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Effective Governance Policies for Water and Sanitation

Mohammed Saleh Al.Ansari[1]

[1] Department of Chemical Engineering, College of Engineering, University of Bahrain, Kingdom of Bahrain

Correspondence: Mohammed Saleh Al.Ansari, Department of Chemical Engineering, College of Engineering, University of Bahrain**,** PO box 32038, Sukhair Campus, Kingdom of Bahrain. Tel: 973-3944-1110. Email: malansari@uob.edu.bh

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Abstract

The true value of water should be utilized to help orchestrate the governance of managing water, in social, economic, and environmentally effective objectives. Despite the fact that water is a fundamental instrument for human survival, it is the most underestimated resource in the world. The question remains, what is the true economic value of this depleting resource? Generally, the sector responsible for controlling water, focuses on the fiscal aspect of this resource, ensuring that the quality and quantity of the resource are upheld. The economic value of water reflects upon the benefits and services that are scarcity affects. The value of water is higher in dry climates, due to the fact that this vital resource is scarce, triggering competition among users (NWRI, 2003). The more pressing question that needs to be analyzed is what purpose is water being used for. The reason why this question is difficult to answer is because the value of water is closely tied to productivity and value of the resource (Ramachandra, Rajanikanth & Ranjini, 2005).

Keywords: water and sanitation, economic value and engineering, managing water

1. The Economic Value of Water

The monetary, value of consumer goods and other associated possessions is based upon, the satisfying effects that they provide and their ability to generate monetary gains- is based upon the price of the good. The price of assets is used to guide the allocation of their utilization. Capturing the value of water is imperative in order to compare the benefits and costs of programmes, policies, and miscellaneous projects. However, capturing the value of this necessary asset is not a simple task. Establishing the economic value of water is one of the most debated and discussed problems in allocating the asset effectively (Gibbons, 1986). Young (2005) has stated that the evaluation of water presents an analyst in economics that is comprised of a range of problems and daunting issues (Xepapadeas, 1996). Due to the fact that the value of water is specific to a site, as well as being temporal, each case comes with its own issues, requiring site-specific valuations to have to be made. Effectively measuring the value of water demands an immense amount of skills, and the application of specific tools to be applied. The tools that have to be implemented include statistical analysis, collection of data, research reports, as well as optimization methods (Poe & Loomis, 2005).

When considering price, the price of water is based upon what consumers are willing to render for the use of it (Amount/Opportunity Analysis). Even though water is a necessary human need, it can be difficult to correctly identify the proper way to price this commodity. Water is one thing that all humans require in order to be able to exist. However, pollutants and other problems with the environment have made what used to be fresh water, inadequate water supplies, that cannot be used for the basic necessities that it should be used for. Consumers will continue to utilize water as long as the costs of water is comparable with its benefits, and the benefits of the asset do not exceed the costs of the product. The obvious benefit of water, is that it nourishes thirst, allows proper sanitation to be obtained, and it along with food, are the basic requirements to a healthy life. Industrial and municipal water provides benefits directly to the users that utilize the asset along with indirect benefits to society as a whole. The direct benefits of water can easily be identified, but are difficult to determine effectively. The indirect benefits of water, such as the impacts that the asset has on the health of the public and their well-being can be daunting to measure and identify. An conceptualization to evaluating the benefits of industrial and municipal water is standard with the valuation method, this method assesses the willingness of consumers to pay for improved and sanitary water, which ensures that the human health factor is met accordingly. Another approach, is known as the conjoint analysis. During this analysis, users are implored to select alternatives to the

asset. Presently, the willingness to render funds for the asset has been considered the most successful application of evaluation techniques for sanitation and water in countries that are still within the development stages (Mitchell & Carson, 1989) and (Niklitschek, León, 1996).

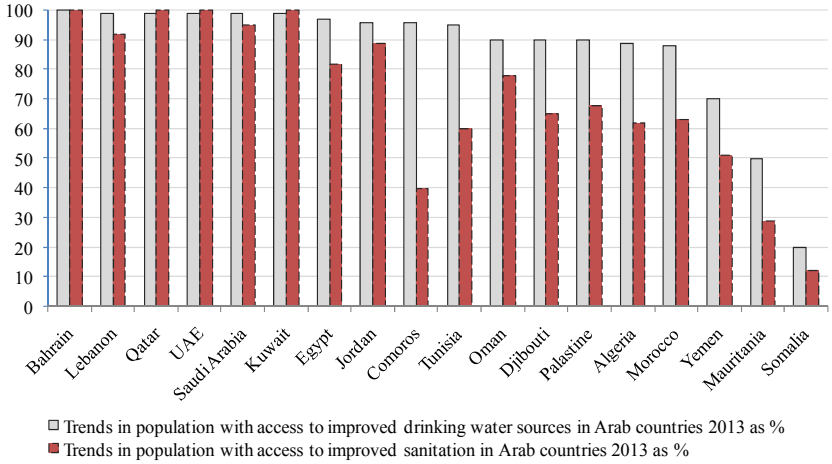

Figure 1. The % trends of populations with access to improved drinking water and sanitations in Arab countries in year 2013

The allocation of resources is dependent upon relying on the mechanisms of the current markets, in decentralized and centralized planning systems, or a combination of the two. Market mechanisms do not have the ability to function properly by themselves for the allocation and management of water. In the current markets, the price of water should be reflective upon the economic value of water. However, in an attempt to place value on water, it all boils down to the fact, that regardless of how much money an individual has to pay for it, that it is something that is required. Because public agencies that maintain water resources average the cost of the service based upon the price of delivery, instead of the value that it has to the producers, the economic value of water is typically never priced at its true economic value to society (Young, 2005). Water can be priced in two different means, it can be priced according to its supply, or it can be priced according to demand of the asset. Pricing water based off of its supply has been a method that has been used for an elongated frame of time, due to the simple fact that the demand for the product, is quickly beginning to out span the supply of the commodity. However, when water is used as an intermediate good, for either the agriculture sector or for industrial purposes, the demand for water is based upon the demand of output and the role of water in producing the agricultural output. In this scenario, the demand for water is comparable to the price of the asset, and the final product. Crops require water in order to grow, meaning that in order to have the two basic necessities for human life, one of the necessities need to be used in order to ensure that there is enough of another. Estimating the economic value of water is equal to isolating the contributions of the output of the total value of the asset (Young and Turner et. Al, 2004). Therefore, the market systems continue to fail to reach the levels of efficiency that they need to be at. Improved situations occur when producers and consumers, may be benefit, without making situations worse, as the Pareto conditions within allocation occurs (Economic theory of the markets). Water rates that are locked in by the marketing and examination systems are typically not set at their highest levels, which leads to misutilization (Abdrabo, 2003). In many countries where subsidies are utilized, water becomes an everyday thing that people openly have access to. This causes people to believe that this resource is always going to be available to them, which in part, then leads to the necessity being overused for things that it does not need to be used for. Developed civilizations and water rich areas, will never be able to fully acknowledge and understand exactly how important this basic life necessity is, until they are forced to be without it, like so many developing countries have been forced to do. The failure of the markets to achieve optimal allocation of water and prices can be a result of several factors, which include ignoring social and environmental benefits and associated costs (Taylor and Young, 2005). Groundwater and surface water, are typically used without paying their true economic value, in quantity and quality. Groundwater's are generally used for agriculture in water rich regions, but in regions, such as the Arab countries, groundwater tends to be their only supply of the product. Decision and policy enforcers concentrate on covering parts of the monetary costs associated with abuse, misuse, and pollution (Koundouri, 2000). Property rights that are vague in nature, can contribute to the markets failing. For example, the absence of rules that govern the exploitation of groundwater, can contribute to over-utilization. People that

have access to groundwater on their lands, are more adamant to utilize the water as they deem fit, without acknowledging the fact that the water that they are using can be used to help others that do not have access to the same resources. The water industry, is a naturalized monopoly, local governing bodies have created public officials to govern and maintain the resource.

2. Water and Its Sanitary Uses

Investing in sanitation and water generates an immense amount of economic, financial, social, and environmental benefits. Enabling access to water that is clean to drink, and that can be utilized for sanitation helps to reduce health risks and frees up some time that can be applied to other productive activities such as education, and improving the social capital of increasing the productivity of labour. Properly disposing waste-water helps to improve the overall quality of life, which in turn, reduces the mortality rate of children, and helps to protect the environment along with other economic sectors. However, the benefits that arise are not considered to be tangible, therefore, they are not presented in feasibility studies, making them invisible to primary decision makers (OECD,2011). Stating the benefits of water as they relate to the human element, are not nearly as important, as stating the benefits in a monetary method. Due to the fact that sanitation and water within Arab countries is not documented accurately, sanitation and water does not receive as much attention as other public expenditures do.

Table 1. Economic benefits arising from water and sanitation improvements (*Source: Hutton and Haller 2004.*)

Beneficiary	**Direct economic benefits of avoiding diarrhoeal disease**	**Indirect economic benefits related to health improvement**	**Non-health benefits related to water and sanitation improvement**
Health sector	Less expenditure on treatment	Fewer health workers falling sick	More efficiently managed water resources and effects on vector bionomics
Patients and Consumers	Less expenditure on treatment and less related costs		More efficiently managed water resources and effects on vector bionomics
	Less expenditure on transport in seeking treatment	Fewer days lost at work or at school	
	Less time lost due to treatment seeking	Less time lost for parent/ caretaker of sick children Loss to death avoided	Time savings related to water collection or accessing sanitary facilities
	The consumer will have a better socioeconomic conditions and better job opportunities		Labor saving devices in household Move away from more expensive water sources Property value rise Leisure activities and non-use value
Agricultural & industrial sectors	Less expenditure on treatment of employees	Less impact on productivity of ill-health of workers	Benefits to agriculture and industry of improved water supply, more efficient management of water resources timesaving or income-generating technologies and land use changes and more labor productivity.

The agricultural and industrial sectors that depends on direct economic benefit of avoiding diarrheal disease makes less expenditures on treatment of employees and less impact on productivity of ill-health of workers. The non-health benefits related to water and sanitation improvement makes much benefits to agriculture and industry of improved water supply, more efficient management of water resources and timesaving or income generating technologies and land use changes and more labor productivity. Non-health benefits related to water and sanitation improvement for consumer benefit is Time savings related to water collection or accessing sanitary facilities, Labor saving devices in household Move away from more expensive water sources, Property value rise and Leisure activities and non-use value. The Agricultural &industrial sectors has its relation to the Benefits to agriculture and industry of improved water supply, more efficient management of water resources timesaving or income-generating technologies and land use changes and more labor productivity.

2.1 Environmental, Health, and Political Costs

Deficiencies in sanitation and water possess high environmental, health, and political costs. Disease outbreaks caused by water along with the costs of treatment reveals the adverse health impacts. The problem is not only the fact that water is absent, but the problem is compounded by the fact that water is mismanaged and unfairly distributed as well. Distribution is based off of economic status and the markets, instead of being based off of the fact that every living creature requires water in order to exist and thrive. Governance policies for water need to address all of these issues.

Affordable and safe sanitation should be able to provide Improved disposal of disease infested waste, and, Improved crops by applying decomposed nutrient-rich waste on fields plus Increased income from left over harvest being used for well-being and food, Improved harvest as a result of decreased sick days, Decreased medical expenditures, and, Improved career and education prospects as a result of decreased sick days, affecting absences from educational endeavors.

Inadequate sanitation and water conditions, pose extreme risks to public health. In 2003, diseases caused by water, notoriously diarrhoea, caused four percent of the disease related burdens globally. Approximately 1.6 million deaths in a year, resulted from unsafe sanitation and water conditions (Hutton, Haller, & Bartram, 2006). The best way to stop the spread of unwanted diseases is to pay attention to the one item that humans require in order to live, and that is to have access to water that is safe, and can be used for health related reasons, sanitation, as well as for hygenic issues. The WHO along with the United Nations Environment Programme (UNEP) reported in 2008 that ninety four percent of the 1.8 million deaths that occurred in the year from diarrhoeal disease were a result of unsafe environmental practices, such as inadequate sanitation and unsafe water for drinking (WHO & UNEP, 2008).

Intervention policies can help to diminish mortality rates and morbidity health costs that result from waterborne illnesses. However, the health related benefits of sanitation and water policies are underestimated when it comes to planning, prioritizing, and budgeting. Evaluation studies related to economics can showcase the health related benefits of sanitation and interventions for drinking water that can be fairly significant. Additional cost related analyses have uncovered that improvements made to sewage treatment facilities and drinking water qualities are greater than investment issues and operational costs. Studies regarding sanitation and water intervention techniques have uncovered that the benefit and cost ratios vary significantly, and can contribute to a significant amount of savings in health care (OECD, 2007).

Water-related diseases have a significant impact on economic costs, associated with the treatment of these conditions. There has been an immense amount of evidence compiled that confirms that there is a link between water and sanitation practices and health. This link occurs from the organisms that reside in the water that can potentially harm human life, causing humans to be inflicted with diseases such as typhoid, cholera, dengue fever, and malaria (Hutton & Haller, 2004). In essence, water has its positive as well as its negative aspects about it. If it is supplied, it has to be supplied with other services being rendered. For example, if there is an abundance of water, but the abundant amount of water that is being supplied is not purified and then given to the people that require it, this can cause just as many problems as if the water was not given to begin with. The primary difference is going to be that the contaminated water will meet the needs of the populace for a short period of time, until that same amount of water starts to harm the health of those that have attempted to utilize it. In the Eastern Mediterranean area, diarrhoeal conditions contributed to sixteen percent of the deaths in children under the age of five; these children were never given the opportunity to elect to drink the water that they wanted, but instead they were given what was accessible, and what ended up being accessible, was the same catalyst that was responsible for taking their lives. The application of safe water can help to reduce twenty one percent of these deaths, by twenty one percent, improvements made to sanitation can reduce incidences by thirty seven percent (WHO, 2011). The value of health benefits from an economic standpoint, will need to be assessed in order to determine if interventions are going to be an economically sound election (OECD, 2007).

Improving sanitation and water infrastructures can help to improve life conditions and livelihoods. A direct method of support pertains to establishing a sanitation plan that can help produce an monetary stream, such as treating waste-water so that it can be later used for agricultural means. Which, would not only allow water to be used for a beneficial means of making food, but it would also ensure that another basic need is met as well. Indirect methods of support, would consist of properly training poor people how to utilize sanitation infrastructures, which would help to eventually bring increased hygiene and health levels. Thinking for the human aspect of the scenario, it seems to be more beneficial to take an indirect approach as opposed to a direct approach, although, both are respectively as more important, because without one or the other, nothing will

change.

In order for domestic sanitation and water to improve on a large scale, investment for the sector has to increase. With reduction strategies being taken to improve poverty conditions, infrastructure developments and international developments are being made to raise income levels, and there is an ample attempt being made to allocate investments into improving sanitation and drinking water. The cost of low-quality water for drinking are high, and further cost and benefit related analyses have placed high return predictions on investing in sanitation and domestic waters (Hutton & Haller, 2004). Proper sanitation helps to allow poor people to take the proper initiatives to mobilize assets that enable them to be able to work. Without proper sanitation efforts being exercised, which will result in effective improvements in health and the environment, poor people will lack the ability to have an ample amount of energy and be able to exercise their productivity to help sustain relevant actions that are required to sustain their existence. The sad part of it all, is that people that are less fortunate, and are forced to reside in poorer areas are not seen as being an important asset to society, unless they are contributing their time and themselves. Without gaining access to proper water and sanitation, these people are the first that feel the effects of not having the items that they require. In the end, since hard work triggers downhill, if individuals that are less fortunate are unable to perform their daily working tasks, it is also felt in higher realms of society as well. Keeping economics in mind, it is important to remember that for everything in life that has become easy, there are still hardworking lower income families that are doing everything in their power to keep the things that the higher societies take for granted, under proper control.

Sanitation and water projects help to provide vital environmental benefits. The negative impacts that arise from untreated water sources are evident in ecosystems all around the world. Unregulated dumping of waste-water has polluted the shorelines and rivers throughout the Arab world. Waste-water that has been left untreated is a primary cause of underground pollution of water resources. Due to the fact that multiple countries within the Middle East depend on water resources that are located underground, the adverse environmental and health impacts of this pollution is immense. Waste-water that has been treated is quickly becoming a primary source of water for the agricultural industry. The benefits of constructing managed sewer networks to help reduce and eliminate underground pollutants are apparent. By working on ensuring that proper sanitation methods are implemented, reduced air pollution can also be achieved. Keeping in mind that what appears below will also affect what is above.

The allocation of water has been admonished as a macroeconomic decision, and a option that policy makers can choose to make on their own accords. However, the implication of decisions, go beyond the economic standpoint, specifically when there are advocacy groups that represent the sector (Molle & Berkhoff, 2005). The costs associated with the mismanagement of water can be excessively high. Economic recession, mass migration, the collapse of social order, as well a state of civil unrest along with other complaints are caused through mismanagement.

2.2 Estimated Cost of Sanitation and Water in Year 2013

In order to determine the social, political, environmental, and economic costs that occur as a result of water deficiencies, the cost-effectiveness approach can be used (Dr. Mohamed Abdrabo & Dr. Emad Karablieh, 2005). This approach is used in order to help categorize and cross-check sanitation and water initiatives that are based on the associated costs to obtain specific objectives. The analysis is utilized, instead of using a cost-effect style analysis, generally whenever the output is unable to be set into monetary numbers. Expected impacts are assessed utilizing the exante appraisal method, while another evaluation known as the ex-post evaluation is utilized to measure the impacts. Focus groups, stakeholder consultations, and expert panel groups can be used in order to provide a better understanding of the socio-economic problems. However, the cost-effectiveness method can only be used to compare options that can easily be implemented, and that have the same impacts each time, but situations like this typically do not exist. Therefore, a combination of approaches has to be performed in order to be able to fully determine the value for money clause. Execution that is quick and easy is going to depend upon the measures that are being taken into consideration as well as the information that is readily available to equate the effects and costs. Cost-effectiveness analyses are straightforward, whenever there is enough data to compare (EC, 2009). The costs of sanitation and water, also take health care costs into consideration, and the willingness of consumers to pay for these sources, and their ability to pay (EC, 2009). When the quality of water is questionable, this will cause consumers to purchase more bottled water products in order to avoid falling ill, due to tainted water supplies.

Estimations have been made in order to determine the costs in 2013, this helps to determine the monetary damage that poor water and inadequate sanitation has had in Middle Eastern countries. The figures obtained

from 2010, are extrapolated for the years after, approximately 2015-2030, which helps to determine the cost of inactions (EC, 2009). Estimations are then made to estimate the investments that need to be done throughout the period. The analysis can help to provide additional insight into the amount of return on the investment, to showcase the benefits of improving water conditions and sanitation.

2.3 The Cost of Purchasing Water Products from Outside Vendors in the Year 2013

During 2013, 63 million people residing within the Middle Eastern region, were unable to gain access to adequate drinking water (WHO & UNICEF, 2010). Due to the fact that the people residing in this area, are underprivelaged or reside in lower income areas, their ability to pay for the things that they require is expected, as opposed to people who have a readily established supply to water networks (Whittington & Mu, 1991). Individuals residing in the area, therefore, rely on the efforts of private entities, water harvesting, and springs, in order to adhere to their watering needs. The basic need, which is fifty litres per capita daily can be met by water vendors providing $1.5 per each cubic meter (Gleick, 1996). The estimated costs of purchasing water from private vendors within Arab countries during the year of 2010 is $1285.56 million.

The countries of Yemen and Sudan suffered from the highest shortage costs when it comes to water, their costs were $250.21 million and $415.42 million. These figures can be a result of people lacking the proper sanitation services and improved water that they required.

Table 2. The costs of bottled water during 2013

Country	Cost in million $	Country	Cost in million $
Sudan	450	Egypt	43
Yemen	280	Tunisia	40
Iraq	200	Oman	34
Morocco	180	Jordan	29
Algeria	160	Djibouti	12
Mauritania	60	Comoros	10

Individuals and households were able to offset the health risks of poor water conditions and sanitation, through utilizing avertive expenditures. The consumption of water that has been bottled is escalating, as a result of taste preferences and the lifestyles of modern civilizations, as well as the water qualities of municipal water decreasing. According to Gleick 1996 that willingness to compensate boosts water supply by private merchants in Jordan in rural areas and during network supply failure and break up pumping in urban areas at about $6 per cubic meter; in Yemen this figure is about $3–$4. An average of $1.5 per m^3 is used here as a very conservative estimate to take differences in living standards into account.

The Lebanese Ministry of Environment Report, released in 2001, determined that 0.5 percent of expenditures that are made in Lebanon are to purchase bottled water products, this implies that the per capita consumption of bottled water is roughly 115 litres annually (Sarraf, Larsen & Owaygen, 2004). The reports estimated that the consumption of bottled water is with perceptions of low water quality, averaging eighty six litres each year. Being at 23 per litre, this is representative of $86 million per year in expenditures that are taken to avert having to utilize inadequate water supplies (Sarraf, Larsen, & Owaygen, 2004).

Table 3. Estimated avertive costs of bottled water purchase from in selected Arab Countries, 2013, million $

Country	Cost in million $	Country	Cost in million $
Eygpt	220	Oman	35
Algeria	150	Jordan	32
Moroco	80	Yemen	31
Iraq	60	Mauritania	15
Tunisia	60	Djibouti	5
Sudan	45	Comoros	6

An estimation was made to analyze the bottled water used throughout 200 countries (Parker, 2010) using a multi-stage approach which heavily rely on the use of certain basic economic assumptions depending on assumption governing the shape and type of aggregate latent demand functions. For every year analyzed, Parker, made estimates for the demand of water, accompanied by the earning potential of bottled water supplies. The demand for bottled water products has risen drastically between 2001 and 2011.

In 2001, the money spent for bottled water was $1429 million, and in 2011 the costs were $2229 million. Estimations for bottled water services within 2010, were $2090 million. If one is able to assume that the purchase of bottled water is being made within the Arab countries in an attempt to avoid the health risks that are associated with drinking inadequate water, this would entail that the avertive expenditures being made by individuals within the Arab countries is roughly $648.5 million every single year. Other estimations of avertive measures may measure at higher amounts.

Table 4. Estimated total costs attributable to none or lack of provision of improved water and sanitation in selected Arab countries, 2013

	Cost of diarrhoeal death	Cost of diarrhoeal illness	Cost of diarrhoeal treatment	Cost of water purchase from vendors	Avertive costs on bottled water	Total cost attributed to none or lack of provision of improved water and sanitation	GDP current	% of GDP
Algeria	1064.133	141.986	139.319	209.677	189.992	1744.98	205713.838	1.0795
Comoros	9.779	0.889	4.953	1.27	0.381	17.272	687.197	3.2004
Djibouti	17.78	1.397	4.572	2.54	0.635	26.797	1332.357	2.5527
Egypt	244.094	225.171	363.982	28.194	274.32	1135.634	277995.761	0.5207
Iraq	832.739	122.555	209.55	231.267	79.629	1475.867	103012.748	1.8161
Jordan	31.242	31.75	33.02	8.636	17.907	122.555	33560.258	0.4699
Mauritania	72.517	4.953	20.701	61.341	5.969	165.481	4589.653	4.572
Morocco	452.755	77.597	122.047	211.074	105.537	969.01	115319.683	1.0668
Oman	58.166	50.419	11.43	11.557	21.59	153.162	73468.484	0.2667
Sudan	848.614	92.964	258.191	527.558	41.529	1768.983	85085.555	2.6416
Tunisia	72.136	32.893	35.052	21.844	69.723	231.648	56182.514	0.5207
Yemen	405.638	46.482	163.957	317.754	16.383	950.214	39424.229	3.0607
Arab countries	4109.466	829.056	1366.647	1632.712	823.595	8761.476	996372.277	1.1176

Countries within the Middle Eastern region that had the highest population counts had the highest burden with bottled water costs, because more people were being forced to take avertive measures to ensure that the water that they consumed was not going to harm them. Algeria and Egypt are the two countries that had the highest bottled water costs, at $149.6 million and $216.0 million (OECD, 2007).

2.4 The Costs of Death in 2010 Caused by Diarrhoeal Problems

Waterborne diseases are an obvious impact of what contaminated water can do to an individuals health. The Middle Eastern region, is affected immensely by the impacts of infected waters. The numbers of reported cases of diseases that are attributed to poor water conditions within recent years, clearly displays that unsafe drinking water continues to be a pressing issue. Diarrhoeal diseases are the largest contributing factor to water-related diseases. Diarrhoea, which is an infectious condition is caused by a variety of bacteria, such as, typhoid fever, E.coli, and cholera (OECD, 2007).

UNEP and WHO (2008) estimate that ninety four percent of the 1.8 million fatalities that occur annually from diarrhoeal conditions are a result of environmental issues, more generally, inadequate water for drinking and poor sanitation practices. Not all of the fatalities that occur are a result of water issues, but by providing proper drinking water, and improving the sanitation within the area, can help to reduce the amount of children that die as a result of diarrhoeal diseases by roughly eighty eight percent (WHO, 2011).

Utilizing the most recent figures regarding deaths and DALYs (DALYs disability-adjusted life years) to determine age related deaths per, are 100000, along with making the assumption that 80% of the diarrhoeal outbreaks are a result of poor drinking water and sanitation, the estimated deaths that result from diarrohea during 2010 are 97583, or 1386675 DALYs (WHO 2004 & 2008). By applying the human approach, and making the assumption that 1 DALY is equal to the gdp in dollars, the yearly cost of deaths that resulted from diarroheal deaths was $3235.84 million within Arab countries during 2010.

The magnitude of these costs within each country is attributed to the numbers of people that died, along with the number of DALYs per fatality along the country level, and GDPs per capita. Therefore, the cost associated with treating the condition, may not all reflect the amount of individuals that died as a result of contracting the disease. DALYs as they equate to death, or GDPs within areas that experience the same amounts of deaths caused by

diarrhoeal outbreaks, may also result in higher death related costs. The highest costs for deaths that occurred as a result of the disease, were in Iraq, Algeria, and Sudan, where costs exceeded within the $500 million range. The areas of Djibouti and Comoros had the lowest costs. However, the lower costs may be a result of the countries lower per capita income levels.

Table 5. Estimated avertive costs attributed to lack of provision of improved water and sanitation in selected Arab Countries, 2013, million $

Country	Cost of Diarrhoeal illness and death	Cost of Bottled water & Water Purchased from Vendors	Total
Sudan	820	510	1330
Algeria	920	400	1320
Iraq	730	500	1230
Egypt	690	230	920
Morocco	430	210	640
Yemen	420	310	730
Tunisia	160	110	270
Mauritania	200	2	202
Oman	90	3	93
Jordan	190	6	196
Djibouti	1	1	2
Comoros	1	1	2

From the above table (5) it shows that the estimated avertive costs attributed to lack of provision of improved water and sanitation in selected Arab Countries, 2013, averaged to be 1100 million $. That's because Sudan reached 1330 million dollar while the Algeria reached 1320 million dollar and Iraq 1230 million dollar. Jordan and Djibouti, Comoros to reach 196 and 2,2 million $.

3. The Cost of Diarrhoeal Deaths during 2010

3.1 Costs of Illness

In order to determine the costs associated with illness and treatment of children suffering from diarrhoea, we used the data obtained by WHO in 2008, and the 2010 population estimates obtained from UNDESA (WHO 2008 & UNDESA, 2011). Assumptions were made that eighty percent of the cases were caused by a inadequate sanitation and water (WHO,2012). The cost of the illness was determined by the total amount of days of productivity that were lost, estimating that the average time to get better from the disease is roughly five days (WHO,2012). Welfare losses, due to parents not being able to attend to their daily tasks at their employer, were estimated opportunity costs of time equal to fifteen percent capita of daily income, utilizing the proxy time table for GDP. Estimations have been made that the total cost for diarrhoeal illnesses within the Arab countries during 2010, is $652.83 million.

Table 6. Projected costs of water purchase from vendors in selected Arab countries, 2015-2030

Countries	Water purchased in Million $	Countries	Water purchased in Million $
Sudan	5500	Tunisia	800
Yemen	2200	Jordan	650
Algeria	2000	Comoros	450
Iraq	1800	Egypt	400
Morocco	1700	Oman	400
Mauritania	800	Djibouti	50

From the above table(6) that express the projected costs of water purchase from the vendors in selected Arab countries that Sudan has reached the upper limit of the cost of 55000 million $ for the years 2015-2030. This ring the bell of warning when the economic development across the country reached the sluggish and difficulties to move forward.

3.2 Cost of Treating Diarrhoea

The complexity and escalating cost of diarrhoea has put an immense amount of pressure on the healthcare sector. In order to determine the costs of treating diarrhoea within the Arab countries, the yearly episodes for all children under the age of five have been calculated utilizing statistics obtained from WHO (WHO,2008). Private and public health expenditures were used in order to estimate the ways to treat diarrhoeal diseases that have occurred as a result of inadequate water and sanitation practices. In order to come up with these figures, certain numbers had to be averaged. For example, a visit to the doctor estimated at $8, medicines accounted for $8.50, and caregiver times accounted for $7. The costs for treating diarrhoea was caused by inadequate water conditions and poor sanitation, eighty percent of children under the age of five are afflicted with the condition, as a result. The cost of inadequate water and sanitation within the Arab countries is roughly around $6898.81 million within 2010, which equates for 0.88 percent of the GDP. Final figures indicated that Iraq, Algeria, and Sudan experienced the highest costs for poor water and sanitation, which exceeded the cost of $1000 million. The overall monetary costs within these countries accounted for a total cost of $3928.93 million, which is roughly fifty seven percent of the costs of all Arab countries that were evaluated during this study. Iraq, Comoros, Sudan, Yemen, and a few additional countries within the Middle Eastern region, had the highest costs of GDP, in accordance with poor water and sanitation, which exceeded two percent.

3.3 Projected Water Cost for 2015-2030

In an attempt to demonstrate the benefits associated with improving sanitation and water, we exasperated the costs of these services not improving for the years of 2010 thru 2020, and the mandated investments for universally provisioning for the same amount of time. The estimates are designed to showcase the total magnitude of investment returns. All of the calculations are not discounted and they are estimated utilizing the 2010 pricing scale. The cost-effectiveness module is able to help to assess the best methods to use in order to meet the increasing demands for water. There are multiple measures that can be done to help obtain the universal water goals, and sanitation provisioning, which will involve the utilization of several technologies and approaches, utilizing funding methods.

Table 6a. The expected cost and benefit of action and expected rate of return on investment in improved water and sanitation provision for 2013–2030 water and sanitation

	Required investments in provision of water and sanitation services ($ million)	**Potential benefit (avoided total cost attributed to none or lack of provision of improved water and sanitation; ($ million)**	**ROR (%)**	**Average annual rate of return (%)**
Algeria	6,628.81	35,325.04	792.21	72.10
Comoros	400.22	733.65	152.44	13.91
Djibouti	520.45	587.25	23.42	2.20
Egypt	8,206.45	20,264.69	268.83	24.52
Iraq	15,037.29	41,455.54	321.53	29.28
Jordan	247.60	2,992.97	2,028.92	184.46
Mauritania	3,927.73	3,244.41	-31.84	-2.93
Morocco	15,526.09	17,583.37	24.34	2.20
Oman	475.25	3,213.48	1,054.26	95.89
Sudan	55,242.39	34,100.77	-70.09	-6.41
Tunisia	2,675.28	4,461.54	122.24	11.16
Yemen	23,281.99	17,874.53	-42.46	-3.84
Total	132,169.92	181,837.04	68.81	6.22

Table (6a) shows the expected cost and benefit of action and expected rate of return on investment in improved water and sanitation provision for 2013–2030 water and sanitation. By taking the prices of inaction into consideration, determinations can be made, what actions should be taken in order to optimally overcome the issue. If there are no further actions taken in order to improve sanitation and water domestically, the numbers of people that will be lacking these services within the Arab world will reach seventy six million and one hundred three million, by the year 2020 (WHO & UNICEF, 2010). The lack of providing improved water and sanitation resources to the area, will force mortality and social related costs to escalate (World Bank, 2004). All of the costs

of treating the sick due to poor water and sanitation practices can be averted, if proper drinking water and sanitation are provided. However, in order for this to work, proper governance over water needs to be established.

3.4 Costs of Purchasing Water from Water Vendors during 2015-2030

By the year 2020, seventy six million people within the Middle Eastern region, are anticipated to lack the required accessibility that they need to have to adequate water that is suitable for drinking. Therefore, in order to obtain the safe drinking water that they require, they will have to rely upon outside vendors, water harvesting, and springs, in order to secure their supply. From what depicted from table (7), the cost of purchasing water from vendors for the years of 2015-2030 within selected Arab countries is going to be $14,481.11 million. The Arab countries that have the highest amount of spending for water vendors during the terms of 2015-2030 includes Iraq, Algeria, Yemen, and Sudan. The projected Cumulative number of households without access to sanitation services in selected arab countries, 2015-2030 for the lowest of Oman and Djibouti were studied to be 600,000 and 3million $.

Table 7. Projected Cumulative number of households without access to sanitation services in selected Arab countries, 2015-2030

Country	Thousands	Country	Thousands
Sudan	9000	Mauritania	5000
Yemen	35000	Algeria	5200
Morocco	25000	Tunisia	5000
Iraq	24000	Comoros	3200
Egypt	18000	Djibouti	3000
Jordan	350	Oman	600

3.5 Costs of Bottled Water for the Years of 2015-2030

Taking into assumption that the current trends that are going on for the consumption of bottled water continue at the same rate, the average demand for this product during the years of 2015-2030 is estimated to be at $15882.72 million (Parker, 2010). Making the assumption that fifty percent of the bottled water that is consumed is due to the low quality of municipal water, this estimates that the averted costs associated with drinking bottled water is roughly $7941.36 million, within selected Middle Eastern countries.

Table 8. Estimated annual rate of return on investment in water and sanitation provision in selected Arab Counties, 2013-2030

Country	**%**	**country**	**%**
Jordan	100	Tunisia	29
Oman	50	Morocco	26
Algeria	40	Djibouti	12
Iraq	35	Mauritania	10
Egypt	32	Yemen	9
Comoros	30	Sudan	6

The number of deaths that were caused by inadequate water and sanitation facilities is roughly around 992363 for the term of 2015-2030 for the Middle Eastern area. This means that 18339459 DALYs occurred over the same period. Through considering an application of the human capitalistic approach, this is assuming that the value of 1 DALY also relates to per capita in GDP dollars, estimating yearly costs of fatality from diarrhoea in Arab countries is $55839.63 million between the time frame of 2015-2030.

3.6 Costs of Morbidity from Diarrohea between 2015-2030

The vast amount of diarroheal cases among children that are under the name of five, has attributed to a loss of 2.734 million of DALYs for selected Middle Eastern countries within the time frame between 2015-2030. The amount of accumulative costs is roughly $9847.82 million in Middle Eastern countries within the same amount of time. Treatment for this illness is estimated to be roughly around $11254.54 million for the time frame between 2015-2030. If illness and treatment costs are added together, then the morbidity cases for poor drinking water and sanitation practices within selected Middle Eastern countries is $21102.36 million for the time frame

of 2015-2030. The costs associated for domestic water and domestic sanitation within the Arab countries is roughly 99364.46 million for the time between 2015-2030. The costs, regardless of who renders the money for them are included social costs. The estimation is conservative, and only direct and avertive health costs have been included. By including and social, political, and environmental costs, this could end up making these monetary estimates higher.

3.7 Direct Investment for Water and Sanitation 2013-2030

Upgrading the sanitation and water services within the Arab countries is an international goal, and is important to the social and livelihoods of people in the area. A new initiative known as the MDG 7 has been committed to by all countries residing in the Middle East, in an attempt to increase sanitation and water products. There have been a lot of countries that have made an immense amount of progress in fixing the inadequacies as they relate to sanitation and water. According to UNICEF (2008), in 2006, eighty four percent of the people residing in the Arab countries had access to water that had been improved. However, even though the progress is notable, only fifty million of the three hundred twenty four million Arabs, who resided mostly in the areas of Yemen, Iraq, Sudan, Morroco, and Syria did not have access to an adequate and secure supply of water (UNICEF,2008). It is important to achieve one hundred percent provisions for clean water. Even though clean water is an important issue that needs to be tackled, there are other issues that deserve an adequate amount of attention as well. Equity, transparency, accountability, affordability, reliability, quality, and efficient distribution need to all be analyzed. These issues all relate to efficiently governing water.

In order to provide a correct estimate of what monetary means are required to achieve safe water and sanitation provisioning, calculations have been done to determine how many people would lack the amount of adequate water that they needed during the time-frame of 2015-2030. These estimations were based on the projections of the population, and the provisioning levels. Estimating the averages for cost of water and sanitary requirements per household, we were then able to correctly calculate the recurrent and capital costs required for providing clean and safe water and sanitation methods (WHO,2011). A cost analysis that estimates the costs of providing water with taking the growth of the population into account, was performed.

Table 9. Water abstractions 2013 cubic meter per capita

Countries	**M^3/Capita**	**Countries**	**M^3/Capita**
France	630	Mexico	800
Australia	670	OECD	920
Japan	680	Canada	1300
Spain	900	EST	1600

The primary data evaluated for investment costs of sanitation and water programme was performed by the WHO, it included in a full investigative report (WHO,2012). The report showed recurrent and capital costs for general sanitation and water projects, assuming that the span of the project lasted for roughly twenty years. The 100,406 million households along with 209,676 million houses in various Middle Eastern countries were in desperate need of enhanced sanitation and water infrastructures (WHO,2012). The costs associated with providing improved water resources between the time frame of 2015-2030 to be at the sum of $19692.35 million. Effective sanitation for this same period of time is expected to be higher than the cost of providing water, the cost for sanitation is $52531.64 million. Bringing the total costs of providing sanitation and water for the term of 2015-2030 to the sum of $72223.99 million.

3.8 The Rates of Return on Investments

Un-discounted estimates for the investments that need to be made in 2015-2030, have been made. If the appropriate actions have been taken, there will be an immense amount of investments that will need to be made to bring the adequate utilities to every country. The investments that are required to improve sanitation and water varies considerably within a variety of Arab countries. A few figures that the countries reached are 8217.06 million, 30187.13 million, and $8484.21 million considerably, for Morocco, Iraq, and Sudan. The returns that occur for investments in improving sanitation and water services are tremendous. The mentioned estimates are unable to capture the environmental and social costs of inaction, such as the amount of time that is wasted obtaining water or getting rid of wasted water. Incorporating these costs would help to increase the estimates, which would also cause the rate of return to also increase drastically as well.

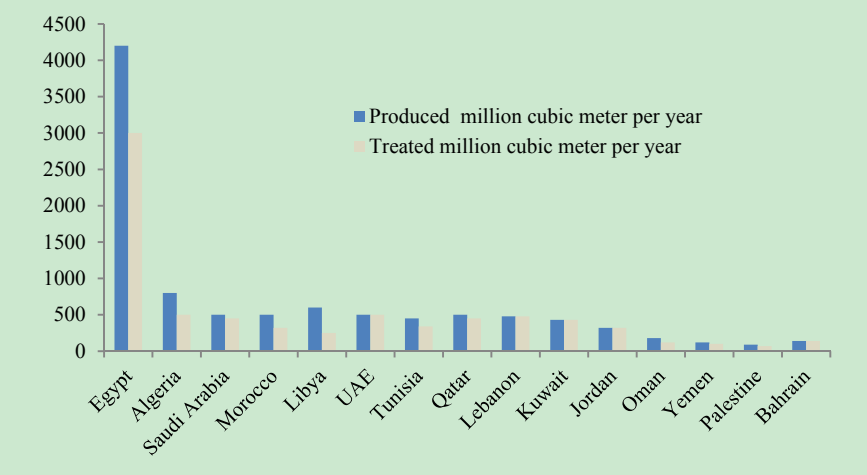

Figure 2. Wastewater produced and treated in some Arab countries, 2013-2030

The rates of return vary considerably, within the countries of Egypt, Oman, Iraq, and Algeria. These countries have returns of 52.37 percent, 13.36, and 15.97 respectively. These higher rates of return are due to the limited amounts of investments that are required in order to improve sanitation and water services, relative to the avoided costs in health care and the benefits of them. However, inadvertently, the rate of returns for poorer countries within the Middle Eastern area were lower and much lower sanitation and water coverage was provided.

Table 10. Trends in population with access to improved drinking water sources in Arab countries 2013 as %

Countries	%	Countries	%
Bahrain	100	Tunisia	95
Lebanon	99	Oman	90
Qatar	99	Djibouti	90
UAE	99	Palastine	90
Saudi Arabia	99	Algeria	89
Kuwait	99	Morocco	88
Egypt	97	Yemen	70
Jordan	96	Mauritania	50
Comoros	96	Somalia	20

This occurred in areas of Yemen and Sudan due to the fact that estimates were based upon the average costs for houses to connect to the resources they required. Options to resolve the issue varies, like in Yemen, where septic tanks and wells are being used for sanitation and water materials, in order to increase the costs. The goal in this scenario should be to identify the best intervention program that will have the highest rates of return, in order to ensure that the proper sanitation and water goals are adhered to. This is a goal that the cost-effectiveness approach aims to achieve.

4. Tools to Establish Water Governance

Improper valuations of sanitation and water has withheld governance and management approaches, negative environmental and socioeconomic repercussions have been established. The value of water should be calculated by also paying close attention to the economic, social, and environmental dimensions of resolving the issue. Taking action to achieve sanitation coverage and universal water services, clearly has a higher return rate, then inaction, which involves waiting in water governance services to be instilled and followed by the government. There are many approaches that can be identified, each having varying costs. Therefore, when taking all of these accounts into consideration, the cost-effectiveness approach appears to come in handy. The return and the benefit of applying several different options, can help countries determine what their best economically centered option is.

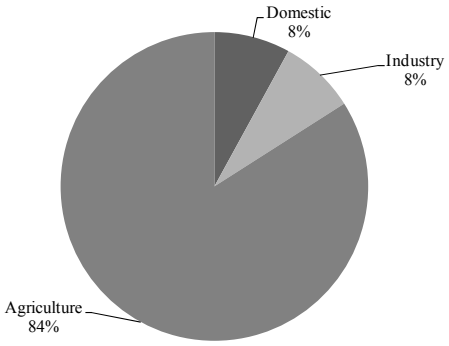

Figure 3. Water uses in Arab countries

The cost-effectiveness method can assist policy makers with bridging the gaps between supply and demand, as they operate towards executing a proper water governance plan. By assessing all of the options, and paying close attention to several different factors, an effective analysis can be reached to rectify the sanitation and water issue within the area. The environmental, political, and health benefits of improved sanitation and water policies are developed through the method. Proper valuations of water through a cost-effective analysis helps to guide policy makers into assessing the efficient methods of utilizing alternative management techniques for water. Figure (3) Water uses in Arab countries estimates that agriculture uses water in the Arab countries to be 84% . Some other areas may vary from 76% to 86% to be consumed for agriculture. The domestic uses of water moves to 8% and industrial activities occupies another 8% for year 2013.

5. Conclusion

Action (achieving universal water and sanitation coverage) is undoubtedly possible and has a higher rate of return than effective (continuing prevailing water governance structures and practices). Many latent approaches to this target can be recognized, all with different costs. Cost-effectiveness analysis thus draw closers in useful. The approach shown and discussed earlier for the costs of action and inaction is virtual for each alternative; the expected return and benefit of each option will help identify the most cost effective alternative. Cost-effectiveness analysis can help decision makers limit the gap between demand and supply as they work to achieve effective water governance. By reviewing policy alternatives with awareness to all the economic, social and environmental variables, cost-effectiveness analysis assists determine consensus along with stakeholders. It reveals the health, political and environmental advantages of improved water and sanitation. The proper valuation of water, all the way through cost-effectiveness analysis, leads decision-makers in assessing the efficiency and costs of option water management strategies. Advancement in the direction of many of the solutions is already underway in different ways transversely the region. However the stress of the current situation needs pick up the paced and advanced combined effort. Many Arab countries are already on the threshold of shortage and scarcity of renewable water. Droughts and famines have become more frequent and agricultural output is falling in the wake of population intensification. The collisions of climate change and demographic and economic growth aggravate the challenge. Current protuberances notify that by the year 2025 the water supply in the Arab region will be only 15 per cent of what it was in 1960.

Research and innovation are critical in setting the stage for effective water policies that ensure sustainability, efficiency and equity in access to and use of scarce water resources in the Arab region. Yet water research organizations are hampered by a lack of adequate human and financial assets and the absence of national science and technology policies. In particular, the links between R&D and production require strengthening.

To succeed, any long-term vision for water governance requires a solid understanding of the social and cultural changes brought by modernization. As lifestyles evolve with rising education levels, accelerating urbanization and ongoing political and social reform, governance must evolve in tandem. Arab countries must also prepare for the impacts of climate change on water resource planning and augment their adaptive capacity. The Arab region's current economic and political transformation could advance water governance reform through increasing participation and accountability, and water governance reforms can in turn catalyze larger social change through water's effects on livelihoods and other socio-economic activities.

Monitoring is important tool for policy reform and implementation. The effective observe allows fine tuning policies and reallocation of financing diagonally reform priorities. Stakeholders should watch the quality of

decisions and implementation. Each Arab country should develop monitoring indicators for water reform progress and impacts. A regional monitoring system may look up the comprehending of problems. This allow them to promote solutions, particularly for transboundary waters interaction. Indicators should be known for monitoring and assessing to permit environment, institutional frameworks, in addition to the, management instruments. Ensuring compliance of water legislation The financial sustainability and viability of effective water governance depend on a clear water financing scheme that identifies financing sources and economic instruments for ensuring optimal funding allocation. Private sector participation in the water sector is growing in response to governments' inability to raise adequate capital to finance, operate and maintain water and sanitation infrastructure. All possible move towards privatization might be counted to be evaluated for effectiveness, efficiency, equity and other elements of effective water governance. Access to data and information is besides resolve necessitate updating water legislation via a participatory approach, disseminating information and providing technical assistance and economic incentives, and developing inspection and monitoring capacities to investigate and penalize violations. The essential for effective water governance. Without good data, water cannot be allocated efficiently. Better water data support decision-making at every scale, from local crop decisions to larger planning efforts for balancing water demand from agricultural, municipal and industrial sectors. Data preserve also progressed the equity and transparency of decisions and support water quality monitoring. It is important to see soon the regional cooperation in water governance due to high dependency on shared water resources. Arab countries must assume a strategic approach that controls their socio-cultural solidarity into a unified political arrangement sustaining the rights of all riparian countries to just equitable shares in international water resources. Cooperation is required with neighboring non-Arab countries to make consensus, nurturing and strengthening institutions to strengthen the joint management of water resources. Cooperation for effective governance of shared surface and groundwater basins will help to achieve sustainable development. Social equity, a declared goal of effective water governance, should anchor policy choices. Policies should rely primarily on approaches that allow meaningful participation of all stakeholders. All or some social groups might be bright to voice their alleges and apprehensions in an open, transparent environment. Replicating on social and gender equity apprehensions in policy formulation and programmes is a precondition for effective water governance. To comprehend the target of comprehensiveness, countries should move beyond legislative arrangements and staged participatory processes to exertion towards cultural change. Public awareness is the establishment for connotation participation and tangible deed. A long-term awareness programme requirements to be introduced that makes local and regional socio-economic and ecological dimensions into explanation.

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