

INFLUENCE OF WATER QUALITY AND SERVICE ON WATER SUBSCRIPTIONS AND FEE COLLECTION

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Abstract

The unwise use of water resources in Lebanon accompanied with the lack of governmental management have reflected in poor water quality, quantity and customer dissatisfaction and thus not many studies have been conducted to solve this problem. To address this problem, this research investigates the Influence of water quality and service on water subscriptions and fee collection while taking into consideration customer satisfaction. This research consists of a detailed survey that covered Bireh and Sin el Fil to assess the main cause that influence customer satisfaction and billing behavior based on changes in governmental work in this sector. Sin el Fil respondents reported that they're in majority more unsatisfied with water quality and supply, paying higher and willing to pay more if service improves than Bireh area. While, both regions considered that water supply is priority over the quality of water and billing services. The analysis indicates that factors such as water cost, satisfaction and water quality are highly influencing the billing behavior. The problem of the water resources in Lebanon should be resolved by pushing forward towards serious local institutional reforms and by proposing advanced water management measures.

Introduction

The water sector in Lebanon plays a critical role in maintaining socio-economic well-being by providing fundamental necessities of life. The reasons for this study were to analyze and assess the water quality and service issues and challenges faced by the subscribers regarding the water subscription and fee collection. It also takes into consideration the factors leading towards a better water quality and service. These solutions can be implemented to improve customer satisfaction.

As per Unicef around 70% of Lebanese are at risk of losing access to water. Due to the collapse of the national electricity sector, rising fuel costs and lack of financing which is decreasing the pumping capacity, not to forget also the costly maintenance operations. However, much of our infrastructure remains inadequate to provide reliable service. There is not enough resources for infrastructure works affecting negatively the water service. Since the service is poor, most Lebanese are not willing to pay the subscription fees, it's a vicious cycle. This leads us to realize the severe problem in this sector. Therefore, the purpose of this research is to study the influence of water quality and service on water subscriptions and fee collection while taking into consideration customer satisfaction.

This research aims to study water services and its influence on water subscriptions and fee collection. This requires not only engineering decisions about maintaining and increasing the water supply, but also economic policies on water services cost affecting its sustainability, efficiency, and equity. This research guideline's aim is to inform the community also on underlying highlighting new ideas and corrective actions. The project seeks to advocate a conceptual framework that will be sent to the local authorities allowing them to take a look on the community perception regarding the water quality and services and its effect on water subscriptions and fee collection. This research seeks also to introduce the importance of water metering, appropriate subscription yearly amount, and allocated amounts.

Literature Review

Lebanon is a country rich in water resources, yet he faces a lot of problems in the management of this sector. An increased debate on the responsibility of the deterioration of the water sector is happening between different concerned institutions. To note, that public network coverage is relatively high with about 78 % of the Lebanese population connected to the public water network (*Water Sector: Public Expenditure Review, World Bank 2010*) but are dealing with low water supply ranging from 3 to 22 hours of daily water supply during the summer season (*Water Sector: Public Expenditure Review ,World Bank 2010*).

The Regional Water Authorities aren't yet performing as financially autonomous entities, despite the progress made since their establishment (*Water Sector: Public Expenditure Review, World Bank 2010*). A lack of metering and a flat fee-based water tariff result in tariffs being disconnected from both consumer demand and the economic cost of service provision. (*see Appendix II*). The current tariff system doesn't provide incentives for demand management, nor does it provide commercial incentives for water authorities to reduce water losses and increase water production. This system will lead to high water losses, unwise use of water and lack of governmental control.

In 2021, Oxfam conducted a survey of households in each water establishment area. The results showed that most of the targeted citizens indicated their willingness to pay more for a better service, expect for North Lebanon. While some respondents associated their responses with enhancing the service, others believed that the service was satisfactory and opposed any enhancements that might result in a rise in costs. The vast majority of the respondents showed their interest in a fixed yearly subscription rather than a metered subscription. The majority of the survey participants reported that they had interacted with their water service provider within the past year, either to pay their bill or to make a complaint.. Some answers are worth having a further assessment as some respondents in Beirut's southern suburb were not interested to contact the Water Establishment.

The majority of the respondents from the Bekaa region considers that the municipalities have a role to play in the water supply (*Oxfam 2021*). These perceptions could be based on the good service provided by the Municipality in Anjar. While in the other regions, the municipality's function was frequently described as monitoring or acting as a mediator between the community and the Waste Establishment. Most of the connected households reported being satisfied with the water service (63%)

The INGO: "Concern" conducted also a detailed survey covering 238 households in Mashta Hammoud during December 2020. The most important factors affecting dissatisfaction of households were the water supply discontinuity, limited water quantities and low water pressure. 79% of the connected households reported being willing to pay more for a better service. Those unwilling to pay more had financial critical cases as primary reason. All households reported also purchasing of water tankers and bottled water. 74% of connected households prefer flat rat billing.

Customer satisfaction measurement enables the relevant authority to make a proper self-evaluation and identify the key factors enhancing customer satisfaction. Since customers' expectations act as a bench mark on which customers evaluate the quality of utility service delivery (Ojo, 2011), improving on customers' satisfaction factors could improve the organization's competitive advantage, which could lead to increase

sales, customer loyalty and sustainable profit. (Bolton, 1998; Ralston, 1996).. In an exploratory study of five small urban water utilities in Uganda. *Mugabi, Kayaga, and Smout (2007b)* identifies that customers consider timely payment of their water bills to be influenced by various factors, including the delivery of bills, meter reading accuracy, billing precision, bill clarity, payment flexibility, and choice of payment options..

In addition to behavioral and institutional constructs such as those reviewed by *Mugabi et al. (2007b)* and others (*Kayaga, Calvert, & Sansom, 2003; Waldron, 2011*) Chipofya, Hoko, and Gustaff (2009) argue that some other institutional factors like transaction time of customers at the bill payment points, monitoring and control measures on the part of water utilities, may also play an additional role in determining customers' satisfaction level and their payment behavior. *Sualihu and Rahman (2014b)* find that reduction in transaction time at bill collection centers not only enhances customer satisfaction, but also shortens the average time it takes for utility customers to pay their bills after receiving them. Also, if utilities increase their monitoring and control roles, they are likely to detect problems such as metering errors and burst pipes, and fix them on time (*Waldron, 2011*). This will increase the level of customer satisfaction and also reduce the delays in customers' bill payment. Therefore, long transaction time and poor monitoring and control are more likely to negatively influence bill payment behavior.

Customer satisfaction results from customers' evaluation of the rewards and costs of their purchase, in comparison to their expectations and anticipated outcomes (*Bolton & Drew, 1991*). Customers are able to tell whether or not they are satisfied with a product by comparing the benefits from using the product relative to its costs (*Bolton & Drew, 1991*). *Oliver (1980)* notes that customer satisfaction arises from the difference between expectations and actual performance (*Oliver, 1980*). *Bolton and Drew, 1991* argue that expectations, performance, and disconfirmation are possible determinants of customer satisfaction and conclude that customers' assessments of provided services may depend on only performance evaluations.

In a comprehensive study on the relationship among and between the major consumer judgmental constructs in the context of a service industry, *Cronin, Brady, and Hult (2000)* show that customer satisfaction is positively associated with behavioral intentions. The authors' findings are based on results of several other prior studies on customer satisfaction and various indicators of behavioral intentions such as customer loyalty, repurchase intention, and switching behavior (e.g., *Andreassen & Lanseng, 1997; Caruana, 2002; Richard & Zhang, 2012; Srivastava & Sharma, 2013*). Therefore, in the context of a utility company, it may be argued that the more consumers are satisfied with service provision, the more likely they are to pay their bills on time. *Sualihu and Rahman (2014b)* conclude that higher customer satisfaction is associated with higher bill payment. As such, it is hypothesized that customer satisfaction is likely to be positively associated with customers' behavioral intentions.

Elinor Ostrom (1990) was a political economist who in 2009 became the first-ever woman to receive the Nobel Prize in Economics for her research analyzing economic governance, with a focus on the management of finite commons within a community. These finite resources are called "commons". Ostrom was able to debunk the popular "tragedy of the commons" theory, which was originally described by environmentalist Garrett Hardin. Garrett Hardin supports the fact that common resources should belong to the government or be divided into private lots to prevent them from running out. On the other hand, Ostrom proved that this isn't always the case, showing that when a resource is shared at the level of local communities, the users can establish rules for its use and take care of it in a way that is both economically

and environmentally sustainable and that any regulation of resource use should be done at the local level, as opposed to a higher central authority that has no direct interaction with the resources. Ostrom has developed important principles for successful management of commons through collective action which emphasizes defining clear boundaries of the commons resource, the rules governing the use of commons resources must correspond to local needs and conditions with participation of their users. The use of common resources must be managed by progressive sanctions combined with the power of the higher authorities to establish rules and the autonomy of the users of the resources. Conflicts should be resolved easily and informally and common resource management should consider local resource management.

Materials and Methods

The starting point of the methodology is a comprehensive assessment of the existing situation. This assessment was explored in the literature review. The study provides information about targeted populations and samples.

This study is a descriptive research and quantitative cross-sectional study using survey method. To provide a first glance to identify the principal factors that influence customer satisfaction of water services across Lebanon, this study uses data from household surveying. This survey was designed to address the Influence of water quality and service on water subscriptions and fee collection.

The survey was administered to respondents from Sin el Fil and Bireh, el Chouf regions, an urban and rural area, respectively. These regions represent geographically, as well as socioeconomically and demographically diverse locations. In Sin el Fil region, samples were collected from Jisr el Basha area an urban and densely populated area with a lot of water problems. In Bireh, samples were collected from a rural area located at 950 m above sea level with abundant water that comes from Barouk and Nabh el Safa River.

The questions were developed with closed and open-ended questions. Unnecessary personal data, complex and duplicated questions were avoided. The survey covers a variety of water issues, socio-economic characteristics including age and number of people living in the household, water tariff (bill amount), willingness to pay and other aspects. The complete list and description of variables are found in Table 1.

Table 1: Survey Questions and Responses

Survey Question	Survey Responses
Region	- Bireh - Sin el Fil
Age	- 18-27 - 27-49 - 49-64 - Over 64
Number of residents per household	- 1

	<ul style="list-style-type: none"> - 2 - 3 - 4 - 5 - 6>
Customer Satisfaction	<ul style="list-style-type: none"> - TotallyUnsatisfied - Unsatisfied - Neutral - Satisfied - Totally Satisfied
Main factors that influence your satisfaction	<ul style="list-style-type: none"> - Water Quality - Water Supply - Billing service
Water Cuts per week	<ul style="list-style-type: none"> - None - 1 - 2 - 3 - 4 - 5 - 6 - 7
Have you ever sent a complaint about a water problem ?	<ul style="list-style-type: none"> - Sent a Complaint - Never Sent a Complaint
How much do you pay for water from the Water Establishment?r	<ul style="list-style-type: none"> - <i>Short Answer</i>
Preferred Paying Method	<ul style="list-style-type: none"> - By sending a person to your house - By OMT, Liban Post... - By going to the Municipality
Preferred Payment Frequency	<ul style="list-style-type: none"> - Yearly - Monthly
Cost of Water Truking per Month	<ul style="list-style-type: none"> - <i>Short Answer</i>
Use of Pumping System	<ul style="list-style-type: none"> - Yes - No
Drink from Tap Water	<ul style="list-style-type: none"> - Yes - No, I drink water from water bottled companies - No, I drink water from a near water spring
Cost of Drinking Water	<ul style="list-style-type: none"> - <i>Short answer</i>
Water Metering technique	<ul style="list-style-type: none"> - With - Against
Willing to Pay More if the Water service is Improved	<ul style="list-style-type: none"> - Yes - No

The primary data have been collected with the help of survey through the structured questionnaire among the users regarding the level of satisfaction and its determinants

In the Literature Review, the necessary independent and dependent variables' secondary data were obtained from official websites, annual reports, audit reports, relevant articles, and publications related to the water supply and sanitation project. Data for the surveys was collected by obtaining responses from a sample of 120 households. To ensure a representative sample of all households in each region, a systematic random sampling method was used. The sample size in both regions was 60, and it was distributed across different zones to accurately represent the entire population of those specific areas. This study intends to examine the level of customer satisfaction. The composite index approach is also a simple and straightforward format that is widely used in planning and evaluating studies such as the human development index and the rating index (Sullivan, 2002; Sullivan et al. 2003). Specifically, this satisfaction scale was developed on the basis of factor analysis to measure user satisfaction. (Fig.1)

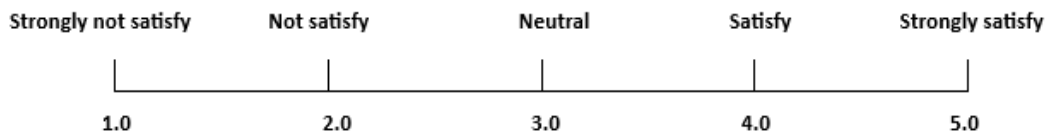


Figure 1: Satisfaction Scale

$$AWI = \frac{f_a(1) + f_b(2) + f_c(3) + f_d(4) + f_e(5)}{N}$$

Where,

AWI = Average weighted index

fa= Frequency of strongly not satisfy fb= Frequency of not satisfy fc= Frequency of neutral fd= Frequency of satisfy fe= Frequency of strongly satisfy N = Total no. of observation.

For easy interpretation, we used the following index scale: very satisfied (4.50–5.00 points); satisfied (3.50–4.49 points); fairly satisfied (2.50–3.49 points); poorly satisfied (1.50–2.49 points); not satisfied (1.00 – 1.49 points)

Results

A weighted tabulation and corresponding percentage of the two different regions responses for selected variables are presented in Table 2, it provides descriptive information about respondents. Tabulations and percentages were calculated for these variables because they are discrete and non-ordinal.

Table 2: Results of Survey

Survey Question	Survey Responses	Bireh		Sin el Fil		Total	
		#	%	#	%	#	%
Region		60	50%	60	50%	120	100%

Age	- 18-27	4	6.7%	1	1.7%	5	4.2%
	- 27-49	15	25.0%	14	23.3%	29	24.2%
	- 49-64	29	48.3%	30	50.0%	59	49.2%
	- Over 64	12	20.0%	15	25.0%	27	22.5%
Number of residents per household	- 1	1	1.7%	2	3.3%	3	2.5%
	- 2	8	13.3%	2	3.3%	10	8.3%
	- 3	14	23.3%	11	18.3%	25	20.8%
	- 4	15	25.0%	25	41.7%	40	33.3%
	- 5	8	13.3%	14	23.3%	22	18.3%
	- 6>	14	23.3%	6	10.0%	20	16.7%
Customer Satisfaction	- Totally Unsatisfied	3	5.0%	34	56.7%	37	30.8%
	- Unsatisfied	8	13.3%	14	23.3%	22	18.3%
	- Neutral	7	11.7%	7	11.7%	14	11.7%
	- Satisfied	23	38.3%	5	8.3%	28	23.3%
	- Totally Satisfied	19	31.7%	0	0.0%	19	15.8%
Main factors that influence your satisfaction	- Water Quality	12	20.0%	7	11.7%	19	15.8%
	- Water Supply	45	75.0%	51	85.0%	96	80.0%
	- Billing service	3	5.0%	2	3.3%	5	4.2%
Water Cuts per week	- None	11	18.3%	0	0.0%	11	9.2%
	- 1	0	0.0%	0	0.0%	0	0.0%
	- 2	8	13.3%	0	0.0%	8	6.7%
	- 3	23	38.3%	1	1.7%	24	20.0%
	- 4	13	21.7%	5	8.3%	18	15.0%
	- 5	3	5.0%	26	43.3%	29	24.2%
	- 6	0	0.0%	17	28.3%	17	14.2%
	- 7	2	3.3%	11	18.3%	13	10.8%
Have you ever sent a complaint about a water problem ?	- Sent a Complaint	13	21.7%	6	10.0%	19	15.8%
	- Never Sent a Complaint	47	78.3%	54	90.0%	101	84.2%
How much do you pay for water from the Water Establishment?	- <i>Short Answer</i>						
Preferred Paying Method	- By sending a person to your house	39	65.0%	28	46.7%	67	55.8%
	- By OMT,	10	16.7%	18	30.0%	28	23.3%
	- Liban Post...	11	18.3%	13	21.7%	24	20.0%

	- By going to the Municipality						
Preferred Payment Frequency	- Yearly - Monthly	55 5	91.7% 8.3%	50 10	83.3% 16.7%	105 15	87.5% 12.5%
Cost of Water Trucking per Month	- <i>Short Answer</i>						
Use of Pumping System	- Yes - No	16 44	26.7% 73.3%	39 21	65.0% 35.0%	55 65	45.8% 54.2%
Drink from Tap Water	- Yes - No, I drink sealed water bottles - No, I drink water from a near water spring	57 3 0	95.0% 5.0% 0.0%	9 39 12	15.0% 65.0% 20.0%	66 42 12	55.0% 35.0% 10.0%
Cost of Drinking Water	- <i>Short answer</i>						
Water Metering technique	- With - Against	17 43	28.3% 71.7%	35 25	58.3% 41.7%	52 68	43.3% 56.7%
Willing to Pay More if the Water service is Improved	- Yes - No	31 29	51.7% 48.3%	52 8	86.7% 13.3%	83 37	69.2% 30.8%

Most head of households were aged between 49-64 (49.2%) and had 4 (33.3%), 5 (18.3%), and over 6 (16.7%) persons living in the household. Households reported that 30.8% were Very Unatisfied, 18.3% Unatisfied, 11.7% Neutral, 23.3% Satisfied, 15.8% Very Satisfied. The major factor related to this satisfaction was the water supply 80.0%, water quality 15.8% and billing services with only 4.2%.

Also, 9.2 % reported that they didn't experience any water cuts, it means that water was all day long filling their tanks and didn't stop pumping from the source, 6.7% had 2 water cuts per week, 20.0% had 3 water cuts per week, 15.0% had 4 water cuts per day, 24.2% had 5 water cuts per week, 14.2% had 6 water cuts per week and 10.8% had no water access all week long.

Even with a high percentage of water cuts and unsatisfied households, Only 15.8% had sent a complaint regarding a water problem and 45.8% of households are relying on pumping systems. The results showed that 55.8% prefer receiving the bills directly to their apartment, 23.3% prefer the payment by OMT, Liban Post and only 20% prefer to pay it at the Municipality. A yearly bill was also chosen by households (87.5%) compared to a monthly billing service (12.5%).

Out of the total respondents, it reveals that about 55 % drink from their Tap water, 35% drink from water bottled companies and only 10% drink from near water springs. The results showed that the water measuring technique was opposed by 56.7% of households, while 69.2% of households expressed a willingness to pay more if the water service quality improves.

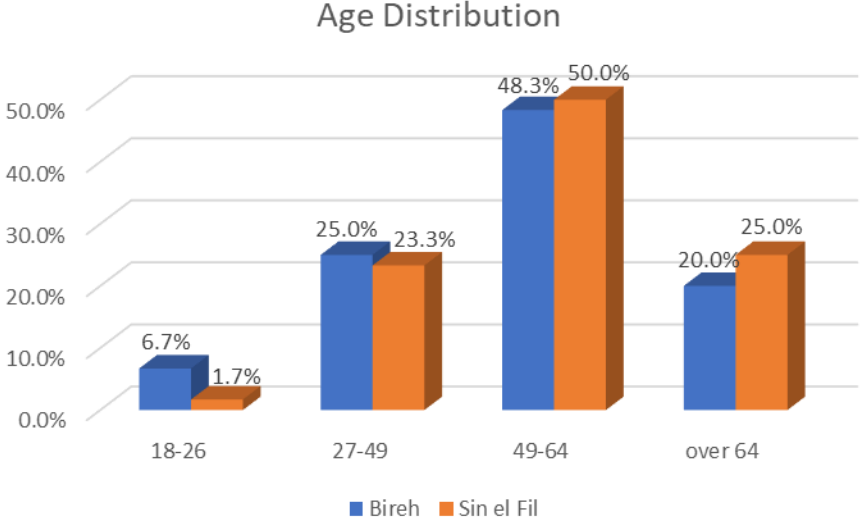


Figure 2: Age Distribution

Fig. 2 gives a graphic representation of how age is distributed between the two regions. The Age distribution between the regions looks similar by the fact that most head of households are between the age of 49 to 64 (50.0% - 48.3%) and 27 to 49 (25.0% - 23.3%).

Number of residents per household

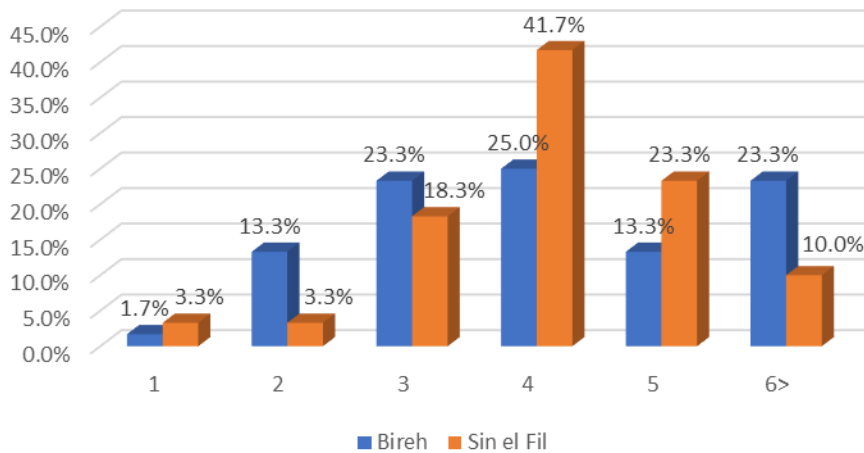


Figure 3: Number of residents per household

Most of household had 4 resident persons in both region (41.7% - 25.0%). Sin el Fil households mostly 4 (41.7%) and 5 (23.3%) people. Bireh households mostly have 4 (25.0%) and over 6 (23.3%) people.

Customer Satisfaction

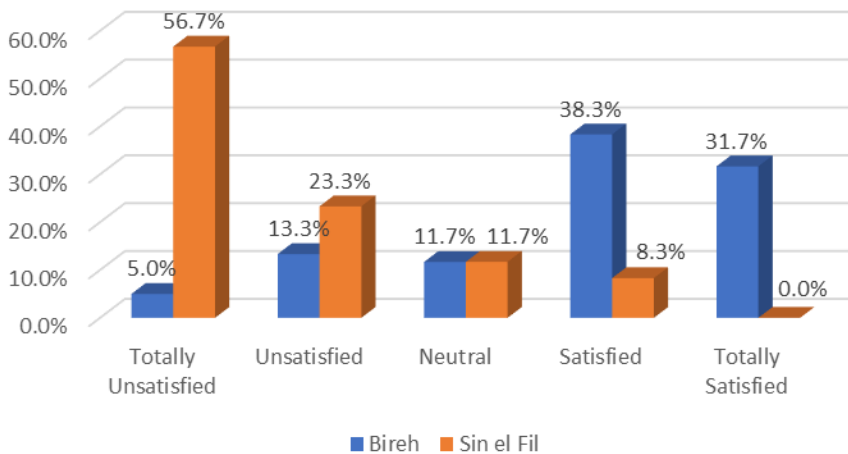


Figure 4: Customer Satisfaction

This graph gives a representation of customers' satisfaction in the two regions. Majority of households in Sin el Fil reported that they're Totally Unsatisfied (56.7%) and Unsatisfied (23.3%) and only 5% and

13.3% reported in Bireh area, respectively. On the other hand, households in Bireh area were more Satisfied (38.3%) and Totally Satisfied (31.1%) than in Sin el Fil (8.3% and 0.0%, respectively).

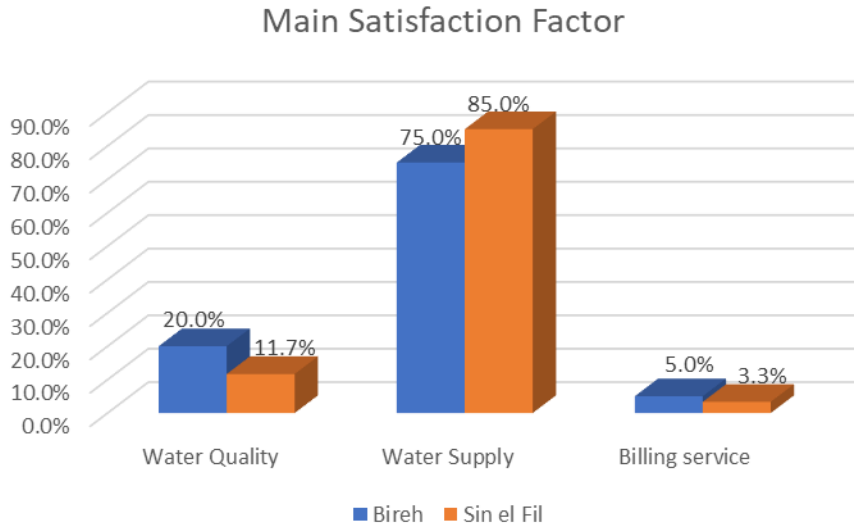


Figure 5: Main Satisfaction Factor

The Main satisfaction factor that is common between the two is Water Supply (85.0%-75.0%). In Bireh area households satisfaction relied more on Water quality (20.0%) than Sin el Fil households (11.7%) as satisfaction factor. Billing service was the least factor influencing customer’s satisfaction (5.0%-3.3%).

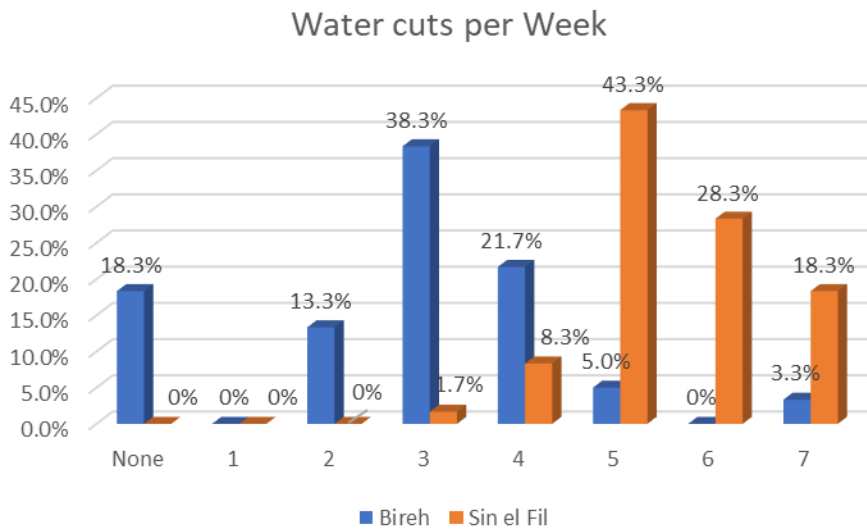


Figure 6: Water cuts per week

Sin el Fil had in majority 5 to 6 days of water cuts per week (43.3%-28.3%) No one had no water cuts per week or one to two days per week. Bireh respondents reported that they experienced less water cuts per week than Sin el Fil, 3 (38.3%), 4 (21.7%) and no water cuts per week (18.3%).

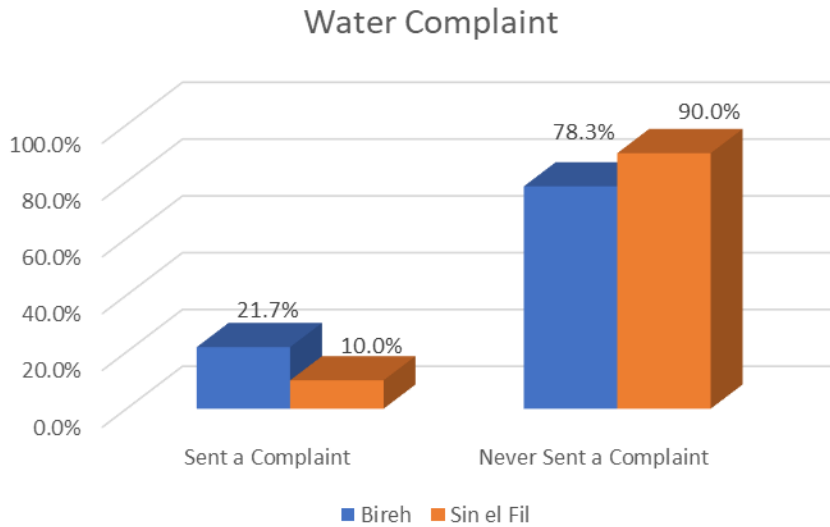


Figure 7: Water Complaint

The majority of respondents in both areas did not file a complaint, ranging from 78.3% to 90.0%.

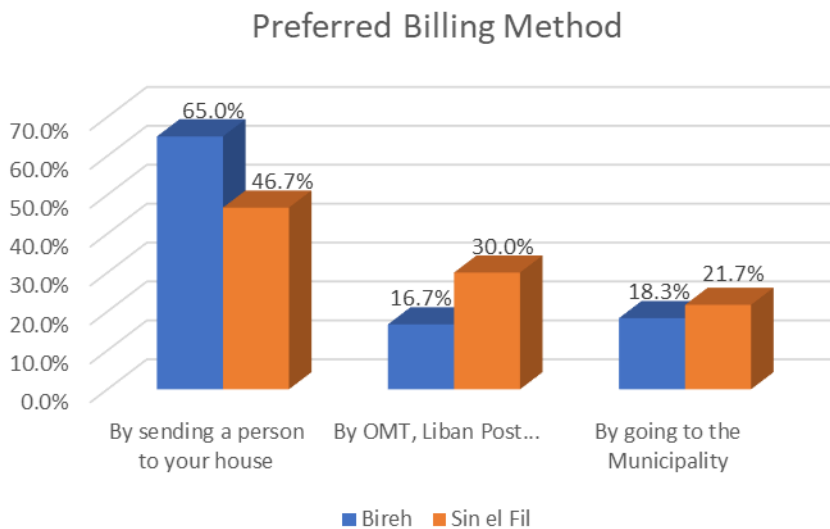


Figure 8: Preferred Billing Method

Both respondents were 65.0% and 46.7% more likely to choose their water bills to be paid by sending a person to their houses. Sin el Fil respondents were 30.0% more likely to choose paying their bills by OMT, Liban Post than Bireh respondents (16.7%). Choosing the Municipality as a reference to pay was approximately the same between the two regions (18.3%-21.7%).

Preferred Payment Frequency

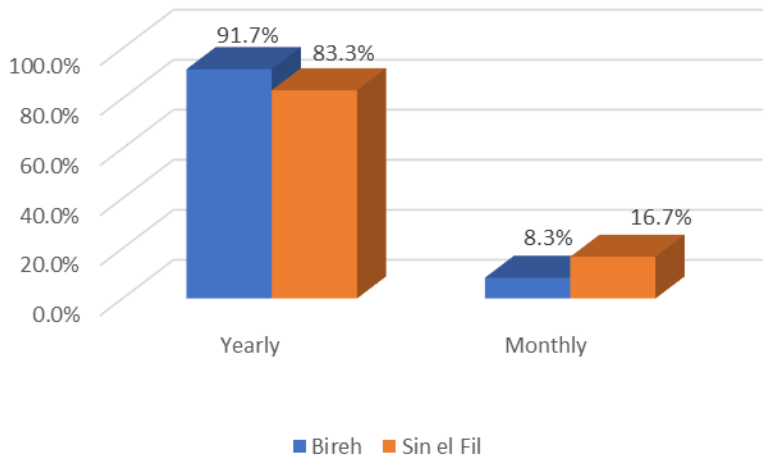


Figure 9: Preferred Payment Frequency

Respondants mainly preferred yearly billing in both regions (91.7%-83.3%).

Pumping System

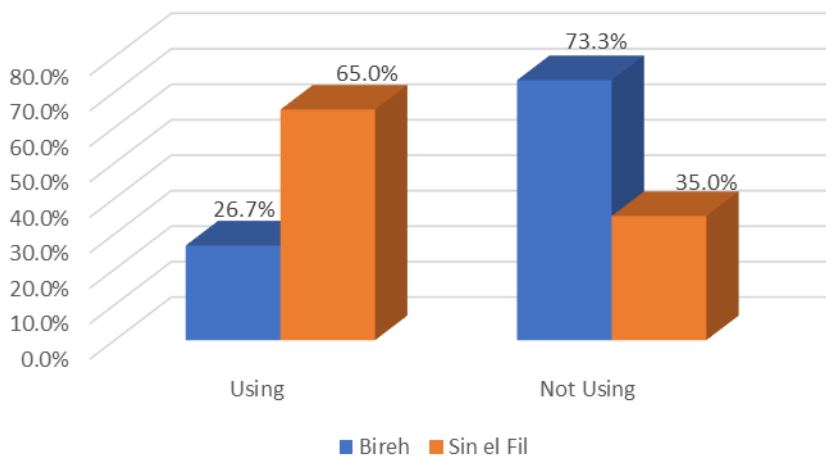


Figure 10: Pumping System

Out of the total respondents, it reveals Sin el Fil households (65.0%) used more Pumping System than Bireh(26.7%).

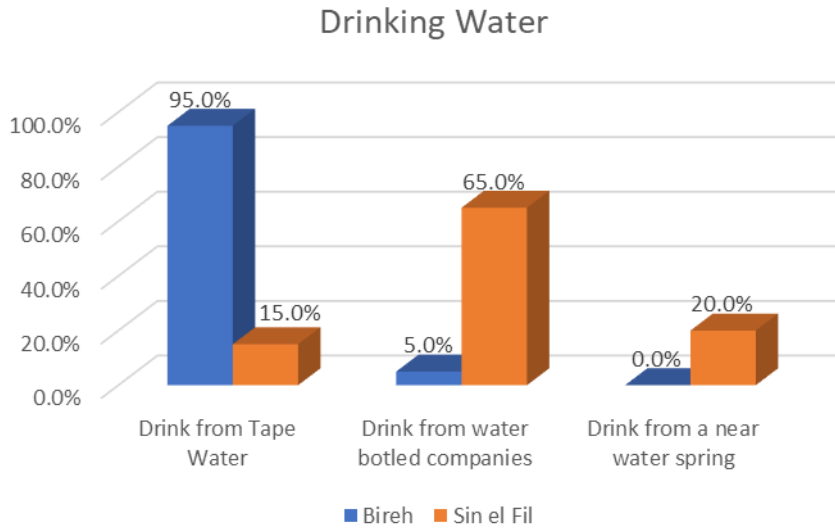


Figure 11: Drinking Water

Overall, Bireh households considered drinking from their Tap water (95.0%), while only 5.0% drink from Water bottled companies and nobody needed to go to a near water spring. Compared to Sin el Fil, only 15.0% of households considered drinking from their Tap water, while the majority consumed water from water bottled companies (65.0%) and filled gallons from a near water spring (20.0%).

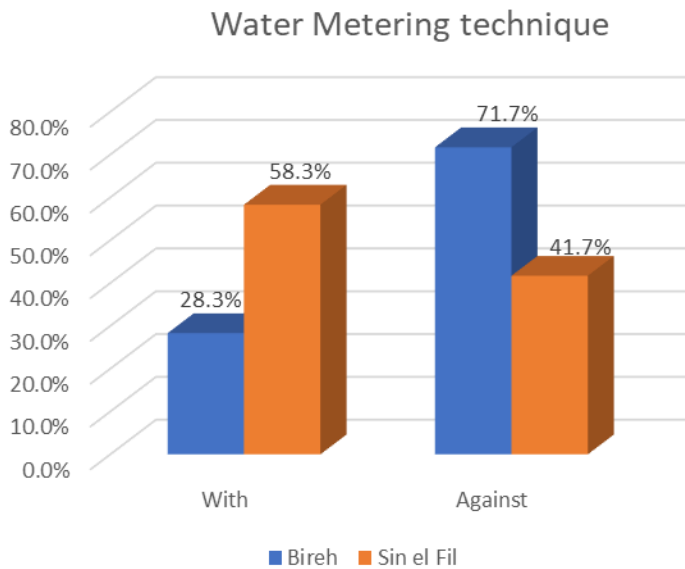


Figure 12: Water Metering technique

Out of the total respondents, it reveals that Sin el Fil households (58.3%) were more with installing Water metering devices than Bireh(28.3%).

Willing to Pay More if the Waterservice is improved

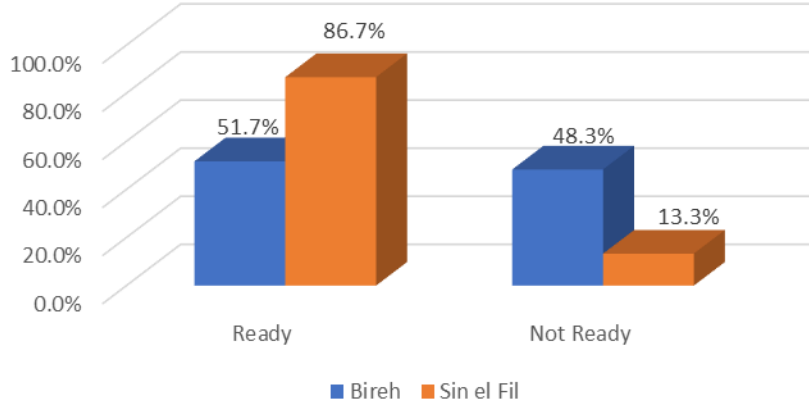


Figure 13: Willing to Pay More if the Water service is Improved

Out of the total respondents, it reveals that Sin el Fil households (86.7%) were more likely to pay more than Bireh (51.7%) if the Water service is Improved.

Table 3: Costs of all types of Water bills per month in Bireh area

Survey Question	Average	Max	Min	Percentage of Payers
Cost of Governmental Water per Month (LBPLBP)	92,000	1,200,000	950,000	100%
Cost of Drinking Water per Month (LBPLBP)	28,000	900,000	200,00	5%
Cost of Water Trucking per Month (LBPLBP)	0	0	0	0%
Total (LBPLBP)	120,000			

According to this table on average a household in Bireh area pays 92,000 LBP and 28,000 LBP with a Total average of 120,000 LBP per month. All households reported that they paid their governmental bills, only 5% paid for water bottled companies and no one spent money on water trucks.

To mention that Lebanese Lira/US Dollar Exchange Rate in August 2022 in the black market was around 32,000 LBP with Sayrafa rate at 27,100 LBP. The current official rate still stands at \$1 = 1,500 LBP and the bank rate at \$1 = 8,000 LBP

Table 4: Costs of all types of Water bills per month in Sin el Fil area

Survey Question	Average	Max	Min	Percentage of Payers
-----------------	---------	-----	-----	----------------------

Cost of Governmental Water per Month (LBP)	80,000	80,000	80,000	100%
Cost of Drinking Water per Month (LBP)	715,000	400,000	2,500,000	68.3%
Cost of Water Trucks per Month (LBP)	324,000	150,000	1,500,000	61.7%
Total (LBP)	1,120,000			

As shown in Table, Households paid an average of 80 ,000LBP per month for governmental water, 715,000 LBP for drinking water, 324,000 LBP for water trucks and with a Total average of 1,120,000 LBP monthly per household. All households reported that they paid their governmental bills, 68.3% paid for drinking water from water bottled companies and 61.7% needed to pay for water trucking to fill their tanks.

Comparison between the two regions:

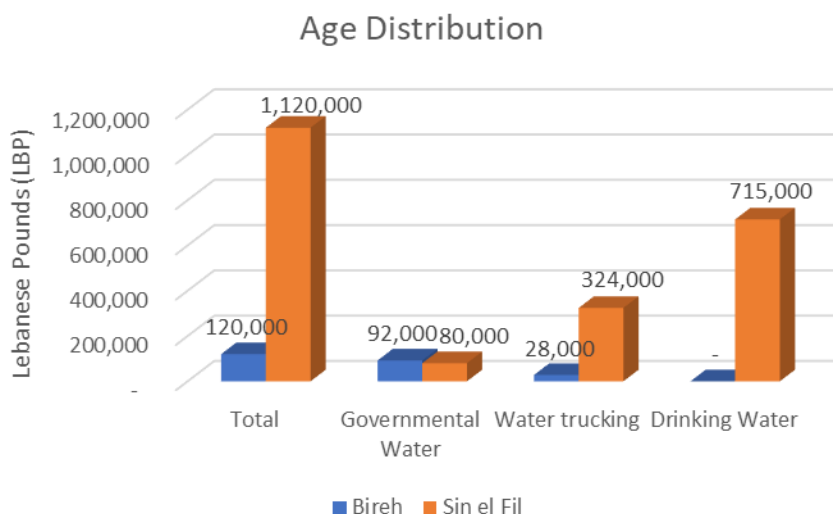


Figure 14: Average Cost of Water per Month

The Results obtained in this Fig.14 shows that Bireh households (92,000LBP) pay a little more than Sin el Fil (80,000LBP) for governmental water bill. On the contrary, Sin el Fil households pays much more for Water Trucks (324,000LBP) and Drinking water (715,000LBP) than Bireh region (28,000LBP and 0.LBP, respectively). Overall, a massive difference is seen in Total cost of water with 1,120 LBP for Sin el Fil households compared to a 120,000 LBP for Bireh region.

Table 5: Customer Satisfaction Index

Region	Average Weighted Index (AWI)
Bireh	3.78
Sin el Fil	1.72
Total	2.75

As defined in the methodology, the calculated AWI will refer to Customer's Satisfaction in general. Table 5 shows that Bireh area has a high AWI of 3.78 and this means that households are satisfied in this area. On the other hand, AWI value of Sin el Fil is 1.72 and this concludes that customers are poorly satisfied. In total, Samples taken from both regions with a calculated AWI value of 2.75 means that residential customers are described as fairly satisfied.

Table 6: Spearman's Correlation

		Correlations												
		Satisfaction	Region	Cost_of_Water	Drinking_Water	Water_cuts_per_week	Satisfaction_Factors	Water_Measurement	Willingness_to_Pay	Using_Pumping_System	Billing_Duration	Age	People_by_Households	
Spearman's rho	Satisfaction	1.000	.693**	-.434**	-.527**	-.694**	-0.060	.307**	.384**	.243**	-.190*	-0.031	-0.099	
	Region	.693**	1.000	-.655**	-.770**	-.771**	-0.123	.303**	.379**	.385**	-0.126	-0.093	-0.028	
	Cost_of_Water	-.434**	-.655**	1.000	.702**	.517**	0.059	-.401**	-.299**	-.283**	0.132	-0.077	0.083	
	Drinking_Water	-.527**	-.770**	.702**	1.000	.519**	-0.011	-.277**	-.324**	-.316**	.187*	-0.061	0.054	
	Water_cuts_per_week	-.694**	-.771**	.517**	.519**	1.000	.189*	-.265**	-.240**	-.309**	0.104	0.032	0.085	
	Satisfaction_Factors	-0.060	-0.123	0.059	-0.011	.189*	1.000	0.071	0.160	0.117	0.055	0.144	-0.014	
	Water_Measurement	.307**	.303**	-.401**	-.277**	-.265**	0.071	1.000	.329**	.208*	-.229*	0.080	-0.067	
	Willingness_to_Pay	.384**	.379**	-.299**	-.324**	-.240**	0.160	.329**	1.000	0.143	-.198*	.195*	-0.029	
	Using_Pumping_System	.243**	.385**	-.283**	-.316**	-.309**	0.117	.208*	0.143	1.000	0.044	.205*	-.230*	
	Billing_Duration	-.190*	-0.126	0.132	.187*	0.104	0.055	-.229*	-.198*	0.044	1.000	0.039	0.025	
	Age	-0.031	-0.093	-0.077	-0.061	0.032	0.144	0.080	.195*	.205*	0.039	1.000	-.273**	
	People_by_Households	-0.099	-0.028	0.083	0.054	0.085	-0.014	-0.067	-0.029	-.230*	0.025	-.273**	1.000	

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

Table 6 show the reduced form of the Spearman correlation matrix for the satisfaction, region, factors, cost of water, drinking water, water measuring and many other variables. Spearman's correlation analysis was used to identify the correlation between different variables in this study. Nominal Variables were transformed into Numerical variables, Satisfaction factor goes from Very Unsatisfied (1) to Very Satisfied (5). For Region, Sin el Fil (1) and Bireh (2), Drinking from Tap Water (1), Drinking from a near water spring (2) and drinking from water bottled companies (3). For Satisfaction factors, Water Supply (3), Water Quality (2), Billing Service (1). Yearly billing duration (1) and monthly (2), Responses with Yes (1) and No (2).

Based on the following Table, Spearman's ρ values are consistently near 1, indicating a significant positive/negative association between variables. This suggests that customer satisfaction is linked with all the variables except for household size, age, and satisfaction factors, which have no demonstrated association with respondents' satisfaction levels. Furthermore, the results imply that the billing service has no impact on customers' satisfaction.

Negative correlation was shown with the cost of water, the drinking water, water cuts per week and billing duration. This suggests that the more customers are satisfied, the less they pay for water services, the less they experience frequent water cuts, the more they are to stay with a yearly billing duration. Positive correlation was related with the region selected, affected by willingness to use water measurement, to pay more and to use a pumping system. This suggests that the less customers are satisfied, the more they are from Sin ell Fil region, the more they are with water metering, the more they are willing to pay more for better service, and the more they are using a pumping system. The highest correlation was with the region and drinking water type, while the lowest was with billing duration.

Also, there is a positive significant relationship between the satisfaction factor and water cuts per week. This correlation confirms that the most important satisfactory factor is water supply over water quality and billing. To note that the higher the cost of water bills per month the more they are willing to put water metering, willing to pay more and the less they are satisfied.

Interpretation & Discussion

Several geographic and socio-economic factors impacted the survey results. Bireh households were more likely to indicate that they're satisfied than Sin el Fil due to better water supply, water quality and resnable water cost. This finding was consolidated with the Average Weighted Index (AWI) that measured the cutomer satisfaction. Overall, the most important factor related to satisfaction was water supply: that was in a positive significant relation with water cuts per week, this means that the more water cuts per week the more people were considering water supply as their main satisfactory factor over water quality and water billing as factors. In contrary, the less water cuts per week the more customers indicated water quality and water billing as their main satisfactory factor. This finding highlights the importance of ensuring a reliable and uninterrupted water supply, which not only enhances the customers' quality of life but also strengthens their confidence in the water management authorities. This confirms that water supply has an effect on water billing and fee subscription. Based on a comparison of the two regions, Bireh had less water cuts than Sin el Fil, this explains why Bireh customers were more satisfied. The specific Bireh area studied received its water from Nabh el Safa, where water is abundant and also due to gravity the water reached households without the need of any pumping system. While Sin el Fil area, located in an urban area needed high water pumping systems to pump water into households and this was also is affected by

the economic crisis and high fuel prices. This leads to the fact that a little water quantity is reaching the households and with time, water shortages will become more critical. Moreover the increased demand is coupled with significant network losses.

This water problem is further worsened by the fact that customers don't send official complaint about water problems they're facing. Actually they do not trust the Water Establishments and their capabilities to find solutions for their problems, so they didn't even try to complain. Even some household's owners does not even know how to contact the relevant water authority. These results may reflect Lebanese lack of awareness regarding their public engagement in local water policy decision and their right to complain and revolt about their basic needs.

Respondents were more likely to consider maintaining the yearly water billing over a monthly billing system. Sin el Fil, the region with the highest rate of unsatisfied customers, showed more interest towards a monthly billing system that would assist households in managing their finances more effectively. This also another finding that supports the fact that the service has an impact on billing service and customers reaction towards it. Based on the results of this research, overall consumers prefer to have their water bills sent to their house directly. This is indicated by the fact that households are used to pay the majority of their bills by the door, which makes it the most convenient option for them, particularly due to increased fuel prices and high cost of transportation to reach the sites to pay the bills. Sin el Fil area showed more interest in paying their bills by OMT or Liban Post and throughout the Municipality. Wich may be due to the fact that Sin el Fil is an urban area and there's an easier possibility to reach OMT and Liban Post offices than in Bireh. It is evident that Lebanese underestimate or don't know the role of the Municipality and especially in rural areas where their vote for the president is based on his family not on his requirements to handle this important local responsibility, this may be the reason for the difference between regions. These findings shows that water providers should pay closer attention to the demands of the households and take into consideration geographically difference in billing method and duration.

Of particular importance is the application of pumping systems in households to transfer water from the ground to their rooftop tanks is particularly significant. This system was mostly seen in Sin el Fil due to water incapability to reach rooftops that can be related to natural lack denivelation, bad network infrastructure and water supply incapacity to reach households. The main usages of water in households are cooking, washing, cleaning and drinking. Findings showed that the majority of households in Bireh drink from their tap water, in contrary to Sin el Fil that rarely drink from their tap water but instead rely on near water spring and/or sealed water bottles since their tap water is salty and not adequate for drinking. This can also confirm the lower level of customer satisfaction in Sin el Fil caused by the drinking water. The main issue with water quality isn't with the water at the source but rather with the distribution network due to cross contamination with the sewer. It requires some time for households to trust the tap water for drinking purposes. On the other hand, the government should be responsible for providing drinking water that meets drinking water quality standards.

The findings revealed significant differences in how households in different regions of the country perceive water supply. Specifically, it identified the need for water measurement in the Sin el Fil area, where households are dissatisfied with the current situation. This research found a negative correlation between households' use of water metering and their satisfaction with the service. Implementing water metering would promote fairness in water distribution, improve system efficiency and reduce costs. This

would also incentivize water authorities to reduce water losses and increase production. However, households in Bireh who already have good water supply and pay a low amount may not support water metering as they lack social responsibility and tend to consume water irresponsibly. In Sin el Fil, however, most households are willing to pay more if the service improves. This research found that people who are unsatisfied with the service are more willing to pay to improve it. This is important for water authorities to understand as it highlights the need to improve services to maintain consumer satisfaction and willingness to pay. Ultimately, the responsibility lies with the Ministries, Water Establishments, and Municipalities to provide adequate water services.

Households living in Sin el Fil were more likely to pay more in total for their water, even though they had a poorer water service than Bireh. This difference in cost of water bill is mainly due to not having enough water supply so households need to fill their tanks with water from water trucking services. This solution should be taken into consideration due to the unknown source of water (that could be polluted). Also, uncontrolled digging of boreholes followed with extensive pumping has become a common observation. Pumping of water directly from rivers and springs is also widespread. Due to the economic crisis, water trucking is becoming more and more expensive with rising fuel prices, this can lead to serious hygiene and sanitary problems. Furthermore, this disproportionately in cost between regions is also due to drinking water, according to most households tap water isn't adequate for drinking but only used for cooking purposes. This problem will lead households to find alternative solutions that can be expensive, the majority went for the easiest solution of buying water bottles and gallons. This is a safe solution because water quality is trusted and matches the standards, but on long term bases this solution will lead to a bigger plastic pollution, especially in case of improper waste management. Also, most of people ignore that plastic bottles releases BPA and other chemicals when put in the sun for a long period of time leading to serious health problems. Nevertheless, some household reported filling gallons from a near water spring for drinking purposes. This solution can be cost effective, but we should not forget for transportation. Noting that water springs can be contaminated and lead to health problems. The only water bill that was mainly similar is the regional water establishment bill with a low amount compared to the amount paid for the alternative solutions. At the same time, the higher customers are paying for their service the less they are satisfied, the more they are willing to pay more and with the application of water metering. The number of people in a household doesn't affect the cost of water, but water authorities should consider this in billing. An average new total cost was generated by the data analysis in this research, the new average monthly bill was calculated by adding the three-monthly average cost of the three different water bills. The cost of 1,120,000 LBP per month can be applied, only if a serious change in the public water sector is shown with a 24/7 water supply, quality drinking water is supplied to tap water and a proper fee collection is applied.

Several of the discoveries made during this research align with those mentioned in the literature review, such as those related to a standardized annual bill, lack of communication with the Water Establishment, water supply as a factor influencing satisfaction, and willingness to pay. On the other hand, some findings were contradictory to the finding in this research regarding the municipalities and local authorities especially in Bekaa region because of their efficient experience with the municipality of Aanjar and the percentage of satisfied customers are more important than those in this research. That said, it is important to acknowledge some limitations of the present research. There is not enough nationwide data available about water service. The studied population was limited to only households not taking samples from schools, hotels, farms and agriculture lands because in the analysis they would appear as outliers, even

though they have negative behaviors on the water sector. The limitations of this paper present several opportunities for future research that expand on this research.

Conclusion

This study provided the examination of household perceptions regarding the influence of water quality and service towards the subscriptions and fee collection while taking into consideration customer satisfaction across two geographically, demographically, and socioeconomically diverse regions. This study supports the water and public policy in three ways:

1. It collected one-of-a-kind survey assessing the need of households regarding water issues given the absence of data in these specific regions.
2. It incorporated these one-of-a-kind survey data into an integrated table and bar graphs models understanding household perceptions regarding the water services.
3. It analyzed and discussed the results and correlations leading to a research paper that should be sent to local authorities to improve customer satisfaction concerning water services.

Model results indicated that water quality and service had an influence on water subscriptions and fee collection, this was proven by the significant relation between cost of water and customer satisfaction, drinking water and willingness to pay more. This means If there are no significant improvements in the quality of drinking water, dissatisfied customers may stop paying for this service. As they are already paying a higher price for alternative water solutions, they are willing to pay more only if the service improves.

In order to enhance this service, water authorities should carry out institutional reforms aimed at empowering their service. Therefore, a national strategy should be developed incorporating the local community in water service management with the participation of the private sector. In some cases it was shows this to be very efficient in managing local water resources with the lowest social and economic cost according to Noble Prize winner Elon Ostrom. This step will push water authorities toward a financial autonomy, upgrading water systems and keeping affordable prices.

The solution for a better water supply is a mix of rehabilitation of old infrastructure, new assets, reduced network losses and a significant improvement in distribution system management. Gradually introduce water meters to households and increase wastewater treatment lowering the cost of environmental and health damages. Promote awareness and prepare workshops for local community increasing their knowledge about their basic rights, the importance of local community in managing water, taking decisions and inform them about the socio-economic benefits of the transition to local governance. Therefore, we can conclude that water authorities and local communities should take advantage of this survey and results and focusing on better communication with unsatisfied subscribers in order to increasing and ensuring water service for the long term.

Appendix

Appendix A:

Table 7: Water Authorities responsibilities

Ministry of Energy and Water	Water Establishments	Ministry of Interior and Municipalities	Municipalities
<ul style="list-style-type: none"> • Set the necessary policies, regulations, strategies, and decrees for the water sector. • Oversee and monitor the RWEs and LRA. • License wells and all water extractions. • Oversee, on a national basis, the allocation and distribution of surface and ground water for drinking and irrigation. • Draft general directive for water and sanitation, updating it continuously. • Control the quality of surface water and groundwater. 	<ul style="list-style-type: none"> • Manage and distribute water resources within their respective areas of jurisdiction. • Operate and maintain the water systems, from generation to distribution, and collect subscription fees. • Manage, operate, and maintain wastewater treatment plants executed by the CDR, and others. 	<ul style="list-style-type: none"> • Ensure that municipalities construct, clean, and maintain storm-water drainage networks. 	<ul style="list-style-type: none"> • Provide services such as maintaining potable water networks and roads. The operation and maintenance of sewer systems. • Public programs for works, aesthetics, cleaning, health affairs, water projects, and lighting. • Authorizing the excavation of public streets, in order to lay water, electricity, telephone and wastewater pipes, and others, in return for a guarantee to return the premises to its previous state, at the expense of the license applicant; the public institutions, the independent services, and the state administrations are not excluded from said authorization.

Appendix B:

Table 8: Cost of Water Bill per Water Establishment

	BML	North	South	Beka'a
Annual fee (Based on 1m ³ /day)	200,000	180,000	175,000	140,000
Gauge maintenance	35,000	10,000	22,000	20,000
Total	235,000	190,000	200,000	160,000

Note: does not include government VAT (10 percent) and stamp fee (1,000 LBP)

Source: RWA submissions.

Appendix C:

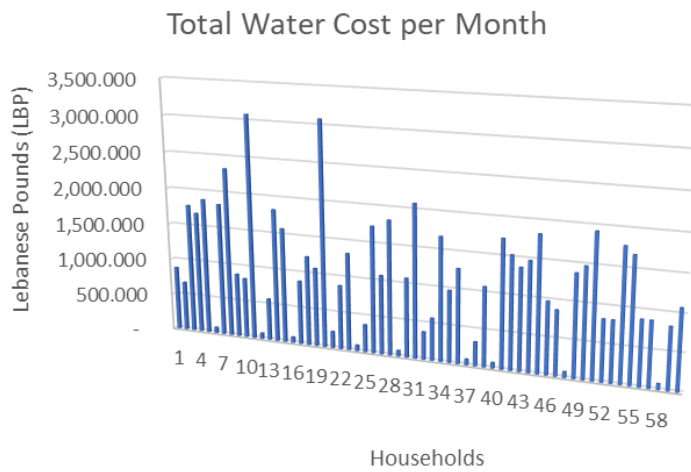


Figure 15: Households distribution of total water cost per month

Appendix D:

Cost of Potable Water per Month

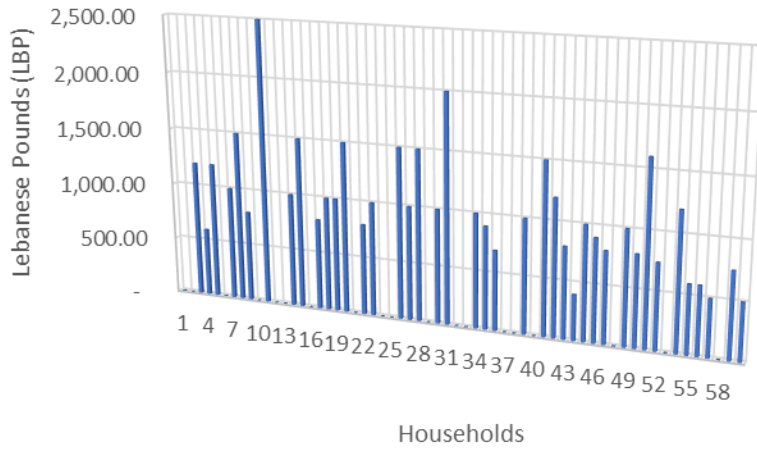


Figure 16: Households distribution of the cost of potable water per month

Cost of Water Trucks per Month

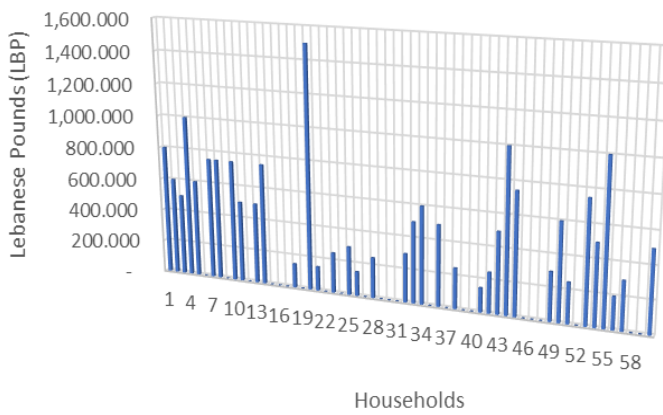


Figure 17: Households distribution of the cost of water trucks per month

Appendix E:

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