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Understanding bottled water consumption: a survey on public perception of drinking water

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ABSTRACT *Despite strict regulations on the quality of drinking water in many countries, the public is increasingly concerned about the safety of municipal utility water. For this reason, acquiring a better understanding of consumer perception of utility water is an important issue for water authorities and utility managers. In this study, the public perception of utility water and factors influencing public's choice in drinking water source was investigated. A qualitative survey was carried out for 384 residents in Male' and results showed that 29.5% of respondents had trust in utility water as a source of potable water. The extent of the prevalence of bottled water was also an important finding, while societal distrust fueled by hearsay was identified as the main reason for public's distrust in utility water. Furthermore, unfavourable taste was identified as an important issue of utility water, alongside distrust in hygiene levels. It was also found that while a majority of respondents were aware about water standards, their perception on the utility water remained largely uninfluenced by the standards. Areas in which the public utility company could improve on to increase public trust and the means through which the company could effectively reach out to the public were identified through the survey as well.*

KEYWORDS *Drinking water, quality, safety, bottled water, perception*

Maldives being a country comprised almost entirely of sea, is very reliant on the marine environment, both for the economy of the country and the welfare of its citizens. It is estimated that over 25% of the country's Gross Domestic Product (GDP) relies on direct contribution from the tourism industry, while the fisheries and fish processing industries amount for about a total contribution of 5% to the country's GDP (National Bureau of Statistics, 2015). In addition to being geographically isolated and dispersed, the islands of the country are also small in land area, with the biggest island of the country, Laamu Gan, having an area of 595.6 hectares (Ministry of Fisheries and Agriculture, 2018). This is significant because, with such small landmasses, any sort of activity carried out on the scarce terrestrial land of the islands have a very high chance of having an impact on the surrounding coastal environment. This is perhaps most evident by the numerous amounts of different types of rubbish that can often be found in the harbours and lagoons of inhabited islands of the country - much of it comprising of empty plastic bottles. Pieces of trash left unattended to on land can very easily find their way to surrounding waters, which can then have lasting negative impacts on coastal environments such as coral reefs and on the marine organisms inhabiting them.

While not much literature exists the types of trash produced in what quantities in the Maldives, the Regional Resource Centre for Asia and the Pacific (2002) as cited in (Pucino, 2016) stated that the amount of municipal solid

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waste generated daily in Male' doubled from about 25 tons per day in 1990 to 50 tons per day in 1995. With a rapid increase in GDP and population density, the amount of solid waste generated daily in Male' increased exponentially to almost 500 tons per day by the year 2000. (Glawe, Visvanathan, & Alamgir, 2005) estimated the amount of waste generated per capita in Maldives to be 0.66 kg/day in the year 2004, while a report published by (Hoornweg & Bhada-Tata, 2012) estimated the per capita waste generation of the Maldivian population to have increased to 2.48kg/day. Nevertheless, these numbers were fairly average figures for similar urban populations.

The prevalence of single-use plastics in our communities is undoubtedly one of the most pressing challenges faced by the natural environment today. The most common single-use plastic items used by consumers in Maldives include plastic bags and plastic bottles. The report on the amount of annual imports published by (Maldives Customs Service, 2018) states that a total of 27,023,165 non-biodegradable plastic bags were imported to the Maldives in the year 2017, in addition to 79,450,627 plastic bags that were classified as biodegradable. This is a drastic increase from the 19,119,091 non-biodegradable plastic bags, and 23,302,925 biodegradable plastic bags that were imported in the year 2016 (Maldives Customs Service, 2016). Furthermore, in recent years, there has also been an increase in the number of local companies producing their own branded bottled water in the Maldives. Male' Water and Sewerage Company (MWSC), the state's public utility company, joined the bottled water industry in 2004 with a brand of bottled water named "TaZa", while simultaneously promoting the utility water provided by the company as being a safe drinking option as well (MWSC, n.d.). The company claims that the business process and strategies of Taza water were formulated with the environment in mind, citing the green cap and label of the bottle as a portrayal of the environmental friendliness of the product (TaZa, 2011). In 2017, another state utility company, the State Electric Company (STELCO) also joined the bottled water industry, with a brand name of "Stelco Fen". Other local brands include "Life" water produced by Happy Market Trading Company (Happy Market, n.d.), "Bonaqua" water produced by Male' Aerated Water Company (Male' Aerated Water Company, n.d.) "Handy Water" by Handy Holdings Pvt. Ltd., (Handy Holdings, 2014), "BoneFene" produced by Maldives Industrial Fisheries Company (MIFCO), "Miyaah" water produced by Diligent Brothers Pvt. Ltd., and a brand of water by the name of "One" produced by a factory in Addu City called One Degree South (Nasooh, 2017). Seven out of eight of these brands of water are sold in plastic bottles ("One" water is currently available in 19-liter barrels) and are manufactured in the Maldives after importing the petroleum based raw materials required from abroad. Maldives also imports mineral water from 21 countries from around the world, most of which comes from Sri Lanka, and almost all in plastic bottles. 19,172,100 liters of mineral water was imported in 2016 (Maldives Customs Service, 2016), which got significantly reduced to 5,631,247 liters in 2017 (Maldives Customs Service, 2018).

Maldives also has a very limited availability of naturally occurring fresh water. Even though the country's islands are naturally blessed with an aquifer lens, continuous long term exploitation of this water, coupled with poor rainfall levels have left most of these natural pockets of water dry or saline (Chachibaia, 2016). Moreover, reports also indicate contamination of these water sources because of

of poor sewage systems in local islands. Hence, most of the population is served with desalinated water while some rural areas use rainwater, collected in specialized tanks. Despite achieving more than 90% water and sanitation coverage, the country faces huge challenges in ensuring sustainability and resilience of these facilities, perhaps most evident by the water shortages that occur on an almost annual basis around the end of the dry northeast monsoon (World Health Organization & UN-Water, 2014). In 2017, acute shortages of bottled water caused by a fall in production coupled with high demand, caused the price of bottled mineral water to inflate up to thrice its normal price (Maldives Independent, 2017), while 2018 saw an even bigger inflation of up to five times the normal price of a water bottle during the water shortage (Maldives Independent, 2018). The reluctance by the general public to use utility water for drinking, even when faced with the shortage of bottled water was an indicator of public perception about tap water. Maldives also underwent a water crisis in late 2014, when a fire erupted in one of the water treatment plants in Male', leaving over 100,000 residents without access to tap water. The dire circumstances at the time led the government to quickly appeal for international assistance from Sri Lanka, China and the United States. Authorities provided residents with bottled water, free of charge for the duration of the crisis, while neighboring countries provided assistance through airplanes and ships stocked full of emergency water (BBC, 2014).

When setting national drinking water quality regulations and standards, many countries consider the World Health Organization (WHO) Guidelines for Drinking Water Quality (GDWQ), and the Maldives is no exception. MWSC, a joint venture company that has 80% government shares and whose board is also appointed entirely by the government, provides water services for more than 50% of the country's population (Transparency Maldives, 2014). Therefore, it is of great importance to both the public utility company and the government of the Maldives, that the general public has continued faith in the services provided by the state utility company. Regarding their utility water, MWSC states that their policy is to maintain a quality of drinking water higher than the minimum standards of WHO, while also complying with the standards set by the Environmental Protection Agency (EPA) of the Maldives. They further reiterate the safety of the water supplied, stating that the physical, microbiological and chemical qualities of the water is continually monitored in their laboratory, which also adheres to standards set by the International Organization of Standardization (ISO) (MWSC, n.d.). However, despite the reassurances by MWSC, the general public's perception towards the company and their utility water has not been the most positive. In recent years, media outlets in the Maldives have reported on issues with the quality of water provided by MWSC, which the company has been quick to dismiss as being false (Sun Online, 2017). The claims made by media outlets have only been anecdotal in nature and no real studies to investigate the quality of the water provided by the public utility company has been conducted thus far. Consequently, claims and questions about the quality of water remain as hearsay - with no real evidence to prove or disprove the claims. This study investigated the public's perception on the quality of utility water and analysed factors that influenced public's choice in choosing their source of drinking water.

Literature Review

While a perception study of drinking water has never been conducted in the Maldives, numerous studies investigating public perception of municipal water, as well as studies analyzing factors influencing public use of municipal drinking water have been conducted elsewhere in the world. One such survey by Fransisco (2014) investigated factors that influenced households to purchase bottled water or purified water from refilling stations in a city in the Philippines. One-on-one interviews were conducted with household heads or their spouses and from the data that was gathered, the author observed that less than half (41%) of households with private water connections consumed the utility water for drinking purposes without prior treatment. Furthermore, only about half (53.3%) of respondents with a private water connection had trust in the utility water as a source of safe drinking water, while 100% of respondents both with and without private water connections had trust in bottled water as a source of safe drinking water. It was also found that the education of household heads, the presence of children, household size and the price of water were factors that influenced households' decision in obtaining drinking water.

A similar study was conducted in Ontario, Canada by Jones et al. (2006), where a public perception study of drinking water was conducted among residents with private water supplies. 246 residences were surveyed, and questions pertaining to the perception of water quality, alternate sources of drinking water, water testing behaviors and the self-identified need for further information were relayed to respondents. The results showed that 33.5% of respondents utilized water directly from their private water supply, while 61% of respondents reported to use bottled water as their primary source of drinking water. The respondents were also asked to judge the quality of water from their private water supplies based on different variables, including taste, smell, color, clarity and safety. Analysis of this data showed that 80% of respondents were "very concerned" or "concerned" about the overall safety of the water from their private supply. Common explanations given for their concern included possible contamination of their private water supply, including contamination from pesticides or other chemicals, and bacterial contamination. In regard to water testing, it was found that 21% of households had never tested the water from their private water supply for contaminants. A large majority of respondents (88%) who had their water tested, only did so for E. coli and total coliforms, while tests for other parameters such as bacteria, heavy metals, nitrates, pesticides and sodium were uncommon; not averaging more than 25%. Furthermore, it was found that the most common frequency of water testing done was once every year (22.6%), followed by households who had never tested their water (21.3%), and households who had their water tested once every 3-4 years (11.3%).

Another study about perceptions of drinking water was conducted by Proulx, Rodriguez, Sérodes, & Miranda (2010) which looked into factors that influenced public perception and use of municipal drinking water in Québec, Canada. The study area was of significance as the water treatment system supplied a large territory, which meant that water residence times in the network remained relatively long. This was identified as a possible factor that could influence the aesthetics of water quality of the municipal water received at homes, as it had the potential for bacterial growth and interaction with the water pipes. One of

the findings from the study was that a significant number of residents (about one third) of the population under study did not drink the municipal tap water in their homes. Three variables were utilised in the survey to deduce public perception of the municipal water: consumption profile, risk perception and global satisfaction. As with the previous studies, bottled water was found to be the most common alternative source of drinking water used, with 49% of respondents perceiving bottled water as being better for their health than tap water. Furthermore, among the respondents that reported to have experienced a health problem attributed to tap water, 85% considered the consumption of municipal tap water to be a high health risk. Contrary to this, 82% of respondents reported being globally satisfied with the aesthetic quality of their tap water. Even so, the author noted that the results of the analysis suggested a relatively high perception of risk or dissatisfaction among residents in regard to municipal water.

A different kind of study related to drinking water looked into the practices and attitudinal behavior about drinking water in an urban slum of India. An epidemiological study was carried out by Verma, Singh, Khurana, Dixit, & Singh (2017) where semi-structured interviews were conducted with mothers of 400 households. The questionnaire schedule based mainly on three domains: demographic characteristics, water facility and its used, as well as water treatment. From the analysis of the gathered data, it was found that 78% of individuals surveyed utilized tap water for drinking purposes, and that 83% of respondents did not treat their drinking water in any way. Questions pertaining to practices regarding diarrhea was also relayed to respondents, as previous studies had shown that pneumonia and diarrhea from contaminated drinking water were responsible for the deaths of as much as 50% of children below 5 years of age in India (International Institute for Population Sciences (IIPS), 2007). It was observed that the mothers who were surveyed were aware of the threat that diarrhea posed to their children, since a large majority (82%) of mothers reported to have stopped breastfeeding during diarrhea. However, it was also observed that while 63% of mothers were aware of ORS as a means to combat diarrhea, only 27% of them took advantage of it for their children.

Numerous scientific researches have also investigated the quality of both bottled and municipal utility waters by conducting different kinds of experiments to find out the level of quality and hygiene among sources of drinking water. Such studies have been conducted in Nepal (Pant, Poudyal, & Bhattacharya, 2016), Bangladesh (Rahman, et al., 2017), India (Singh, et al., 2015) and Saudi Arabia (Ahmad & Bajahlan, 2009), (Chowdhury, Kabir, Mazumder, & Zahir, 2018). Additionally, studies have also looked into factors that can deteriorate the quality of drinking water during storage (Falconi, et al., 2017), as well as the possible contaminations of utility water via the pipes that transport them (Griswold, 2008). Similar studies could prove valuable in a Maldivian context, as the quality of utility water provided in the Maldives has been called into question (Sun Online, 2017).

Methodology

The methodology of this research consisted of conducting a qualitative survey of residents over 18 years of age, living in the greater Male' region. Administratively, Male' consists of the four districts of the island of Male' (Henveiru, Galolhu, Mahchangolhi, Maafannu) and the nearby islands of Hulhumale' (also administratively considered as being part of the Henveiru district and referred to as Hulhu henveiru), Villingili (administratively a district of Male', referred to as Villimale') and Hulhule'. The island of Hulhule' is administratively listed as an uninhabited island, as the island does not house a permanent population and hence is not included in the census data. All residents over 18 years of age living in the administrative region of Male' were applicable for the survey as MWSC was the sole utility water supplier for all of these districts.

As per the last census data, the population of Maldivians living in the Male' region was recorded as 129,381. (National Bureau of Statistics, 2015). However, since the target population was limited to residents over 18 years of age, 31,256 residents below 15 years of age were not included in calculating the sample size. The age group 15-19 years of age however, had to be included in the calculation of the sample size as there were no official statistics available for the population over 18 years of age. This resulted in a target population of 98,125 residents living in the Male' region. The sample size required for the survey was generated using a computer software that applied Formula 1 below. The calculation resulted in a sample size of 384, which was calculated to an error margin of 5%, and to a confidence level of 95%.

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

Formula 1. Used for calculating sample size, where N = population size, e = margin of error, z = number of standard deviation in reference to confidence level (SurveyMonkey, n.d.)

In the formulation of the survey questionnaire, the Theory of Planned Behaviuor (Ajzen, 1991) was utilized to get a better understanding of the respondents' perception and intention in choosing their source of drinking water. The theory states that a person's behavioural intention is shaped according to their attitude towards the behaviour, subjective norm, as well as their perceived behavioural control. The survey questionnaire was formulated in such a way that questions related to all three of these dimensions were incorporated.

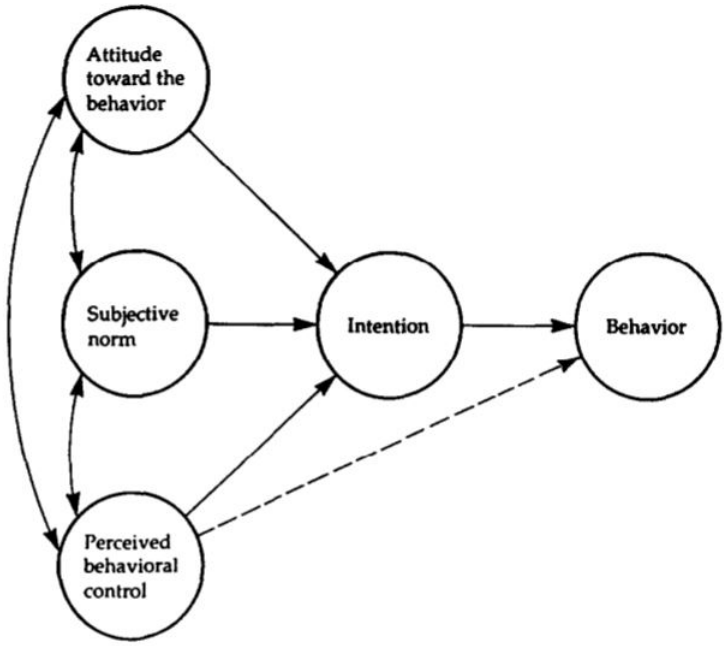

Figure 1. Theory of planned behaviour (Ajzen, 1991)

The survey was carried out via a survey form created on Google Forms (attached in Appendix 1). In order to achieve the target sample size, a mix of random sampling and snowball sampling was utilized (Fricker Jr, 2008). A link to the survey form was posted online to gather responses from younger age groups, while face-to-face surveys were carried out with randomly selected respondents for older age groups; particularly for respondents over 50 years of age.

The collected data were analyzed via the analytical tools in Google Forms, as well as using Microsoft Excel. A gender balanced sample population was sought and a fairly even result of 52.5% female and 47.5% male respondents was achieved. It was also observed that the distribution of the age group profiles of the survey sample was close to the profile of the target population of Male' (National Bureau of Statistics, 2015).

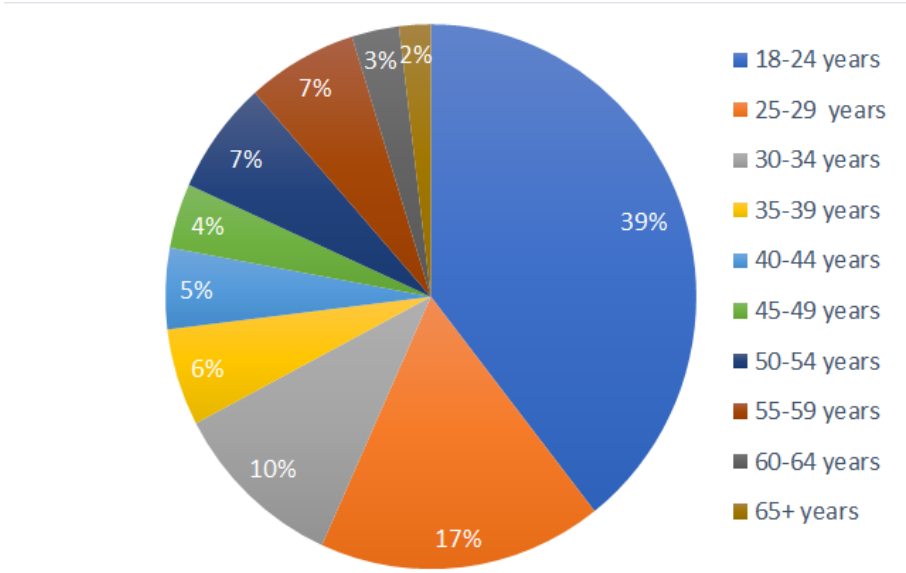

Figure 2. Age groups of respondents in percentage

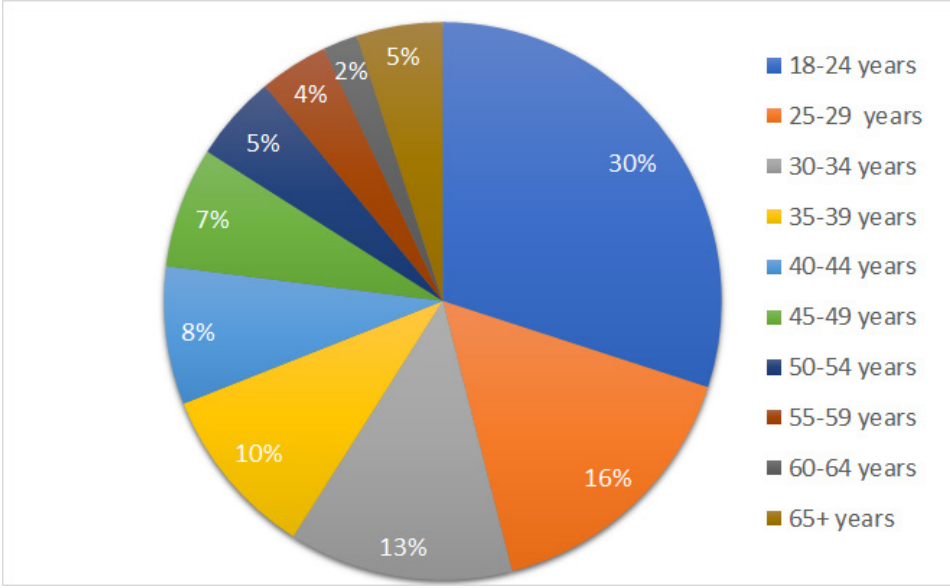

Figure 3. Age groups of target population in percentage Adapted from the Population & Housing Census 2014 (National Bureau of Statistics, 2015). Retrieved from http://statisticsmaldives.gov.mv/nbs/wp-content/uploads/10/2015/Census-Summary-Tables1.pdf

Results

The extent to which the public trusted in MWSC's utility water as a source of safe drinking water was one of the key questions of the survey. Additionally, public's trust in mineralised bottled water as a source of safe drinking water was also analysed, as it allowed for a comparison between trusts in utility water versus trust in bottled water.

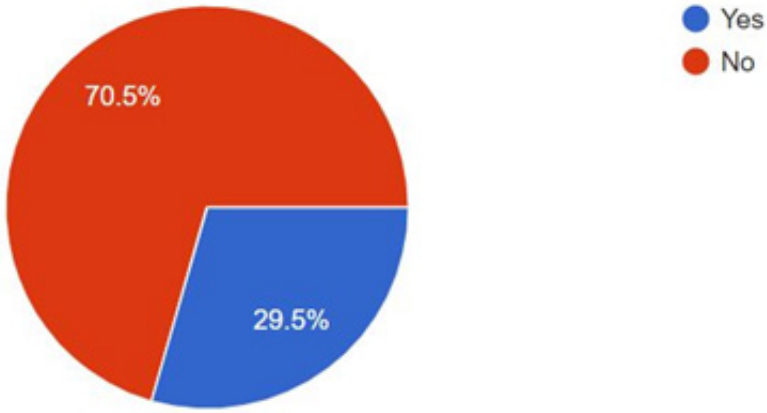

Figure 4. Percentage of respondents that trusted public utility water as a source of safe drinking water

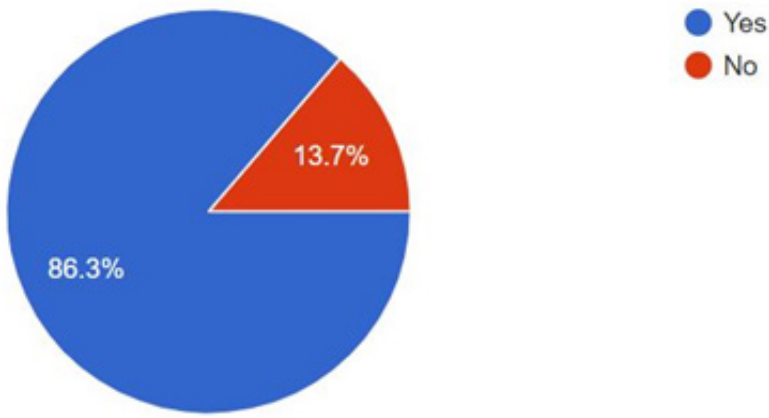

Figure 5. Percentage of respondents that trusted mineralised bottled water as a source of safe drinking water

The questionnaire also prompted respondents to identify sources of drinking water at home, at work and at their place of education separately. This revealed that bottled water was the most popular source of drinking water at all 3 spaces.

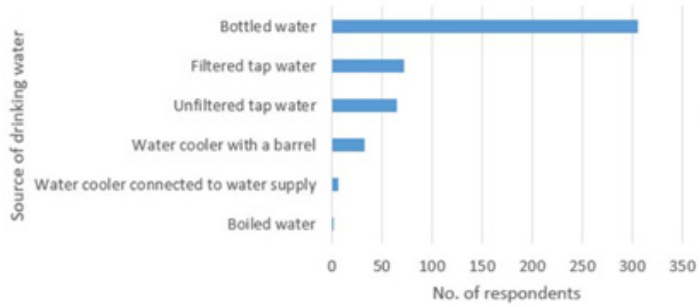

Figure 6. Sources of drinking water at home by number of responses

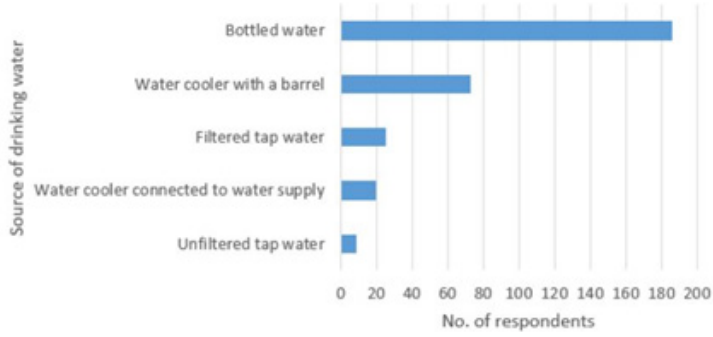

Figure 7. Sources of drinking water at work by number of responses

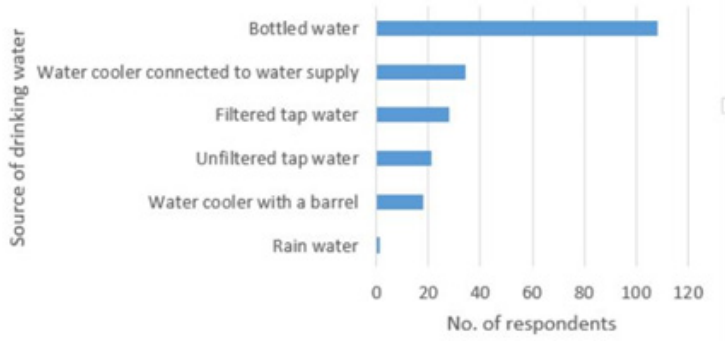

Figure 8. Sources of drinking water at place of education by number of responses

Combining the data for sources of drinking water for all three spaces revealed that bottled water was the choice source of drinking water 60% of the time, while filtered tap water was chosen 13% of the time, followed by water cooler with a barrel, which was chosen 12% of the time. Unfiltered utility water straight from the tap was only chosen 9% of the time, signifying the extent of public's distrust in the utility water.

Analysis was conducted on the 29.5% of respondents that had trust in the public utility water as a source of potable water, in order to identify their choice sources of drinking water. The analysis revealed that even among respondents that had trust in utility water, bottled water was the popular source.

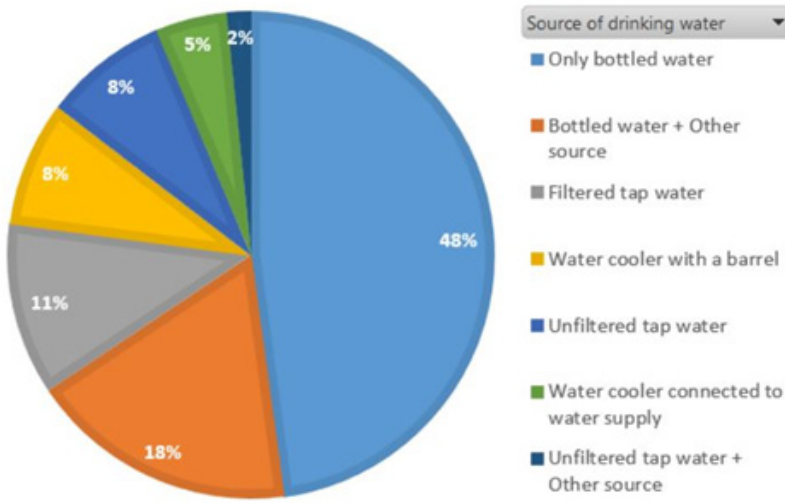

Figure 9. Sources of drinking water among respondents that had trust in public utility water as a source of safe drinking water

Analysis was also conducted to identify whether there were any trends in age, educational qualification or income as factors that influenced respondents' trust in utility water as a source of safe drinking water. However, no such trend was observed, and further analysis was done to identify whether there were any trends in factors that influenced respondents' decision in choosing a source of drinking water. While the prevalence of bottled water was observed across all the different age groups, educational qualifications and income levels, a trend in increased percentage of bottled water use among older age groups was observed. However, no such trends in regard to education or income levels was detected.

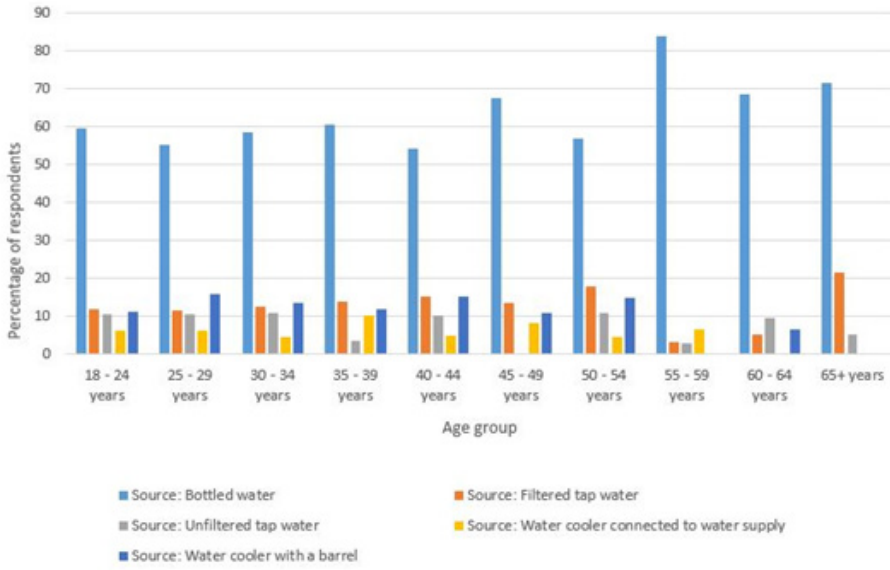

Figure 10. Sources of drinking water by age groups of respondents

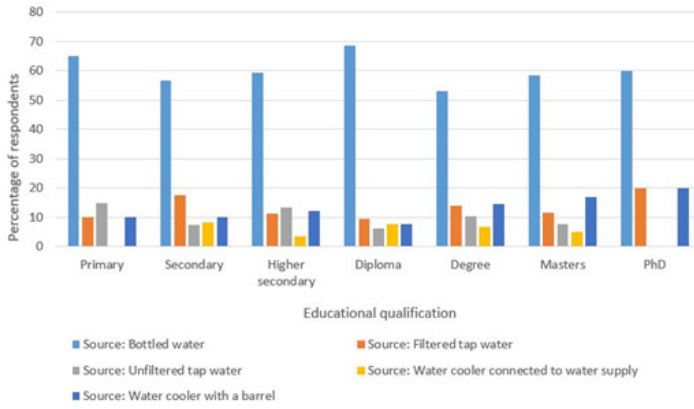

Figure 11. Sources of drinking water by educational qualification of respondents

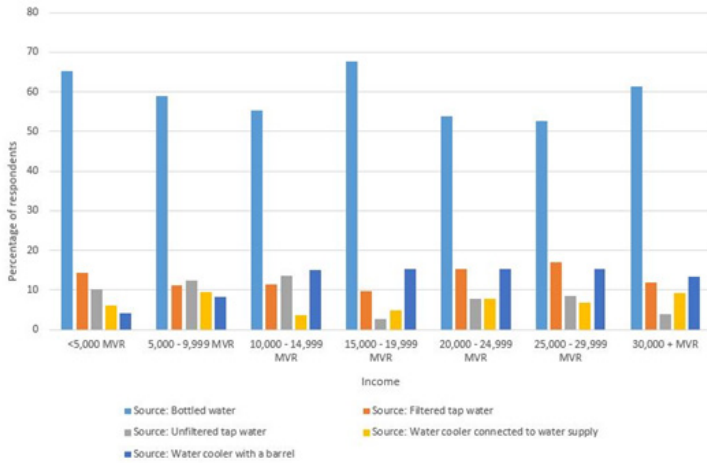

Figure 12. Sources of drinking water by income of respondents

Since perception of utility water was a complex concept difficult to express with a single variable, perception on multiple variables were questioned, including taste, smell, color/clarity, and safety/hygiene of the drinking water. Respondents were asked to give a score out of 5 for each of the variables, with 1 being very bad in their perspective, up to 5 being excellent. The results of these questions showed that the taste of utility water was one of the main factors influencing the public's choice to opt for bottled water over public utility water, as almost half (%46.8) of respondents gave the taste of utility water a score of 2 and below, while %39.3 of respondents gave the taste a neutral score of 3. Only %2.1 of respondents gave the taste of utility water an excellent score of 5. The smell and color/clarity of utility water fared much better, where %84.7 of respondents gave a score of 3 and above for smell, while %94.1 of respondents gave a score of 3 and above for color/clarity. In rating the safety/hygiene of drinking water, respondents were asked to give a score for both utility water and bottled water, visualized in Figure 13 and Figure 14.

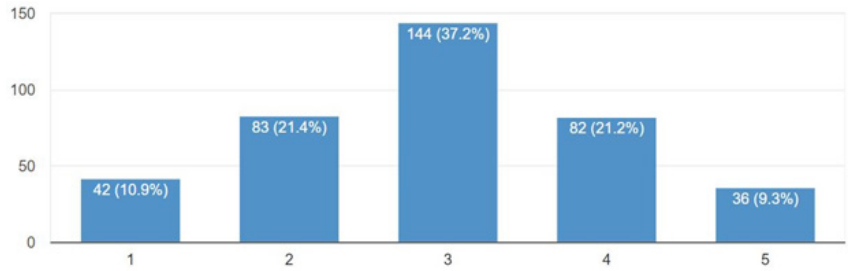

Figure 13. Respondents› scores for safety/hygiene of utility water

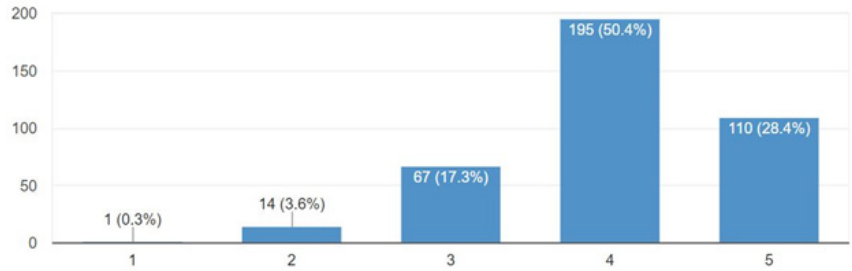

Figure 14. Respondents› scores for safety/hygiene of bottled water

The respondents' level of awareness about the standards to which MWSC's utility water was required to adhere to, and whether the standards had any influence on the respondents' perception of utility water was also questioned. While a majority of respondents (%54.3) were aware about the WHO and EPA standards to which MWSC were required to adhere to, %51.2 of respondents stated that the standards did not influence their perception, and that they still would not trust the utility water as a source of potable water. %19.9 of respondents claimed that they were now willing to consider utility water as a source of safe drinking water after learning of the standards via the survey, while %24.8 of respondents expressed that they trusted the utility water regardless of the standards. Further analysis was also conducted to find whether age, educational qualification or level of income were factors that influenced respondents' level of awareness about MWSC standards. This analysis revealed respondents between the ages of 59 – 45 years of age to be the most aware about the standards to which MWSC were required to adhere by, while none of the respondents 64-60 years of age had heard about the standards.

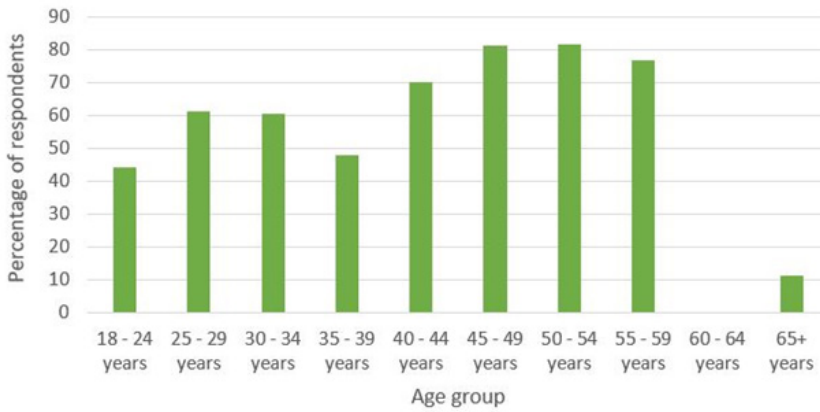

Figure 15. Percentage of respondents that were aware about water standards by age group

Educational qualification was also found to have had an influence on the awareness level of respondents. While none of the 11 respondents with primary level education were found to be aware of the standards, a significant percentage of respondents with secondary educational qualifications claimed to be aware of the standards MWSC adheres to. With the exception of primary and secondary education, a general trend of increasing awareness was observed with better educational qualification. Respondents with the highest level of income were also found to have a high level of awareness about MWSC's standards, while respondents with the lowest level of income and unemployed respondents were found to be the least aware.

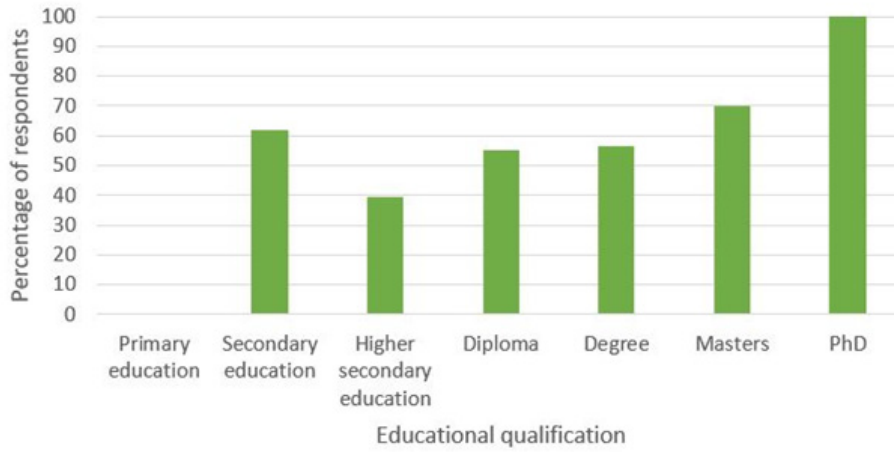

Figure 16. Percentage of respondents that were aware about water standards by educational qualification

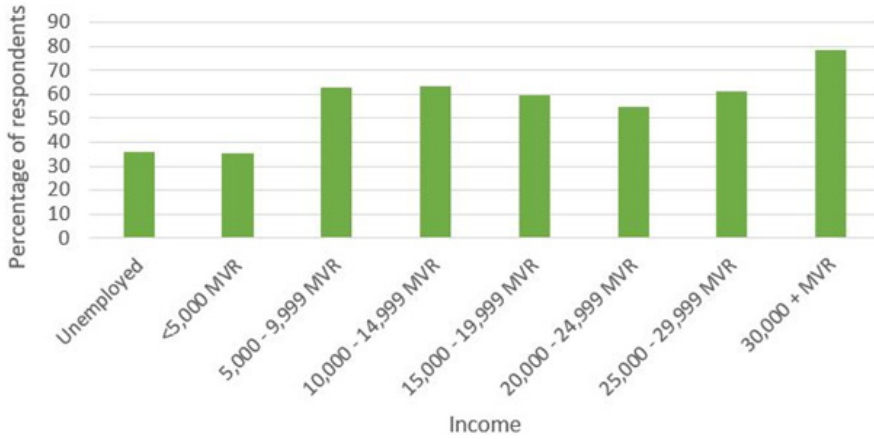

Figure 17. Percentage of respondents that were aware about water standards by income

The reasons for respondents' trust or distrust in MWSC's utility water were also analyzed. While %52 of respondents that trusted the utility water as a safe drinking source claimed to do so because of the standards to which the utility water was required to adhere to, %24 of respondents claimed that their reason for trusting the utility water was because they had not come across any problem from using the utility water thus far. The numerous reasons for public's distrust in utility water are visualized in Figure 18 below:

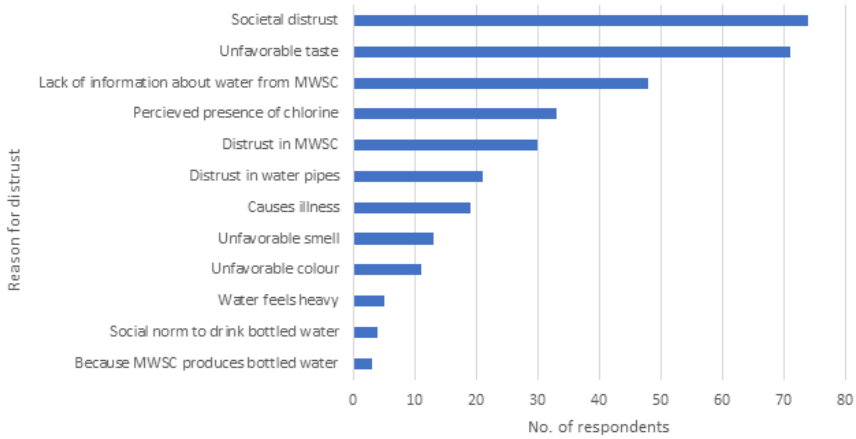

Figure 18. Reasons for distrust in MWSC utility water as a source of safe drinking water by number of responses

Respondents were also questioned about the reasons for their choice in opting for bottled water over public utility water, to which the hygiene level and taste of utility water were the most prominent reasons chosen (41.6% and 41.1% respectively).

Respondents were further prompted about whether they would be willing to drink the MWSC utility water after it had been filtered/purified or boiled, to which a large majority (73.1%) of respondents claimed that they were indeed willing to drink the water after it had been treated in any of the aforementioned ways. 18.1% of respondents were willing to drink the utility water without any sort of treatment, while 8.8% of respondents claimed that they were unwilling to drink the utility water even after such treatment.

Another important question pertained to the creation of plastic waste from bottled water, and whether this was a factor that had any influence on their decision in choosing a source of drinking water. Analysis of the results to this question is visualised in Figure 19 below.

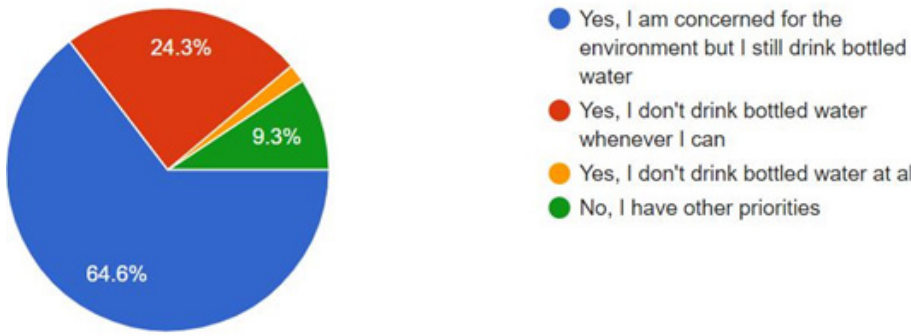

Figure 19. Percentage of responses to the question regarding whether the creation of plastic waste from bottled water influences respondents' decision in choosing a source of drinking water

The respondents' level of awareness about water testing was also analyzed, and it was found that 50.6% of respondents were aware that it was possible to get laboratory tests done to check the level of quality and hygiene of their water but had never done it themselves. 40.3% of respondents were unaware of the possibility of getting their water tested in a laboratory setting, while 9% of respondents had tested their own water. The most common sources of information about water, water safety and water borne diseases were also investigated, which showed that online articles were the most common source of information for the respondents (70%). The news (62.8%), social media (56.3%), trusted family, friend or colleague (47.5%), television (42.9%) and academic papers (30.2%) were also common sources of information among the respondents.

Discussion

It is vital that in a country such as the Maldives that relies extensively on the preservation of the natural environment, that the use of plastic products is minimized as much as possible. One such way towards that goal is to incentivise citizens to utilize alternatives to plastic products. In this regard, increasing public's trust in the public utility water as a source of potable water, and encouraging the use of re-usable water bottles are ways to reduce the prevalence of plastic bottles.

Bottled water sales around the world have been decreasing amidst consumer concerns on the environmental impact of plastic bottle disposal (Business Source Complete, 2009). However, as indicated from the survey results, it has been observed that the prevalence of plastic bottles in the Maldives has been increasing, and that promoting the use of the utility water as a source of safe drinking water has not been a priority.

Nevertheless, there has been work done in other areas regarding plastic pollution in the Maldives; particularly in the area of recycling plastic products. World Environment Day of 2018 saw the introduction of the first ever plastic recycling lab (Maldives Independent, 2018), and the introduction of the first ever "smart bin" to the Maldives (Rehan, 2018). The plastic recycling lab built by Parley for the Oceans is capable of recycling up to 500kg of plastic on a daily basis, while the smart bin by MWSC has a capacity of 538 bottles per day. While these were positive steps in the right direction, a joint statement from 13 Non-Governmental Organizations (NGOs) was released on the same day, "condemning the environment ministry's hypocrisy and incompetence in creating and expanding a culture of bottled water consumption" (Maldives Independent, 2018).

The public utility company MWSC has been providing utility water services to the Maldivian population since 1995 and has been involved in the business of bottled water since 2014 (MWSC, n.d.). Respondents to the survey noted MWSC's involvement in the bottled water business as a reason for their distrust in the public utility water, also noting that amount of information about the utility water provided by the company as being inadequate. Furthermore, public's distrust in the pipes used in the provision of utility water was also noted, in addition to the perceived presence of chlorine in the utility water. MWSC notes on their website that "disinfectants such as chlorine, chloramines, and ozone and chlorine dioxide are used as disinfectant to kill pathogens such as bacteria and viruses by breaking the chemical bonds in their molecules" (MWSC, n.d.).

The number one reason for public's distrust in utility water was summarised as being "societal distrust", which includes reasons such as "rumours about the quality of utility water", "rumours about the utility water causing illnesses" and other similar hearsay. While this indicates that MWSC lacks transparency about the quality of their utility water, it also indicates that dispelling rumours and hearsays about the water by providing more information and increasing awareness could do well to increase public trust in the utility water. A higher level of transparency would also help garner public trust in the company itself – another factor that also influenced respondents' trust in utility water. . Furthermore, a significant number of respondents (64.6%) also expressed concern for the environmental impact caused by plastic bottles, but still claimed to drink bottled water, while 24.3% of respondents claimed to avoid the use of plastic bottles whenever possible. This indicates that proving the hygiene quality of utility water and increasing public's trust in the water could reduce plastic bottle use dramatically.

Conclusion

This investigation was aimed at identifying public perception of municipal drinking water and analysing factors that influenced public perception in choosing a source of drinking water. The methodology of the study involved carrying out a qualitative survey of residents in the Male' region, both online and face-to-face.

The study focused on understanding respondents' satisfaction with public utility water, prevalent sources of drinking water, respondents' awareness about water standards and water testing, as well as perception on the plastic waste generated from bottled water. The results of the survey showed that bottled water was the most popular source of drinking water, at home, at work and at places of education as well. Public utility water was only very rarely utilized, and most respondents preferred to treat the utility water before consumption, mostly due to perceived taste and hygiene issues. While most respondents were aware of the standards to which the public utility company was required to adhere to, a majority of respondents were also uninfluenced by the standards. A significant number of respondents also reported to be concerned about the environmental impact of bottled water disposal. A majority of respondents were aware of the possibility of getting their own water tested in a laboratory setting as well.

The findings of this public perception survey could be of significance to MWSC and the government of Maldives, as it shows a high amount of public distrust in MWSC and the water service provided by them. Areas in which the public utility company could improve upon to increase public trust have also been identified in light of the survey results. This includes increasing transparency about the company, publishing results of the company's water tests, raising awareness about the company's water services, examining the quality of the water pipes, increasing company engagement with the public and improving the taste of the utility water provided. The results of the survey showed the possibility for a vast reduction in bottled water consumption, if public's trust in utility water could be improved. Additionally, the methods for effective outreach that could be employed by the company have also been identified through the survey. Online articles, news, television, social media, academic papers and awareness sessions were some of the most popular means of accessing information about water safety and water borne diseases chosen by the respondents.

One of the main challenges in carrying out the survey was the lack of time and manpower for the face-to-face survey. Consequently, online snowball sampling was utilised with the risk of introducing bias. Therefore, repetition of a similar survey without bias to further confirm the results of this survey could prove beneficial. To improve the methodology and implications of research in this area, future studies might consider the following elements:

- Surveying perception of households as opposed to individuals, since sources of drinking water are often similar for individuals of the same household.
- Investigating the quality of utility water from households and comparing the results with perception of household individuals. Additionally, the results of the water tests from households could also be compared with the results of the water tests from the utility company.
- Employing additional enumerators for the survey and carrying out the survey for a larger sample group for increased accuracy.
- Ensure the elimination of bias by avoiding methods such as snowball sampling and employing only random sampling.
- Conducting seasonal-based surveys to evaluate the temporal variability of utility water perception.

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