Building a Participatory National Consensus on Wastewater Reclamation and Reuse in Palestine

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1. Introduction

Water scarcity is a major constraint for economic and social development and sustainability of the agricultural sector in the Middle East in general and Palestine in particular. Such water scarcity will become more critical as domestic and industrial sectors place higher and higher demand on water; Palestine will experience serious water deficit which will be about 271 MCM in year 2020 (PWA, 2005). The Palestinian water demand for various sectors goes far beyond the available and accessible water resources. Groundwater is only partly accessible to Palestinians due to unfair Israeli control and dominance. The severely limited water resources in Palestine forced the search for other water resources, even those with inferior quality; in several locations, raw sewage is used by farmers for irrigation of fruit trees and vegetables. Various alternatives including inter-basin water transfers and desalination have been recognized for augmenting water availability. However, in most cases, these alternatives are expensive and face daunting logistical and political constraints (Abu-Madi, *et al*, 2008). The reuse of treated wastewater and water demand management, particularly in irrigated agriculture, are the most recommended alternatives for alleviation of the severe water shortage in Palestine. This is mainly because agriculture dominates the Palestinian water consumption with about 70%, while leaving 30% for domestic and industrial purposes (Abdo, 2008; RAND, 2007). Reuse of treated wastewater in irrigated agriculture would, on one hand, provide additional water supplies and, on the other hand, it would reduce environmental pollution caused by untreated/poorly treated wastewater.

During the past decade, many institutions and donor agencies tried to improve the situation through wastewater reuse. The progress made with respect to wastewater reuse is very limited when compared to efforts and investments. The only centralized wastewater treatment plant (WWTP) that is operating at high efficiency rate exists in Al-Bireh in the Ramallah District and is serving Al-Bireh city, two refugee camps, and a small part of Ramallah city. The other existing WWTPs that were constructed during the occupation period are not functioning at all, except for Tulkarm ponds that were rehabilitated in 2004. Moreover, the wastewater that is collected by vacuum tankers is discharged directly into open areas without any treatment. The major wastewater streams flow in Wadi Zeimar, Wadi Al-Sajour, Wadi Betunia, Wadi Al-Samen, and Wadi Al-Nar. Al-Bireh WWTP were planned and implemented with the objective to apply its treated effluent for agricultural irrigation at Deir Debwan town (Al-Sa'ed, 2001). Now, after 8 years of project operation, most of the treated effluent from Al-Bireh WWTP is discharged into the nearby Wadi without utilizing this water which is valuable for agricultural irrigation, despite

many facts: (i) water scarcity in the Palestinian Territories and the need for additional water supplies, (ii) availability of agricultural lands, (iii) availability of large amounts of high quality treated wastewater, and (iv) availability of poor people in the nearby communities (Burqa, Betein, Ramon, and Deir Debwan). The WWTP produces on average 3,200 m^3/day (1.2 MCM/yr) which is potentially appropriate for irrigation of about 230 ha of agricultural land (Al-Sa'ed, 2007). The agronomics of such irrigated land can provide food security and contribute to poverty alleviation for a large number of poor households. Very little has been done to understand the reasons behind not using the reclaimed wastewater in the area (Abu-Madi *et al*, 2008).

Successful implementation of a wastewater reuse project depends on - in addition to its economical and environmental feasibility - the support of the farmers and general public, who, ultimately, pay for, and might be affected by, the treatment and reuse project. Irrespective of scientific and engineering-based considerations, public opposition has the potential to cause a wastewater reuse project to fail, before, during, or after its execution (Abu-Madi *et al*, 2008; Is'eed *et al*, 2008). Reuse schemes may face public opposition resulting from a combination of prejudiced beliefs, fear, attitudes, lack of knowledge and general distrust, which is often not unjustified, judging by the frequent (and highly publicized) failures of wastewater treatment facilities worldwide. In Palestine, Al-Bireh wastewater treatment and reuse project applies activated sludge treatment system with the objective to produce treated effluent for reuse in irrigated agriculture in Deir Debwan town. Despite the high technical performance of the WWTP, the reuse component of the project did not achieve its objectives, and the reasons yet are not clear.

This paper aims at better understanding of the political economy of wastewater reclamation and reuse and developing a participatory national consensus on the current and future status of wastewater reclamation and reuse in Palestine.

3. Approach and Methodology

The research team adopted participatory approaches that involved all stakeholders and encourage dialogue and involvement of marginalized communities on equal footing together with dominant governmental and non-governmental institutions. In order to achieve the project objectives:

- The team identified and analyzed the potential role of each stakeholder. The major stakeholders that were involved include: (i) Palestinian Water Authority, (ii) Ministry of Agriculture, (iii) Environmental Quality Authority, (iv) Ministry of Health, Ministry of Local Government, (v) Municipalities and village councils, (vi) NGOs, (vii) aid agencies and donors, (viii) Universities, (ix) Women Associations, (x) Farmers' Unions, (xi) Youth Unions, (xii) Private sector, (xiii) schools, and (xiv) common public. The team organized many meetings with those stakeholders.
- The team implemented several training courses on wastewater treatment and reuse through targeting middle career professionals of the different institutions and extension workers of the Ministry of Agriculture.

- The team implemented a questionnaire survey in Deir Debwan town as representative to the Palestinian communities. A questionnaire survey was carried out by a group of 6 persons that belong to the targeted community. A total of 320 households (individuals) have participated in the study. The questionnaire was prepared by active participation of stakeholders and was pilot-tested on about 15% of the sample size. Perceptions were assessed using several questions on acceptance to use treated and untreated wastewater as well as related crops or products. Descriptive analysis included frequencies of variables of interest that associate peoples' perceptions and selected socio-economic variables. Data entry and analysis were completed using the SPSS statistical software.
- The team organized 10 specialized national workshops: general, technical, agricultural, environmental, health, guidelines and standards, institutional, financial and economic, socio-cultural, and religious. Each of the 10 workshops was attended by 20-30 participants representing a wide spectrum of stakeholders. Each workshop was opened by briefing participants on the context of this research project and the objectives of these workshops. A number of key speakers presented their experiences related to the specific themes of each workshop. The team provided sufficient time for open discussion where all participants had the chance to reflect on the presentations and raise questions. The workshops' facilitators encouraged debate amongst participants. Each of the workshops was closed by a conclusions and recommendations session applying innovative moderation techniques. The card method was applied to allow each participant or group of participants to formulate specific conclusions and recommendations on various aspects. These cards were categorized in clusters and prioritized through participants' voting. A simple questionnaire was distributed and filled by all participants of the workshops.
- The Institute of Environmental and Water Studies at Birzeit University organized the first symposium on "Wastewater Reclamation and Reuse for Water Demand Management in Palestine"; 2-3 April 2008. The symposium was attended by about 200 persons from the stakeholder community where 30 papers were presented and discussed. The symposium was closed with a conclusions and recommendations session which allowed all participants to participate in formulating the way forward regarding wastewater treatment and reuse in Palestine.
- The team disseminated the research findings to large number of people and policy-makers through: (i) workshops, (ii) a symposium, (iii) radio and TV interviews, (iv) articles in local newspapers, (v) theatre play and a song, and (vi) a video tape that documents water and wastewater experiences in Palestine.

4. Major Research Findings

4.1. Knowledge and perceptions

Knowledge about water crisis: People showed high level of knowledge about water crisis. Around 89% realized the water crisis in the Middle East, 93% realized the water crisis in Palestine, 90% realized the water crisis in their village, and 77% realized the water crisis in their households (Figure 1).

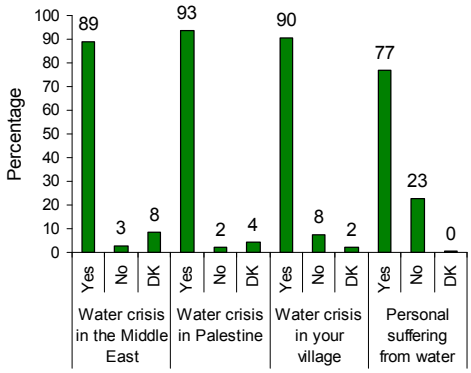

Figure 1: People's knowledge about water crises.

Knowledge about wastewater reuse: As expected, people knew that wastewater can be used for agricultural and industrial applications but not for potable purposes. People were divided in two groups regarding using wastewater as a drinking water for animals (Figure 2). About 73% of the sample knew about the harmful effects of using untreated wastewater in agriculture and about two-thirds knew that reuse of treated wastewater in agriculture is not harmful. Interestingly, only 39% of the sample knew that there are standards and regulations concerning reuse of treated wastewater.

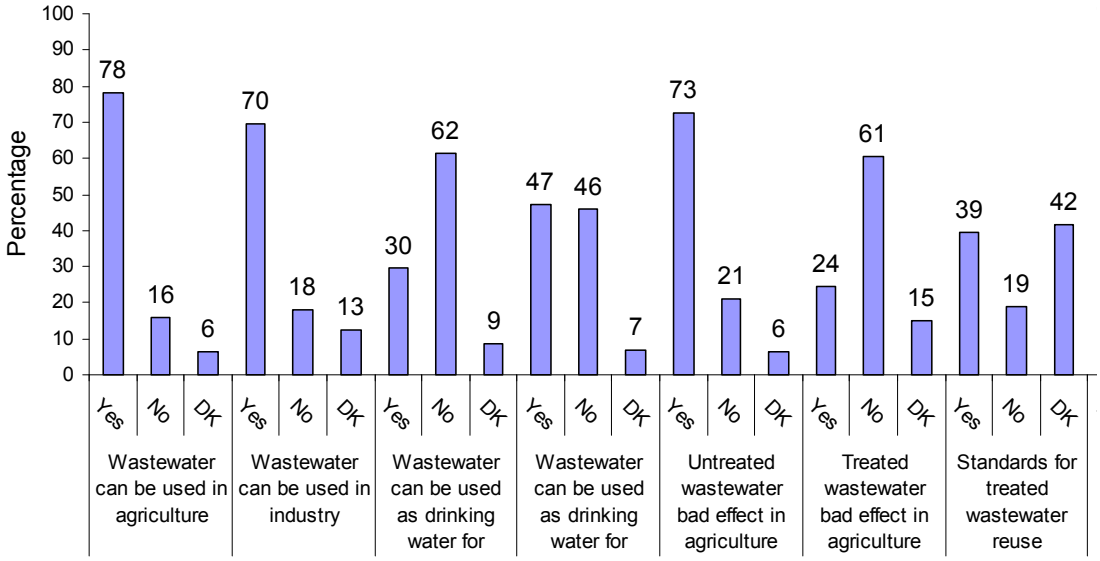

Figure 2: Knowledge about wastewater reuse.

Public perceptions towards reuse of treated and untreated wastewater: Given the good level of knowledge about wastewater reuse, it was important to know whether their knowledge would influence their perceptions. Only 10% of the people were willing to reuse untreated wastewater while 85% were willing to reuse treated wastewater. This variable includes all the questions addressing people perceptions including the reclaimed wastewater and irrigated products. Most of the participants refuse to use untreated wastewater. There were insignificant differences between males and females, employment status, and land ownership. There were significant differences in the monthly income as those with lower income were more likely to accept using wastewater than

those with higher income. Overall, people's refusal to use products irrigated with untreated wastewater was less than them using it. The main difference was among land owners and those with low income. The differences were not clear with age and education. The main reason for not accepting untreated wastewater was health issues. Around 95% of the participants refuse to use untreated wastewater due to health concerns. However, no further information was collected regarding types of health problems. Environmental concerns accounted for 13% while social and religious concerns were very decimal.

As mentioned earlier, people's perceptions toward treated wastewater were different from their perceptions toward untreated wastewater. Those not accepting to use treated wastewater were mainly working, do not own land, older than 50 years old, and with preparatory education. The reasons for not accepting to use treated wastewater were similar to those mentioned for untreated wastewater. The concern for potential health impact was the main reason followed by environmental and social reasons.

4.2. National stakeholder workshops and symposium

The major findings of the 10 national stakeholder workshops and the symposium are:

1. Wastewater reuse is recognized by all stakeholders as a valuable non-conventional water resource that needs better utilization. Therefore wastewater reclamation and reuse could contribute substantially to augmenting the prevailing water stress in Palestine.
2. Institutional conflicts among the water institutions in the country are a major constrain for development of reclaimed wastewater as a non-conventional resource; i.e., between government institutions, between NGOs, between government and non-government institutions, and between common public and policy makers. The role of all institutions should be based on the principle “complete not compete” to avoid institution conflicts.
3. There is a big gap between the Palestinian research and academic institutions and those implementing projects such as government, NGOs, and donors. Universities and research institutions should play a significant role in investigating and studying updates related to the issue of wastewater treatment which must be considered when putting guidelines and standards in place and formulating national policies. Therefore, it is important to encourage scientific research on the short and long term impacts of wastewater reuse as well as policy and socio-economic research.
4. There is poor utilization of the existing knowledge and experiences due to poor dissemination of research and projects implemented by various institutions. There is a need to initiate a national open-access data bank of all documents related to the subject.
5. There exists a controversy on the appropriateness of centralized and decentralized wastewater treatment systems. However, there was a consensus on the application of both systems depending upon the number of targeted population. Onsite collection and treatment seems to be more appropriate in the Palestinian rural and peri-urban areas due to large landscape and availability of land. Offsite collection and treatment seems to be appropriate for large urban communities. Onsite systems such as grey water systems do not require permission from the Israelis. Therefore, it was recommended to encourage their application in the Palestinian rural and peri-urban communities. More applied research projects are needed to study the efficiency and application of various onsite treatment systems.

6. The technical and economic feasibility of different treatment systems is driven by many factors. It was agreed that technologies could function properly under a sound enabling environment. This means that availability of skilled personnel, spare parts, and effective monitoring is more crucial than the type of technology. The Palestinian expertise in the field of wastewater treatment is well established. However, adoption of certain treatment systems in the country is influenced by donors and foreign consultancy firms.
7. The importance of offering capacity building programs to technicians and managers working at treatment plants to help in cost reduction and more efficiency in operating and maintaining these plants. Selection of appropriate technology for wastewater treatment should focus on suitability of effluent for irrigation and low treatment costs. However, this should not compromise public health and environmental protection. It is worth mentioning that there are no large scale reuse projects in Palestine. Most research on wastewater reuse in the country is based on small and pilot scale.
8. Secondary treated effluent is potentially appropriate for agricultural irrigation. Therefore, there is a consensus that reuse of reclaimed wastewater should be permitted only for restricted irrigation (irrigation of fodder crops, olives, and landscape) in order to minimize health risks. This might be developed in the future to allow unrestricted irrigation such as vegetables and crops eaten raw or uncooked.
9. Wastewater treatment plants should be located close to agricultural lands in order to reduce transport and conveyance costs. Besides, availability of effluent storage facilities is decisive to success of any reuse project. This is due to seasonal variations in wastewater production and agricultural water demand.
10. Community refusal seems to play a negative role in the majority of wastewater reuse projects in the West Bank and Gaza. The increasing fear of applying wastewater reclamation and reuse projects is attributed to many social, farming, marketing and particularly health considerations – which represents obstacles in applying the use of treated wastewater in agriculture. There is an ultimate need for extensive awareness campaigns in order to increase community acceptance of wastewater projects. These programs must be directed to various sides including individual consumers, students, and national institutions. There is lack of awareness efforts at various levels - including policy makers, farmers, and the common public - on the health impacts of wastewater reuse. There is a need for constructing real demonstration sites for wastewater reuse to encourage the community; for example, irrigation of public parks or gardens with treated wastewater.
11. The Palestinian standards were formed to reduce fears related to the use of treated wastewater. The current Palestinian Standards for reuse of treated wastewater in irrigated agriculture were concluded from various international guidelines such as WHO, Jordanian, and Israeli guidelines. The Israelis require that the Palestinians have to comply with the Israeli standards for quality of treated effluent, which is difficult as it requires sophisticated technologies, skilled labor, and huge financing, in addition to political and socio-cultural obstacles. There is a need for consistent evaluation of the current Palestinian Standard to make it suitable for the Palestinian needs. This requires involving the major public bodies especially the PWA, the Institute of Standards, Environmental Quality Authority, Ministry of Health, and other stakeholders.
12. There is a need to establish a national committee for wastewater reuse to function as the backbone to all working institutions under auspices of Palestinian Water Authority. This committee needs to have representatives of all major stakeholders in the country. This

committee could create specialized groups on the various fields related to wastewater reclamation and reuse.

13. Huge financial investments are needed under conditions of poor cost recovery and low involvement of the private sector. This leads to over-reliance on donor funding which is also very limited and conditional. Governmental institutions suffer form lack of financial resources which leads to less labor and activities` effectiveness. Besides, the strict standards of the Israeli occupation for quality of treated effluent impose restrictions on the establishment of wastewater treatment plants.
14. Palestinian farmers in general have access to freshwater at very low price. Therefore, pricing of freshwater for irrigation should be recalculated and carefully adjusted in order to make reuse of treated wastewater attractive. However, under the prevailing bad economic conditions of Palestinian farmers, this move might create severe damage to the Palestinian farming system.
15. The high concern for health aspects of using treated wastewater in irrigated agriculture stems from global and national political considerations. Policy makers, in general, tend to over restrict irrigation with treated wastewater by taking precautionary measures that do not compromise public health. The treated effluent might have very low concentrations of dangerous constituents since most of the Palestinian wastewater is from domestic sources. Post treatment is often needed to minimize potential health risks.
16. There seems to be evidence that some Palestinian farmers use raw sewage illegally for agricultural irrigation, which might have serious health risks. There is a lack of applicable strategies, efficient monitoring systems, and emergency plans. There is a need to activate the mechanisms of applying rules and legislations including penalty on illegal practices.
17. The application of participatory approaches and public involvement is very young and needs further development. There is a need to encourage dialogue between Palestinian policy makers and the common public and illustrate its positive influence while developing new water policies or strategies.
18. There is a misperception that Islam restricts reuse of treated wastewater. It was clearly emphasized that Islam permits application of reclaimed wastewater to all uses even human drinking as far as it is appropriately treated. The only confusion is about the definition of treatment as the Islamic statements (Fatwa) available so far limit the definition to retaining water to its original characteristics (color, smell, and taste). There is an urging need to involve water experts and produce a new Fatwa that uses more scientific terms.

4.3. Policy impact

Early involvement of stakeholders including policy-makers in the implementation of various activities created an enabling environment for dialogue and understanding the political economy of wastewater reuse in Palestine. This research project succeeded in having a positive impact on the following:

- Policy makers: the project attracted the attention of different government ministries on the importance of wastewater reuse as an integral part of the Palestinian water resources management. Specifically, the project impacted on the Palestinian Water Authority (PWA) and the Ministry of Agriculture (MoA). The PWA took practical steps towards establishing a national referendum team on wastewater treatment and reuse. The MoA involved many of its staff in the implementation of this project which was concluded by organizing different

training courses for its framers' extension units in the West Bank. Besides, the project improved the level of coordination and cooperation between the various institutions.

- Framers: the perceptions of farmers were improved through involving them in public meetings, workshops, and the symposium as well as through capacity building of farmers' extension.
- Public: the project raised public awareness on the various impacts of wastewater reuse.
- National research agenda: the project succeeded in attracting all Palestinian research and academic institutions to include wastewater reuse to their research agendas.

5. Conclusions and Recommendations

- There seems to be an overall consensus on the important role that reclaimed wastewater should play in augmenting Palestine's limited water resources. Participants representing a large number of water and environmental institutions expressed their views and discussed several aspects that help integration of wastewater reuse with Palestinian water resources management.
- The current political restrictions hinder the implementation of centralized wastewater treatment plants and reuse schemes. Therefore, it is recommended to pay more attention to decentralized and small scale systems such as grey water at household level.
- There is good acceptance by the Palestinian communities to apply treated wastewater for irrigation of non-market crops such as fodders, olives, fruit trees. These crops do not require advanced level of wastewater treatment. However, those communities are reluctant to use wastewater generated by other communities. This partly justifies why the treated wastewater from Al-Bireh is not used in Deir Debwan and neighboring villages.
- Islamic religion is not an obstacle for wastewater reuse. On the contrary, it could be a stimulus and must be well tackled during awareness campaigns in the future. A potential project that might have influence with that respect is to target preachers in mosques.
- The institutional cooperation is very poor and requires better coordination. It was strongly recommended that the PWA establishes a national committee for wastewater reuse in order to function as advisory to the various Palestinian water institutions.
- There is insufficient cooperation between the academic institutions and those implementing development projects on the ground and policy-makers.
- Dissemination is very poor and there is a need for gathering all available information and experiences under the umbrella of the PWA.
- Public awareness on the application of grey water treatment and reuse is very primitive and thus requires more attention by the various institutions.
- Low tariffs of freshwater for agricultural irrigation might be a major limiting factor for pricing of treated wastewater in accordance to cost recovery.

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