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Nudging greywater acceptability in a Muslim country: Comparisons of different greywater reuse framings in Qatar

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ABSTRACT

With very low annual rainfall and increasingly depleted groundwater resources, the Gulf Cooperation Council (GCC) countries are some of the most water scarce in the world and rely on growing quantities of desalinated water and Treated Sewage Effluents (TSEs) to meet their ever-increasing water demand. In Qatar, the government heavily subsidizes the desalination and retreatment processes, but the country's demographic growth coupled with its high water consumption rate of 557 liters/day/inhabitant has led to increasing subsidy costs. These expenses are a concern for the government, especially as it tried to cut costs after the 2014 fall in oil prices. With little treatment, greywater (i.e. gently used water from showers, swimming pools, AC units, etc.) can replace more expensive TSEs or desalinated resources for several basic purposes such as landscaping or toilet flushing in hotels and new public buildings (e.g. mosques, universities, swimming pools). This study presents the findings of a national survey in Qatar that reveals that the country's population can be highly accepting of greywater reuse depending on how people are introduced to the benefits of greywater. This study found that the framing of greywater reuse as a cost saving or as a water conservation measure generates the highest acceptance among both Qatari nationals and expatriates.

1. Introduction

The drylands of the Gulf Cooperation Council (GCC) region feature some of the most arid lands on earth and their nations face severe water stress, meaning that demand for freshwater largely outstrips their limited renewable resources (Darwish et al., 2015). As a result, these countries have been depleting their groundwater resources over the past decades of strong demographic growth and have increasingly relied on desalination and wastewater treatment plants. Although home to only 2.2% of the world's population, the Arabian Gulf region (i.e. Bahrain, Kuwait, Saudi Arabia, Iran, Iraq, Oman, Qatar and the United Arab Emirates) hosts today over half the world's desalination capacity (Shahzad et al., 2017). The governments of these countries have long provided water to their populations for only a limited fee and still heavily subsidize their desalination industry and retreatment processes (Lambert, 2014; Lahn, 2016). Gulf countries also feature strong demographic growth rates and some of the highest per-capita water consumption figures in the world (Barau and Al Hosani, 2015). As a consequence, the cost of subsidizing desalination and retreatment generates a substantial and growing state expenditure. The 2014–2015 fall in oil prices has caused many of these nations to introduce sharp cost reduction policies in non-revenue generating activities and more careful state expenditure management in general (Gengler and Lambert, 2016; Lahn, 2016). As water demand is projected to grow steadily across the region alongside demographic growth, water expenditures are also expected to grow considerably if no meaningful and comprehensive reforms are implemented (Al-Zubari, 2011).

Using Qatar as a case study, this paper investigates how greywater reuse could be introduced to the population in a publicly acceptable manner. More precisely, it investigates how the Gulf states can make greywater reuse largely acceptable in the context of a culture that generally shuns TSEs (seen as religiously impure in many Gulf Muslim countries) and where desalinated water bills do not represent a large cost to households, if any at all, but rather are a growing state expenditure.

Greywater is gently used water coming from showers, swimming pools, ablutions sinks, AC units, and lavatory sinks. Greywater is distinct from more heavily polluted blackwater, which comes essentially from toilets and dishwashers. Consequently, with sometimes little treatment, greywater can safely be used for several basic purposes, such as landscaping and toilet flushing. It can replace water resources such as desalinated seawater or TSEs which are more expensive (Godfrey et al., 2009). Therefore, recycling greywater could help mitigate the growth in demand for other unconventional waters, thereby containing

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some of the costs that the government of a water scarce country like Qatar will have to pay (Tangsubkul et al., 2005).

This research shows that the manner in which greywater reuse is introduced to the population can lead to different but generally high levels of public acceptability. The paper proposes an explanation for these several levels of greywater reuse acceptability in Qatar, according to the diverse framings used to introduce them.

In the following section, this paper reviews the literature on greywater in the Middle East and beyond. It highlights the acceptability problem of retreated waters in the region, before explaining Qatar's freshwater conundrum. The third section of the paper describes the methodology of the nationally representative telephone survey experiment conducted by the Social and Economic Survey Research Institute (SESRI) at Qatar University in 2017 and of the face to face semi-structured interviews of different stakeholders in Qatar's water industry. The fourth section of the paper presents the new findings from the nationally representative survey.

2. Qatar's water challenges and the question of greywater reuse

Like the other small GCC countries, Qatar has an arid climate, an areic land and no permanent surface freshwaters (Alsharhan et al., 2001). To cope with their lack of sufficient freshwater resources, the governments of the GCC have essentially pursued a supply-side water strategy ever since the revenues from oil exports enabled them to do so (Lambert, 2014). This strategy has led to the full reliance on desalination and TSEs to meet municipal freshwater demand, and to the significant depletion of the country's limited groundwater resources, essentially used for agricultural purposes. Qatar has extracted the latter at a rate far beyond its estimated replenishment rate. According to Alhaj et al. (2017), total groundwater withdrawal in Qatar reached 250 million m^3/year, which is around 5 times the average natural replenishment rate of 58 million m^3/year. This has been all the more unsustainable due to the fact that the 2008–2015 period witnessed a decrease in average rainfall, as compared to the 1962–2015 average (MDPS, 2017). The impact of the food blockade against Qatar, which started in June 2017, and of related new food security projects in the country are still unknown, but are expected to deteriorate the situation further (Lambert and Hashim, 2017).

The production of desalinated water has quadrupled during the two decades prior to the current one and is expected to continue growing rapidly (Al-Zubari, 2011; Gulf Intelligence, 2016). In Qatar and all other small GCC coastal states (i.e. Bahrain, Kuwait, Oman and the United Arab Emirates) desalination is used to satisfy most if not all the freshwater demand in urban areas (Zekri et al., 2014; Gulf Intelligence, 2016). However, desalination is an energy-intensive and costly industrial process. Because the Qatari government subsidizes water for its citizens and Qatari companies (who host large numbers of foreign workers), the state bears a majority of the cost for desalination. In fact, the Qatari nationals are exempt from paying any utility bill for their (main) residence. It is worth mentioning though that in Qatar, similarly to other small Gulf states, the Qatari citizens constitute a small demographic minority in their own country. The majority of inhabitants is made of foreign workers, most of whom are blue collar workers working essentially in the construction sector. The latter generally live in labour camps or dormitories and do not pay any utility bill, which is collectively paid by their employer. The white collar foreign workers however, generally live in the country with their nuclear family in family accommodations and are supposed to pay for their water consumption, although some of them live all year long in hotels and never receive a utility bill, while for some others, their employer may pay for it as part of their expatriation package. In the end, only a minority of Qatar's inhabitants have to pay a water and electricity bill. Also, the national legislation forbids the ownership of a land or accommodation in Qatar by a foreigner, except in very few and small special economic areas, such as the Pearl Qatar. This means that most of those who own their housing (essentially, the Qatari nationals), do not pay water bills, and the populations who do not own their accomodation (i.e. most foreign residents) are the ones who have to pay a utility bill. This means that homeowners have no direct interest in investing in water efficiency devices. The government however, has been subsidizing water and electricity services for decades at an increasingly heavy cost, largely due to the steady demographic growth and an opaque system of cross-subsidies.

2.1. The cost of desalination

Qatar, like the other GCC states, primarily uses thermal processes (such as multi-stage flash distillation, or 'MSF') to desalinate seawater. A 2015 report from Kahramaa (the state-owned corporation that runs all of Qatar's desalination processes) assessed that over 99% of the 535 million m^3 of water that was desalinated in Qatar the year before was produced by thermal processes, which largely dominate the desalination industry in the Gulf. However, reverse-osmosis (RO) technology is more popular in the rest of the world, because it is (1) more energy efficient and thus (2) less expensive to run overall, particularly during periods of high energy prices. But the readily available and low cost hydrocarbon resources in the Gulf states have long made countries like Qatar less sensitive to energy cost efficiency concerns. It has allowed them to continue using thermal desalination processes, which are also better suited for the geochemistry of the Gulf waters. Mohamed (2017) emphasized the embedded energy gap between Qatar's thermal desalination which typically consumes 9–15 kW h per distilled m^3 of potable water, and water treatment in the UK which requires less than 1 kW h per m^3. As long as the population of the Gulf states remained small however, using thermal desalination did not generate too much economic damage in the absolute. With the rapid demographic growth of the past decades however, total water and energy demand have only been escalating and made the Gulf states' policy of supply side management (i.e. always increasing the production of desalinated water to meet the demand) a growing drain on the state budget. Based on data from Kahramaa (Kahramaa Statistics Report, 2015), this paper assesses the total annual cost for desalination alone in Qatar to be at least 327 million USD, as can be seen in Table 1 below (see also Zotalis et al., 2014; Ghaffour et al., 2013; Mordor Intelligence, 2016).

The Qatari government also fully subsidizes wastewater treatment, which, by the lowest estimates, costed about 89 million USD in 2015 (Jeuland, 2015; Mohamed, 2017). This is approximately equal to the total revenue collected from all public utility fees in Qatar the previous fiscal year (MDPS, 2014, 22). What's more, population and water demand in Qatar are projected to grow considerably in the near and medium-term future (Kemp, 2014), meaning that the country will have to increase its desalination and wastewater treatment outputs, expectingly resulting in higher total subsidy costs for the state. The government of Qatar's online platform ('Hukoomi') explains in explicit terms its difficult situation as follows:

> "Seawater is the most important source of water for the people of Qatar, accounting for about half of the water used. Water is desalinated though a costly and energy-intensive thermal process. Production of desalinated water has quadrupled during the last two decades, a trend that is expected to continue."[1]

2.2. The beginning of reforms

Faced with the high costs of a supply-side water strategy, several governments in the Gulf regional have implemented demand management programs to try and ease pressure on their water and energy

[1] See 'Water and Desalination', available at: http://www.hukoomi.qa/wps/portal/topics/Environment+and+Agriculture/wateranddesalination