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# Water Pricing as a Means to Ensure Water Conservation: A Case Study from Palestine

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**Abstract.** Water pricing has gained widespread acceptance as a valuable and versatile tool to promote a number of goals. Borland and Whittington (2000) have identified the main goals of water pricing as follows: economic efficiency, revenue stability, equity, income redistribution, and water resource conservation. Therefore, policies should be as simple and as transparent as possible, they should also be both publicly and politically acceptable in order to reduce friction among the public and the governing bodies. In most developing countries, water management has reached its limit at the centralized level. Water supply infrastructure has been developed to serve large portions of the population in these countries including Palestine. It is now the task of local governments to provide their citizens with potable water at a price that people can afford, and at a price that will create revenue stability for the utilities in charge of supply and distribution while ensuring water use efficiency and revenue redistribution. What this demands is a pricing scheme that needs to be tailored to the social, economic, environmental and political situation of the respective country. In the West Bank, water supply management is highly scattered and is not well organized. There are many actors charged with the task of supplying water for the communities. In addition, the current situation of most of the water utilities in the West Bank reveals that the financial inefficiencies that they are faced with are partly due to the economic hardship facing people as a result of the political situation and partly ascribable to unclear pricing policies. The current paper is based on a research conducted by PHG on developing a sound pricing policy in Palestine.

**Keywords.** Water pricing, – Water conservation – Income redistribution – Revenue stability – Stakeholder participation – Local water supply management.

## ***Tarification de l'eau comme moyen pour assurer la conservation de l'eau: un cas d'étude en Palestine***

**Résumé.** La tarification de l'eau est largement acceptée comme un outil valable et versatile pour atteindre un certain nombre d'objectifs. Borland et Whittington (2000) ont identifié les objectifs principaux de la tarification de l'eau, à savoir: l'efficacité économique, la stabilité des recettes, l'équité, la redistribution du revenu et la préservation de la ressource eau. Il s'ensuit que les politiques dans ce secteur devraient être aussi simples et transparentes que possible et en même temps, acceptables d'un point de vue public et politique afin de réduire la friction entre le service public et les organismes chargés de la gestion. Dans la plupart des pays en développement, la gestion de l'eau a atteint ses limites au niveau de la centralisation. Les infrastructures pour l'approvisionnement en eau ont été développées pour desservir une grande partie de la population dans ces pays, y compris la Palestine. Aujourd'hui, ce sont les gouvernements locaux qui devraient assurer aux citoyens l'eau potable à un prix abordable et capable de créer une stabilité des recettes pour les entreprises chargées de l'approvisionnement et de la distribution, tout en garantissant l'efficacité d'utilisation de l'eau et la redistribution des recettes. L'enjeu est donc d'adopter un régime de tarification prenant en compte les conditions sociales, économiques, environnementales et politiques du pays concerné. En Cisjordanie, la gestion de l'approvisionnement en eau est très fragmentée et mal organisée. Il existe plusieurs acteurs chargés de fournir l'eau aux communautés. En plus, actuellement, la plupart des entreprises de l'eau sont concentrées en Cisjordanie, ce qui laisse ressortir les faiblesses financières auxquelles elles doivent faire face et qui sont imputables, d'une part, aux difficultés économiques dont souffre la population à cause de la situation politique et d'autre part, aux politiques de tarification peu transparentes. Le présent travail se base sur une recherche menée par le Palestinian Hydrology Group concernant le développement d'une politique de tarification raisonnée en Palestine.

**Mots-clés.** Tarification de l'eau – Conservation de l'eau – Redistribution du revenu – Stabilité des recettes – Participation des parties prenantes – Gestion locale de l'approvisionnement en eau.

## I – Introduction

The water sector in the West Bank and Gaza has remained undeveloped over the past three decades of occupation. Since 1967 West Bank water resources have been controlled and managed by the Israeli Military Authority through a number of Military Orders. These orders have barred Palestinians from participating in the planning and management of water resources and prevented them from developing local water resources in concert with growing water needs.

During this time, management of public resources was completely within Israeli domain; decisions were made without Palestinian participation, and with little regard for Palestinian needs and interests. As a result, the Palestinians have developed a distrustful, often antagonistic relationship with public authorities. Respect for public goods and public management decisions represented acceptance of or agreement with the Israeli occupation.

The lack of investments in improving infrastructure (physical water losses reach 50% in some areas), the scattered nature of the water supply and management utilities with the absence of adequate rules and regulations and absence of stakeholder participation has resulted in the deterioration of the entire water system.

In reality, the change in the political process in the early nineties was not merely an opportunity for greater water use, but rather a challenge to form new, responsive public institutions to govern water sector properly. It is for that the Palestinian Water Authority (PWA) was established in 1995 and was assigned the task of formulating and implementing a comprehensive water strategy and water law, which would entail setting up adequate rules and regulations including proper water pricing policy for the West Bank and Gaza. Due to the fact that Palestinians have not gained yet the full control over their water resources and the issue has been left to the final status negotiation, PWA faced with many constraints to implement the Water Law. Accordingly, no final regulation on water pricing policy has been formulated as of yet. The existing pricing schemes are those ones prior to the establishment of the water authority. They reflect mainly accounting costs of supply and allocation at each locality, while neglecting many of the economic, social and environmental costs aimed at generating a higher level of efficiency in the sector. As a result, public satisfaction with the current pricing policies hasn't been met in most of the areas in the West Bank.

In an earlier research done by Palestinian Hydrology Group (PHG), it was shown that the pricing policies used by various municipalities varied substantially, with tariffs ranging anywhere from 0.19 \$/m<sup>3</sup> (in Qalqiliya) to as high as 1.69 \$/m<sup>3</sup> (in Bethlehem). However, it may reach nearly 3 \$/m<sup>3</sup> in some localities where no proper water supply systems exist. Water obtained by Tankers may cost 5-6 \$/ m<sup>3</sup> in the areas lacking water supply services (40% of localities) in the same time the quality they get is much lower.

To further exacerbate the situation, it was shown that no local water utility in the West Bank was recovering accounting costs in excess of 85%. In some areas cost recovery was as low as 62%. It is worth noting that these recovery costs do not take into account any social, environmental, or opportunity cost.

It is with this in mind that PHG has undertaken the “pricing policy” research project, with the following main objectives :

1. Increase transparency of policy reform through the analysis of publicly collected data on affordability, willingness to pay, and water use levels in the West Bank;
2. Fostering participatory decision making mechanism in the field of Water Resources Management;
3. Formulating a water pricing policy that will meet the criteria of economic efficiency, effectiveness, affordability, democracy, legality, water conservation and revenue stability.

## II – Research Problem

In recent years, water pricing has gained widespread acceptance as a valuable and versatile tool for municipalities and utilities to promote a number of goals. The most common goals associated with a sound water pricing policy, as specified by Borland and Whittington (2000), are identified as: economic efficiency, revenue stability, equity, income redistribution, and resource conservation. In addition to these five cardinal objectives, it is also important to consider the socioeconomic implications of the policy, and therefore policy makers must also strive to formulate a policy that will be both publicly and politically acceptable. In order to reduce friction from the public as well as the governing body, a policy should also be as simple and as transparent as possible, which will only lead to greater ease in the implementation of any water rate structure.

Much of the debate concerning the issue of water pricing has regarded the issue of decentralization of water management and the role local municipalities play in the process of policy formulation and implementation. In most developing countries, water management has reached its limit at the centralized level. Water supply infrastructure has been developed to serve large portions of the communities in these countries including Palestine. It is now the task of local governments to provide their citizens with potable water at a price that people can afford, and at a price that will create revenue stability for the utility in charge of supply and distribution. What this demands is a pricing scheme that needs to be tailored to the social, economic, environmental and political situation of the respective country.

In the West Bank, water supply management is highly scattered and is not well organized. There are many actors charged with the task of supplying water for the communities. The lack of cooperation between the utilities has been one of the major factors contributing to the inefficient methods of pricing, supply, and distribution. The result of this is that we find areas where a low-income household is spending 15% or more of their yearly income on household water use alone. And given the inelastic demand of water used for household consumption, little can be done to avoid these high costs of water.

In addition, the current situation of most of the water utilities in the West Bank reveals that the financial inefficiencies that they are faced with are mainly because of the people's inability to pay for the water supply services. Moreover, the water pricing policies adopted by these utilities rarely reflects the public willingness to pay and to the extreme, it is sometimes driven by political motives rather than social, economic or environmental values. For example, in areas where water prices have traditionally been low, local municipalities face pressure to keep that price (often times artificially) low, regardless of whether it is a true reflection of the total cost of water. This creates a vicious cycle that neither allows for sufficient revenue stability, nor provide sufficient incentives for the consumer to practice any type of water conservation practices. These two effects combined have a devastating impact on the water utilities themselves and on the general welfare of the public.

Accordingly, it is imperative that one of the main goals of any water pricing policy reform in the West Bank should be the socially equitable and just administration of potable water. In brief, the price of water is a major lifestyle determinant in the West Bank. Therefore, margin families will receive the greatest marginal benefit from a pricing policy that considers their socioeconomic circumstances. Conversely, they will face the greatest marginal cost if water policy fails to address their needs. This would entail to consider both environmental and social (user) costs when developing such policy. These two costs represent externalities that must be included in the final price of water in order for the local utilities to gain the public acceptability and insure full cost recovery of supplying water to the public for domestic use. Any failure to do so will only result in further deficits, decline in revenue stability and hence will lead to further deterioration of both water infrastructure and services.

The current paper is summarizing most of the concerns listed above and tried to reflect public opinion in the formulation of the basis for the future water pricing policy in Palestine.

### III – Methodology

After reviewing the existing literature concerning the different economic theories, social aspects, willingness to pay models and their valuation techniques and game theories, special attention was given to the decision theory and bidding game in particular. The decision theory establishes that if people are not able to communicate about their decisions they usually have a worse outcome as when they were able to talk with each other about it. The bidding game is a tried and tested method to determine the willingness to pay for water. This is based upon the premise that the water supply is regular, clean and potable. The game allows the users to imagine that they are bidding for water in accordance with their current income levels.

The main concepts established were to define the best methods of reflecting the willingness to pay while assessing the various factors influencing it. In addition, to assess the gender aspects of water issues and to reflect on the water use practices and the level of awareness that people have. Furthermore, the relation between the water price and the quantity used as well as how a sound pricing policy might influence the rationing of water use was also studied.

These concepts were reflected in a form of questionnaire. After that a sample size has been selected using multistage stratified cluster sampling and conducted on four stages:

- a) Selecting a population location using probability proportional to size sampling (PPS);
- b) Selecting a cluster or census track from the population location. The cluster or the census track contains approximately 100 to 150 households;
- c) Selecting 1 household from the cluster using systematic sampling;
- d) Selecting an adult from the people living in the selected household using simple random sampling.

Despite the fact that cluster sampling is less efficient than simple random sampling, yet it is more cost effective. Accordingly, a margin of error of 4% was considered under simple random sampling then the effect that should be used under cluster sampling to produce the same margin of error was derived. It was concluded that the sample size would be around 1250 households, then reduced to reflect real target population to 1190  $\pm$ 10%.

The questionnaires were then classified for both clusters of the communities connected to water supply and those who are not connected, and distributed to the pollsters in the different parts of the West Bank. It is good to mention that the pollsters were divided into groups of two one male and one female for the same cluster. The rationale behind sending one male and one female to the same cluster is to reflect the gender aspects properly in the survey. In addition, it is socially more acceptable to females in the team to enter houses when the head of the house is not there and the female pollster can interview the female respondent in the house.

Following to the completion of the survey, questionnaires were analyzed using one of the specialized statistical packages (SPSS), and results generated. However, it was realized that there are some aspects that could not be covered by the questionnaires. Therefore, a second track was used to capture such information using focus group meetings.

The methodology used in the meetings was the participatory rapid appraisal (PRA). The PRA method allows people to go beyond the quantitative aspects that are covered by the questionnaire. It also attempted to promote open group discussion on the value placed on water. In addition, different tools such as the matrix mapping and pie chart were used during the meetings.

The results obtained on willingness to pay and affordability, public perception, the type and efficiency of water pricing schemes in place and the gender perception of water issues in conjunction with the information collected through focus group meetings together with the findings of the theoretical background of economic theories and the actual socio-economic conditions in the West Bank were then used to propose a draft water pricing mechanism to be considered in Palestine.

## IV – Discussion

It was realized that water pricing policy is not just about money and law. It is in the first place about people. What people are willing to pay and what they can afford to pay for the water? How do they value water and how do they perceive water pricing policy?

Accordingly, the challenge was how to address these issues and how to adequately value water in a way that people will endorse and deal with it. Mitchell (1984, quoted by Brooks *et al.*) presents three procedures that provide a framework for placing a value on water.

- Next best alternative: a value can be assigned to water in terms of the cost of the next best alternative. This approach reflects the cost of obtaining and delivering alternative supplies;
- Value-added: the value of water can be established with reference to the value added to the manufacturer's products or consumer's satisfaction. This concept also applies in the case of water uses that deplete or degrade the water supply for downstream users;
- Intrinsic value: an intrinsic value could be assigned to water before it is developed, as is done with other natural resources, such as oil and gas. The cost to the user would include this intrinsic value of water plus the costs of supply, treatment, and distribution. One way to determine the in-source value of water is through bargaining among interested parties. Other ways involve techniques such as willingness-to-pay and contingent valuation.

The main message adopted from conducting the valuation is that, the later is a useful process whereby it assist in safeguarding the public interest through defining the net benefits in excess of costs imposed on third parties or environment; it will also assist in monitoring and regulating water exchange; and finally will assist in developing better water pricing by addressing the people's WTP and the demand elasticity for different types of uses, purposes, quality and reliability in the different seasons of water demand.

Determining people's WTP is always a relative issue since there is often a gap between what people say and what they actually do. The challenge is how to narrow this gap and how to be as much close as possible to the real price that people is willing to pay under various conditions. Although many do not trust WTP for policy recommendation because it is hypothetical data and not market data. In theory, the Compensated Income Variation (CIV) or the Equivalent Income Variation (EIV) can measure WTP (Van Ireland, 1993). Both measure the consumer surplus, the CIV measures how much income is needed to put a consumer at his initial level of utility to prevent being at a lower indifference curve. The EIV measures how much income the consumer is willing to sacrifice (and go back to the initial utility level) in order not to face the new prices. Therefore, water pricing policy is not just one figure or one scenario, it is merely a mix of scenarios under which prices are set for water.

The issue that remains is how best to advocate for such water pricing policy. The pricing notion often creates some reaction especially at the poorer sectors of the community. Therefore, it is imperative to introduce the pricing as a regulatory mean and as an incentive to achieve water conservation within a framework of water policy. It is also imperative that such policy clearly

addresses the interest of the different groups, including the most marginal part of them and adopt means that ensures social fairness among all layers of society. The principle of “the more you use the more you pay” is just a means to ensure this and also to ensure rationing of water use. In addition, people participation in developing the water pricing policy will create an ownership obligation that people may adopt.

Therefore, it was realized that the best approach to adopt in developing the water pricing policy for Palestine was the increased block tariff (IBT) approach where it ensures the basic needs at lower price, where poorer sectors can afford. In the mean time, it compensates for the cost by charging those who use more in a manner that the richer sector will subsidy the poorer sector. In this way more social cohesion and fairness might be felt in the society. In addition, IBT rate structure is designed to promote the conservation of water. As the price per unit of water increases with each block, it is assumed that given water is a normal good, consumption will decrease. People will be less likely to use water in wasteful ways or in ways where its benefit is below its cost.

It is concluded that a proper water pricing policy would need three main issues: regulation, economics and information. Moreover, to ensure people participation, a good governance system needs to be in place. It is clear that good governance would entail the presence of adequate regulation which is based on proper laws. In the mean time economic means will be necessary to develop the viable pricing policy and finally the information is very crucial for both categories to be realized and for the actors to know better about their system. Numerous studies have shown that water pricing policies are most effective when they are used in conjunction with complimentary legislative mechanisms and other economic incentives such as increased options for reallocation of water among water users and public support .

## V – Results

It was found that there is large spatial variation in the water use and water price across the West Bank districts. However, it can be concluded that there is an inverse relation between the price of water and the quantity used in the areas that traditionally have no abundant water while it was difficult to provide a clear relation in the areas that traditionally have water abundance such as Tulkarm, Qalqilia and Jericho in the case of connected areas. The comparison was much harder in the case of the areas not connected, as shown in Figures 1 & 2.

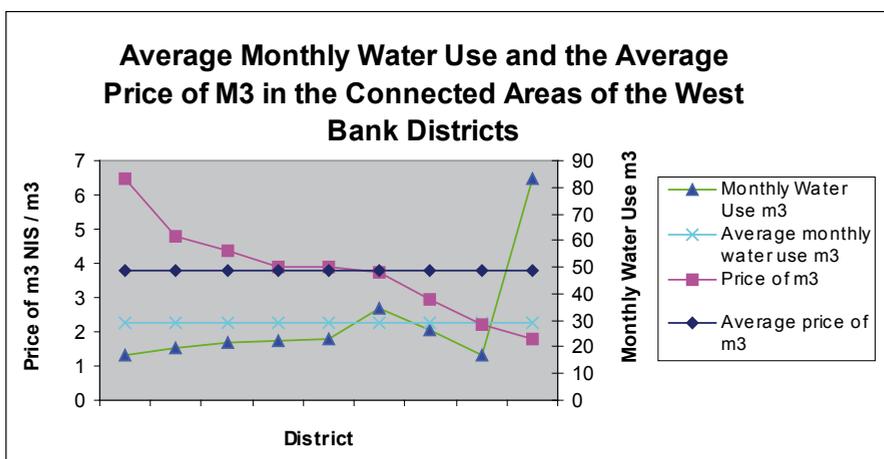


Figure 1. Water use and water price in the connected areas.

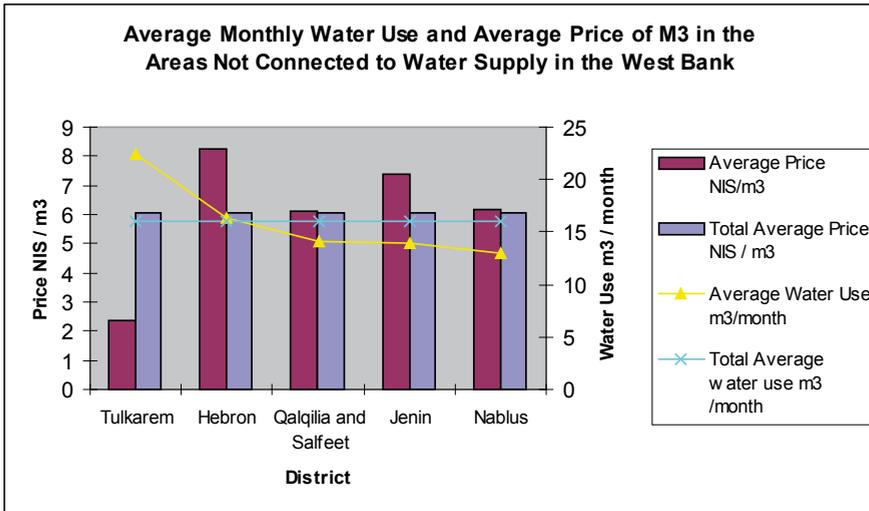


Figure 2. Water use and water price in the areas not connected.

As can also be seen from the two figures when the price of water is much below the average price, water use is much higher than the average in the two examples mentioned earlier.

In addition, it was realized that there is a big gap between the current water use levels and the quantities needed in the areas not connected with water supply in Palestine as shown in figure 3.

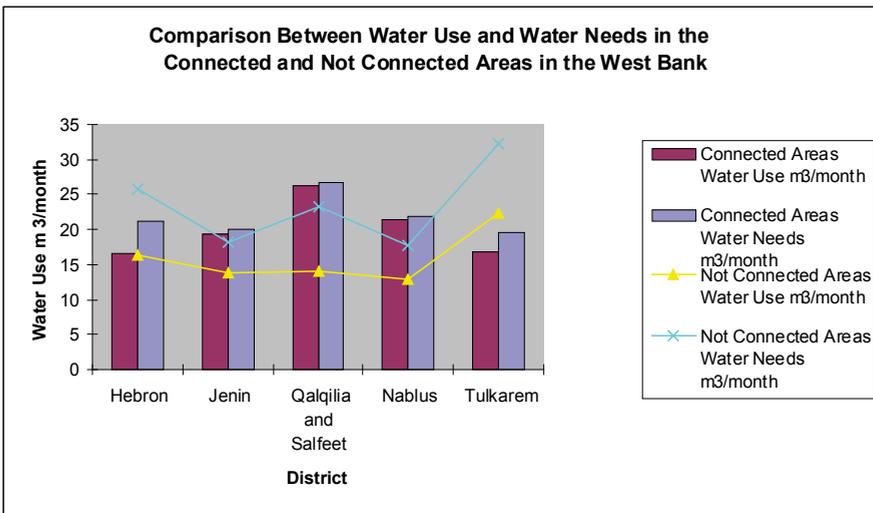


Figure 3. Water use versus water needs in both connected and not connected areas.

Generally speaking people in both connected and not connected areas are aware of the importance of rationing water use. However, they don't do much to practice such rationing. It will be important to conduct a public awareness campaign for rationing the water use in the West

Bank for both areas. Table 1 shows no much difference in several features and practices in both areas. The major differences are in the areas of grey water reuse, the use of toilet flush and the cause of water problem. It is obvious that people with less water quantities available will do every possible effort to use the water as much efficient as they can. This of course is certainly done on the expense of other issues such as hygiene.

**Table 1. Water conservation and water use practices in the connected and not connected areas in the West Bank.**

<b>Connected areas</b>	<b>Unconnected areas</b>
85.9% open the faucet at low level during water use	88.5% open the faucet at low level during water use
96% uses water for main needs	96% uses water for main needs
79.9% use old faucets	86.4% use old faucets
27% re-use grey water	55.24% re-use grey water
88.7% are aware of importance of rationing water use	92.4% are aware of importance of rationing water use
51.3% mop the floor instead of washing it	69.7% mop the floor instead of washing it
50.4% don't irrigate gardens	58% don't irrigate gardens
46.6% don't use the hose	57% don't use the hose
78.25% don't use any mean to reduce water in toilet flushes	80.6% don't use any mean to reduce water in toilet flushes
21.6% of houses lack the flushing toilet system	56.8% of houses lack the flushing toilet system
90% support the need to pay for water	86.4% support the need to pay for water
7% disagree with the need to pay for water	10% disagree with the need to pay for water
96.9% reject illegal water connection	96.4% reject illegal water connection
33% attribute water problem to Israeli control of Water Resources	87% attribute water problem to Israeli control of Water Resources
77% support women's strong role in water resources management	80% support women's strong role in water resources management

The gender issue was one of the key issues that was also analyzed. The main issues addressed are the difference between males and females in the water use practices, the willingness to pay for water and the attitude toward women participation in managing water resources. The key results obtained from the survey are listed in Table 2.

**Table 2. The gender aspects of water in the West Bank**

<b>Females</b>	<b>Males</b>
86.4% support the idea of women having strong role in water resources management	74% support the idea of women having strong role in water resources management
63.9% use grey water	46% use grey water
67.5% use the hose	45.3% use the hose
87.5% indicated facing problem of high water prices	95.7% indicated facing problem of high water prices
66.7% are satisfied with the quantities and qualities obtained	46.9% are satisfied with the quantities and qualities obtained
45.6% are worried about waterborne diseases	61.5% are worried about waterborne diseases
79% perceive paying for water	95% perceive paying for water
Oppose illegal connection	Oppose illegal connection
Have strong feeling of responsibility for providing water for future generation	Have strong feeling of responsibility for providing water for future generation

It can be noticed from the table that there is a strong attitude from both males and females toward the women participation in the water management. In addition, the males have a stronger perception to pay for water than females.

## VI – Conclusion

- Willingness to pay is generally higher than the level of the current water prices.
- There is a general will to pay for a good and sustainable supply.
- There is substantial variation in the willingness to pay for water between districts and within each district. This makes the development of a comprehensive water rate structure very challenging task in the West Bank.
- The type of water pricing schemes currently exists in the West Bank vary from the flat rate water pricing structures to the increased block tariff water pricing in the best cases. All of them are rarely take into consideration much more than the accounting costs of water supply and distribution.
- It was noticed that there is an inverse relation between the price of water and the quantity used in the areas that traditionally have no abundant water while it was difficult to provide a clear relation in the areas that traditionally have water abundance such as Tulkarm, Qalqilia and Jericho in the case of connected areas.
- People in both connected and not connected areas are aware of the importance of rationing water use. However, they don't do much to practice such rationing.
- It was concluded that people are spending nearly 2% of their monthly income for water, although it can reach 8% at the low income families in the connected areas while people in the areas not connected are paying 3.4% but may also reach 9.5% in the low income families.
- It was noticed that there is a strong well among the people to get connected to sewage systems (92.5%). The majority is also willing to pay for a wastewater service a fixed monthly or yearly payment (58.6%).
- It was concluded that the weighted average water price that people are willing to pay is 6.7 NIS/ m<sup>3</sup> while the largest percentage (nearly 62.5%) indicates that they are willing to pay 3NIS /m<sup>3</sup>
- It was noticed that willingness to pay to cover the cost of water and to insure its sustainability is higher at the area not connected than it is in the connected areas.
- It was noticed that the willingness to pay to cover cost is mainly influenced by the geographic location of the respondent. However, this factor is interrelated with income in some districts, with gender in some other districts and with water supply reliability in some others too.
- It was noticed that people are not in favour of privatizing the water services in the West Bank since 96% of them in favour of public sector.

## VII – Recommendations

- It is recommended to consider a **progressive tariff system that truly reflects the social and environmental costs of water and allocates the basic water needs for people before water is allocated to other needs in the West Bank.**
- It is recommended to establish a monitoring program that will keep an eye on the changes in water prices and how this will effect the socio-economic and health conditions of the people and assists to set adequate pricing policies for the areas not served with water yet.

- It is recommended to establish a proper mechanism of information sharing and feed back between public and water utilities; especially pertaining to the water prices and the way they have been calculated.
- It is recommended to include social and environmental costs (the major externalities) within water pricing structures in the West Bank.
- It is recommended to develop a flexible water pricing structure in which water prices need to be set at rates equivalent to the rate of natural changes in the supply (scarcity value).
- It is recommended to conduct a public awareness campaign for rationing the water use in the West Bank for both connected and not connected areas.
- It is recommended to conduct a research on willingness to pay for wastewater services (collection, treatment and reuse) in the West Bank.
- It is recommended to organize the water supply to the areas not connected with water more efficiently and to set a price for cubic meter not exceeding the limits that people are willing to pay.
- It is recommended to conduct capacity building programs targeting women to enable them from participating in the management of water resources.

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