reclaimed after the expiration of the contract.
- Contracts for construction and operation such as BOOT (Build, Operate, Own, Transfer), BOO (Build, Own, Operate), BOT (Build, Operate, Transfer) and ROT (Rehabilitate, Operate, Transfer).
- Direct Sales: where the government is selling the entire enterprise to a private company, including fixed assets such as land, plants and water systems operated.
- Offers the establishment of a joint stock company is by assessing the assets and the establishment of the company and sell shares in the financial market where the government can retain a portion of them to have a role in the management of future in order to ensure provision of appropriate service to the public. This method has many advantages, including keeping the largest possible part of the shares belong to the national capital and be an incentive for small savers to invest their money rather than frozen. But also has disadvantages, including fragmentation of property, which is weakening the administration in the future as it limits the participation of foreign capital.

The objective of participation of public and private sector in the water sector is to apply values and principles of water demand management through the new trend of partnership between the public and private sector. Jordan is one of the most water deficient countries in the world. The efficiency of the water and sanitation systems is poor. Cost recovery of operations and maintenance is good in larger urban systems such as in Amman, where there is a private sector operator and Aqaba, but is lesser in rural areas. The water and sanitation sector is subsidized. Some projects which have been achieved n Jordan can be summarized as assamra water treatment plant, Disi- Mudawarra to Amman water conveyance scheme and water authority of Jordan (WAJ): LEMA.

The main negative aspects of privatization is related to the political costs about entering foreign capital, along with the various funding institutions and the subsequent contracts and binding agreements which may limit the powers of the government. Sometimes privatization leads to raise the prices of services significantly, which could lead to social problems.

CONCLUSIONS

The people in Jordan have suffered from water shortages due to its semi-arid climate, associated limited annual rainfall, a simultaneous increase in size of population and demand for domestic and industrial users. Also, the population grew at high average annual rate and the municipal water supply over the whole country decreased from 150 liters/capita/day in 1996 to 130 liters/capita/day in 2001 and it is now 90 liters/capita/day. It should be noted that demands in Greater Amman during the summer period increase dramatically due to a large influx of Jordanians returning from abroad for their holidays in addition to tourists from the region.

The Jordanian government should develop and formulate policies and plans concerning the status of water in Jordan. The government should develop strategies for short-term and long term and the management of water at the national level in collaboration with other centers and institutions in order to rationalize the processes of distribution and consumption. Also, an efficient media plan for the rationalization of water consumption and awareness through programs should be developed. Also, a regular maintenance of water systems should be carried out in order to reduce the wastage of water.

It has been clearly shown that the Disi conveyance system can solve the problem partially. The Disi project will have an indirect effect on the quality of wastewater which in turn will lead to better quality water to be used for irrigation as a replacement for valuable freshwater. The average abstraction of this well field will be 100 million m^3/year. The proposed Red Sea - Dead Sea Water Conveyance Project can contribute to solve the problem of water shortage in Jordan. The inflow of seawater into the Dead Sea will supply Jordan with renewable water resources around 750 million m^3/year, leaving an annual deficit which has grown steadily, despite the huge program of investment in the water sector.

Finally, water privatization in Jordan can contribute to overcome the water deficit in Jordan. There are many positive phenomena associated with the process of privatization such as the positive reflects on the economy, create competition, improve the quality of service and level of performance, ease of entry to the international capital market and funding sources and ease the pressure on the public budget.

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